SIGNALING

1894 1894

A CATALOGUE

OF THE

DEVICES AND THEIR PARTS

MANUFACTURED BY

THE UNION SWITCH & SIGNAL CO.

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President.

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Vice-Pres't and Gen'l Man'g'r.

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Preface.

SINCE the organization of The Union Switch & Signal Co. a large amount of work has been performed in the interlocking and block signaling field. A few statistics illustrating the scope of our business may prove of interest, and will certainly be instructive as showing the widespread and growing demand for safety appliances on railroads.

The Saxby & Farmer Improved Interlocking Machine is of the type which is most widely in use throughout the world, and almost to the exclusion of other types on this continent. More than 900 distinct plants, containing over 16,000 levers, have been built by us, and equipped with this machine. Nearly every railroad in the North and East maintains at least one of these installations, while most roads have a great many more than one. For instance, on a certain great system, there are in service about 200 machines that contain in excess of 4,100 levers, while on one of the large railroads in the East there are 175 machines, containing 2,200 levers.

The Electro-Pneumatic Interlocking Machine, which is the highest development of the idea yet reached, is in use at 46 different points, comprising 1,600 levers. A large proportion of these plants are at the most important terminals in the country, where the performance required of them is of the most exacting kind; the Union Station at St. Louis; the Pennsylvania Railroad terminals at Jersey City, Philadelphia and Pittsburg; the complicated grade crossing at Stewart Avenue and Twenty-second Street, Chicago; the Philadelphia & Reading Railroad terminal at Philadelphia; the Chicago & Northwestern Railway terminal at Chicago, and the Boston & Maine Railroad terminal at Boston are amongst some of the larger places.

In Electro-Pneumatic Automatic Block Signaling a most encouraging progress is to be noted. About 1,500 signals have been erected, which, placed one third of a mile apart, about the average distance, cover five hundred miles of road.

The Union Electric Banner, Target and Disc Signals are widely distributed, and are in common use, not only as automatic block signals, but as a protection for isolated switches, junctions, tunnels, drawbridges, sharp curves, and for many other purposes.

The Union Lock and Block System is also being extended, and now comprises nearly 600 block instruments in actual service.

Even a careless examination of this book will show that we are prepared to furnish any sort or kind of interlocking, block signaling, switch or frog work that commends itself as safe and reliable, but with devices whose main claim to attention is their cheapness we do not care to deal. All of the special arrangements that we manufacture are fully protected by patents, our rights in which we propose to maintain and protect.

In our last catalogue, issued in 1889, we endeavored to accomplish two things; first, to describe and illustrate the devices manufactured by us, and, second, to explain the theory and principles by which we are governed. The edition of 1889 (8,000 copies) is exhausted, but it has been so widely distributed, and the railroad public is now so well informed as to the best signaling practice, that we shall confine ourselves in the present volume to an illustrated list and description of the articles which we manufacture and erect. The present work, therefore, aims only to show the machines, signals and methods which are considered reliable and best for the object to be accomplished.

We shall take pleasure in showing our works and in explaining our methods to all those interested in railroad signaling and maintenance who will do us the honor of calling on us.

PART I.

Table of Contents.

PART I.

THERE IS AN ALPHABETICAL INDEX IN THE BACK OF THE BOOK.

How to Order.

IN ORDERING material for repairs, if single parts only are needed, they will be found illustrated on the Plate devoted to the arrangement to which they belong, while on the page or pages following a descriptive list is given. If a Saxby & Farmer Latch Handle is wanted, it should be ordered as "No. 26, Plate 3," which is all the description that is necessary, since only one kind of Saxby & Farmer Latch Handle is made. A Saxby & Farmer Lever, however, is made in two sizes, and the order in that case must read "No. 22, Plate 3, for distant signal," or for one of the other purposes named in the description of the part.

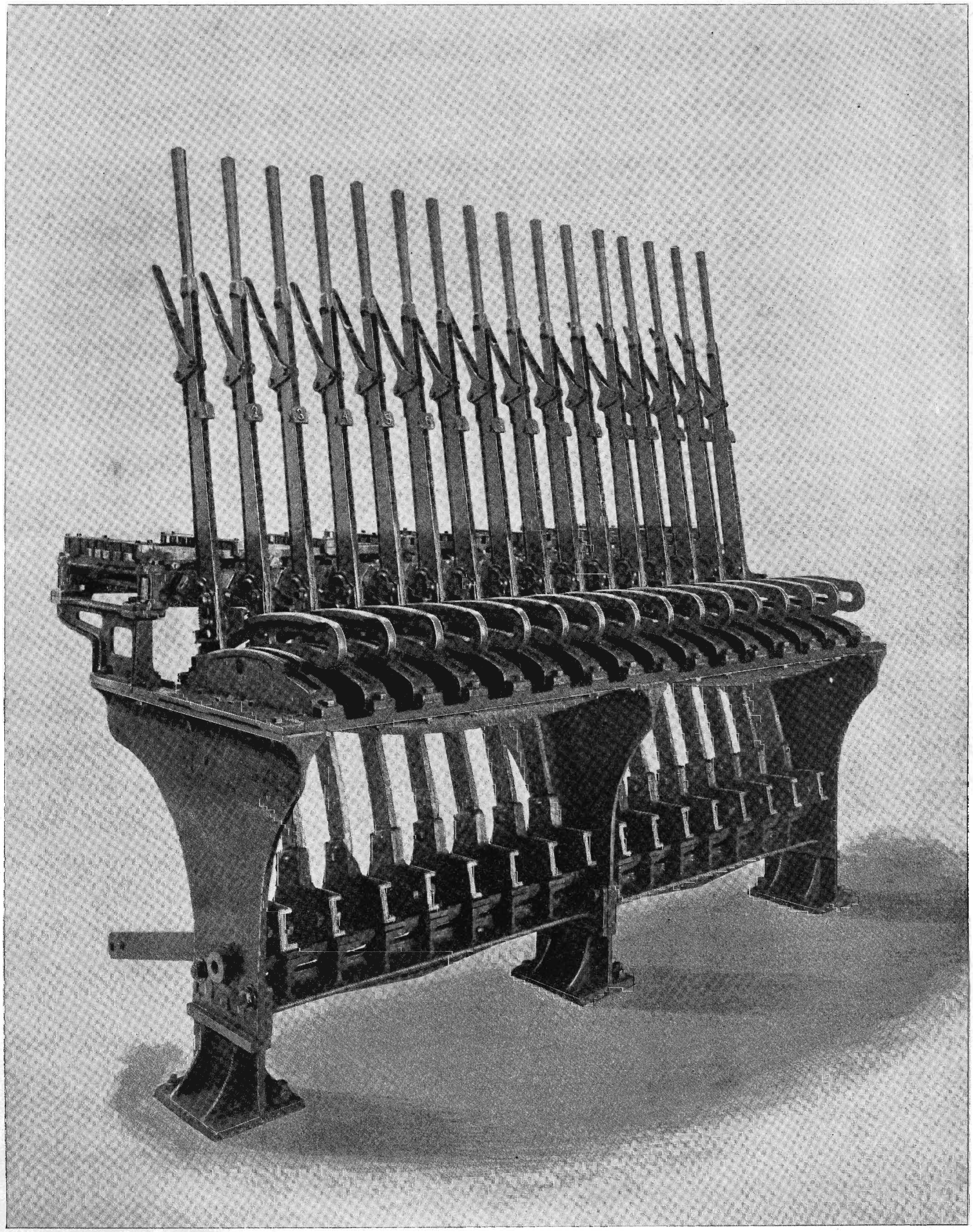
It would have been impossible to describe all of the combinations of parts, but we are able to promise that anyone wishing to order certain assemblages such as a "Saxby & Farmer Lever Complete," may do so in the confidence that all of the parts naturally belonging to that combination will be sent.

To order successfully, state the number of the part, the Plate on which it is illustrated, and if it is made in more than one form, give the particular kind that is wanted; also state whether the shipment is to be made by express or freight.

In a field so new as signaling is in this country, it follows that a considerable amount of experimenting will be done, and during the life of The Union Switch & Signal Company many devices have been tested which, on experience, have been considerably altered or abandoned for something better. We do not illustrate or describe any of these original forms, but beg to assure our patrons that the patterns are kept in stock, and that we shall take pleasure in filling orders for any broken or worn-out parts, upon being furnished with an adequate description, or the part which it is desired to replace.

Our facilities for shipment are unusually complete, owing partly to our location, which is eight miles east of Pittsburg, directly on the line of the Pennsylvania Railroad, and in close proximity to the Baltimore & Ohio and Pittsburg & Lake Erie Railroads.

We have a private telegraph office in our works, the address of which is SWISSVALE, PA.



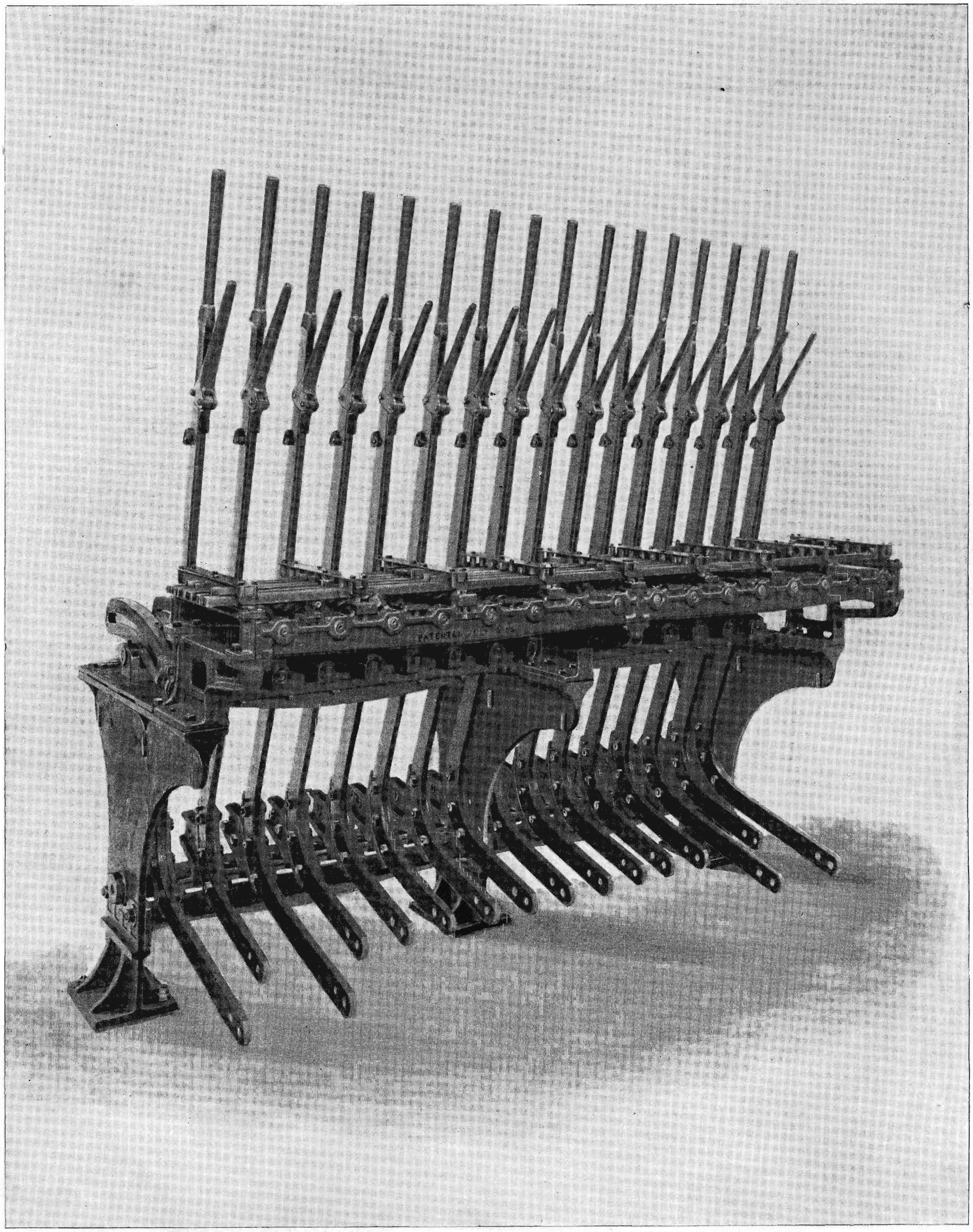
The Saxby & Farmer Improved Interlocking Machine.

PLATES 1 AND 2.

THE history of interlocking in this country, and for that matter throughout the whole world, is indelibly impressed with the characteristics of this type of machine. As used on this continent, it originally contained all of the checks and elements of safety which were required, but the locking was inconvenient in many ways, and before the present form was adopted the limit of combinations had apparently been reached in the large machines which began to be called for at about that time. The construction of the old locking in two tiers was often embarrassing and always expensive from a maintenance standpoint, since a slight alteration, when it occurred in the lower tier, required that the machine should be dismantled and thrown out of service. It was even found necessary to remove a part of the walls of the cabin on several occasions in order to get the bars out of the lower tier.

The discovery was also made that the particular form of box lock which had always been regarded as a necessary element of the machine was extremely limited in its application and, owing to its peculiar construction, practically useless when more than two or three levers were involved.

PLATE 2.



All of these defects led us to seek for some simpler and more rational form of locking, which has been secured to an eminent degree, and has been used exclusively in our work for the past three years.

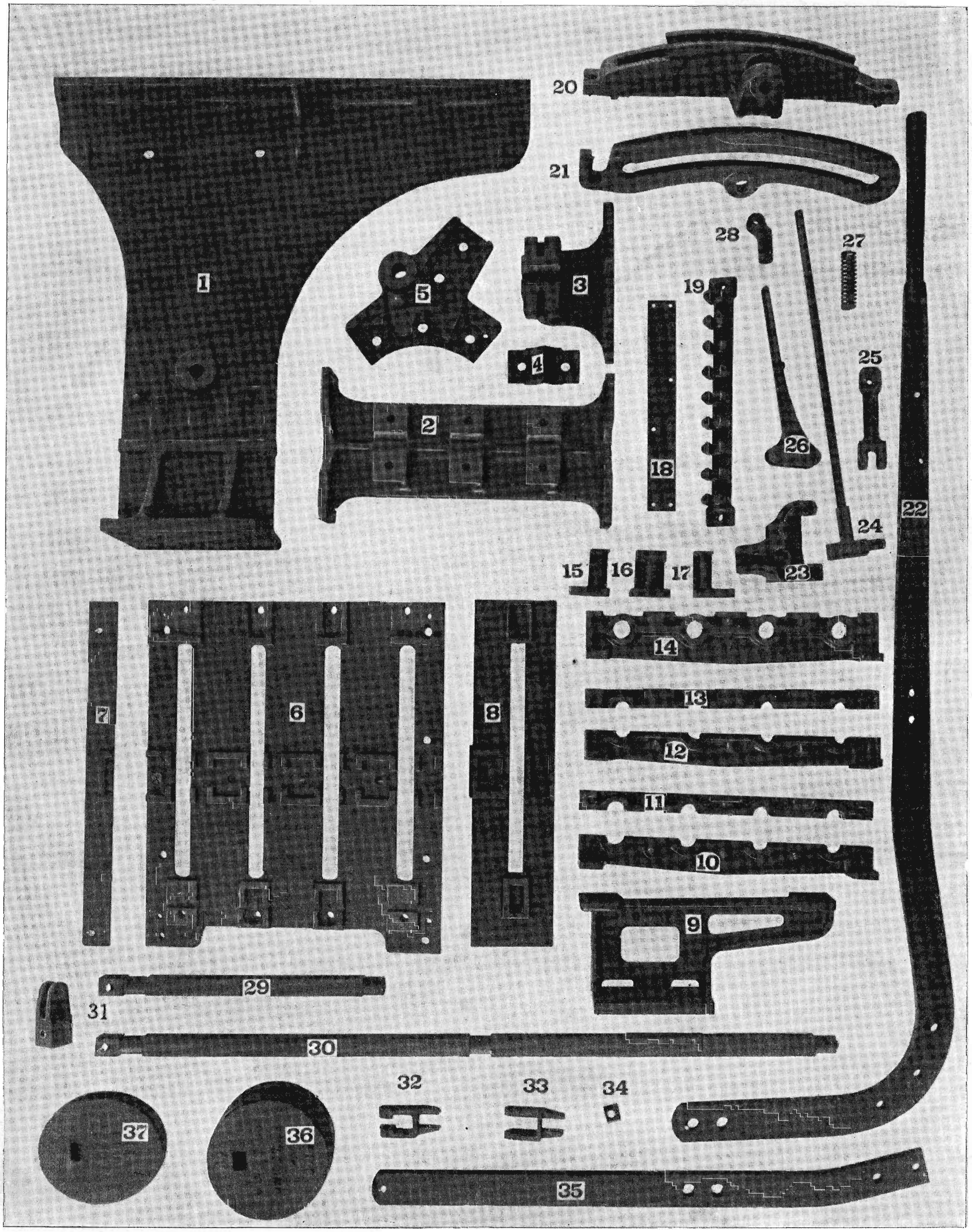
In the present machine the rocker and link, which transmit the movement of the latch handle to the locking, have been retained, but the ancient "flop" has been replaced by a square shaft, which revolves in turned bearings and drives the long locking bars exactly as was done in the old machine.

The locking is now disposed in one tier, and any required changes may be made by removing the caps which prevent the locks from lifting and protect the parts from dirt.

The arrangement of the bars permits the greatest amount of locking in the smallest space and, since the small cross-locks only are driven by impact, the wear on the dogs is reduced to a minimum. In this feature the locking differs from, and is superior to, any other form that we know of.

We do not attempt to give a detailed description of this machine, since our space is limited, and it is familiar to most practical men: to others who are not familiar with it we shall be happy to send the information in another form.

A detailed list and description of the parts will be found in connection with the two following plates.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Saxby & Farmer Improved Machine.

LARGE PARTS.

PLATE 3.

THE FRONT OF THE MACHINE IS THAT PART OCCUPIED BY A MAN WHEN OPERATING THE LEVERS.

ORDER BY PLATE AND NUMBER.

No.

1. Leg.
2. Bottom Rail.—This is made in two sizes, 4-way and 8-way; a 4-way is shown.
3. Bottom Rail.—This form is used only when it is desired to add a lever to the outside of a machine already in service.
4. Cap for Bottom Rail.
5. Lever Shoe.
6. Top Plate.—This is made in two sizes, 4-way and 8-way; a 4-way is shown.
7. End Strip for Top Plate.—This is made in two forms, right-hand and left-hand; a right-hand strip is shown.
8. Top Plate.—This form is used only in connection with No. 3, when it is desired to add a lever to the end of a machine already in service.
9. Bearing for Front, Intermediate and Back Rails.—This is made in many sizes; the particular size is always cast on the part and should be named in ordering duplicates; an 8-way is shown.
10. Front Rail.—This part is made both as a 4-way and an 8-way; a 4-way is shown.
11. Cap for Front Rail.—This is also made as a 4-way and 8-way; a 4-way is shown.
12. Intermediate Rail.—This part is not used until the number of spaces in the locking bracket exceeds 20. It is made in two sizes, 4-way and 8-way; a 4-way is shown.
13. Cap for Intermediate Rail.—Made as 4-way and 8-way; a 4-way is shown.
14. Back Rail.—This is made as a 4-way and 8-way; a 4-way is shown.
15. Left-Hand End Block.
16. Intermediate End Block.
17. Right-Hand End Block.
18. Cap for Locking Bracket.—These are made in lengths to suit the locking brackets.
19. Locking Bracket.—This form is made in many sizes, which are distinguished by the number of locking bar spaces contained in each one; an 8-way is shown.

No. PLATE 3.

20. Quadrant.

21. Rocking Link.

22. Lever.—This is made in two sizes; the first (the one shown) is for the operation of switches, locks, movable frogs and home signals when not too far from the tower. The second size is used always for distant signals, and sometimes for home signals.

23. Latch Shoe.

24. Latch Rod.

25. Universal Link.

26. Latch Handle.

27. Latch Spring.

28. Latch Rod Thimble.

29. Locking Shaft.—The kind shown is an 8-way, and is used when the number of spaces in the locking bracket does not exceed 20; it is made in different lengths, determined by the number of spaces contained in its locking bracket. Some of the earliest shafts were made of round steel, and if new drivers or other parts are desired for them the shape should be stated.

30. Locking Shaft With Intermediate Rail.—This style is made in different lengths, but is only used when the number of spaces contained in the locking bracket exceeds 20. The remarks appended to No. 29, concerning the determination of lengths and round shafts, apply to this as well. A 24-way is shown.

31. Crank for Locking Shaft.

32. Driver for Locking Bar.—Standard.

33. Driver for Locking Bar.—This form is used only when a new driver is to be applied to a machine already in service.

34. Filling Block for No. 33.

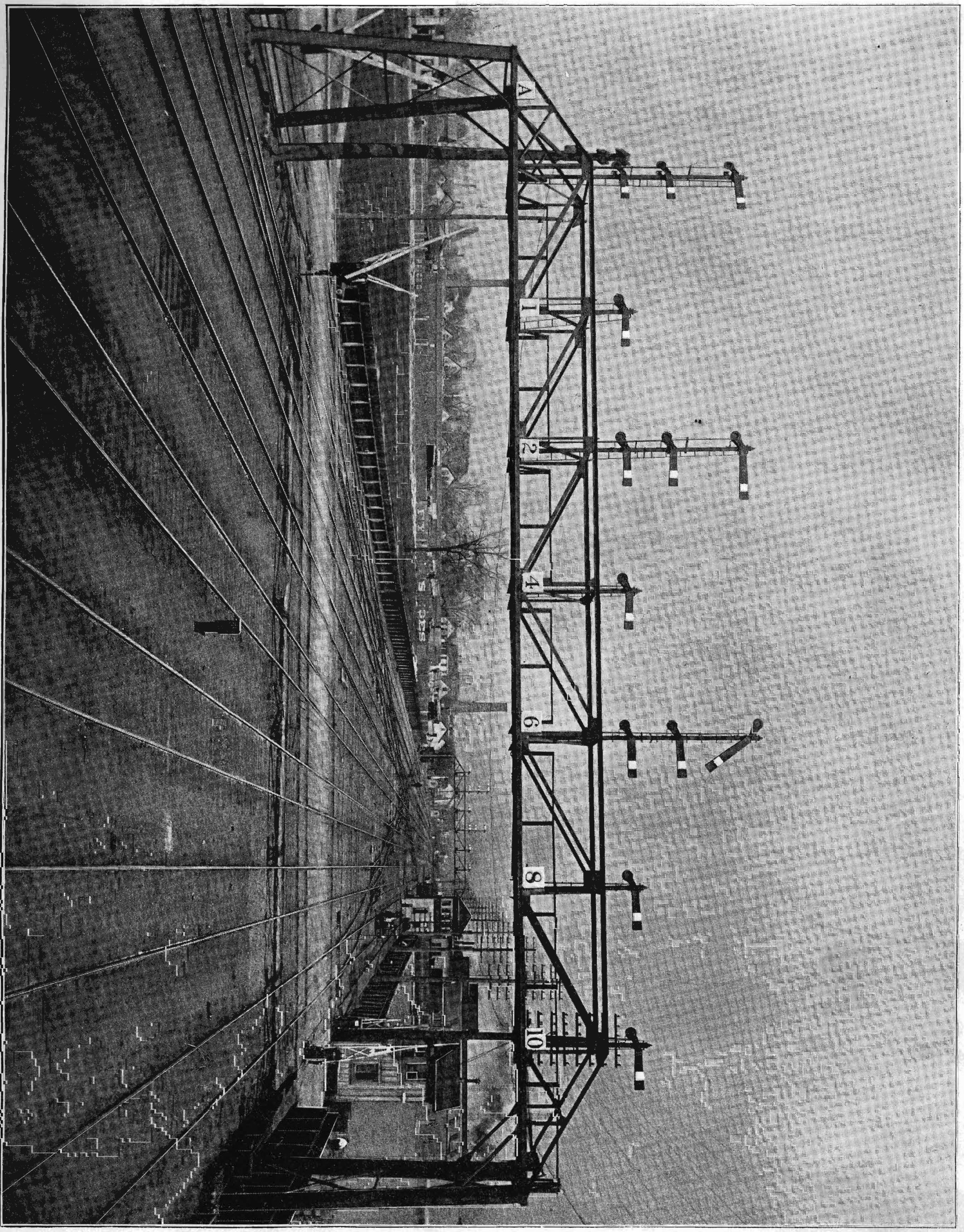
35. Tail Lever.—Made in two sizes to correspond with the levers No. 22.

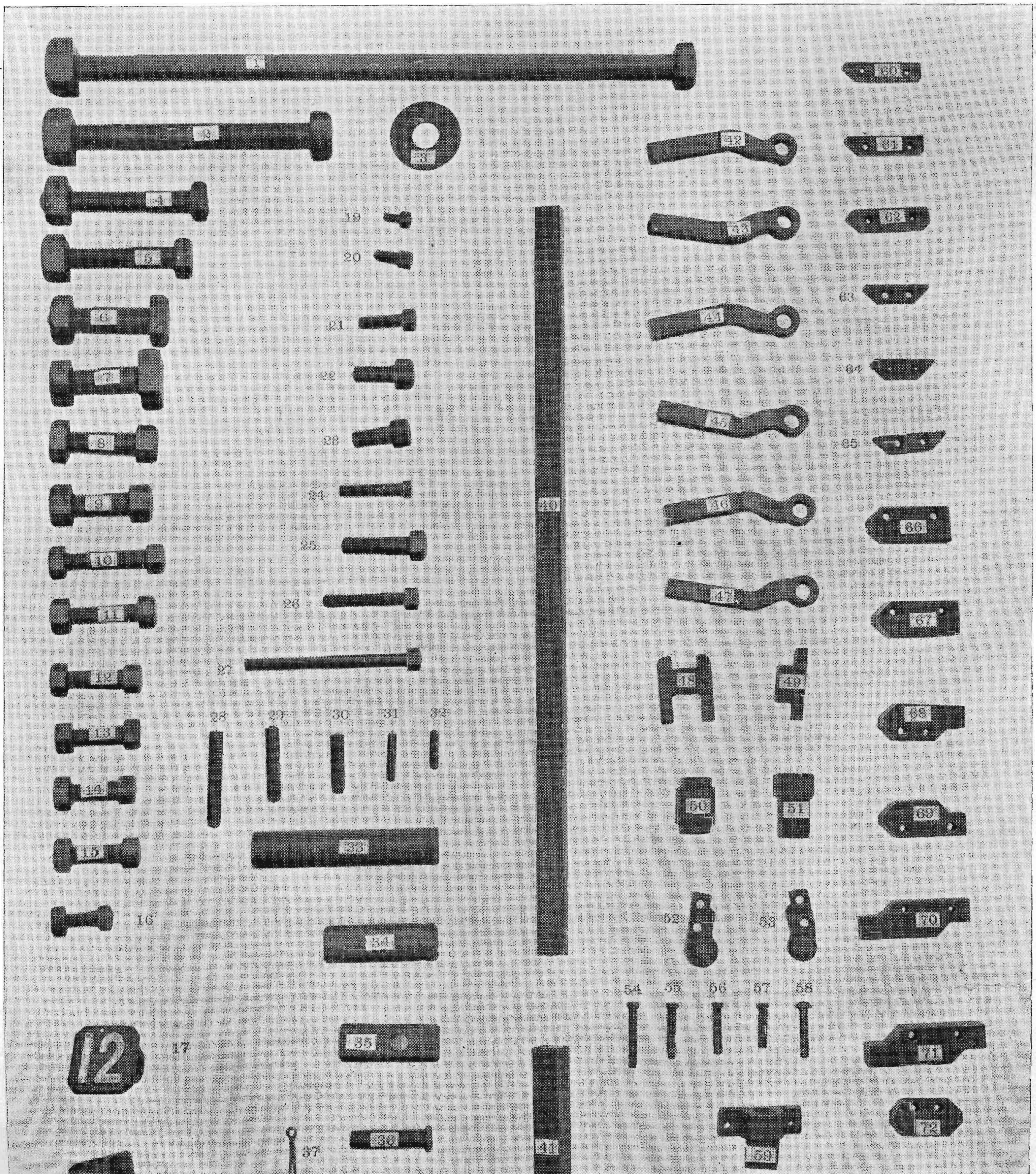
36. 40-Lb. Weight.
37. 14-Lb. Weight.
} For the tail lever. A 56-lb. weight is also made and can be furnished if desired. These weights are also used on the counter-balance levers of signal poles.

PLATE 4.

View of tracks and signals at Detroit, Mich., operated by a Saxby & Farmer Improved Interlocking Machine. Another view of this place is shown on Plate 35.

PLATE 4.

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Saxby & Farmer Improved Machine.

SMALL PARTS.

PLATE 5.

ORDER BY PLATE AND NUMBER.

No.

1. Bolt, ¾″ x 17″, for fastening leg to upright timber.
2. Bolt, ¾″ x 7″, for fastening leg to bottom timber.
3. Washer, ¾″, for Nos. 1, 2 and 7.
4. Bolt, ⅝″ x 4″, for 14-lb. weight.
5. Bolt, ⅝″ x 3½″, for 40 and 56-lb. weights.
6. Bolt, ¾″ x 2½″, for fastening bottom rail to intermediate leg.
7. Bolt, ¾″ x 2¼″, for fastening bottom rail to end leg.
8. Bolt, ⅝″ x 2¼″, for clamping driver to locking shaft.
9. Bolt, ⅝″ x 2″, for fastening lever and tail lever to lever shoe.
10. Bolt, ½″ x 2½″, for fastening quadrant, middle and front.
11. Bolt, ½″ x 2¼″, for fastening crank to locking shaft.
12. Bolt, ½″ x 1⅞″, for fastening bearing of locking to leg, and back end of quadrant to top plate.
13. Bolt, ½″ x 1¾″, for fastening cap to bottom rail.
14. Bolt, ½″ x 1⅝″, full head, for fastening top plate and end strip to leg.
15. Bolt, ½″ x 1⅝″, ½-head, for fastening top plate and end strip to leg.
16. Bolt, ⅜″ x 1″, Hex head and nut, check bolt for end of tail lever.
17. Lever Number.
18. Die for Rocking Link.
19. Cap Screw, ¼″ x ½″, for fastening cap to locking bracket.
20. Set Screw, ⅜″ x ¾″, for fastening link pin.
21. Tap Bolt, ⅜″ x 1¼″, for fastening locking bracket to back rail.
22. Tap Bolt, ½″ x 1⅛″, for fastening top plate to leg.
23. Cap Screw, ½″ x 1¼″, for fastening lock rails and end blocks to bearings.
24. Machine Screw, ⅜″ x 1¾″, for fastening cap to middle rail.
25. Tap Bolt, ½″ x 1¾″, for fastening latch shoe to lever.
26. Cap Screw, ⅜″ x 2¼″, for fastening locking bracket to front rail.
27. Cap Screw, ⅜″ x 4⅜″, for fastening locking bracket through end block to bearing.
28. Dowel Pin, ⅜″ x 2½″, through bearing and leg.
29. Dowel Pin, ⅜″ x 2″, through top plate and leg; through lever shoe and lever.
30. Dowel Pin, ⅜″ x 1½″, through latch shoe and lever.
31. Dowel Pin, ¼″ x 1¼″, through ¾″ dog to locking bar.
32. Dowel Pin, ¼″ x 1″, through locking rails to bearing; through ⅜″ and ½″ dogs to locking bars.
33. Lever Shoe Pin, 1″ x 4⅞″.
34. Rocking Link Pin, 1″ x 3″.
35. Swivel Pin, flat, 1″ x 2⅝″.

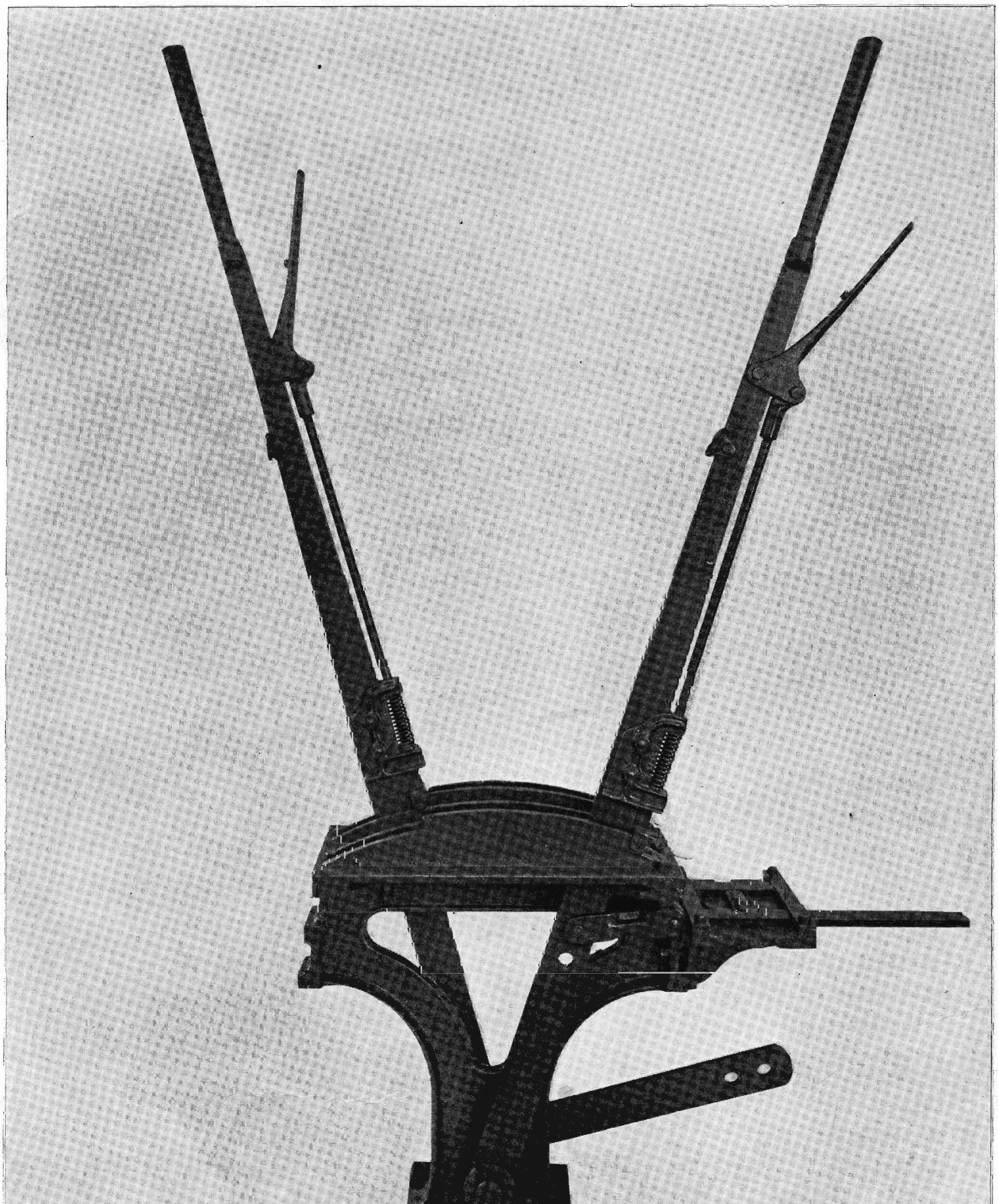
No. **PLATE 5.**

36. TURNED PIN, $\frac{1}{2}'' \times 2''$, for fastening swivel pin to universal link.
37. SPLIT COTTER, for No. 36.
38. TURNED PIN, $\frac{1}{2}'' \times 1\frac{11}{16}''$, for fastening latch handle and number plate to lever, and universal link to locking crank.
39. SPLIT COTTER, for No. 38.
40. PIECE OF LOCKING BAR, $\frac{1}{2}'' \times \frac{3}{4}''$ in section (any length).
41. PIECE OF $\frac{3}{4}'' \times \frac{3}{4}''$ STEEL, used for cross locks (any length).
42. RIGHT HAND TAPPET, $\frac{3}{8}''$.
43. LEFT HAND TAPPET, $\frac{3}{8}''$.
44. RIGHT HAND TAPPET, $\frac{1}{2}''$.
45. LEFT HAND TAPPET, $\frac{1}{2}''$.
46. RIGHT HAND TAPPET, $\frac{3}{4}''$.
47. LEFT HAND TAPPET, $\frac{3}{4}''$.
48. FILLING PIECE FOR LOCKING BAR.
49.
50. FILLING PIECES FOR CROSS LOCKS.
51.
52. RIGHT-HAND TRUNNION.
53. LEFT-HAND TRUNNION.
54. RIVET, $\frac{1}{4}'' \times 1\frac{13}{32}''$, for $\frac{3}{4}''$ locking dogs, Nos. 62, 65, 67, 68, 69, 71, 72, 73 and 74.
55. RIVET, $\frac{1}{4}'' \times 1\frac{11}{32}''$, for $\frac{1}{2}''$ locking dogs, Nos. 61, 64, 66, 70.
56. RIVET, $\frac{1}{4}'' \times 1\frac{7}{32}''$, for $\frac{3}{8}''$ locking dogs, Nos. 60, 63.
57. RIVET, $\frac{1}{4}'' \times 1\frac{1}{16}''$, for trunnions.
58. RIVET, $\frac{1}{4}'' \times 1\frac{5}{16}''$, for driving piece and block.
59. DRIVING PIECE AND BLOCK.
60. LOCKING DOG, $\frac{3}{8}'' \times \frac{1}{2}''$.
61. LOCKING DOG, $\frac{1}{2}'' \times \frac{1}{2}''$.
62. LOCKING DOG, $\frac{3}{4}'' \times \frac{1}{2}''$.
63. LOCKING DOG, $\frac{3}{8}'' \times \frac{1}{2}''$.
64. LOCKING DOG, $\frac{1}{2}'' \times \frac{1}{2}''$.
65. LOCKING DOG, $\frac{3}{4}'' \times \frac{1}{2}''$.
66. LOCKING DOG, $\frac{1}{2}'' \times 1''$.
67. LOCKING DOG, $\frac{3}{4}'' \times 1''$.
68. LOCKING DOG, $\frac{3}{4}'' \times 1''$.
69. LOCKING DOG, $\frac{3}{4}'' \times 1''$.
70. LOCKING DOG, $\frac{1}{2}'' \times 1''$.
71. LOCKING DOG, $\frac{3}{4}'' \times 1''$.
72. LOCKING DOG, $\frac{3}{4}'' \times 1''$.
73. LOCKING DOG, $\frac{3}{4}'' \times 1''$, offset.
74. LOCKING DOG, $\frac{3}{4}'' \times 1''$, offset.

Patents Relating to Mechanical Interlocking.

NAME.	DATE.	NUMBER.
W. BUCHANAN,	OCTOBER 23, 1877,	196,428
W. BUCHANAN,	DECEMBER 25, 1877,	198,449
C. H. JACKSON,	APRIL 1, 1879,	213,754
A. G. CUMMINGS,	JUNE 17, 1879,	216,510
C. H. JACKSON,	JULY 15, 1879,	217,536
C. H. JACKSON,	AUGUST 5, 1879,	218,123
A. G. CUMMINGS,	AUGUST 12, 1879,	218,496
H. W. SPANG,	NOVEMBER 11, 1879,	221,625
C. H. JACKSON,	JANUARY 13, 1880,	223,516
C. H. JACKSON,	JANUARY 20, 1880,	223,650
C. H. JACKSON AND F. S. GUERBER,	FEBRUARY 17, 1880,	224,540
A. G. CUMMINGS,	APRIL 13, 1880,	226,499
J. SAXBY,	JULY 20, 1880,	230,200
C. H. JACKSON,	JULY 27, 1880,	230,418
A. S. VOGT,	AUGUST 24, 1880,	231,511
F. W. AND W. W. BRIERLEY,	AUGUST 31, 1880,	231,648
H. F. COX,	SEPTEMBER 14, 1880,	232,176
H. F. COX AND R. H. SOULE,	MARCH 15, 1881,	238,861
J. WOOD (Re-issue),	MARCH 22, 1881,	9,614
F. S. GUERBER,	MAY 3, 1881,	240,904
A. G. CUMMINGS,	AUGUST 16, 1881,	245,794
I. FISHER,	AUGUST 30, 1881,	246,485
H. F. COX,	SEPTEMBER 6, 1881,	246,662
C. H. JACKSON,	NOVEMBER 29, 1881,	250,075
M. N. FORNEY,	DECEMBER 6, 1881,	250,517
H. F. COX,	APRIL 4, 1882,	255,774
H. JOHNSON,	JUNE 20, 1882,	259,865
H. F. COX,	AUGUST 22, 1882,	262,931
H. F. COX,	OCTOBER 24, 1882,	266,350
M. N. FORNEY,	OCTOBER 31, 1882,	266,802
M. N. FORNEY (Re-issue),	NOVEMBER 14, 1882,	10,237
H. F. COX (Re-issue),	JANUARY 2, 1883,	10,265
A. G. CUMMINGS,	JANUARY 2, 1883,	270,024
A. G. CUMMINGS,	FEBRUARY 6, 1883,	271,608
A. G. CUMMINGS,	FEBRUARY 6, 1883,	271,808
A. G. CUMMINGS,	FEBRUARY 13, 1883,	272,122
A. G. CUMMINGS,	MAY 1, 1883,	276,564
A. G. CUMMINGS,	MAY 8, 1883,	277,118
G. W. BLODGETT AND G. R. HARDY,	SEPTEMBER 11, 1883,	284,716
J. T. HAMBAY,	DECEMBER 23, 1884,	309,618
C. R. JOHNSON,	JANUARY 6, 1885,	310,519
J. T. HAMBAY,	JULY 14, 1885,	322,283
J. T. HAMBAY,	NOVEMBER 3, 1885,	329,643

(Continued on Page 39.)



Stevens Machine.

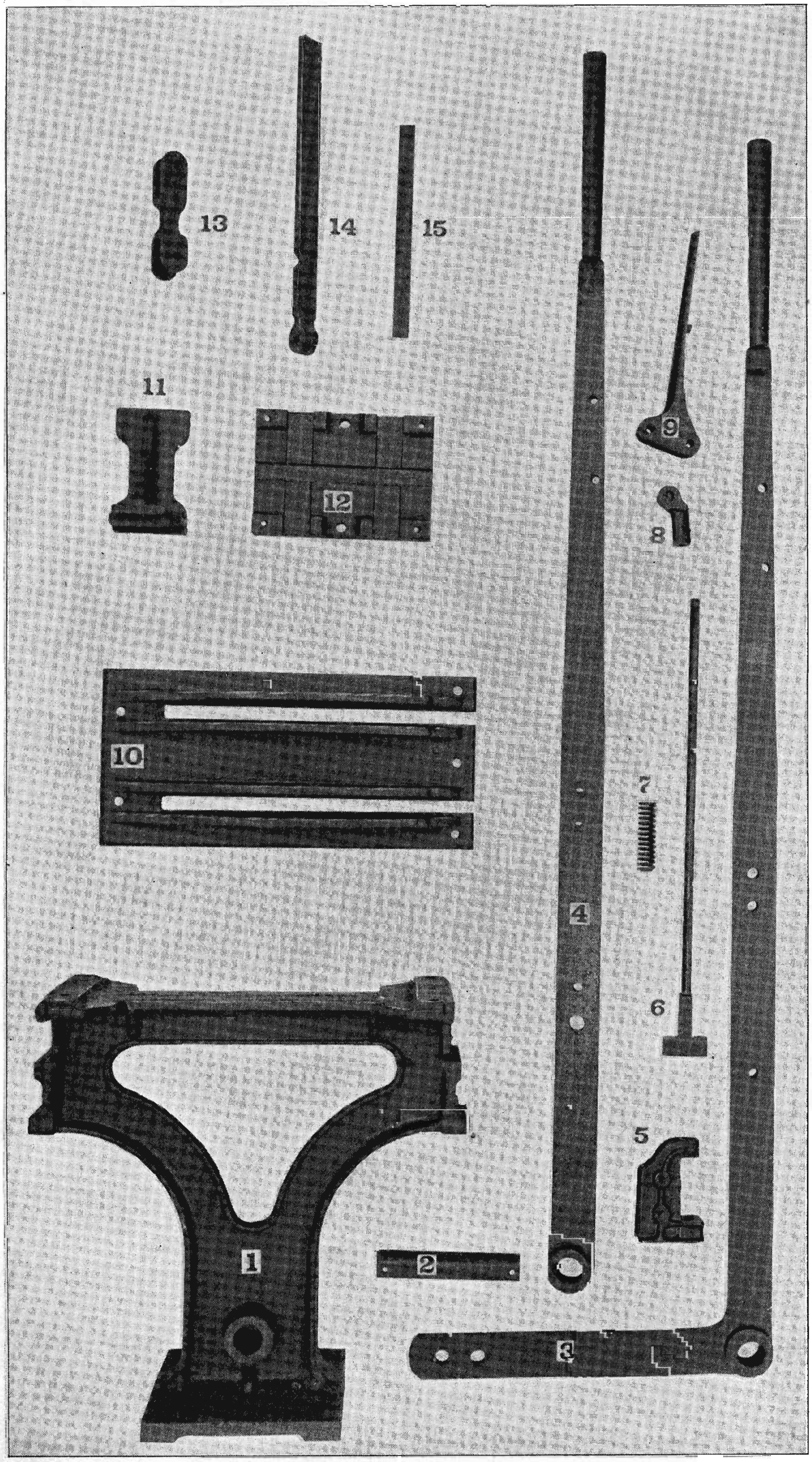
PLATE 6.

THIS machine, although it is made of the best quality of material, has no preliminary locking arrangement, and is best adapted for throwing side track switches or switches in ladder tracks where it would be inconvenient and expensive to have a man running from one switch stand to another, or to have a number of men stationed at the different switches. By assembling all of the switch stands at one central point in the form of a machine, one man can easily do the work of half a dozen under the old plan, and do it better.

If locking is desired, it can be supplied of the ordinary Stevens type, but we do not advise the use of this machine for anything but yard work.

As it can, like all other machines that we build, be placed in either a high tower or at the ground level, it is best to specify its location in ordering.

A list of its parts will be found on the next page.



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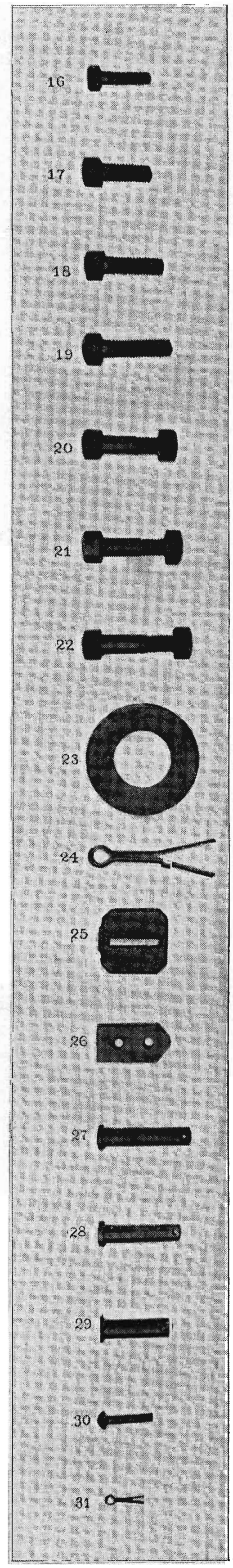

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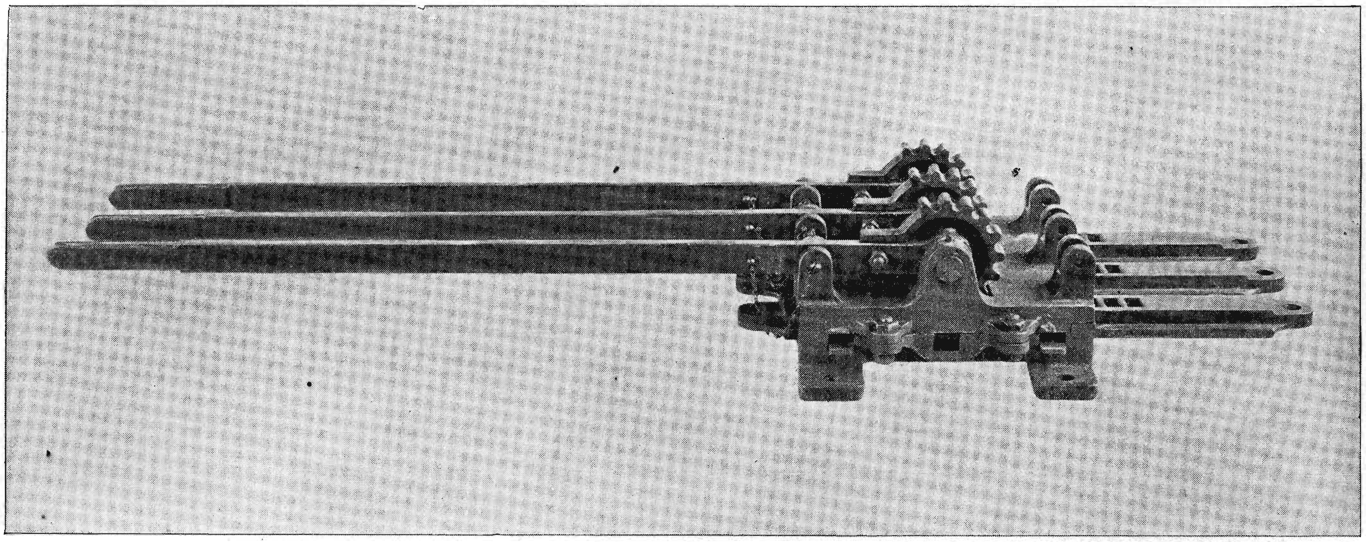
Stevens Machine.

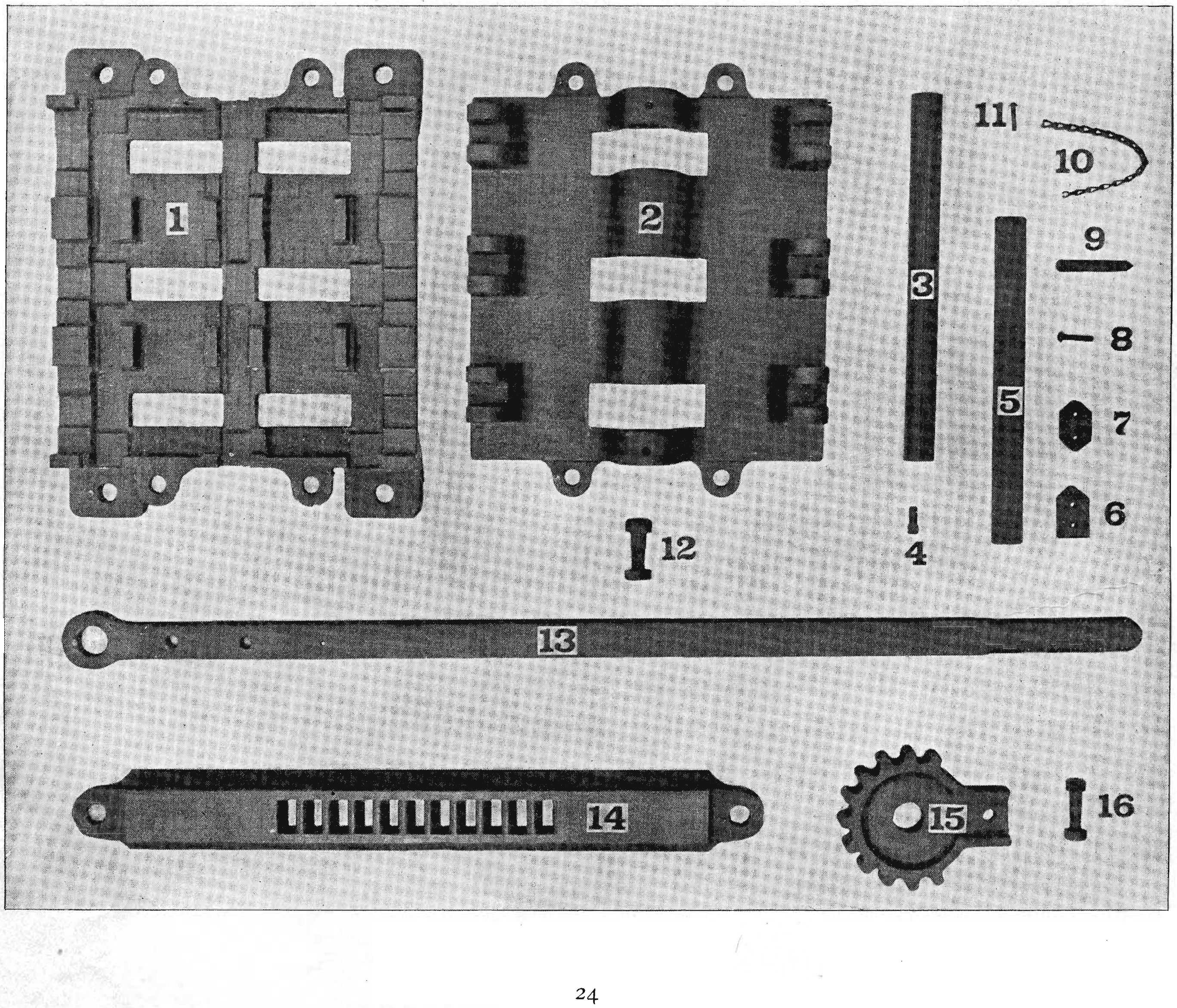
PLATE 7.

ORDER BY PLATE AND NUMBER.

No.

1. Leg.
2. Turned Pin, 1½″ diam., on which lever moves.
3. Lever (used only in high tower).
4. Lever (used only in low tower).
5. Latch Shoe.
6. Latch Rod.
7. Latch Spring.
8. Latch Thimble.
9. Latch Handle.
10. Quadrant.
11. Bearing. (This is made in two sizes; the smaller one is shown.) Specify the number of bars when ordering.
12. Locking Plate. Specify the number of bars and the number of levers when ordering.
13. Tappet Link.
14. Tappet. Specify the size of the machine and the number of locking bars when ordering.
15. Steel Plate, 1″ x $\frac{3}{16}$″. Used as a cap for the locking and for locking bars. (When wanted as a cap, specify number of levers in machine.)
16. Tap Bolt, ⅜″ diam., for fastening the cap to the locking plate.
17. Tap Bolt, ½″ diam., for fastening locking plate to bearing.
18. Tap Bolt, ½″ diam., for fastening quadrant to leg.
19. Tap Bolt, ½″ diam., for fastening latch shoe to lever.
20. Bolt, ½″ diam., for fastening legs together in machines containing more than two levers.
21. Bolt, ½″ diam., for fastening quadrant to leg.
22. Bolt, ½″ diam., for bolting bearing to leg.
23. Washer, 1½″ inside diam., for No. 2.
24. Cotter, 2½″ for lever pin.
25. Lever Number.
26. Locking Dog. Made in different shapes.
27. Turned Pin, ½″ x 2¼″, for fastening tappet link to tappet.
28. Turned Pin, ½″ x 2″, for fastening tappet link to lever.
29. Turned Pin, ½″ x 1$\frac{11}{16}$″, for fastening latch rod, latch handle and lever number.
30. Rivet, ¼″ x 1¼″, for fastening locking dog to locking bar.
31. Cotter, ⅛″ x ¾″, for turned pins numbers 27, 28 and 29.

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Triple Ground Lever.

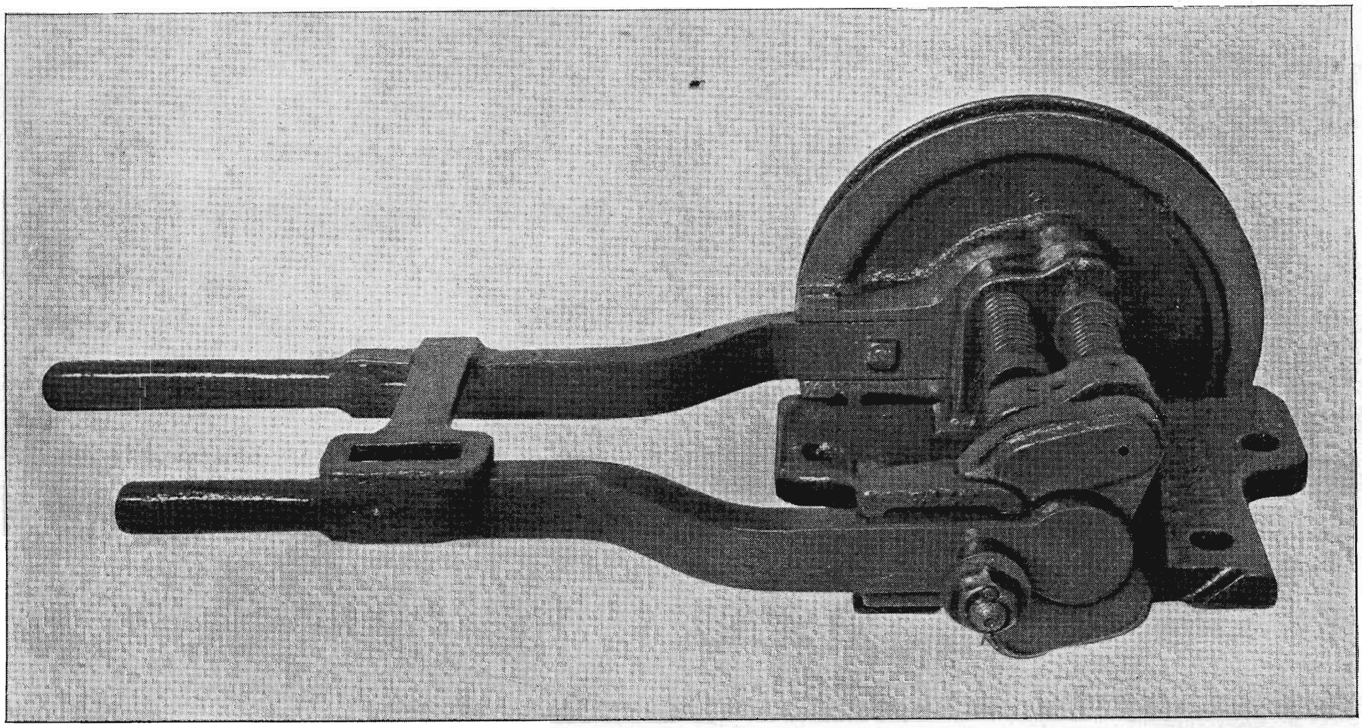
PLATE 8.

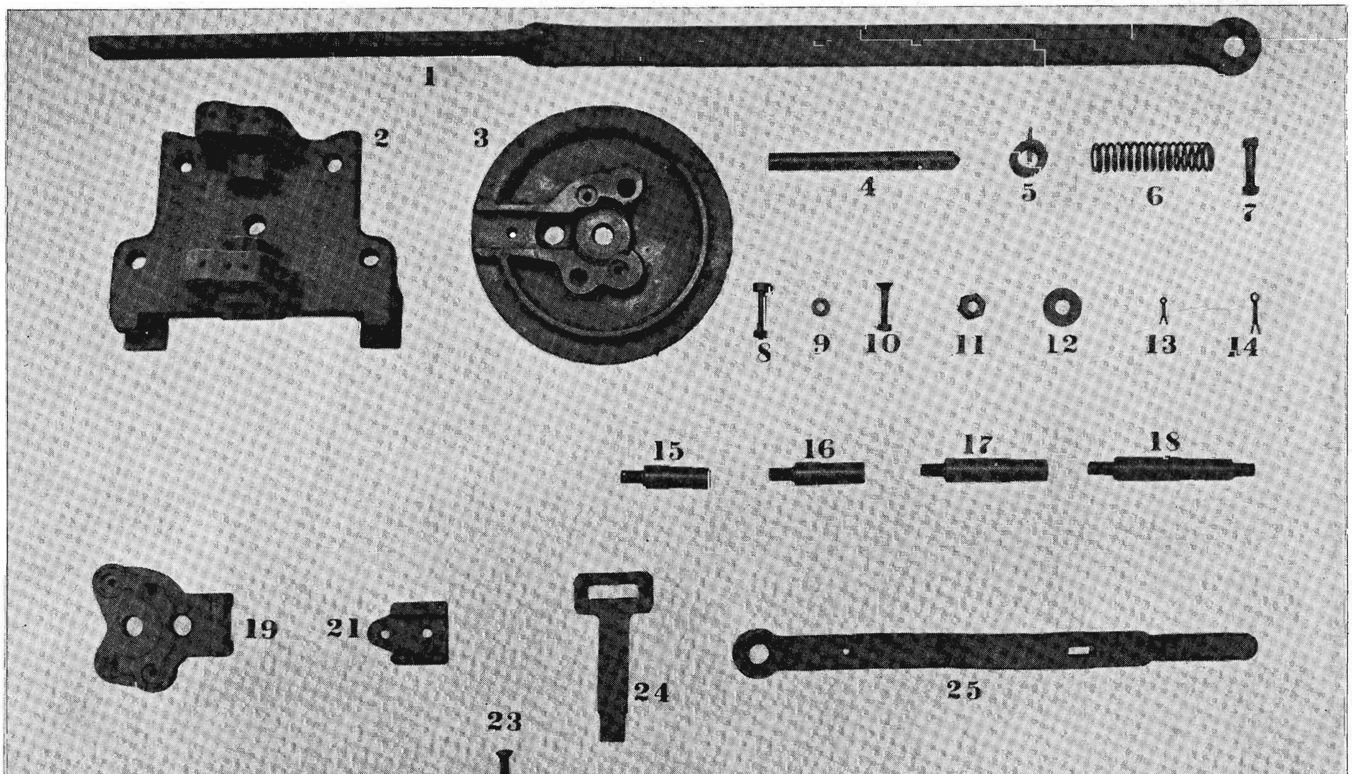
THE Triple Ground Lever is really an interlocking machine, since the Stevens locking is attached to it. It is of great value where one or two switches and one or two signals must be operated, and where it is not desired to maintain a signal man. Its use is recommended at such places as the end of double track and out-lying cross-overs. Since the end of double track is frequently moved, the interlocking device, through the simplicity of its construction, can be moved with it at small expense.

ORDER BY PLATE AND NUMBER.

No.	
1.	BASE.
2.	TOP.
3.	SHAFT, 1¼″ diam.
4.	SET SCREW, ⅜″ x ¾″, for shaft.
5.	LOCKING BAR, ⅜″ x 1¼″.
6. 7.	Two forms of Locking Dog.
8.	RIVET, ¼″ x 1″, for locking dog.
9.	PIN, ½″ x 3″, for fastening lever.
10. 11.	CHAIN, RIVET, for attaching pin No. 9.
12.	BOLT, ⅝″ x 1½″, for fastening top.
13.	LEVER.
14.	RACK.
15.	PINION.
16.	BOLT, ½″ x 1¼″, for pinion.

PLATE 9.





Double Ground Lever.

PLATE 9.

THIS device was designed for throwing a switch or cross-over and distant signals at outlying points on the main line of a railroad, and is of particular value on curves or at other places where the switch lights cannot for any reason be seen.

It is positively interlocked in such a manner that the signals cannot be cleared until the switch is right for the main track, and, conversely, so that the switch cannot be moved from the main track route until the signals have been thrown to danger.

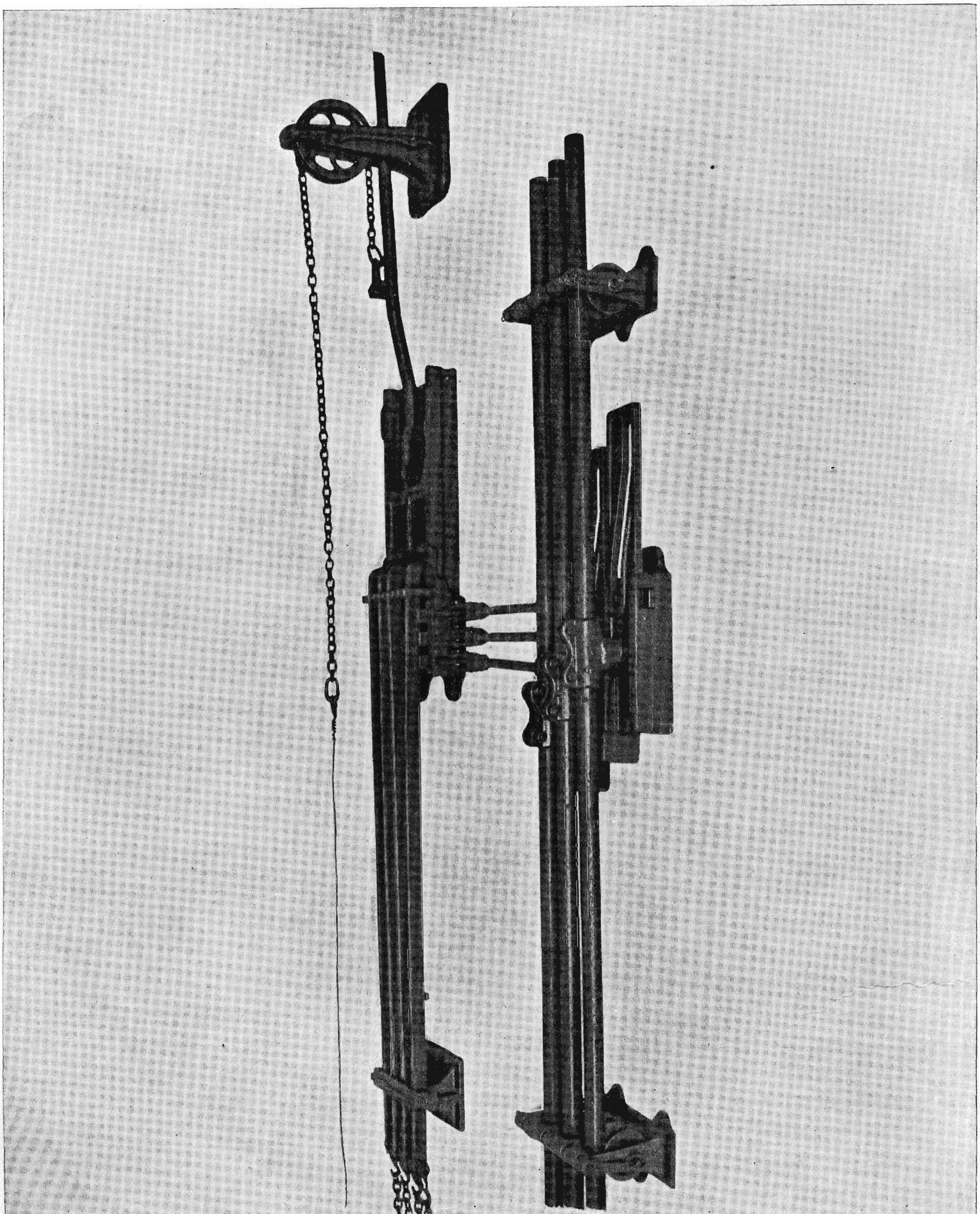
The Double Ground Lever was the forerunner of the Triple Ground Lever, which is illustrated on Plate 8.

ORDER BY PLATE AND NUMBER.

No.

1. Lock Bar, in ordering give length required.
2. Base.
3. Chain Wheel.
4. Locking Pin.
5. Collar and Dowel Pin, for bearing of No. 6.
6. Spring, for No. 4.
7. Bolt and Nut, $\frac{1}{2}''$ x $2\frac{1}{2}''$, for fastening No. 25 to No. 3.
8. Bolt and Nut, cheese head, for filling lock holes in Nos. 3, 19 and 20; this is made in two sizes, $\frac{3}{8}''$ x $2\frac{1}{2}''$, for No. 3; and $\frac{3}{8}''$ x $1\frac{1}{2}''$, for Nos. 19 and 20.
9. Washer, $\frac{3}{8}''$, for Nos. 8 and 10.
10. Bolt and Nut, countersunk head, for filling lock holes in Nos. 3, 19 and 20; this is made in two sizes, $\frac{3}{8}''$ x $2\frac{1}{2}''$, for No. 3; and $\frac{3}{8}''$ x $1\frac{1}{2}''$, for Nos. 19 and 20.
11. Hex Nut.
12. Washer $\frac{3}{4}''$. } For left-hand ends of Nos. 15, 16, 17 and 18.
13. Split Cotter, $\frac{5}{32}''$ x $1\frac{1}{4}''$.
14. Split Cotter, $\frac{7}{32}''$ x $2''$, for right-hand end of No. 18.
15. Stud, for switch rod connection on No. 27; this also helps to join Nos. 19 and 27.
16. Stud, used only when a pipe connection is desired with No. 3.
17. Stud, for joining Nos. 2, 19 (or 20), and No. 27.
18. Stud, for joining Nos. 2, 3 and 25.
19. Switch Lever Casting, this is fastened to No. 2, and is used in connection with No. 27.
20. Switch Lever Casting, this is fastened to No. 2, and is used in connection with a separate ground lever, in which case No. 27 is not provided.
21. Clip, used with No. 20, when the separate ground lever is of flat iron.
22. Clip, used with No. 20, when the separate ground lever is of round iron.
23. Rivet, for fastening No. 21 or No. 22 to No. 20.
24. Cross Arm, for No. 25.
25. Signal Lever.
26. Staple.
27. Switch Lever.

PLATE 10.



Standard Selector.

PLATE 10.

THIS is the Union Switch & Signal Company's Standard Selector, and is the result of ten years' practical experience in the manufacture of interlocking material. The three pipes shown in the foreground are the ones which operate the three switches that control the action of the selector. The motion is transferred from the switch pipes through the trunnions, the motion plates, etc., to the selector itself, the rods in the selector being thrown out of engagement by dogs which are attached to the driving bar; three of these dogs are plainly shown against the nearest hook bar.

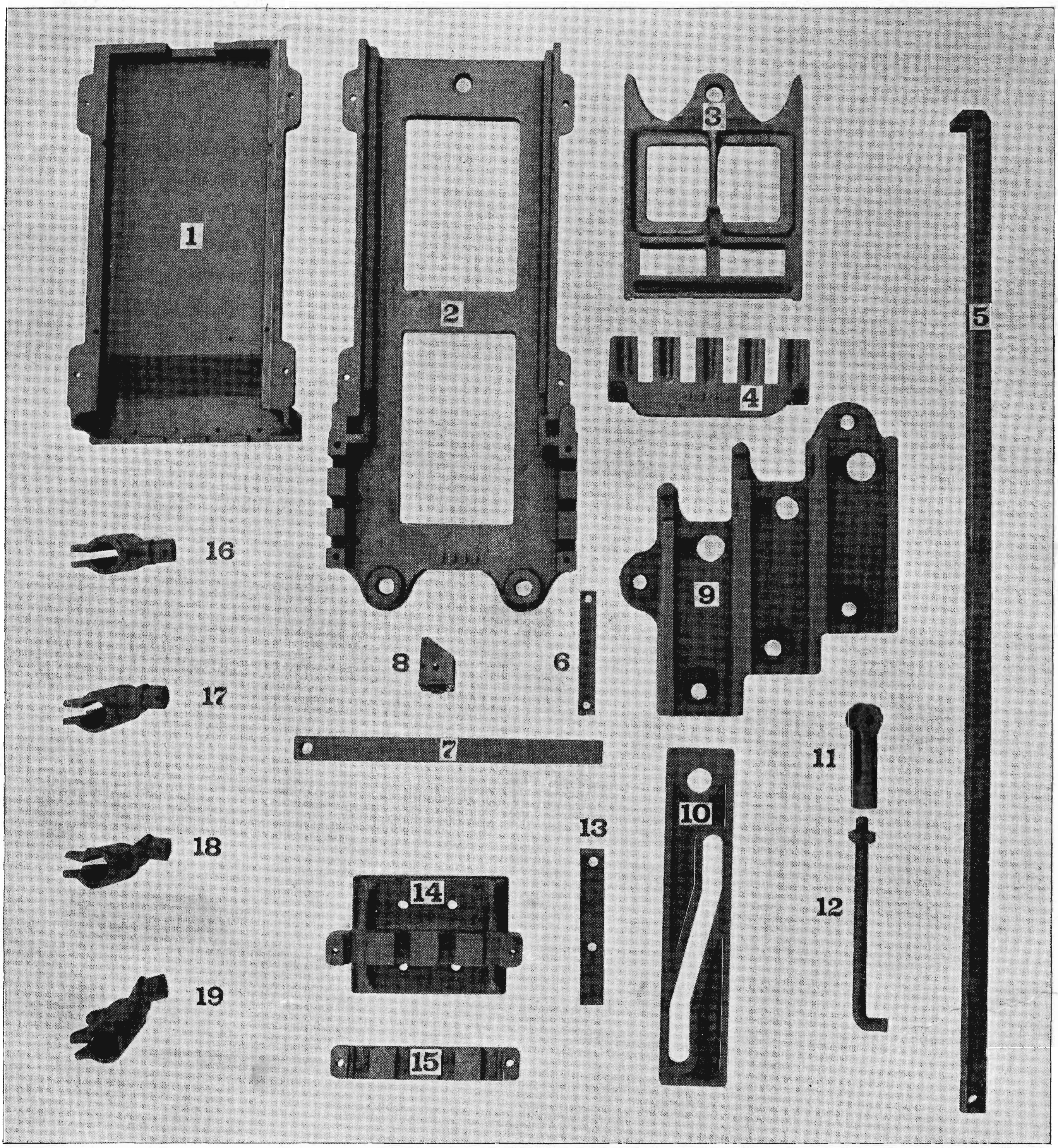
The selector itself is shown without the cover, which in practice is placed upon it, and prevents the escape of the hook bar from the slide plate when the latter is reversed.

The selector may be made in any size, although it is not usual to make them larger than an 8-way.

It is well to note that a selector is known always by the number of switches which are connected with it, and not by the number of hook bars. The selector shown on the opposite page is known as a 3-way selector.

A detailed list of the parts will be found upon the next page.

PLATE 11.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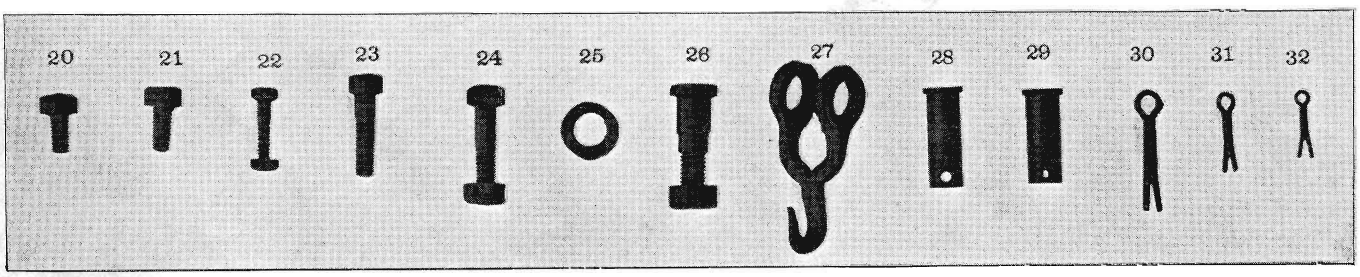
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Standard Selector.

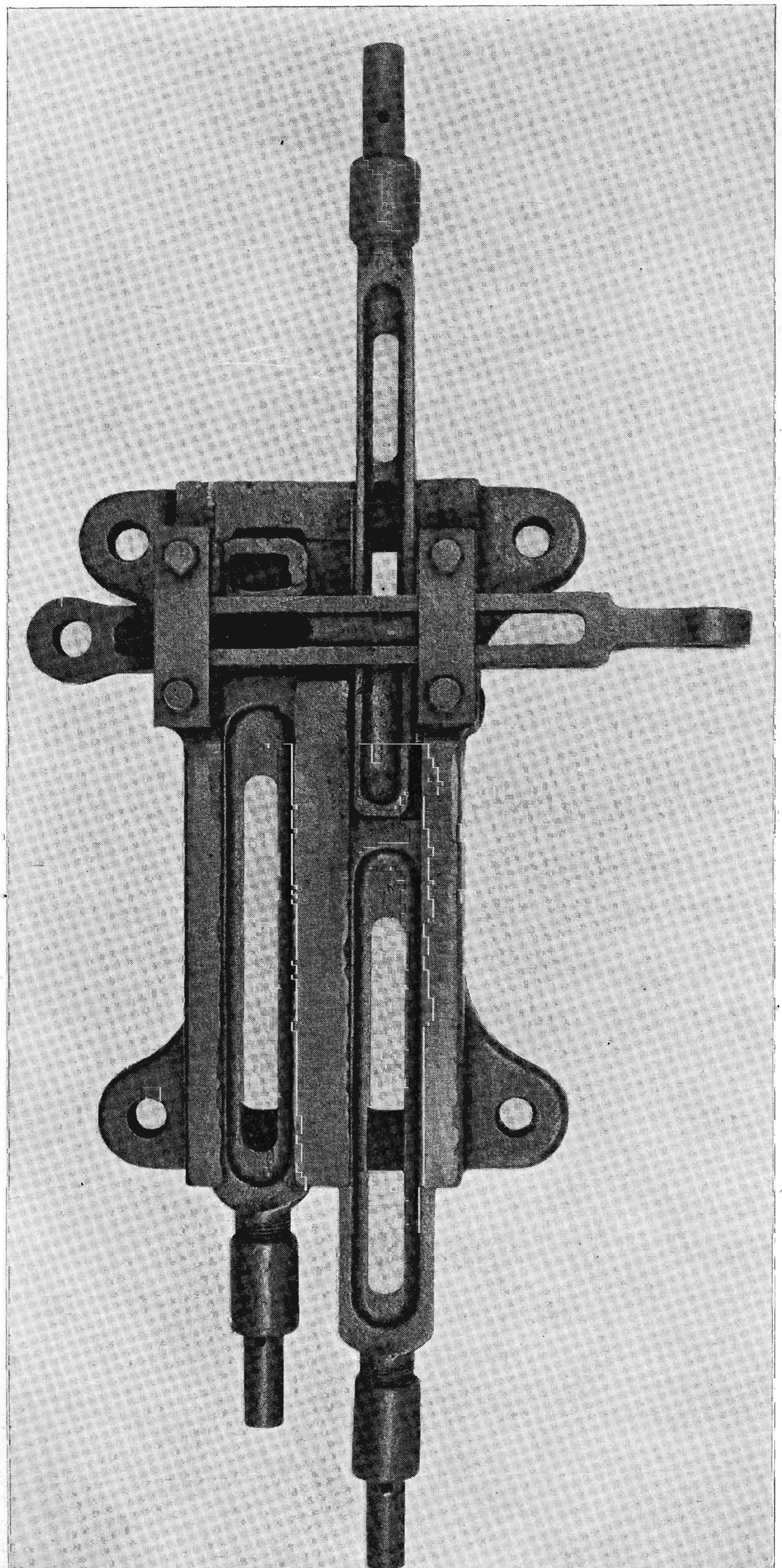
PLATE 11.

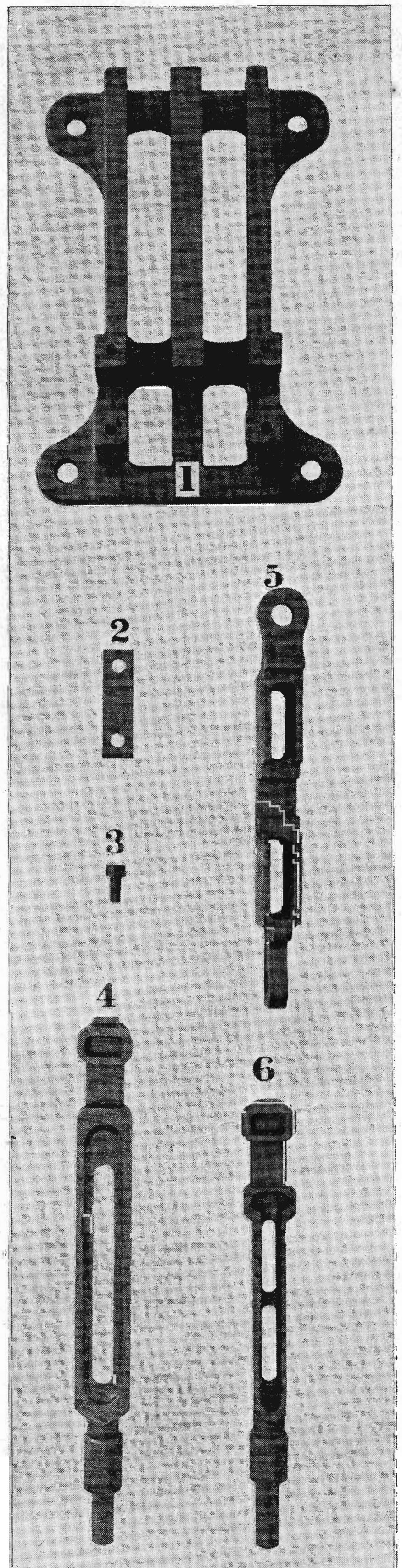
A SELECTOR is known by the number of switches which are connected with it. Not by the number of hook bars.

ORDER BY PLATE AND NUMBER.

No.

1. Cover.—Made in different sizes, 3-way is shown.
2. Selector Base —Made in different sizes, 3-way is shown.
3. Slide Plate.—Made in different sizes, 3-way is shown.
4. Guide.—Made to suit selector base.
5. Hook Bar.
6. Outside Strip for Base.—Made in different sizes, 3-way is shown.
7. Motion Bar.—Made to suit the width of base.
8. Selector Dog.
9. Motion Plate Base.—Made in sizes 1, 2, 3 and 4-ways; a 3-way is shown.
10. Motion Plate.
11. Malleable Iron Screw Jaw.
12. Hook Bolt.—In ordering for repairs, state the length required.
13. Driving Bar for Motion Plate.
14. Hook Bar Stand.—Made in different sizes.
15. Cap for Hook Bar Stand.—Made to suit No. 14.
16. Trunnion, Straight.
17. Trunnion, ½″ offset.
18. Trunnion, 1″ offset.
19. Trunnion, 1½″ offset.
20. Tap Bolt, ⅜″ x ⅝″, for selector dog.
21. Tap Bolt, ⅜″ x ¾″, for outside strip.
22. Bolt and Nut, ¼″ x 1⅛″, for cover.
23. Tap Bolt, ⅜″ x 1½″, for hook bar stand.
24. Bolt and Nut, ⅜″ x 1¾″, for trunnions.
25. Steel Roller, 1″ x ⅝″, for motion bar.
26. Roller Pin and Nut, ⅝″ diam., for steel roller.
27. Shackle Hook.
28. Pin, ⅝″ x 1⅞″, for shackle hook.
29. Pin, ⅝″ x 1¾″, for screw jaw.
30. Split Cotter, $\frac{3}{16}$″ x 1½″, for trunnion.
31. Split Cotter, ⅛″ x 1¼″, for ⅝″ pins.
32. Split Cotter, $\frac{3}{32}$″ x ⅞″, for steel roller pin.

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Pipe Selector.

PLATE 12.

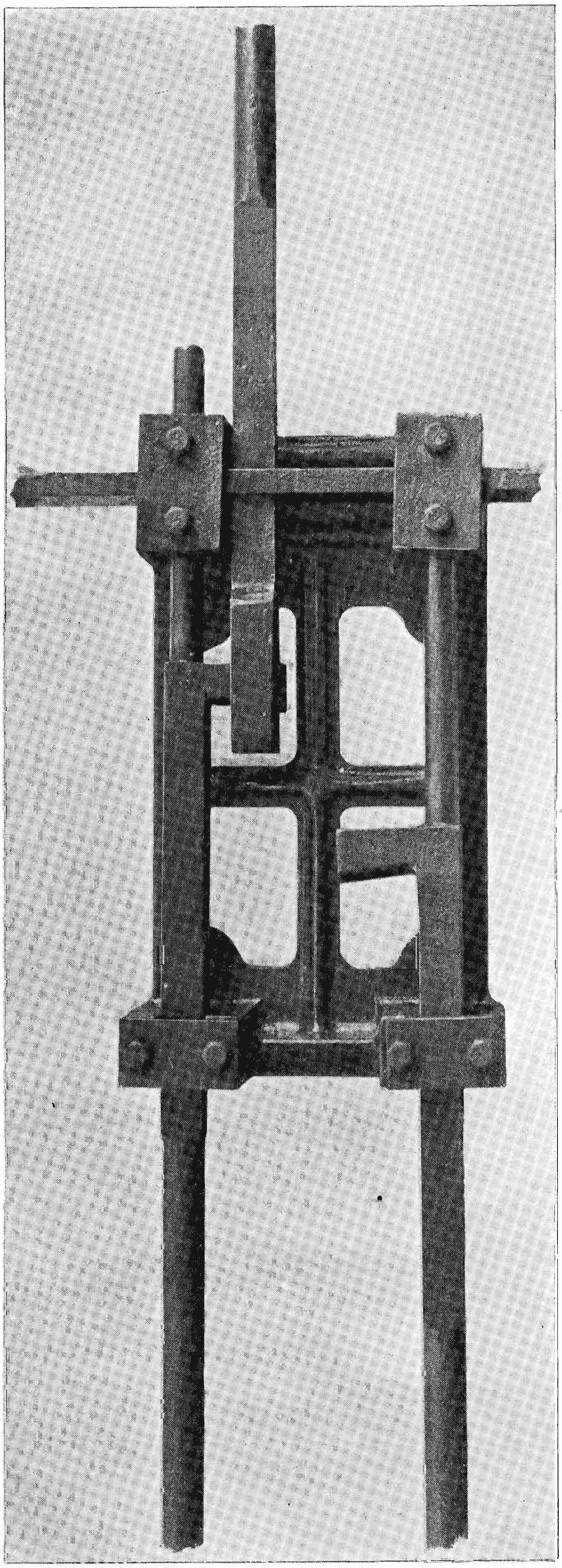
THIS selector is the one usually employed when home signals are operated by pipe. It is, as the illustration shows, an extremely simple affair and is in addition very reliable. It is usually placed immediately opposite the switch that is concerned in the combination, and since the switch bar of the selector is then connected directly with the lock rod of the switch, when either of its bars are reversed, the selector locks its other bar and the switch positively. One of these bars is shown in its reversed position.

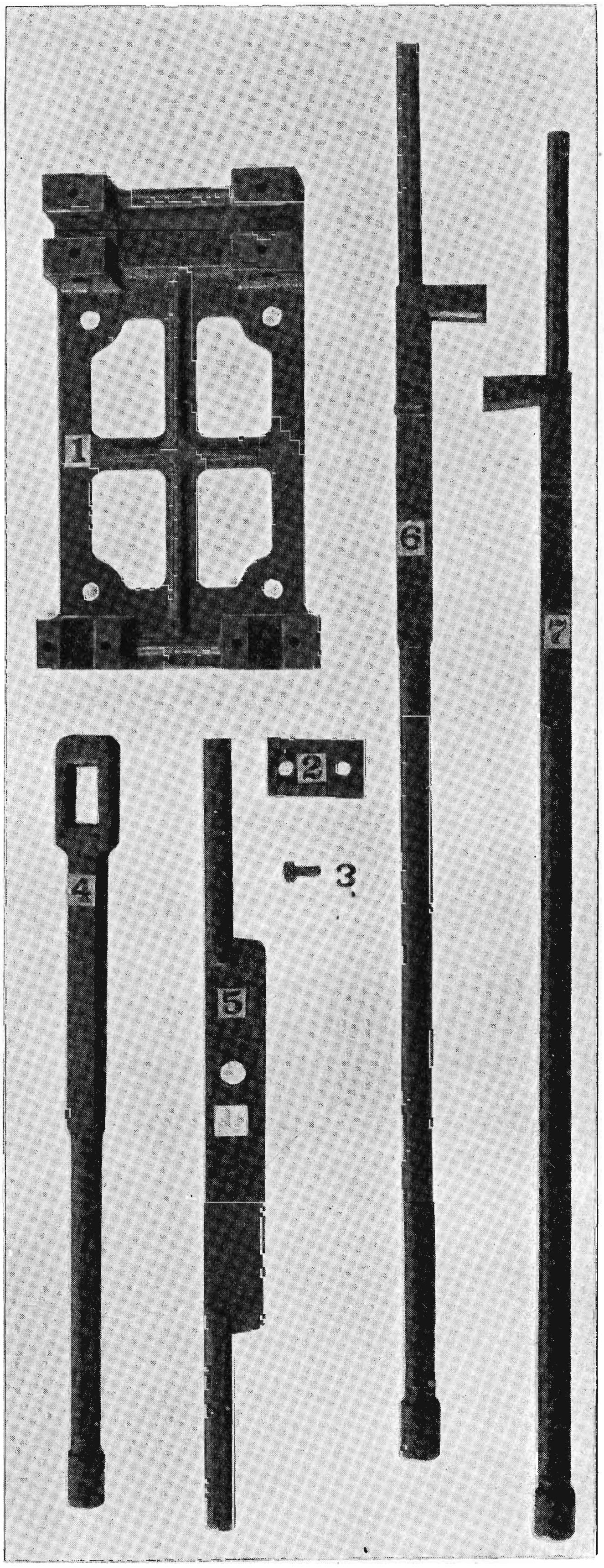
ORDER BY PLATE AND NUMBER.

No.

1. BASE.
2. CAP.
3. TAP BOLT, ½″ x ⅞″, for fastening cap No. 2.
4. SIGNAL BAR.
5. SWITCH BAR.
6. DRIVING BAR.

PLATE 13.





Hook Gear.

PLATE 13.

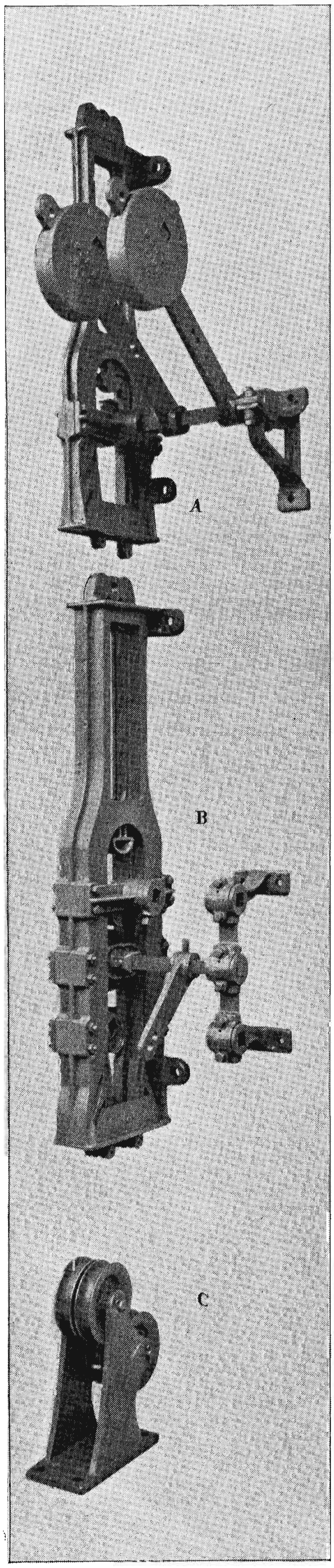
THE hook gear is really a one-way pipe selector, and has one feature of particular importance, which is the locking arrangement for the switch. The shifting bar of the hook gear is a continuation of the lock rod of the switch, and by referring to the cut on the opposite page it will be seen that the hook bars, as shown by the one on the left-hand, have their ends formed of round iron, which when one of them is reversed projects through the shifting bar and accomplishes the same purpose as a facing point lock. The advantage of this arrangement will be readily seen, since it secures an independent locking of the switch.

ORDER BY PLATE AND NUMBER.

No.

1. Base.
2. Corner Plate. (This is made in two sizes; specify which is needed.)
3. Tap Bolt, ½″ x 1″, for corner plate.
4. Engaging Bar.
5. Shifting Bar.
6. Right-Hand Hook Bar.
7. Left-Hand Hook Bar.

PLATE 14.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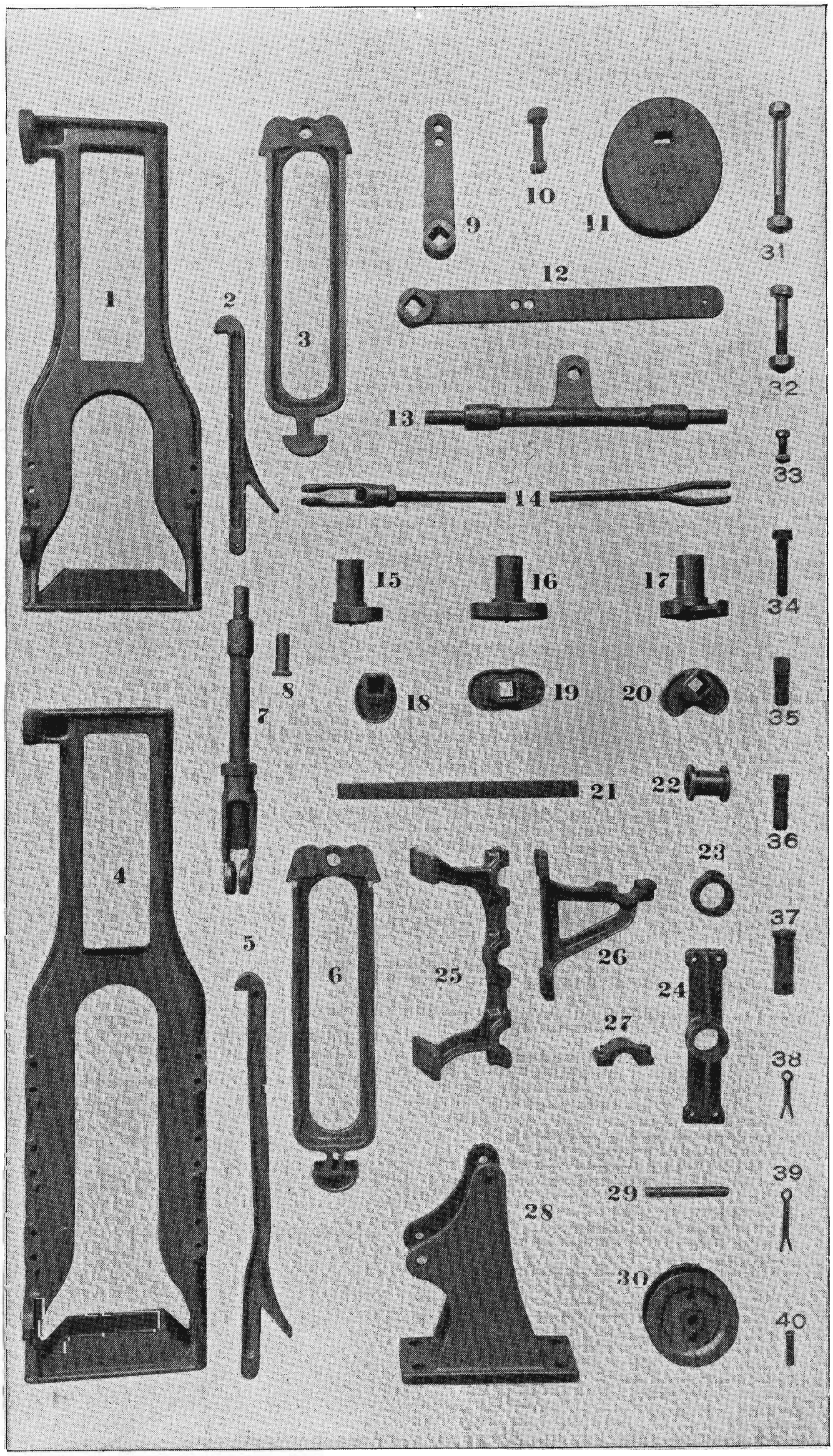
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The Cabin Selector.

PLATE 14.

THIS selector is a recent invention, and, although until now it has not been placed upon the market, it has received conclusive tests which prove that it is designed according to correct principles. For two years several of them have been in use upon one of the most important railroads in the country, where we have closely watched its operation. We have now secured the sole right to manufacture this desirable addition to interlocking devices, which is the invention of Mr. C. A. Christofferson, foreman of interlocking on the C., C., C. & St. L. R'y.

It is intended to be placed in the cabin directly under the signal lever, which is connected with the slide plates (Nos. 3 and 6) by the screw jaw (No. 7). The hooks (Nos. 2 and 5) are contained in their respective frames (Nos. 1 and 4); the shaft (No. 21) runs parallel with the long axis of the interlocking machine, and has mounted upon it, first, the arms (Nos. 9 and 12) which form the connections with the switch levers that govern the action of the selector, and, second, the cams (Nos. 15, 16, 17, 18, 19 and 20), which when revolved by the motion of the shaft disengage the several hooks from or permits their engagement with the slide plate.

The use of this selector greatly simplifies the arrangement of the lead out in complicated plants, and does away with the necessity, so frequently found now, of inserting bell cranks or rocking shafts amongst the wire lines at the ends of a machine.

A. 1-Way Selector.—This selector is fitted up to show the manner of connecting more than one switch with a single shaft; it is done by running a piece of chain from each of the weighted arms to the corresponding switch lever. The weighted arms are here shown raised up in the position they would occupy were one of the switch levers, with which they are connected, reversed.

B. 3-Way Selector.—Here only one shaft is shown, in order that the side of the selector may be more clearly seen. This form is also used as a 2-way selector, by abandoning one of the shafts.

C. Vertical Wheel.—This is shown in the position that it occupies under the selector when placed in the cabin; it is also made with two wheels for the 1-way selector.

A list of the separate parts will be found upon the next page.

ORDER BY PLATE AND NUMBER.

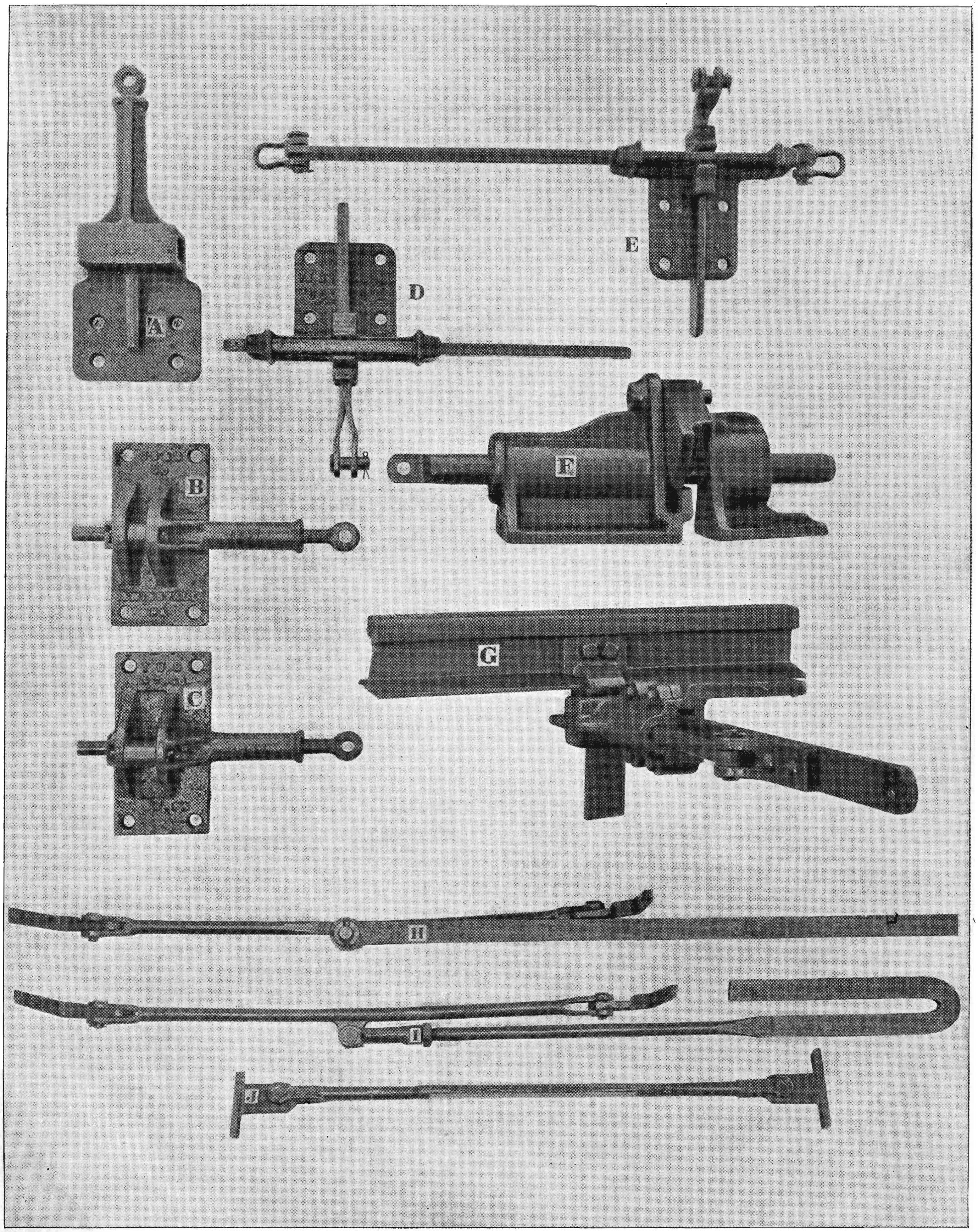
No.

1. FRAME. } For Fig. A.
2. HOOK. } For Fig. A.
3. SLIDE PLATE. } For Fig. A.
4. FRAME. } For Fig. B.
5. HOOK. } For Fig. B.
6. SLIDE PLATE. } For Fig. B.
7. STANDARD SCREW JAW, for joining Nos. 3 and 6 to the interlocking lever.
8. TURNED PIN, 7/8" x 2 3/8" for No. 7.
9. SHORT ARM, for rigid connection with switch lever.
10. BOLT AND NUT, 5/8" x 3 1/2" for No. 11.
11. WEIGHT, for No. 12. This is usually furnished 14 lbs., but may be heavier if desired.
12. LONG ARM, for chain connection with switch lever.
13. PIPE LUG, for switch lever connection, 5/8" hole in the lug. This is sometimes made with two lugs.
14. CONNECTING LINK, for joining Nos. 9 and 13. This is made in different lengths to suit the connection; the two pieces are joined by 3/4" pipe, to which they are welded.
15. SINGLE CAM. } With journals.
16. DOUBLE CAM. } With journals.
17. RIGHT ANGLE CAM. } With journals.
18. SINGLE CAM. } Without journals.
19. DOUBLE CAM. } Without journals.
20. RIGHT ANGLE CAM. } Without journals.
21. SQUARE STEEL SHAFT.
22. JOURNAL, for No. 21.
23. COLLAR. } For Nos. 15, 16 and 17.
24. BEARING. } For Nos. 15, 16 and 17.
25. 3-WAY BRACKET.
26. 1-WAY BRACKET.
27. CAP, for Nos. 25 and 26.
28. VERTICAL WHEEL STAND, for 3-way selector. See description of Fig. C.
29. ROD, for Nos. 28 and 30.
30. WHEEL, for No. 28.
31. BOLT AND NUT, 3/8" x 3 3/4", for fastening No. 24 to No. 4.
32. BOLT AND NUT, 3/8" x 2 1/2", for fastening No. 24 to No. 1, and for fastening No. 27 to Nos. 25 and 26.
33. BOLT AND NUT, 1/4" x 3/4", for end of No. 12.
34. TAP BOLT, 3/8" x 1 1/2", for fastening No. 27 to No. 25 at inside holes on the ends
35. SET SCREW, 1/2" x 1", for Nos. 9, 12, 18, 19 and 20.
36. SET SCREW, 1/2" x 1 1/4", for Nos. 15, 16, 17 and 23.
37. TURNED PIN, 5/8" x 1 3/4", for jaws on No. 14.
38. SPLIT COTTER, 5/32" x 1 1/4", for Nos. 29 and 37.
39. SPLIT COTTER, 5/32" x 1 1/2" for No. 8.
40. RIVET, 1", for Nos. 2 and 5.

PATENTS RELATING TO MECHANICAL INTERLOCKING.—(Continued from Page 19.)

NAME.	DATE.	NUMBER.
J. T. HAMBAY,	November 17, 1885,	330,395
F. S. GUERBER,	November 17, 1885,	330,832
J. T. HAMBAY,	January 5, 1886,	333,852
H. F. COX,	February 23, 1886,	336,701
H. F. COX,	February 23, 1886,	336,702
A. G. CUMMINGS,	April 20, 1886,	340,489
A. G. CUMMINGS,	April 20, 1886,	340,490
J. T. HAMBAY,	June 1, 1886,	342,907
V. SPICER and J. SCHREUDER,	July 27, 1886,	346,387
C. H. JACKSON,	August 17, 1886,	347,608
J. T. HAMBAY,	April 19, 1887,	361,510
A. G. CUMMINGS,	April 19, 1887,	361,617
A. G. CUMMINGS,	September 27, 1887,	370,453
J. SCHREUDER and V. SPICER,	November 1, 1887,	372,569
V. SPICER and J. SCHREUDER,	November 1, 1887,	372,578
J. G. SCHREUDER,	August 7, 1888,	387,452
G. D. FOWLE,	September 18, 1888,	389,558
J. T. HAMBAY,	November 27, 1888,	393,557
J. T. HAMBAY,	March 19, 1889,	399,888
J. T. HAMBAY,	March 19, 1889,	399,889
J. G. SCHREUDER,	June 18, 1889,	405,682
J. T. HAMBAY,	July 2, 1889,	406,211
J. T. HAMBAY,	July 2, 1889,	406,212
J. T. HAMBAY,	July 2, 1889,	406,213
J. W. HANCOCK,	July 9, 1889,	406,836
J. T. HAMBAY,	August 6, 1889,	408,616
J. T. HAMBAY,	October 1, 1889,	412,178
J. T. HAMBAY,	November 12, 1889,	414,862
J. T. HAMBAY,	November 12, 1889,	415,168
J. T. HAMBAY,	December 3, 1889,	416,162
J. T. HAMBAY,	December 10, 1889,	416,783
J. T. HAMBAY,	December 10, 1889,	417,177
G. KOENIG and S. H. STUPAKOFF,	April 1, 1890,	424,485
J. T. HAMBAY,	June 3, 1890,	429,193
W. M. GRAFTON,	July 8, 1890,	431,888
G. KOENIG and S. H. STUPAKOFF,	September 16, 1890,	436,360
J. T. HAMBAY,	October 21, 1890,	439,063
J. T. HAMBAY,	August 4, 1891,	456,952
S. LLOYD WIEGAND,	October 27, 1891,	461,970
J. J. TURNER,	March 1, 1892,	470,148
J. J. TURNER,	July 19, 1892,	479,230
J. J. TURNER,	July 19, 1892,	479,380
S. H. STUPAKOFF,	November 15, 1892,	486,303
S. H. STUPAKOFF,	May 16, 1893,	497,733
J. G. SCHREUDER,	February 27, 1894,	515,722

AND OTHERS.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J

Facing Point, Bridge and Bolt Locks.

PLATE 15.

ON THIS page are shown several forms of plunger locks and bolt locks:

A. STANDARD OUTSIDE FACING POINT LOCK.—It is used in connection with lock bars H and I, near the bottom of the page. When the casting is placed on the tie as shown in the illustration, the curved bar is used. When the casting A is turned upside down, the opening lies below the rail, and the straight bar is used.

B. SINGLE INSIDE FACING POINT LOCK.—This is used in connection with J, shown at the bottom of the page.

C. DOUBLE INSIDE FACING POINT LOCK.—This has a wider opening than B, but is otherwise just like it; with C it is possible to lock the rods connected with two pairs of points, such as in the case of a double; slip or a movable frog; it is usually placed in the middle of the track.

D. PIPE BOLT-LOCK.—It is used in connection with a double point switch and lock movement, when the home signal governing the movement of trains is operated by a line of pipe. D is also made as a 2-way.

E. WIRE BOLT-LOCK.—This is constructed on the same principle as D, but is intended for use only when the home signal is operated by wire. It is somewhat lighter in all its parts than D, and the signal connection has a greater stroke. It is made as a 1, 2 or 3-way; a 1-way is shown.

F. GRAVITY BRIDGE LOCK.—F not only locks the draw when it is closed, but locks itself as soon as the draw has moved. The casting on which the letter F is shown is usually placed upon the drawbridge, and the other casting upon the abutment. A stud, which projects from the top of the abutment casting, holds the swinging dog away from the end of the plunger when the draw is closed, but when the draw is open this same stud, being removed from its previous position, permits the lock-casting to fall in front of the plunger. The automatic locking of the plunger when it is withdrawn holds all of the other levers on the drawbridge in their normal position, through the interlocking on the machine. The plunger is unusually heavy, and the whole device forms an extremely strong bridge lock.

PLATE 15.

G. RAIL LOCK.—Like F, it is intended for use upon draw bridges. Most modern swing-bridges are provided with mechanism for raising the rails at the ends of the draw before opening it, and in order that every possible check should be provided for the safe operation of the interlocking mechanism, this device was designed. A hole is drilled in the plate that projects downward from the rail, which, when the rails are lowered and resting on their bases, permits the entrance of the lock plunger. When the rails are raised, the solid face of the plate is brought in front of the lock plunger, and the lever in the cabin is held in its normal position. This device also serves to hold all of the levers in the cabin in their normal position when any movement has taken place in any of the mechanism connected with the draw.

H. One form of lock-bar and front rod for an Outside Facing Point Lock. If desired the lock-bar may be turned back, as on I.

I. This differs from H in the fact that a lug instead of a pin, and a jaw instead of an eye is used for connecting the front rod with the lock-bar; either a screw jaw as shown or a plain wrought jaw may be used, and the lock-bar may be made straight like H if desired. Both H and I are used with A as explained above.

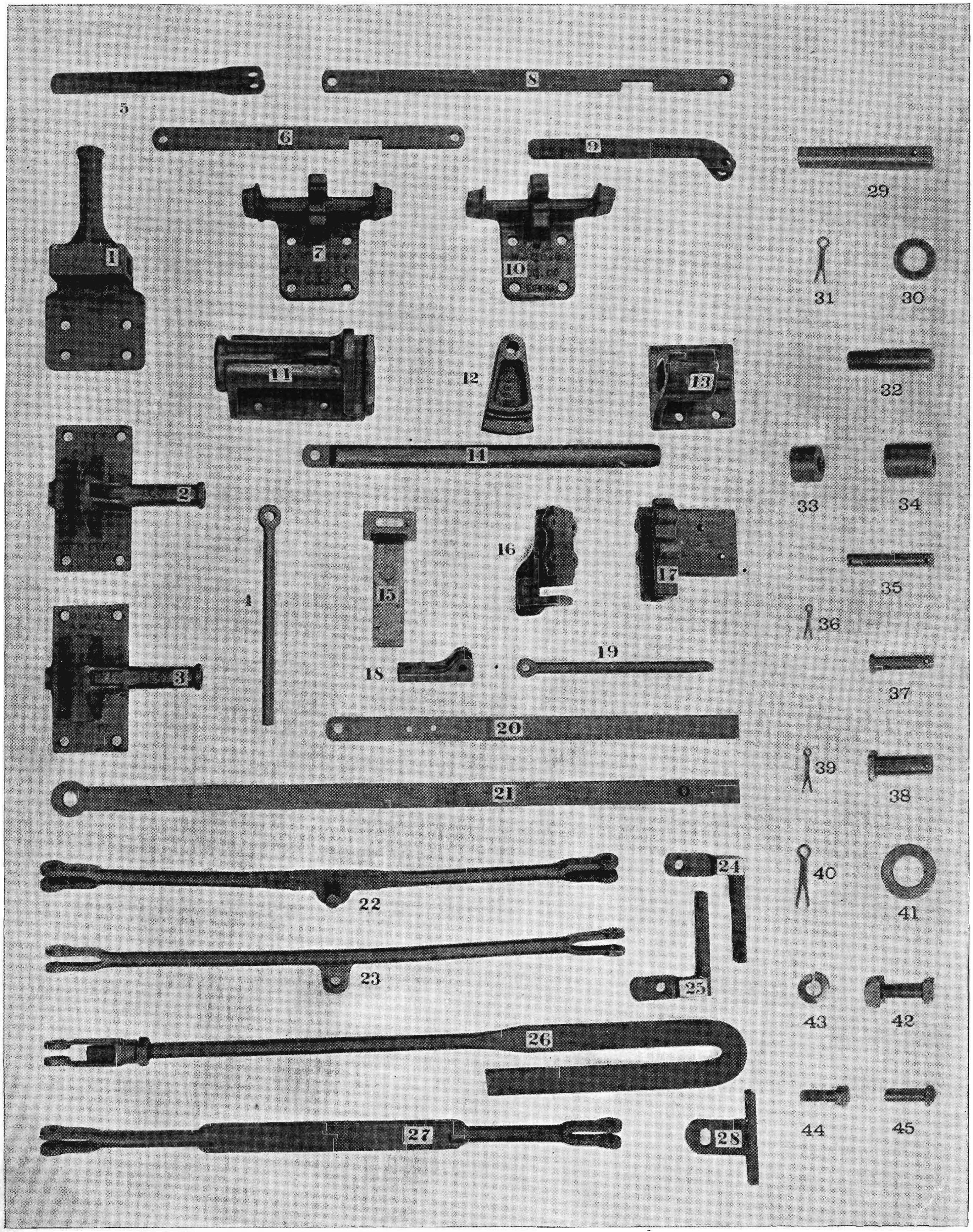
J. ORDINARY COMBINATION FRONT ROD AND LOCK-BAR, which is used in connection with an Inside Facing Point Lock.

A list of the parts will be found upon the following pages.

PLATE 16.

View of tracks and signals in the yard, immediately outside of the Grand Central Station, New York.

This is one of the largest mechanically-controlled plants in the United States.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Facing Point, Bridge and Bolt-Locks.

PLATE 17.

ORDER BY PLATE AND NUMBER.

No.

1. Casting, for Outside Facing Point Lock.
2. Casting, for Single Inside Facing Point Lock.
3. Casting, for Double Inside Facing Point Lock.
4. Plunger, for Facing Point Locks.
5. Switch Bar, for Pipe Bolt Lock.
6. Signal Bar, for Pipe Bolt Lock.
7. Casting, for Pipe Bolt Lock.
8. Signal Bar, for Wire Bolt Lock.
9. Switch Bar, for Wire Bolt Lock.
10. Casting, for Wire Bolt Lock.
11. Bridge Casting, for Bridge Lock.
12. Swing Piece, for Bridge Lock.
13. Abutment Casting, for Bridge Lock.
14. Plunger, for Bridge Lock.
15. Rail Piece, for Rail Lock.
16. Plunger Casting, for Rail Lock.
17. Base, for Rail Lock.
18. Lug, for Rail Lock.
19. Plunger, for Rail Lock.
20. Slide Bar, for Rail Lock.
21. Lock Bar, for Outside Facing Point Lock. (To go with No. 22), this may be bent back like No. 26 if desired.
22. Front Rod, used for outside Facing Point Lock and for Double Point Switch and Lock Movement.
23. Front Rod with Lug, also used for Outside Facing Point Lock.
24. Left-Hand Foot. } These fit both Front Rods Nos. 22 and 23.
25. Right-Hand Foot. }
26. Lock Bar with Screw Jaw.—This is also made with a plain jaw, and is sometimes straight instead of being bent back. To go with No. 23.
27. Combined Front Rod and Lock Bar, for Inside Facing Point Lock.
28. Foot, for No. 27.
29. Pin, 1″ x $5\frac{1}{4}$″, for Bridge Casting No. 11.
30. Washer, Special 1″, for Pin No. 29.
31. Split Cotter, $\frac{3}{16}$″ x $1\frac{1}{2}$″, for Pin No. 29.
32. Stud, 1″ x $3\frac{1}{4}$″, for Abutment Casting No. 13.

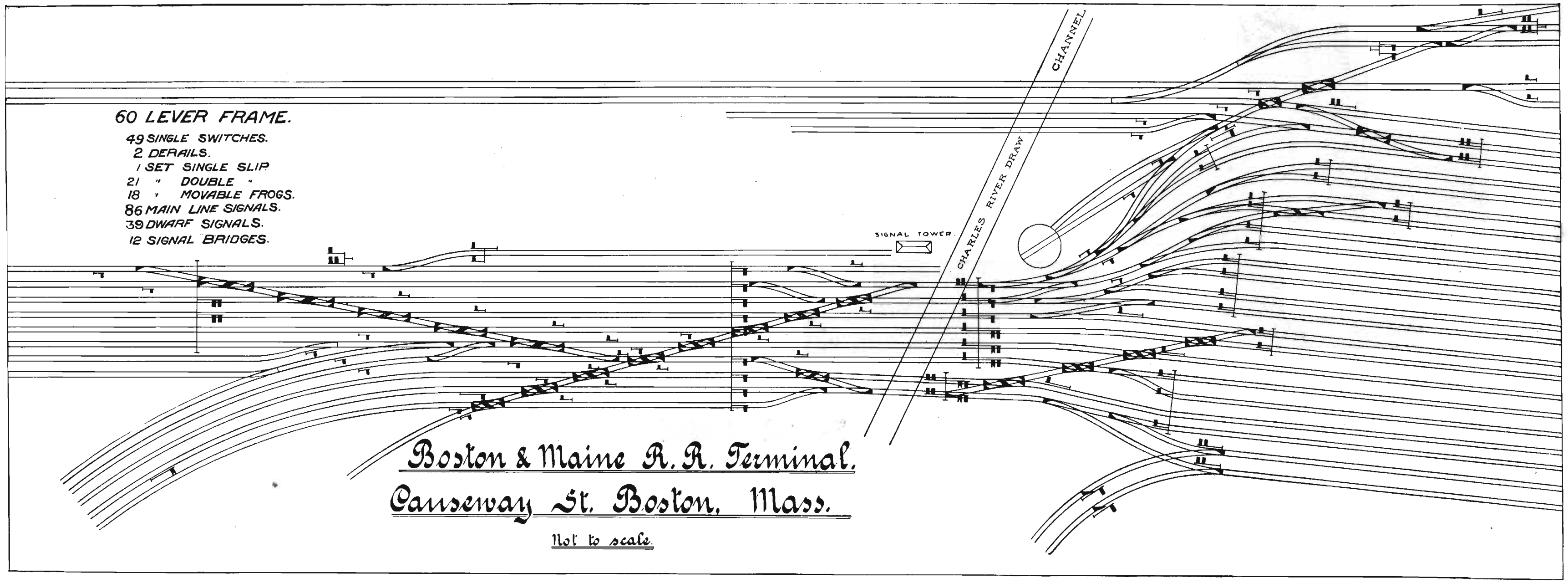
No. **PLATE 17.**

33. ROLLER, 1″ x 1½″, for Single Inside Facing Point Lock.
34. ROLLER, 1⅞″ x 1½″, for Double Inside Facing Point Lock.
35. ROLLER SHAFT, ⅝″ x 3¾″, for single and double Inside Facing Point Locks.
36. SPLIT COTTER, $\frac{3}{16}$″ x 1⅛″, for Roller Shaft No. 35, and for Pin No. 37.
37. PIN, ⅝″ x 2″, for Plunger No. 19.
38. PIN, ⅞″ x 2⅜″, for front rod, jaws and lugs.
39. SPLIT COTTER, $\frac{3}{16}$″ x 1½″, for front rod jaw pin.
40. SPLIT COTTER, $\frac{5}{16}$″ x 2″, for stud on front rod No. 22.
41. WASHER, special 1¼″, for stud on front rod No. 22.
42. BOLT AND NUT, ⅝″ x 2⅜″, for fastening rail piece No. 15, and feet Nos. 24, 25, 28.
43. NUT LOCK, ⅝″, for Bolt and Nut No. 42.
44. TAP BOLT, ½″ x 1½″, for joining Plunger Casting and Base, Nos. 16 and 17.
45. RIVET, ½″ x 1¾″, for fastening Lug No. 18.

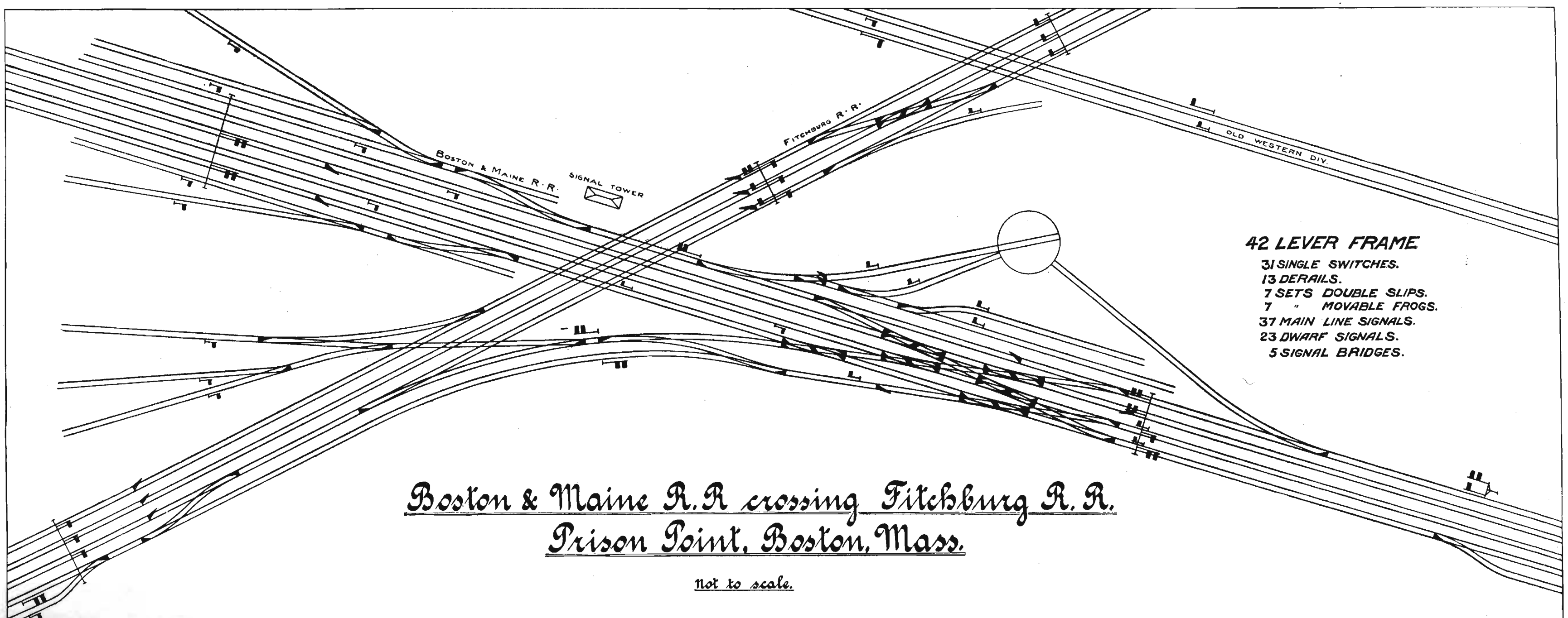
PLATE 18.

Plans of two large systems of tracks that are controlled by Electro-Pneumatic Interlocking Machines.

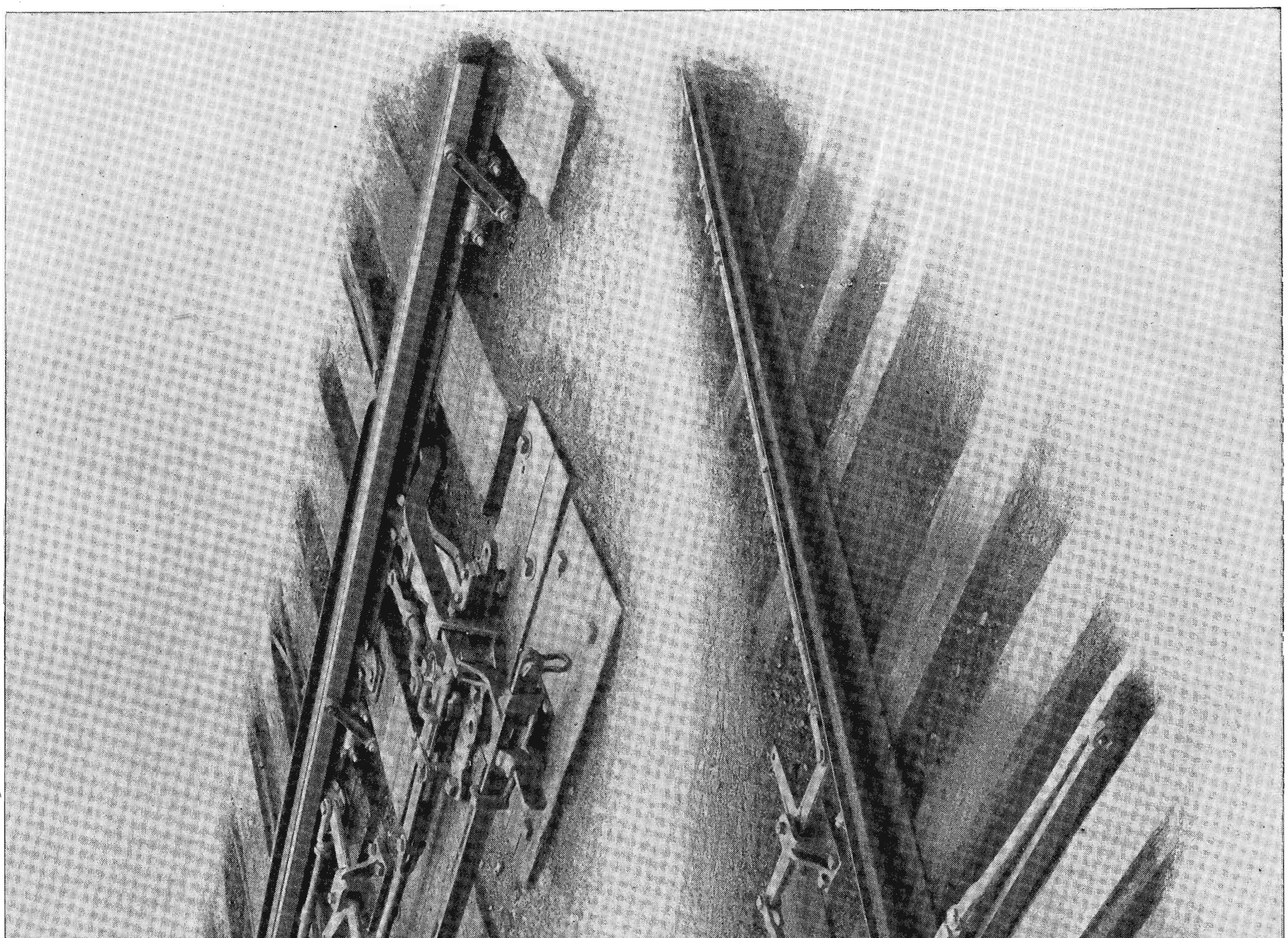
It will be seen that at Causeway Street a large number of switches and signals are entirely separated from the cabin by the Charles River Draw Bridge. This does not interfere with the operation of the plant in any way, for the main air pipe and electric wires are run under water. The machine that is located in the cabin at Causeway Street is illustrated on Plate 126.



Boston & Maine R. R. Terminal.
Causeway St. Boston, Mass.
Not to scale.



Boston & Maine R.R crossing Fitchburg R. R.
Prison Point, Boston, Mass.
Not to scale.



The Double Point Switch and Lock Movement.

PLATE 19.

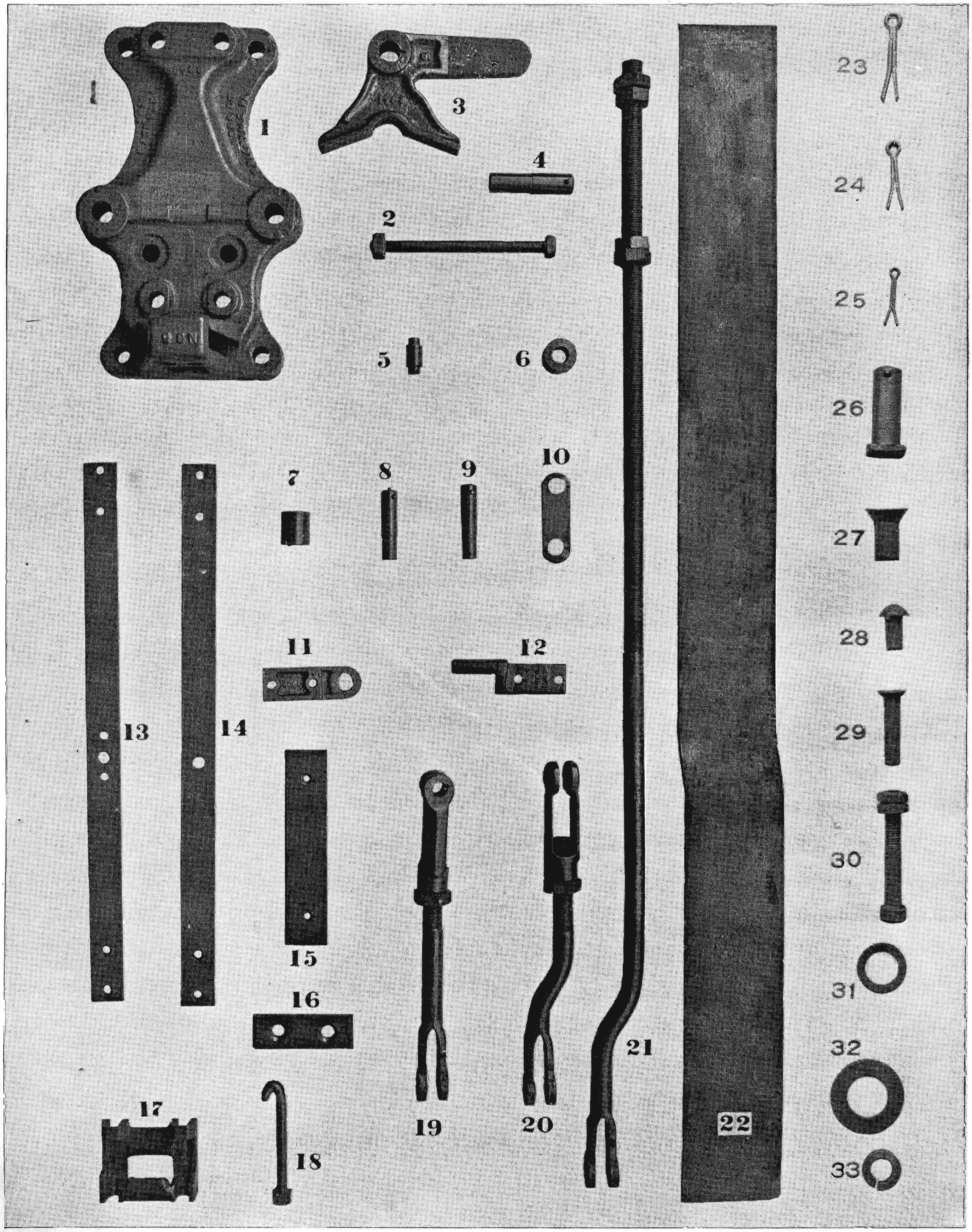
THIS arrangement has now been in constant service for five years during which time we have had no reason for altering our first opinion of it, and we can safely say, when it is properly placed in connection with a pipe or wire bolt lock (Figs. D and E, Plate 15), as on the opposite page, that it is a more reliable device than even a separate facing point lock.

Unless otherwise specified, the numbers referred to in this description are illustrated on Plate 20.

The crank (No. 3), which is pivoted to the base (No. 1), is joined to the switch by the link (No. 20), or the switch rod connection (No. 21); two lock pins (No. 12) are fastened to the slide bars (Nos. 13 and 14), which bear between them the operating roller (No. 6) and are connected with the interlocking lever in the cabin through a T crank, which also serves to connect the detector bar; the lock bar (No. 21, Plate 17) passes from the front rod of the switch through the base (No. 1), and the whole device is mounted upon 4″ x 12″ oak plank framed and bolted to the ties, and held to a fixed distance from the rails by the tie plate (No. 22) to which the rails are rigidly braced.

When the lever in the cabin is in either of its extreme positions, the detector bar is lowered, one of the switch rails presses against the main rail and one of the lock pins projects through the lock bar; a movement of the lever first withdraws the lock pin and at the same time raises the detector bar until, just before reaching the center of the movement, the operating roller strikes against one of the surfaces of the crank and forces it to revolve, carrying the switch and lock bar with it; the last part of the operation is devoted to lowering the detector bar and locking the switch in its new position. The two views upon this plate are taken from different points and show, in addition, that the detector bar may be connected to either end of the movement.

The separate parts of this device are illustrated upon Plate 20.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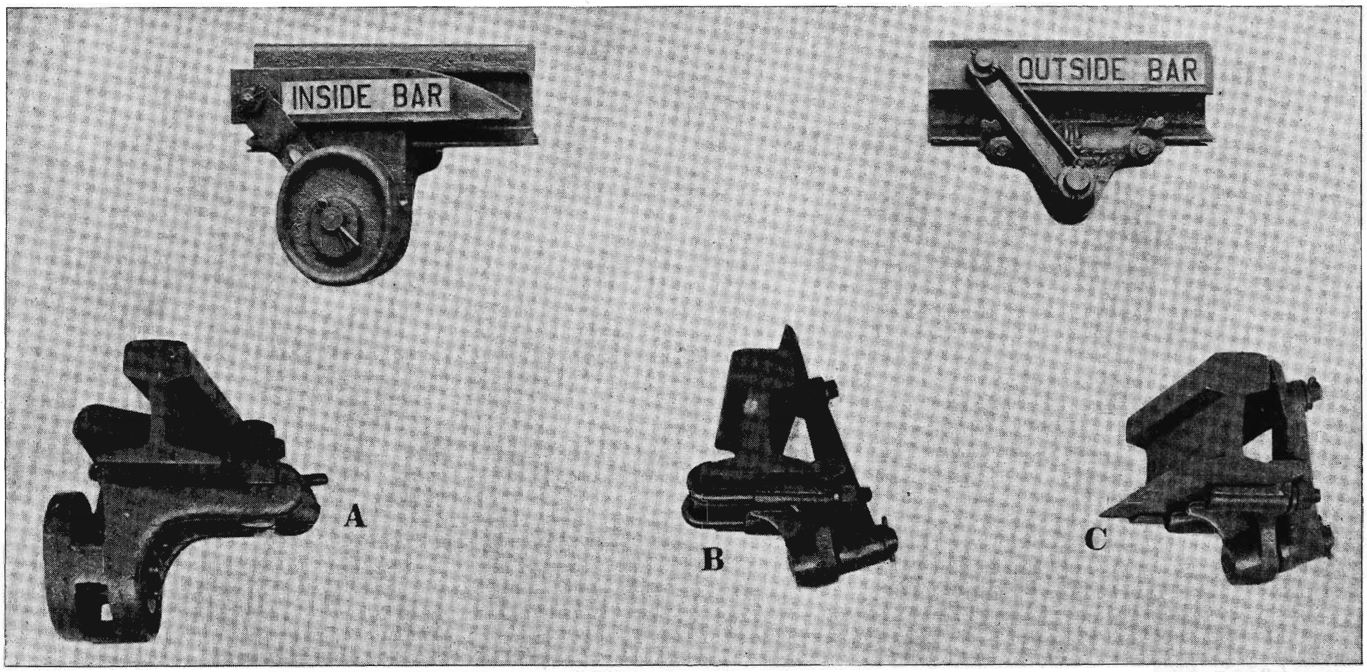
Double Point Switch and Lock Movement.

PLATE 20.

No. **ORDER BY PLATE AND NUMBER.**

1. Base.
2. Bolt and Nut, for fastening No. 1. These bolts are given more particularly on Plate 36.
3. Switch Crank.
4. Stud, for No. 3.
5. Stud, for No. 6.
6. Operating Roller. Bears against No. 3, and is placed between Nos. 13 and 14.
7. Side Roller.
8. Stud, for No. 7. Placed at lower end of No. 1.
9. Stud, for No. 7. Placed at upper end of No. 1.
10. Cap, for No. 9.
11. Lug. Placed at each end of and between Nos. 13 and 14.
12. Lock Pin.
13. Upper Slide Bar.
14. Lower Slide Bar.
15. Strip, for switch rail to slide on. Placed on No. 22.
16. Rail Brace Plate. Placed back of No. 19 (Plate 21), and on top of No. 22.
17. Bracket, for the connecting rod of a derail. Placed on other side of track from derail, and hung to rail by No. 18.
18. Hook Bolt, for No. 17.
19. Adjustable Link, for detector bar connection.
20. Adjustable Link, for switch connection.
21. Adjustable Switch Rod Connection. Intended to be used with device Fig. C (Plate 38), and to take the place of No. 20, as shown here.
22. Tie Plate.
23. Split Cotter, $\frac{9}{32}$" x 2½", for No. 4.
24. Split Cotter, $\frac{5}{32}$" x 1½", for Nos. 8 and 9.
25. Split Cotter, $\frac{3}{16}$" x 1½", for No. 26.
26. Turned Pin, ⅞" x 2⅜", for Nos. 19, 20 and 21.
27. Rivet, ¾" x 1½", for fastening No. 16 to No. 22.
28. Rivet, ½" x 1", for fastening No. 12 to No. 13.
29. Rivet, ½" x 2¼", for joining Nos. 11, 13 and 14 at lower end of slide bars.
30. Bolt and Two Nuts, ½" x 3¼", for joining Nos. 11, 12, 13 and 14 at upper end of slide bars.
31. Washer, 1"–1½", for No. 8.
32. Washer, 1¼"–2¼", for No. 4.
33. Nut Lock, for No. 18.


INSIDE BAR
OUTSIDE BAR
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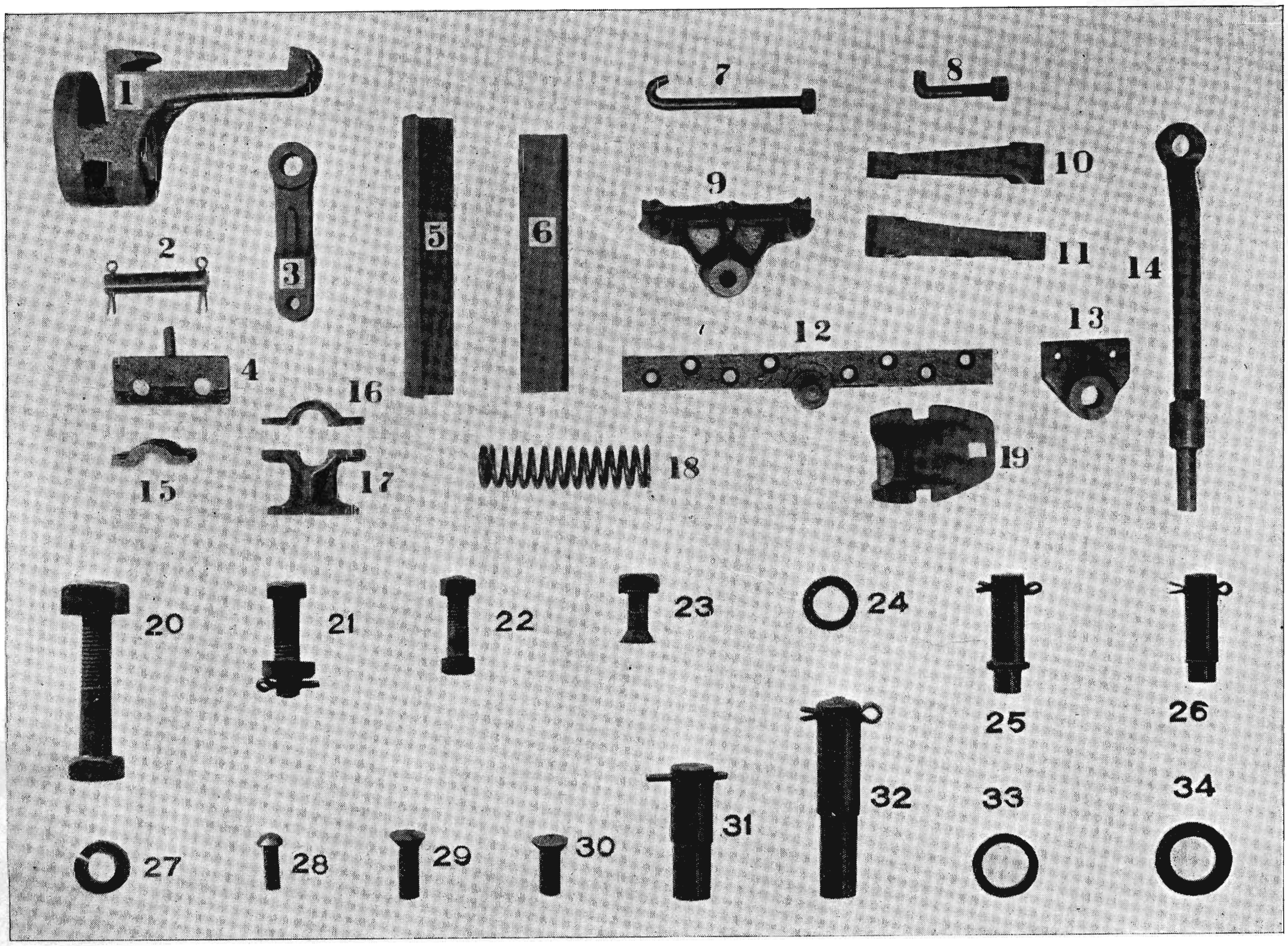
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Detector Bars and Special Rail Brace.

PLATE 21.

A. INSIDE BAR.

B. OUTSIDE BAR WITH LONG HOOK BOLTS.—This is the manner in which the outside bar is usually applied; the bolts are placed under the rail, the nuts screwed up and the thing is done.

C. OUTSIDE BAR WITH SHORT HOOK BOLTS.—When a bar overlaps a switch, and on some other rare occasions, it is found necessary to drill the base of the rail, and the short hook bolt is required.

The principle upon which all of these bars work is the same as will be seen by referring to the two upper figures; the inside bar rises to about the top of the rail when in its middle position, but the outside bar should rise considerably above the top of the rail, not less than $\frac{3}{4}''$. The inside bar is mainly useful at places where the gauge of the track is necessarily much wider than the gauge of the wheels.

We wish particularly to call attention to our special form of rail brace, which was designed for use at detector bars, but which is so extremely light, strong and durable that its use may properly be extended to other places. See No. 19.

ORDER BY PLATE AND NUMBER.

No.

1. BRACKET, for inside bar.
2. PIN, $1'' \times 4\frac{1}{2}''$ AND COTTERS, for No. 1.
3. MALLEABLE LINK, for inside bar; in ordering give height of rail.
4. CLIP, for inside bar.
5. INSIDE DETECTOR BAR, $2\frac{1}{4}'' \times 2\frac{1}{4}''$ angle iron; give length required when ordering.
6. OUTSIDE DETECTOR BAR, beveled edge, $2\frac{1}{4}''$ wide; for mechanical work the bar is made $\frac{3}{8}''$ thick; for pneumatic work the bar is made $\frac{7}{16}''$ thick. In ordering give length required.
7. LONG HOOK BOLT, for outside bar.
8. SHORT HOOK BOLT, for outside bar.
9. BRACKET.
10. MALLEABLE LINK, for mechanical work.
11. MALLEABLE LINK, for pneumatic work.

(Nos. 9–11:) These are for the outside bar and are made in various sizes to suit different sections of rail; therefore, in ordering give the size of rail for which the parts are wanted.

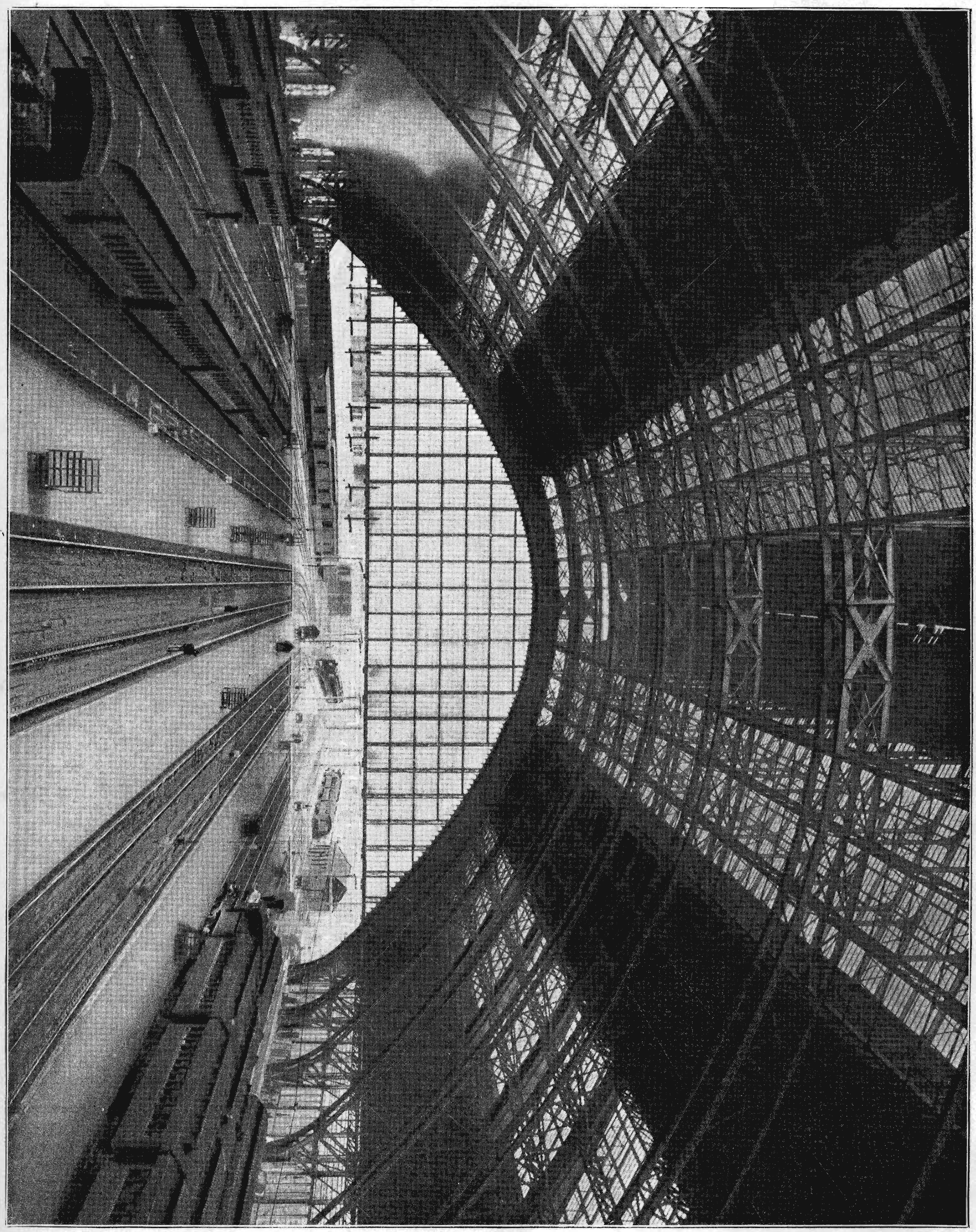
12. COMBINED SPLICE AND DRIVING PIECE, for inside or outside bar. Four of the holes are fitted with bolt No. 23, and four with rivets Nos. 29 and 30.
13. MALLEABLE DRIVING PIECE, for outside bar.
14. EYE ROD, for inside or outside bar.

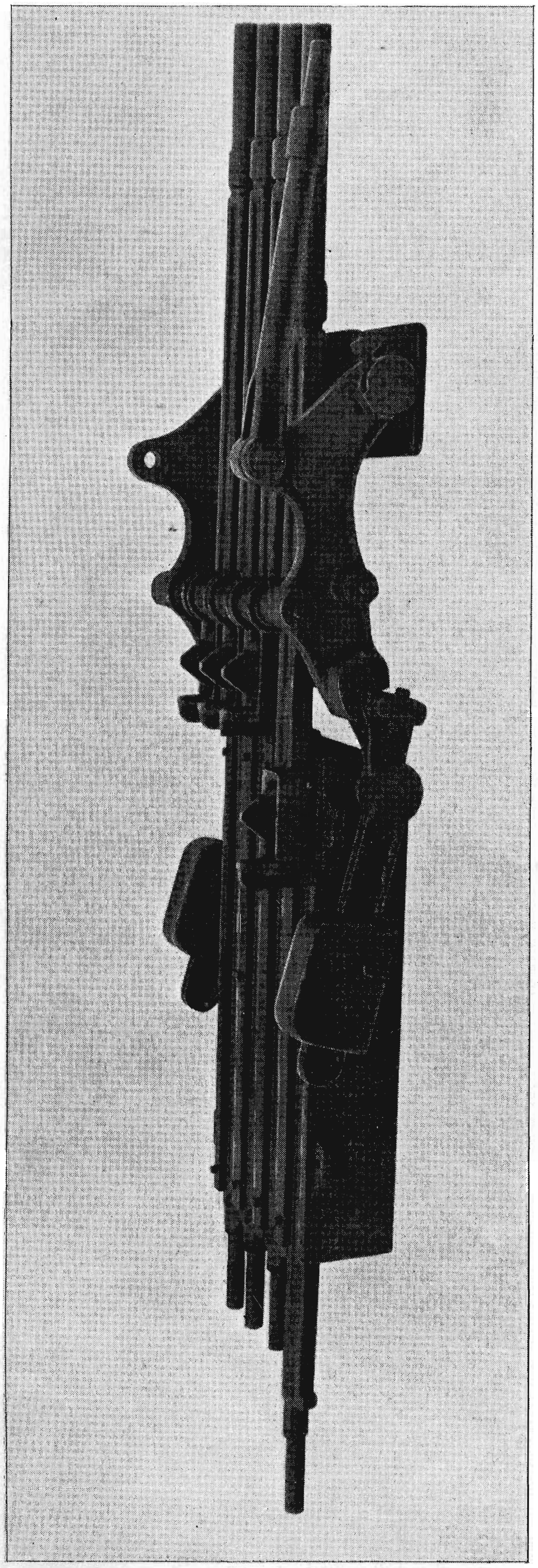
No.

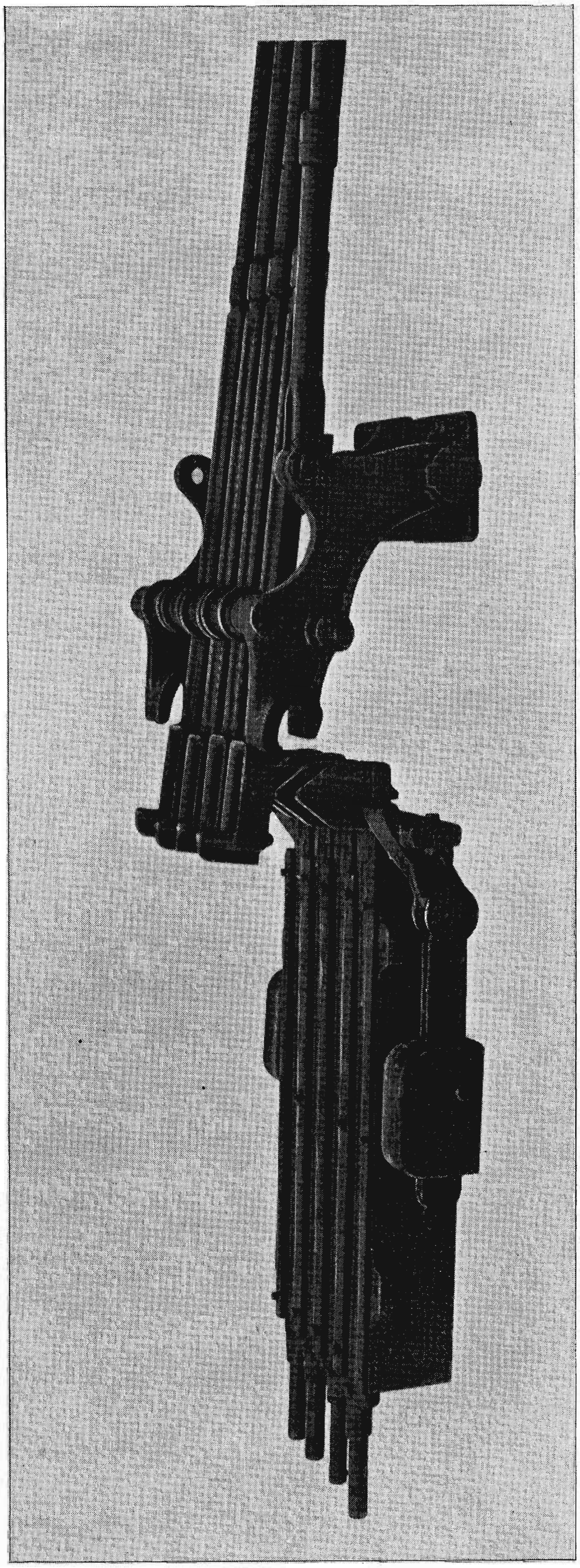
15. Pipe Clamp, for holding spring.
16. Cap, for pipe guide No. 17.
17. Pipe Guide.
18. Spring, for driving the bar.
19. Rail Brace, this is made in many sizes to suit the height of rail, therefore specify in ordering.
20. Bolt and Nut, ¾″ x 4″, for fastening clip No. 4 to base No. 1.
21. Bolt and Nut, ⅝″ x 2¼″, cotter $\frac{3}{16}$″ x 1⅛″, for fastening link No. 3 to bar No. 5.
22. Bolt and Nut, ½″ x 1⅝″, for joining pipe clamps No. 15 and for joining cap No. 16 to guide No. 17.
23. Bolt and Nut, ⅜″ x 2″, for joining one half of splice No. 12 to detector bar.
24. Special Washer, ¾″ diam., for studs Nos. 25 and 26.
25. Upper Stud and Cotter, for pneumatic link No. 11.
26. Upper Stud and Cotter, for mechanical link No. 10.
27. Nut Lock, ⅝″ diam., for hook bolts Nos. 7 and 8.
28. Soft Iron Rivet, $\frac{5}{16}$″ x 1½″, for fastening driving piece No. 13 to bar.
29. Soft Iron Rivet, ⅜″ x 1⅝″, for fastening one half of No. 12 to bar in pneumatic work.
30. Soft Iron Rivet, ⅜″ x 1½″, for fastening one half of No. 12 to bar in mechanical work.
31. Stud and Cotter, for driving piece No. 13.
32. Lower Stud and Cotter, for bracket No. 9; this is used in both mechanical and pneumatic work.
33. Special Washer, 1″ diam., for No. 32.
34. Standard Washer, 1″ diam., for Nos. 31 and 12.

PLATE 22.

A view in the train shed of the Pennsylvania Railroad at Broad Street, Philadelphia. The suspended starting signals show quite plainly. This is an extremely important plant, and is illustrated in other ways on Plates 31, 101, 120 and 122.







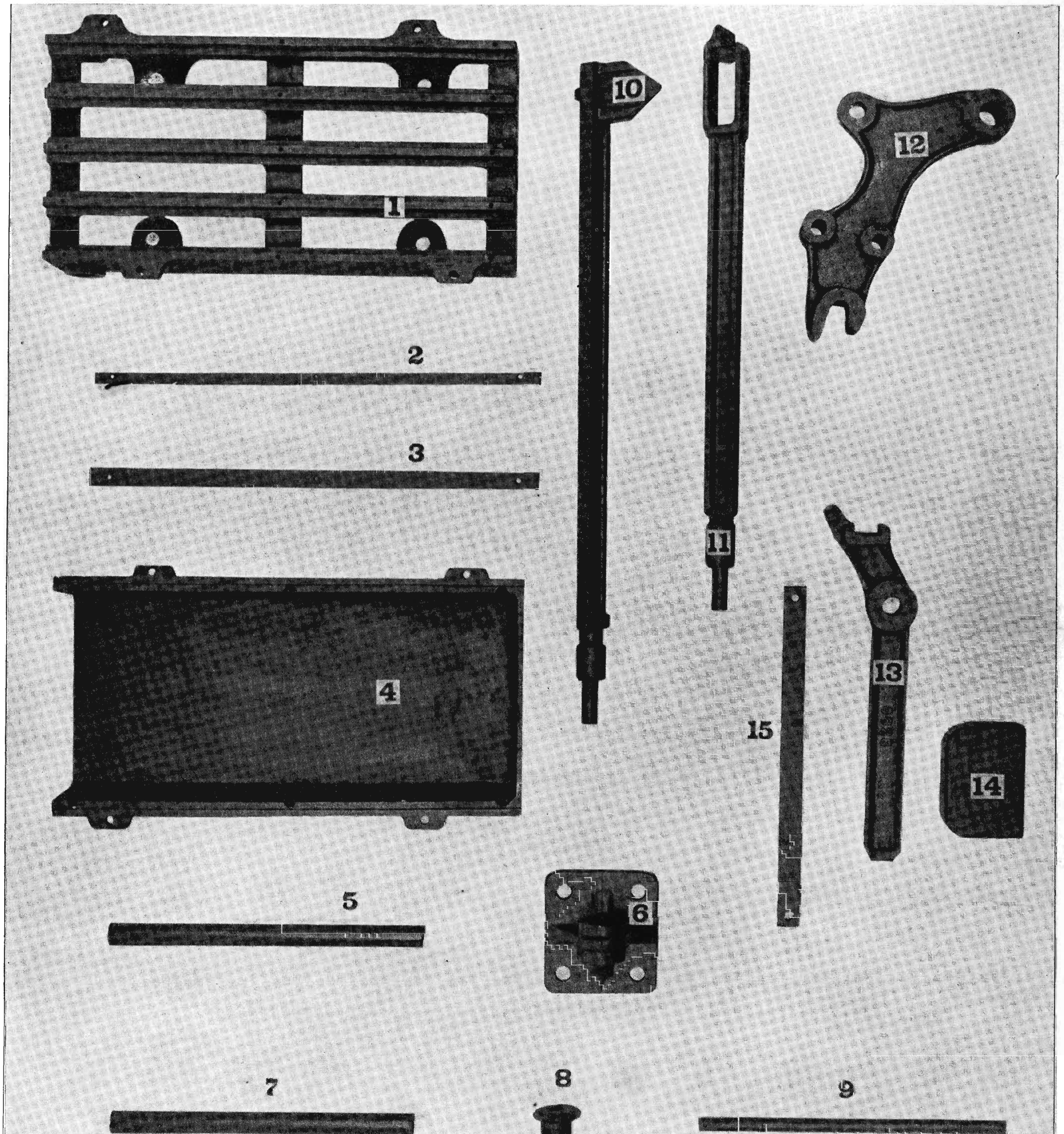
Multiple Bridge Coupler.

PLATE 23.

THIS Multiple Bridge Coupler is the only successful device that we know of for accomplishing the movement of several signals and switches on shore by a machine located on a revolving drawbridge. The figure on the left shows the position of the coupler when the drawbridge is closed and one of the levers in the machine is reversed. The figure on the right shows the device uncoupled, the shore connections and bridge connections locked, and the drawbridge ready to swing. They may be made of considerable width, since the effort required to disengage the coupler is very slight. In large plants it is sometimes necessary to use several couplers, owing to the fact that the distance between the trusses and the rails is occasionally quite limited.

This is a device, the action of which is absolutely reliable under all of the conditions of traffic or temperature that we have ever met.

A list of the parts will be found upon the next page.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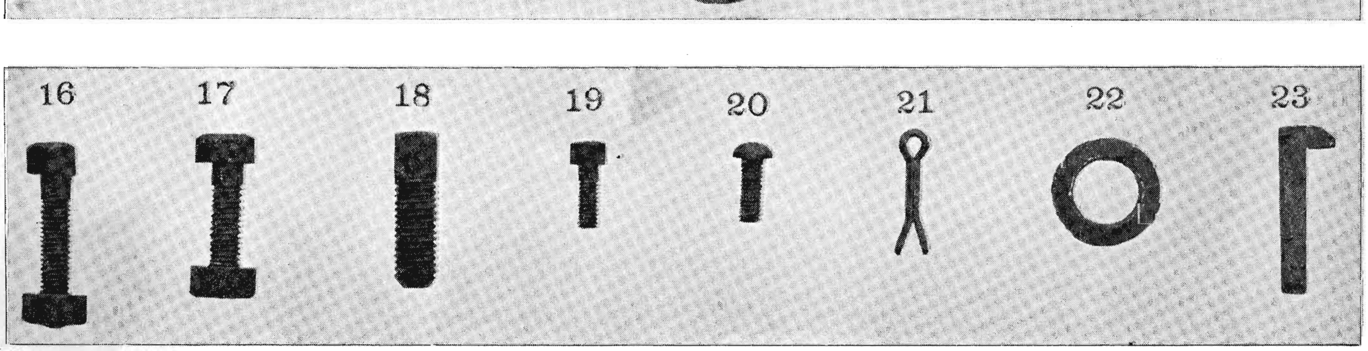
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Multiple Bridge Coupler.

PLATE 24.

NOTE.—Numbers 1, 4, 5, 7, 9 and 15 are shown on plate 24, as constructed for a 4-way coupler. We furnish any of them to go with 2, 4, 6, 8, 10 or 13-way couplers.

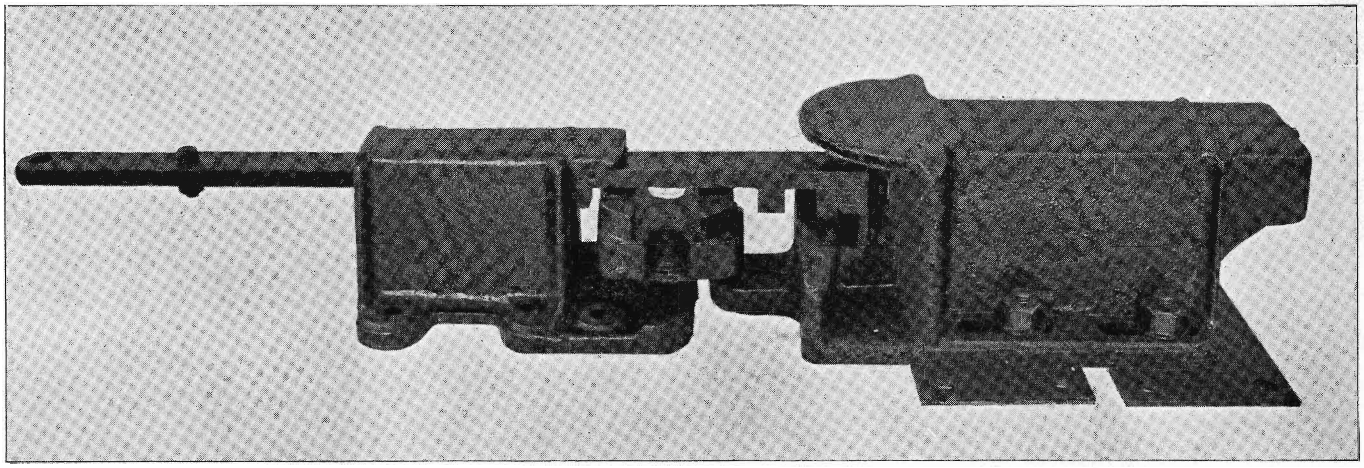
ORDER BY PLATE AND NUMBER.

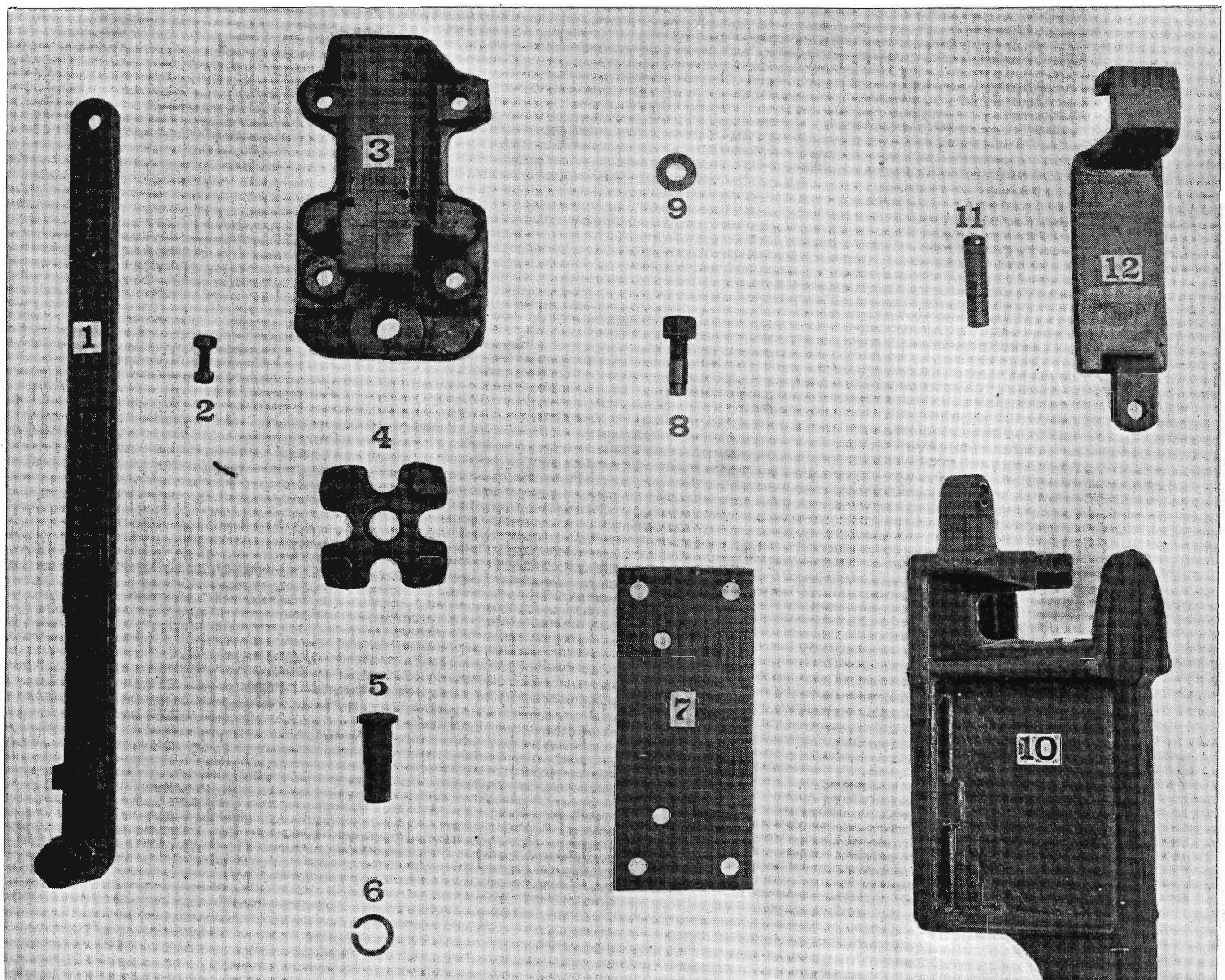
No.

1. BASE.
2. SIDE STRIP.
3. MIDDLE STRIP.
4. COVER.
5. ENGAGEMENT SHAFT.
6. BEARING, for engagement shaft.
7. COUNTERWEIGHT SHAFT.
8. ROLLER.
9. ROLLER SHAFT.
10. HOOK-BAR.
11. ENGAGEMENT-BAR.
12. ENGAGEMENT ARM.
13. COUNTERWEIGHT ARM, made both as a right-hand and left-hand; a right-hand is shown.
14. COUNTERWEIGHT.
15. LOCK-BAR.
16. BOLT AND NUT, 3/8" x 1 3/4", for lock-bar.
17. BOLT AND NUT, 3/8" x 1 1/2", for cover.
18. SET SCREW, 1/2" x 1 1/2", for counterweight.
19. CAP SCREW, 1/4" x 3/4", for middle strip.
20. MACHINE SCREW, 1/4" x 3/4", for side strip.
21. SPLIT COTTER, 3/16" x 1 1/4", for roller shaft.
22. SPECIAL WASHER, 3/4", for roller shaft.
23. KEY, for shafts 5 and 7.

A special solid jaw is used for connecting with the engagement arm, and is shown on Plate 39. Fig. D.

PLATE 25.





Automatic Bridge Coupler.

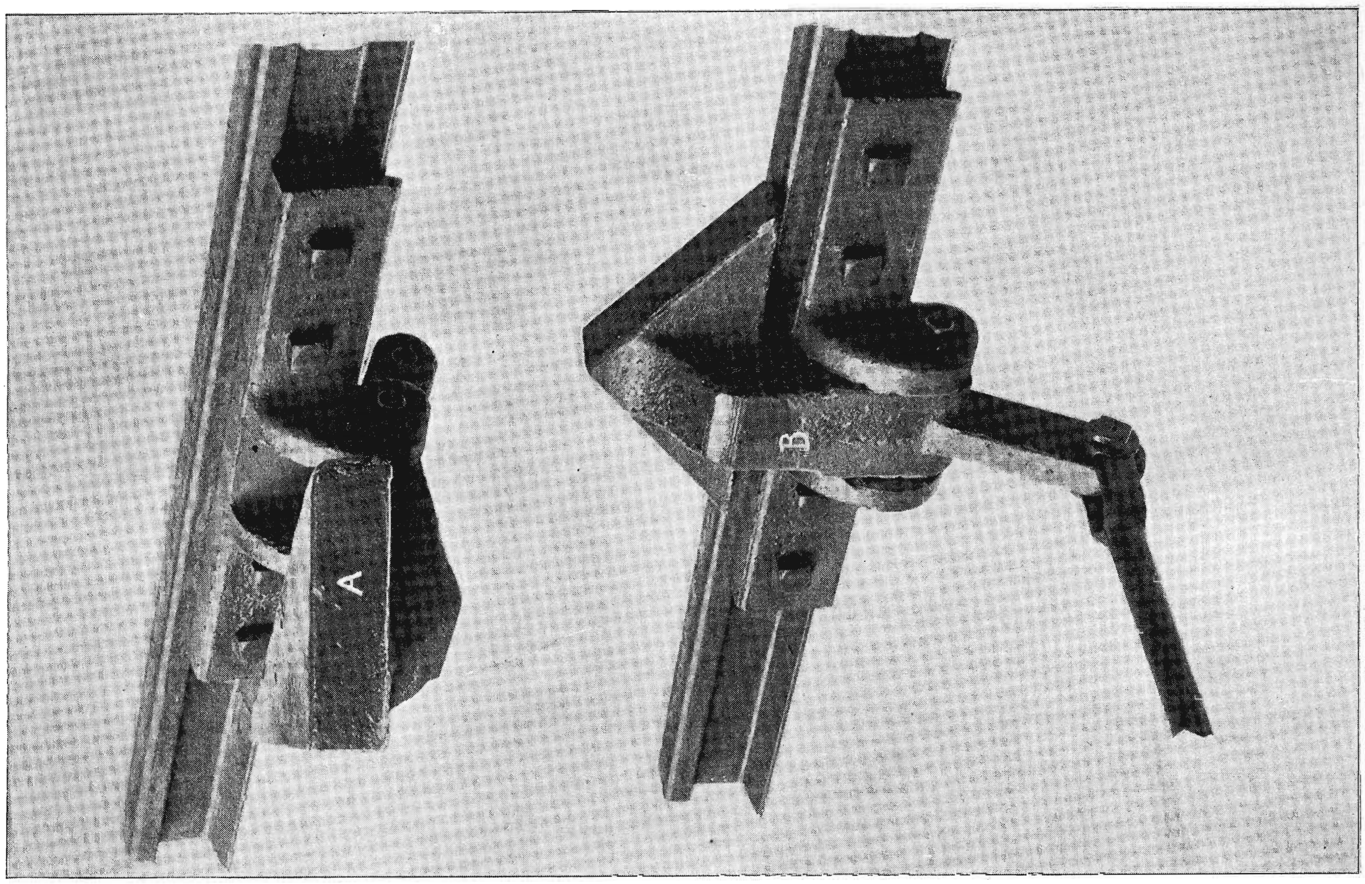
PLATE 25.

THE Automatic Bridge Coupler is used at drawbridges where it is only necessary that one signal, or at most a signal and derail, shall be used for protecting the movements of trains across the draw. The coupler is entirely automatic in its action, and locks itself through the movement of the bridge. Its main features are evident from the illustration on the opposite page. When the operating lever is on the bridge the casting on the right is placed upon the bridge and the one on the left upon the abutment, but under certain circumstances this arrangement may be reversed. A finger (No. 11), which projects up from the bridge casting (No. 10), engages with a spider (No. 4), which is connected with the abutment casting (No. 3), and when the bridge is turned places the dogs built upon the spider in engagement with the lugs shown on the hook bar (No. 1).

The self-locking of the device takes place upon the first movement of the draw in opening, and the unlocking upon the last movement of the draw in closing.

ORDER BY PLATE AND NUMBER.

No.
1. Hook Bar.
2. Stop Bolt, ½″ x 1½″.
3. Abutment Casting.
4. Spider.
5. Turned 1¼″ Pin, for spider.
6. Spring Washer, for spider.
7. Foundation Plate.
8. Stud, ⅞″ diam., for foundation plate.
9. Special Washer, for stud.
10. Bridge Casting.
11. Turned 1″ Pin, for bridge casting.
12. Slide Plate.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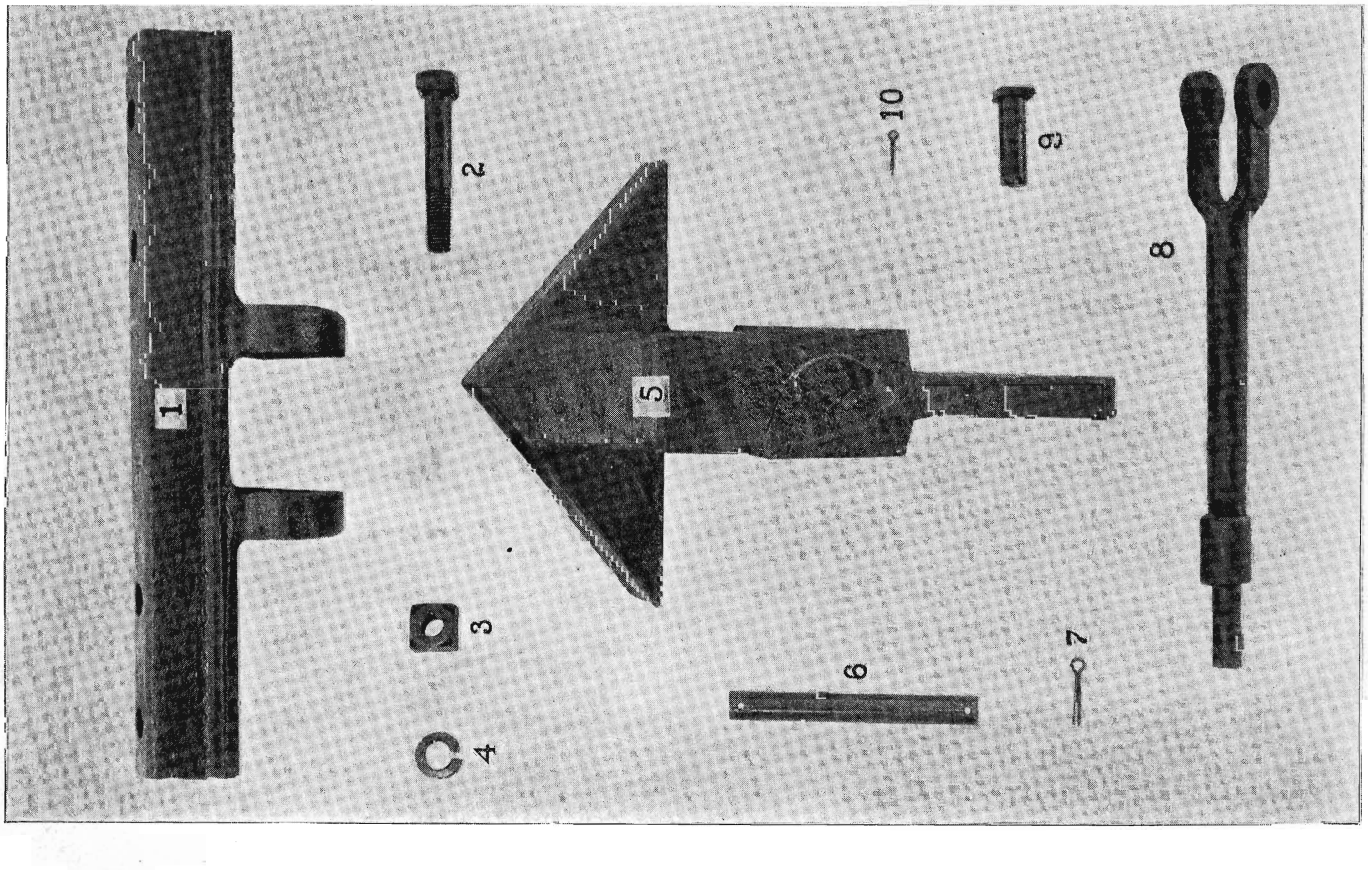
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Scotch Block.

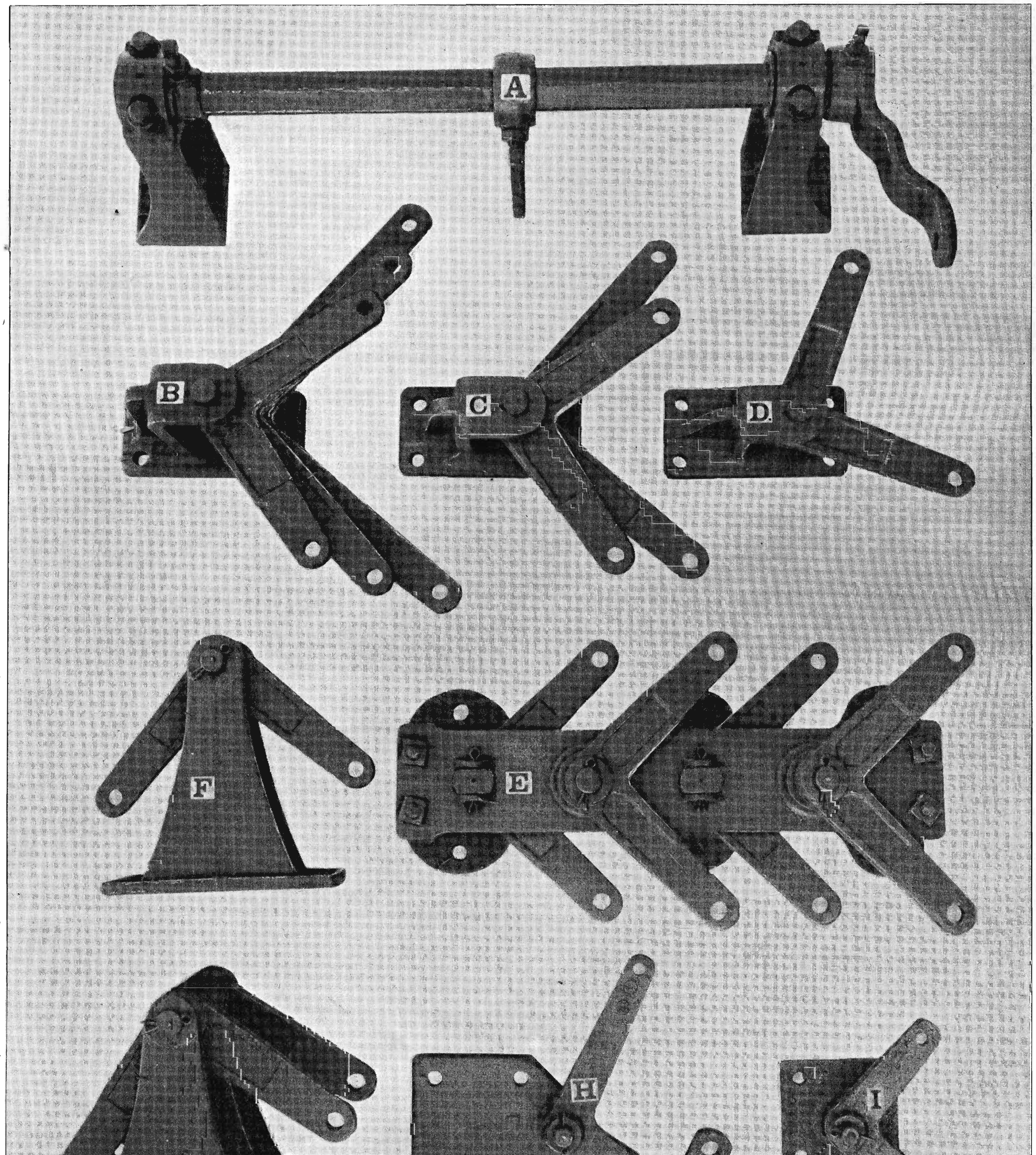
PLATE 26.

THE Scotch Block is a derailing arrangement. In figures A and B the view is taken on the outside of the track. Fig. A shows the scotch block in what is called its reversed position, that is, in such a position as to allow the passage of trains. In Fig. B the block rests on top of the rail, and a wheel striking it would be derailed. The scotch block is used when it is necessary to effect a sudden derailment, and is often placed on side tracks where it is desirable that cars shall stand as near the danger point as possible, and be prevented from running on to the main track or a crossing track. The section of rail to which the scotch block is to be applied should always be mentioned.

ORDER BY PLATE AND NUMBER.

No.

1. Bearing.—In ordering this piece give the section of rail which it is to fit.
2. }
3. } Bolt, 7/8″ x 5″, and Nut, for fastening bearing to rail.
4. Spring Nut Lock, for Nos. 2 and 3.
5. Wedge Block.
6. Bearing Shaft.
7. Cotter, 1/4″ x 2″, for Bearing Shaft.
8. Special Jaw.
9. Pin, for Special Jaw.
10. Cotter, 3/16″ x 1 1/2″, for Special Jaw Pin.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Rocking Shafts and Bell Cranks.

PLATE 27.

A. THE ROCKING SHAFT shown here is one of the most notable improvements in interlocking devices of the present period; the shaft itself is hexagonal in section, and is encircled by the off-set and straight cranks and by the collars which fit in the bearings, and are punched to exactly fit the shaft. The bearings themselves are made much like those used in the now obsolete welded rocking shaft. The straight and offset arms are drop-forged, and all parts are interchangeable. Through the use of this shaft it is possible to ship them from our works knocked down, to be assembled and placed in their proper position when it seems likely that no further changes will be made in the lead-out. The sole right of manufacturing this device is vested in us.

B.
C. } These are respectively 3-way, 2-way and 1-way horizontal cranks.
D.

E. LEAD-OUT BOX CRANK.—It is made in any number of ways from a 4-way up, as shown in the illustration.

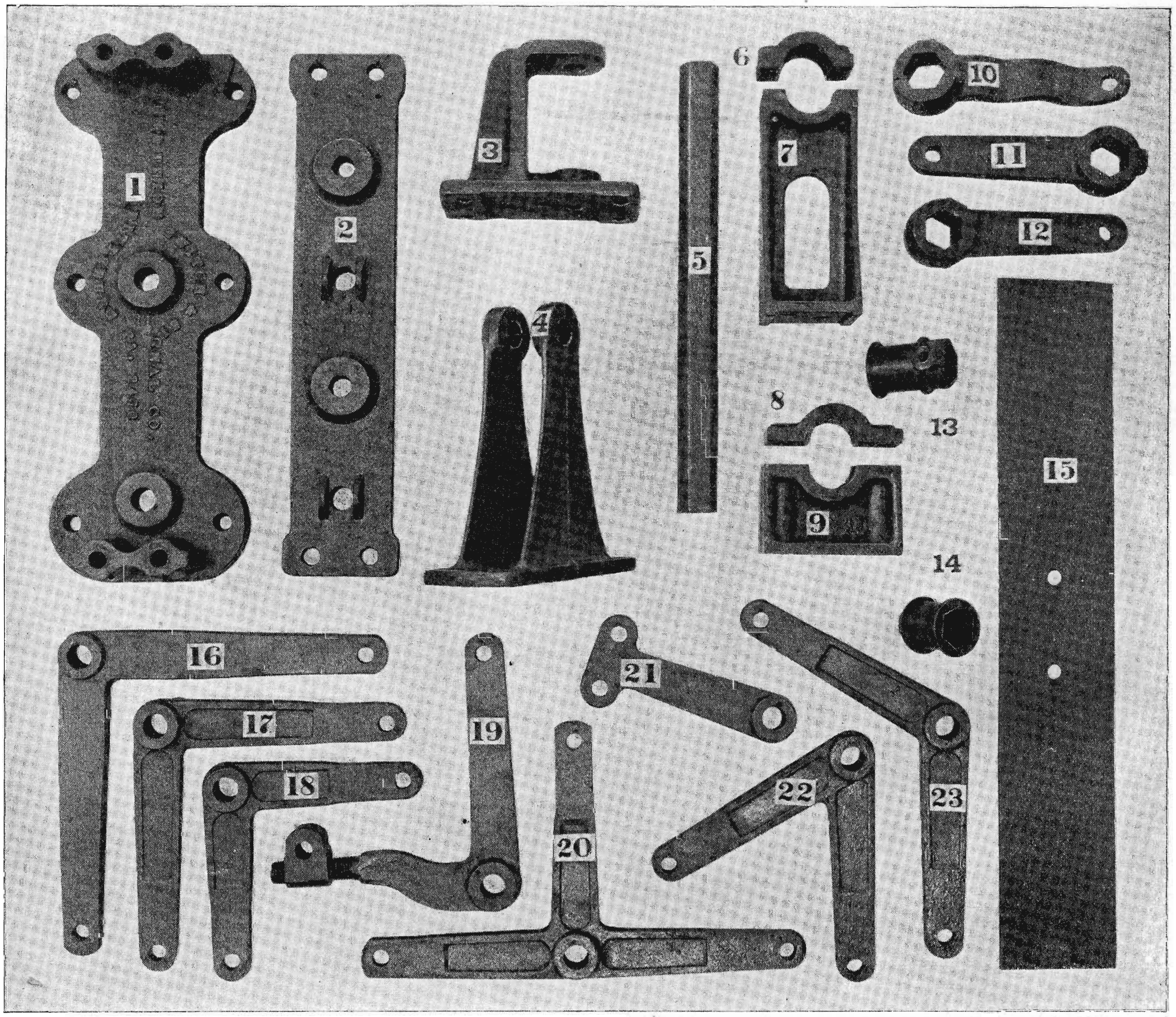
F. ONE-WAY VERTICAL CRANK.

G. TWO-WAY VERTICAL CRANK.

H. ADJUSTABLE CRANK.—It has a movable eye on one arm and is an arrangement of unusual convenience since it permits the changing of the stroke without the drilling of holes in the crank arm. The one shown is of a kind adapted to signals only, but the crank itself can be made of a size to fit in the base D on this same page.

I. SMALL LIGHT CRANK.—Intended for use principally upon block signal posts.

The parts are illustrated on the following page.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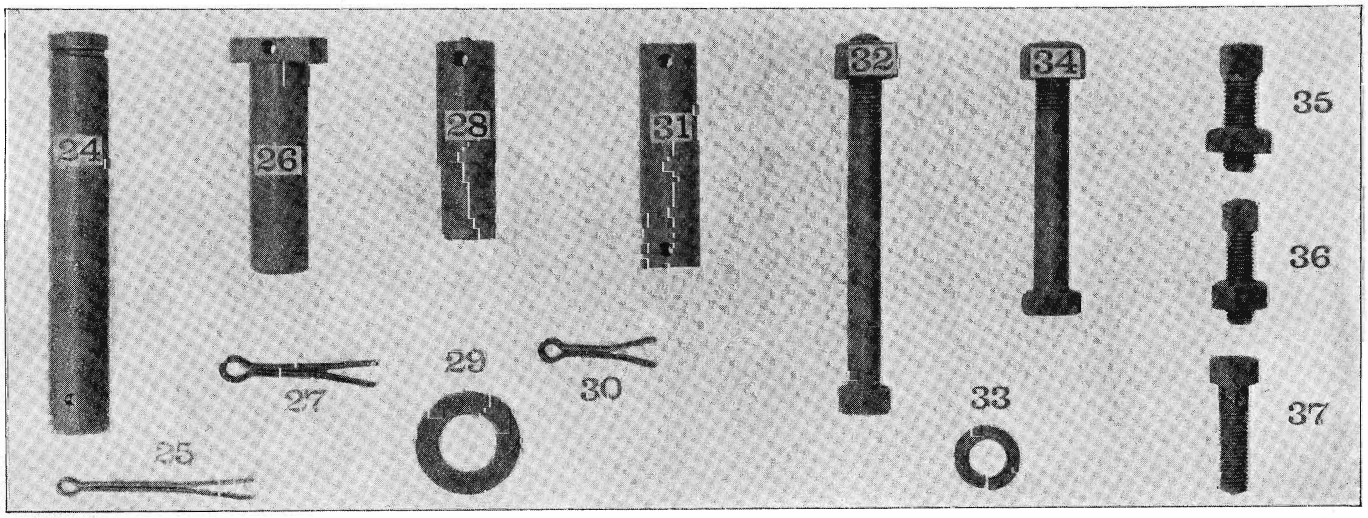
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List of the Parts of Cranks and Rocking Shafts.

PLATE 28.

ORDER BY PLATE AND NUMBER.

No.

1. Base of Crank Box. } Made in several sizes; a 4-way is shown.
2. Top of Crank Box. }
3. Stand, for horizontal crank, made as a 1, 2 and 3-way; a 3-way is shown.
4. Stand, for a vertical crank; made also as a 2-way.
5. Hexagonal Rocking Shaft, made in various lengths, and used both at the lead-out and for moving detector bars.
6. Top, for high or low lead-out bearing; this is made also as a 2-way.
7. High Lead-Out Bearing; made also as a 2-way. A low lead-out bearing is constructed which uses the same top (No. 6), and is also made as a 1-way and a 2-way.
8. Top, for bearing No. 9.
9. Bearing (used only with detector bars).
10. Offset Lead-Out Arm.
11. Arm, for shaft (used only with detector bars).
12. Straight Lead-Out Arm.
13. End Rocking Shaft Journal.
14. Intermediate Rocking Shaft Journal.
15. Tie Plate, for detector bar rocking shaft.
16. Right Angle Crank, made in different sizes.
17. Right Angle Crank, 11¾″ arms.
18. Right Angle Crank, 9″ arms.
19. Right Angle Crank, adjustable arm. This is made both for use at switches and on signal posts, and with arms of different lengths. See Plate 27, Fig. H.
20. T Crank, made in different lengths.
21. Radial Arm, made in different lengths.
22. Acute Angle Crank. } Made in different sizes; used on Pipe Compensators, and for turning corners which are not a right angle.
23. Obtuse Angle Crank. }
24. Turned Pin, 1¼″ diam.; made of a length to suit horizontal crank stand No. 3.
25. Split Cotter, ¼″ x 3¾″, for pin No. 24.
26. Turned Pin, 1¼″ diam., for lower row of cranks on Fig. E, Plate 27.
27. Split Cotter, $\frac{5}{16}$″ x 2¾″, for pin No. 26.
28. Turned Pin, 1¼″ diam., for upper row of cranks on Fig. E, Plate 27.
29. Special Washer, 1¼″ x 2¼″, for pins Nos. 24 and 28.
30. Split Cotter, $\frac{5}{16}$″ x 2″, for pins Nos. 28 and 31.
31. Turned Pin, 1¼″ diam., for vertical stand No. 4. Made in two lengths.
32. Bolt and Nut, ¾″ x 7½″, for joining Nos. 8, 9 and 15.

No. PLATE 28.

33. NUT LOCK, for bolt No. 32.
34. BOLT AND NUT, ¾"x 5¼", for joining base No. 1 and Top No. 2.
35. SET SCREW AND JAM NUT, ¾"x 1¾", for rocking shaft arms Nos. 10, 11 and 12.
36. SET SCREW AND JAM NUT, ⅝"x 1¾", for end rocking shaft journal No. 13.
37. TAP BOLT, ⅝"x 2¼", for joining top and lead-out bearing Nos. 6 and 7.

Deflecting Rods.

PLATE 29.

BOTH A and B are intended to be placed in a line of pipe where it is necessary to make a considerable diversion from a straight line, but where the bend is not sharp enough to require a crank. Both devices are made in many different sizes; 4-ways are shown.

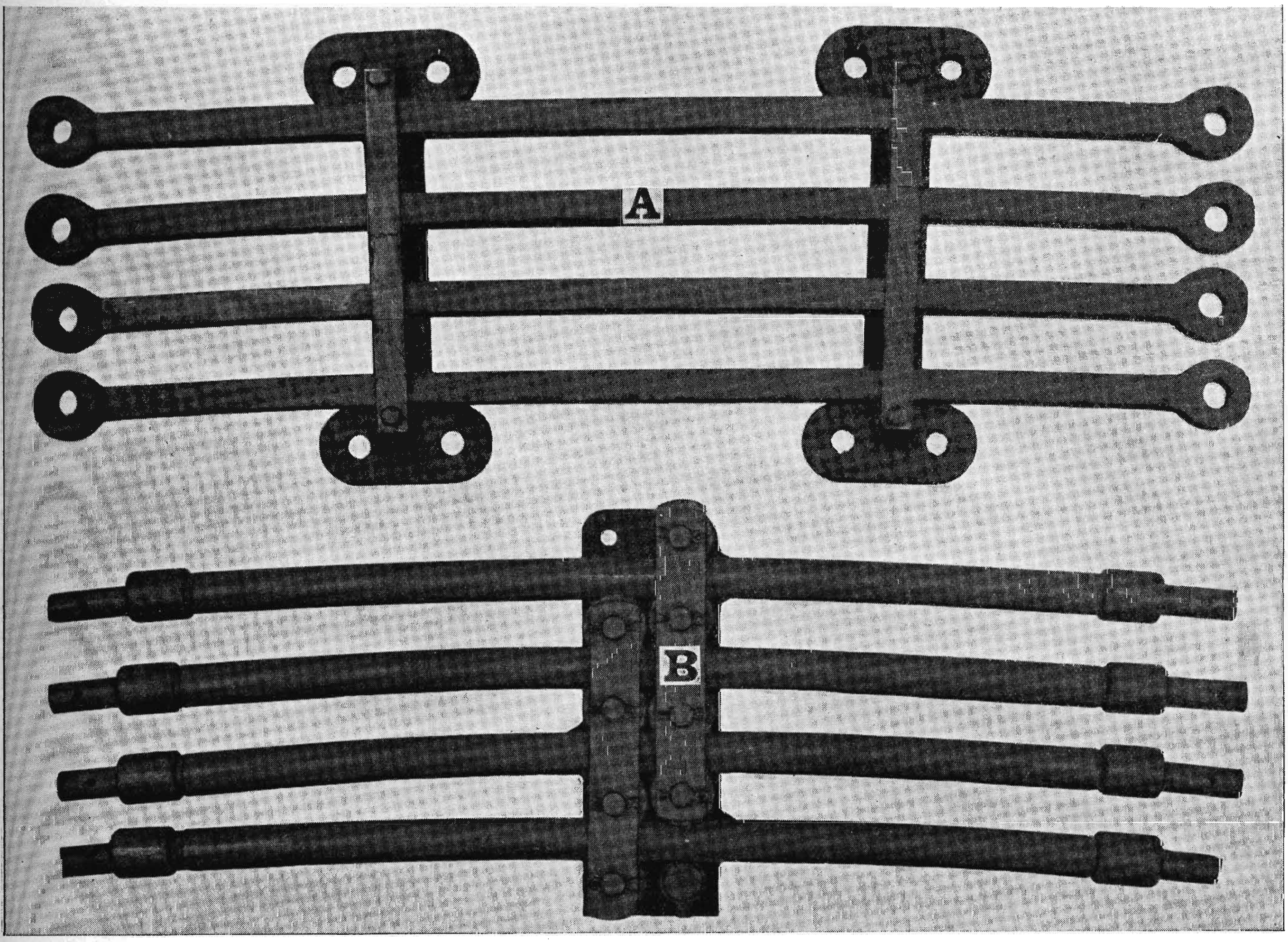
A. Is composed of square 1" rods, having eyes on the ends to which it is intended to connect the pipes through the medium of standard wrought jaws.

B. Consists of solid round 1¼" rods with tang ends, to which the pipe is directly connected.

ORDER BY PLATE AND NUMBER.

No.

1. SQUARE 1" ROD.
2. BASE, for Square Rods, a 4-way is shown.
3. COVER, for Square Rods; it is made to fit base No. 2.
4. BASE, for Round Rods; a 4-way is shown.
5. COVER, for Round Rods; it is made to fit base No. 4.
6. ROUND 1¼" ROD.
7. TAP BOLT, ⅜"x ¾", for square rod cover.
8. ROLLER, for Round Rods.
9. PIN, ¾"x 3½", for Round Rod Roller No. 8.
10. SPLIT COTTER, ⅛"x 1¼", for Roller Pin No. 9.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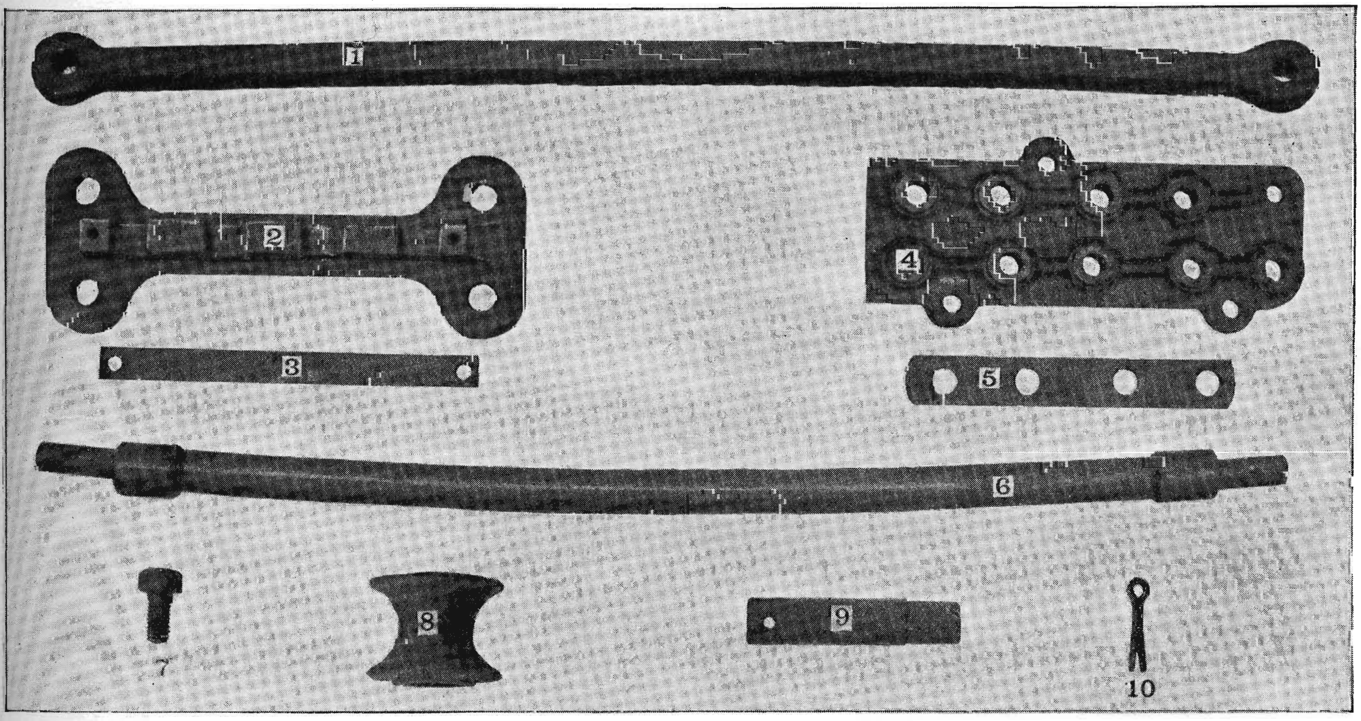
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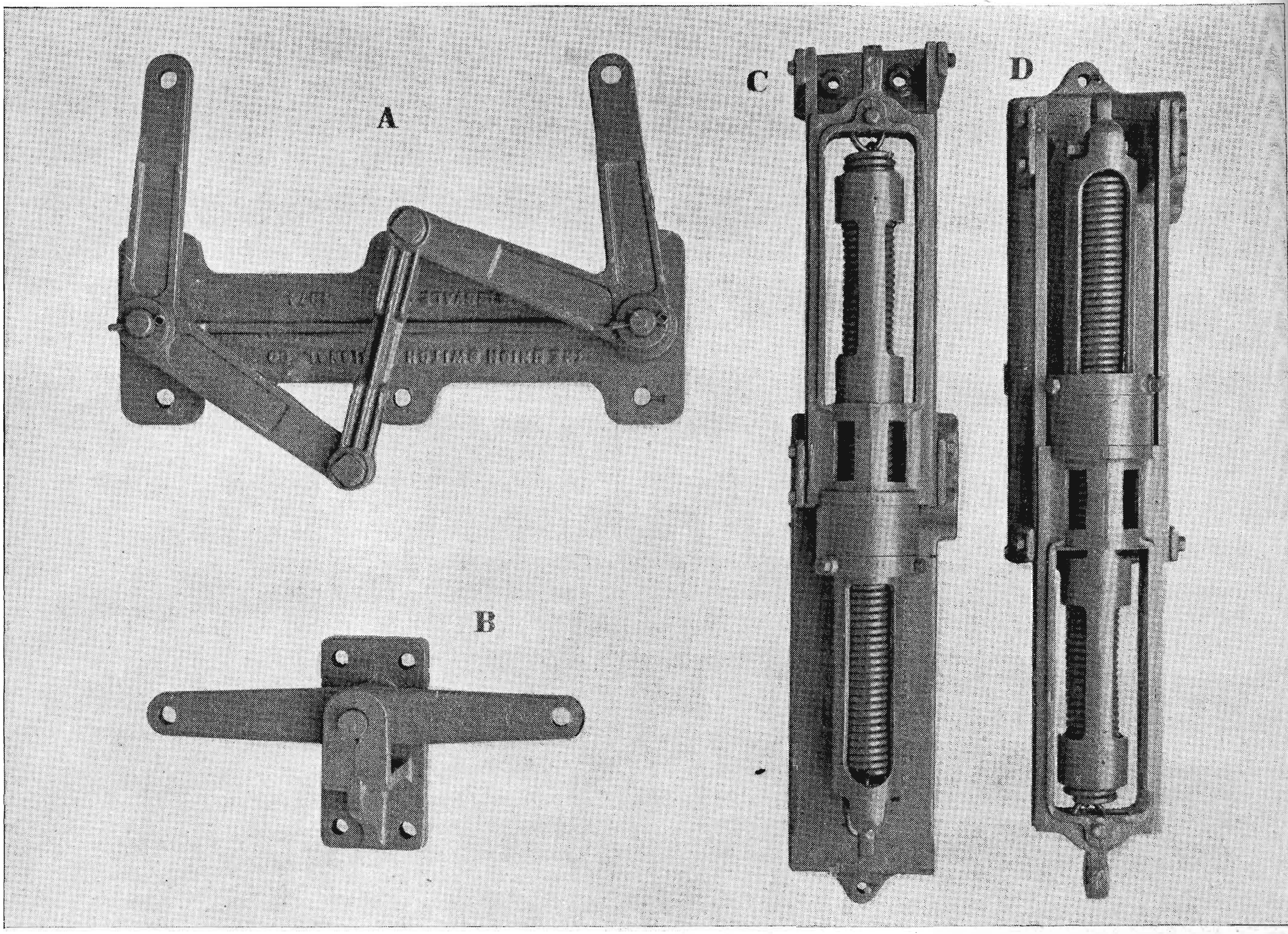
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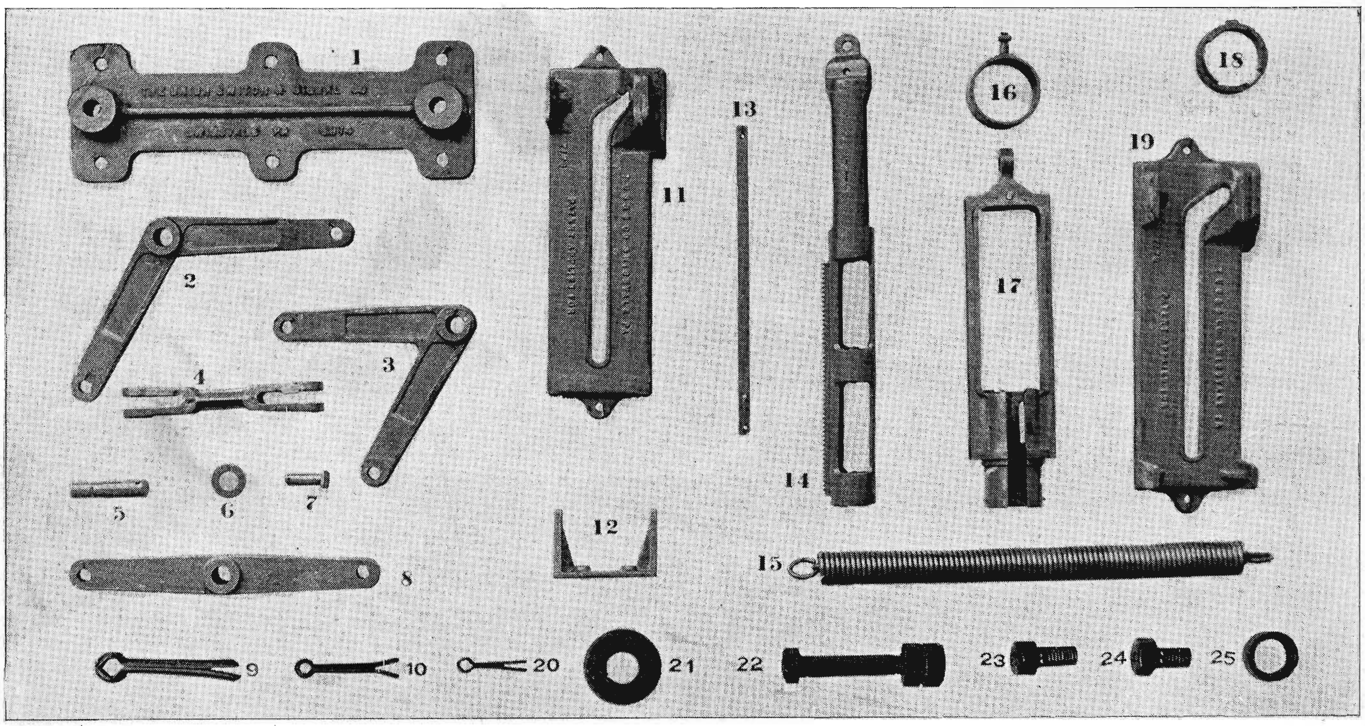
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Compensators for Pipe and Wire.

PLATE 30.

A. STANDARD PIPE COMPENSATOR.—This is made as a 1-way, 2-way and 3-way; a 1-way is shown.

B. STRAIGHT ARM PIPE COMPENSATOR.—The arm is made in different lengths, and is mounted on an ordinary crank stand. B is also made as 1, 2 or 3-way. See No. 8 below.

C. BACK WIRE COMPENSATOR.

D. FRONT WIRE COMPENSATOR.

For many years we have sought for a reliable wire compensator and have at last found one, which is illustrated in figures C and D.

Thousands of dollars have been expended in heretofore abortive attempts to produce a compensator which would be at once simple and effective, but until this one was conceived all of those previously produced have proved either too complicated for ordinary purposes or else entirely useless from having been constructed upon incorrect principles.

The one we are now dealing with is adapted to either long or short lines of wire, and is intended to be placed in the cabin where it is easily accessible. It requires no adjustment, and is so constructed that the wire is compensated only while the interlocking lever is in its normal position, thus avoiding the danger, which has existed in most of its predecessors, that the compensating spring or weight might, under certain conditions, be pulled instead of the signal.

ORDER BY PLATE AND NUMBER.

PARTS RELATING TO A OR B.

No.

1. BASE, for A.
2. OBTUSE ANGLED CRANK. } In ordering please give distance from each end hole to middle hole.
3. ACUTE ANGLED CRANK. }
4. LINK, a malleable is shown, but, if particularly specified, it may be furnished of wrought iron.
5. STUD, $1\frac{1}{4}'' \times 4\frac{3}{4}''$, for Nos. 2 and 3; state whether wanted for a 1, 2 or 3-way.
6. WASHER, $1\frac{1}{4}''$–$2\frac{1}{4}''$, for No. 5.
7. TURNED PIN, $\frac{7}{8}'' \times 2\frac{3}{8}''$, for No. 4.
8. COMPENSATING ARM; give length required between centers of holes.
9. SPLIT COTTER, $\frac{9}{32}'' \times 2''$, for No. 5.
10. SPLIT COTTER, $\frac{5}{32}'' \times 1\frac{1}{2}''$, for No. 7.

PLATE 30.

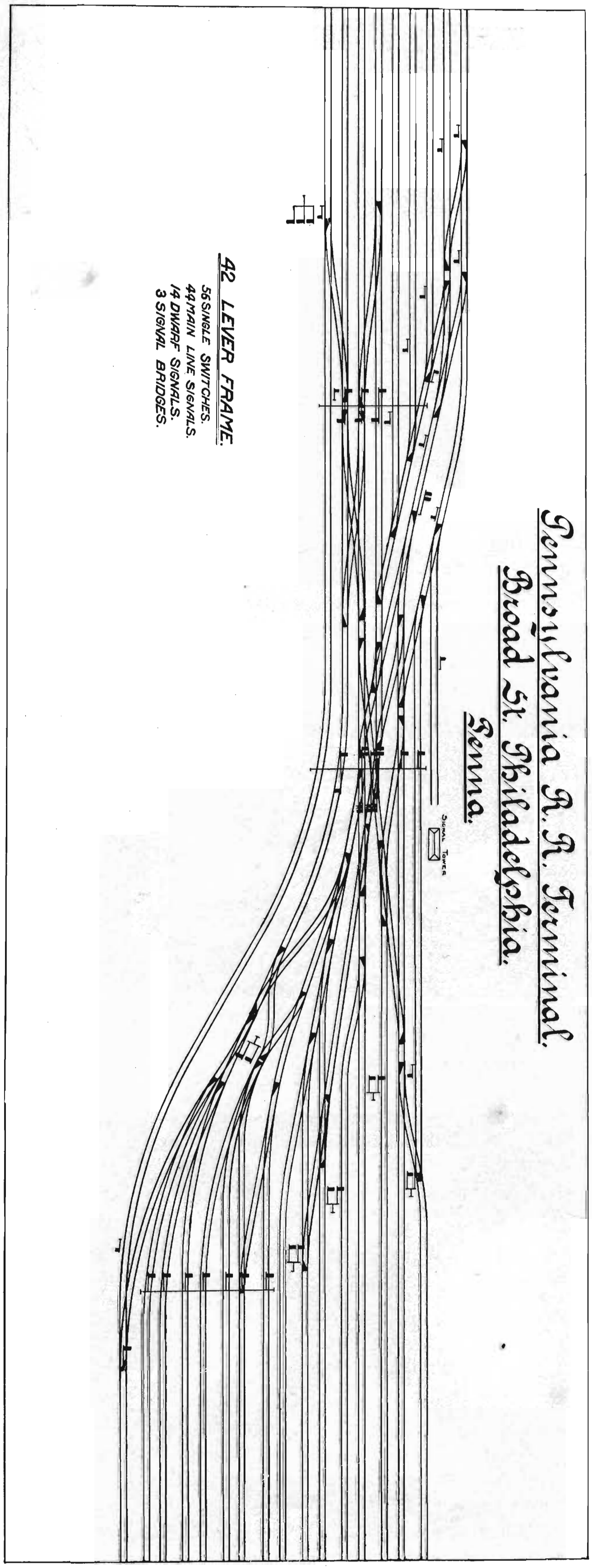
Parts Relating to C or D.

No.		
11.	Base.	These parts belong to Fig. C only.
12.	Support, for No. 13.	
13.	Guide Bar.	
14.	Inside Cylinder.	
15.	Spring.	
16	Revolving Collar, with stud and nut.	
17.	Outside Cylinder.	
18.	Fixed Collar.	
19.	Base, for Fig. D.	
20.	Split Cotter, $\frac{3}{32}''$ x 1″.	For No. 16.
21.	Washer, ⅝″–1⅜″.	
22.	Bolt and Two Nuts, ⅜″ x 2½″, for fastening No. 15.	
23.	Bolt, ⅜″ x ¾″, for fastening No. 13 to Nos. 11, 12 and 19, and for fastening one side of No. 18 to No. 17.	
24.	Bolt, ⅜″ x ⅝″, for fastening one side of No. 18 to No. 17.	
25.	Roller, for stud on No. 16.	

PLATE 31.

Two important terminals at Philadelphia that are controlled by the Electro-Pneumatic Interlocking System.

PLATE 31.


Pennsylvania R.R. Terminal.
Broad St. Philadelphia.
Penna.
42 LEVER FRAME.
56 SINGLE SWITCHES.
44 MAIN LINE SIGNALS.
14 DWARF SIGNALS.
3 SIGNAL BRIDGES.
Signal Tower

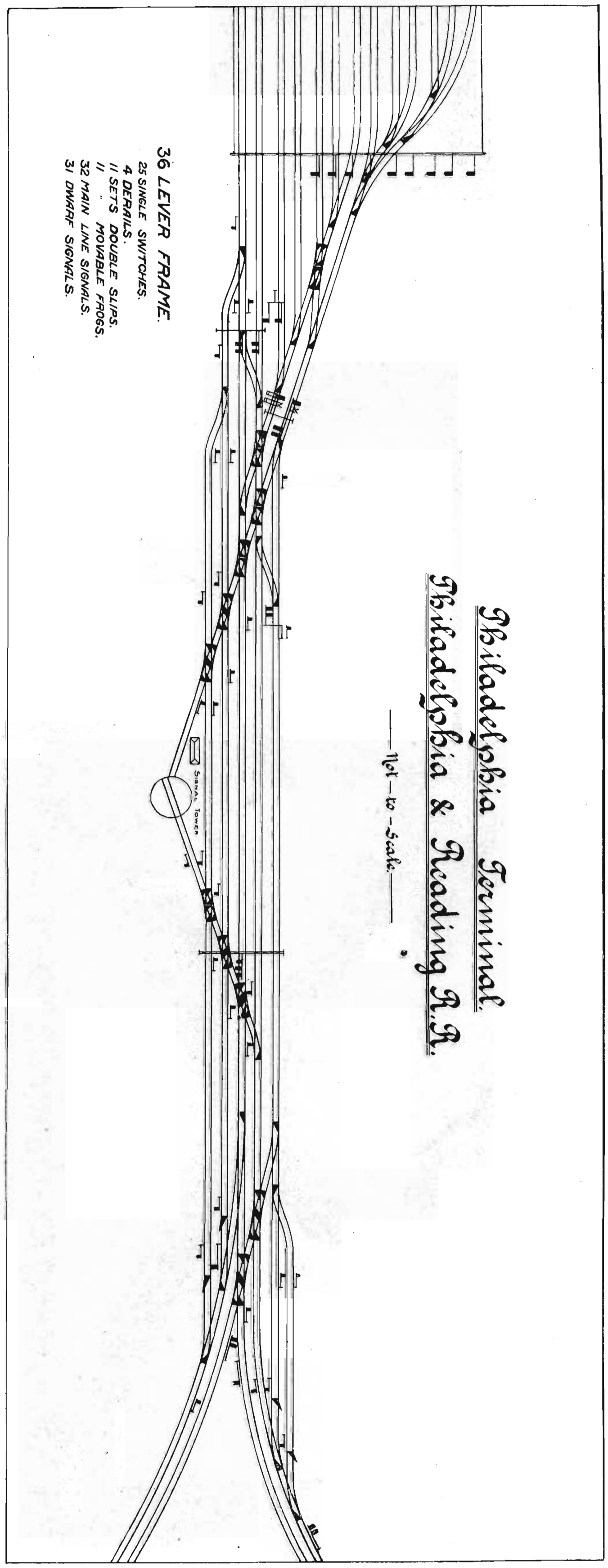
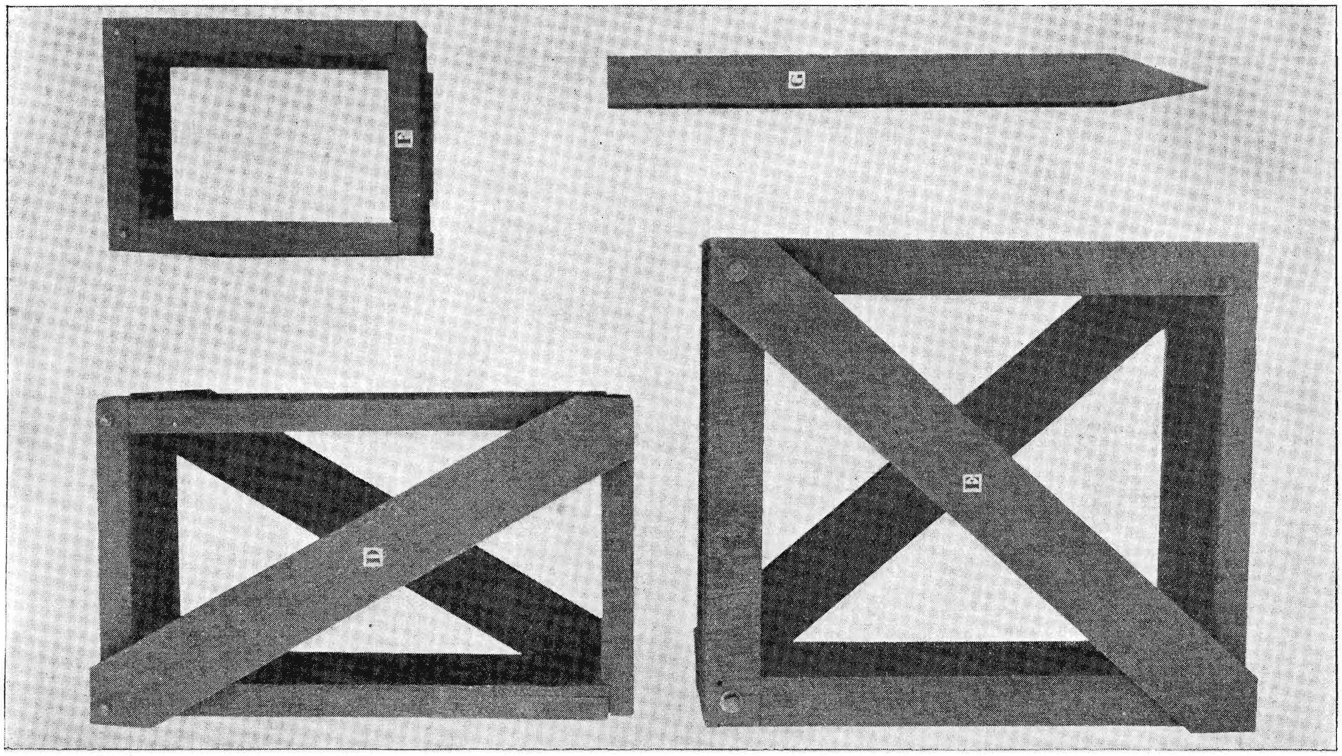
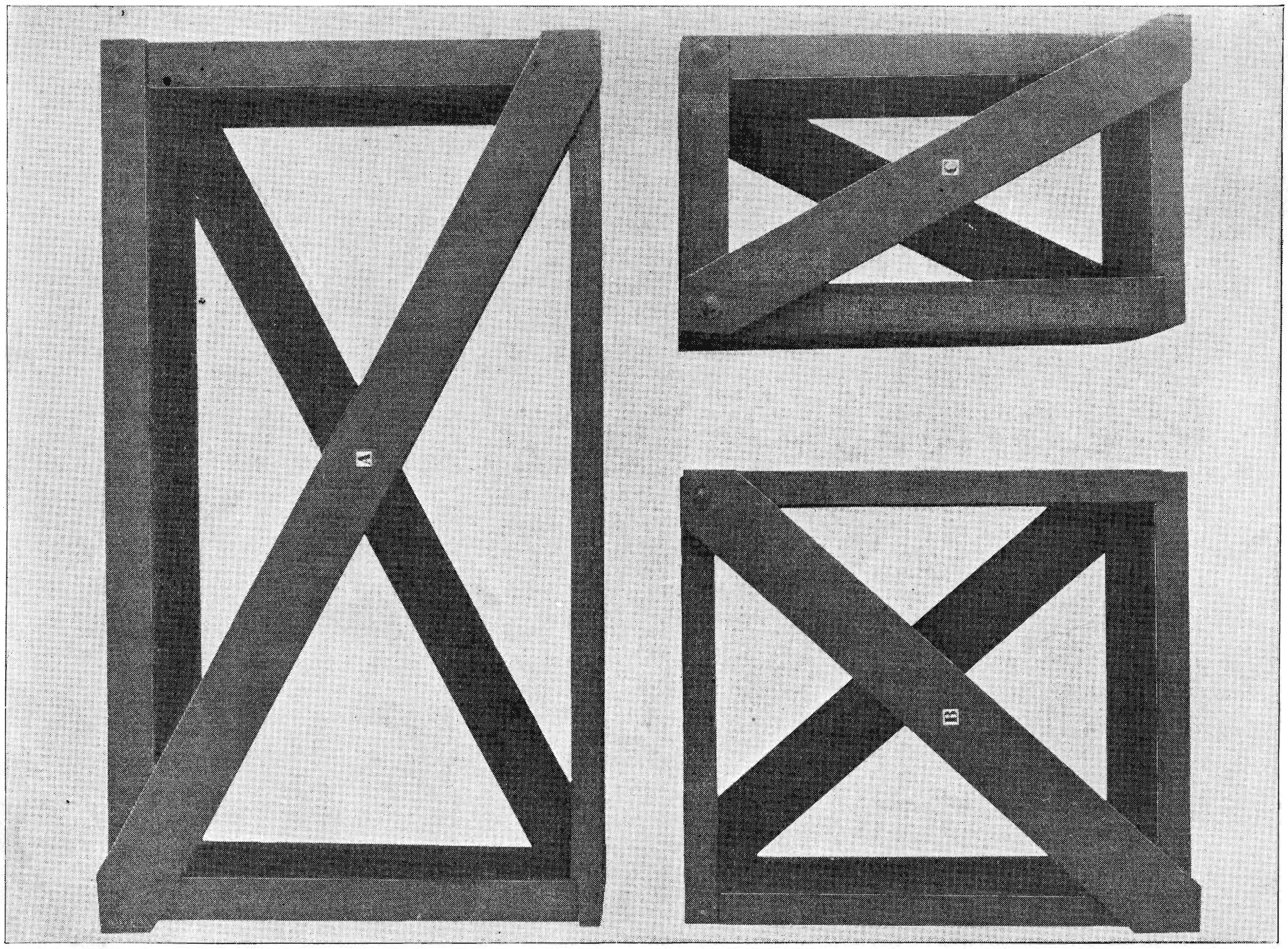

Philadelphia Terminal.
Philadelphia & Reading R.R.
—Not to Scale—
36 LEVER FRAME.
25 SINGLE SWITCHES.
4 DERAILS.
11 SETS DOUBLE SLIPS.
11 " MOVABLE FROGS.
32 MAIN LINE SIGNALS.
31 DWARF SIGNALS.
Signal Tower

PLATE 32.





Oak Foundations and Stake.

PLATE 32.

ALL of these foundations are made by machinery from seasoned White Oak, the tops and sides being dove-tailed and bolted together.

ORDER BY PLATE AND LETTER.

A. Selector Foundation.—6′ long, 1′ wide, 3′ 4″ deep.

B. Dwarf Signal Foundation.—3′ long, 1′ wide, 3′ 4″ deep.

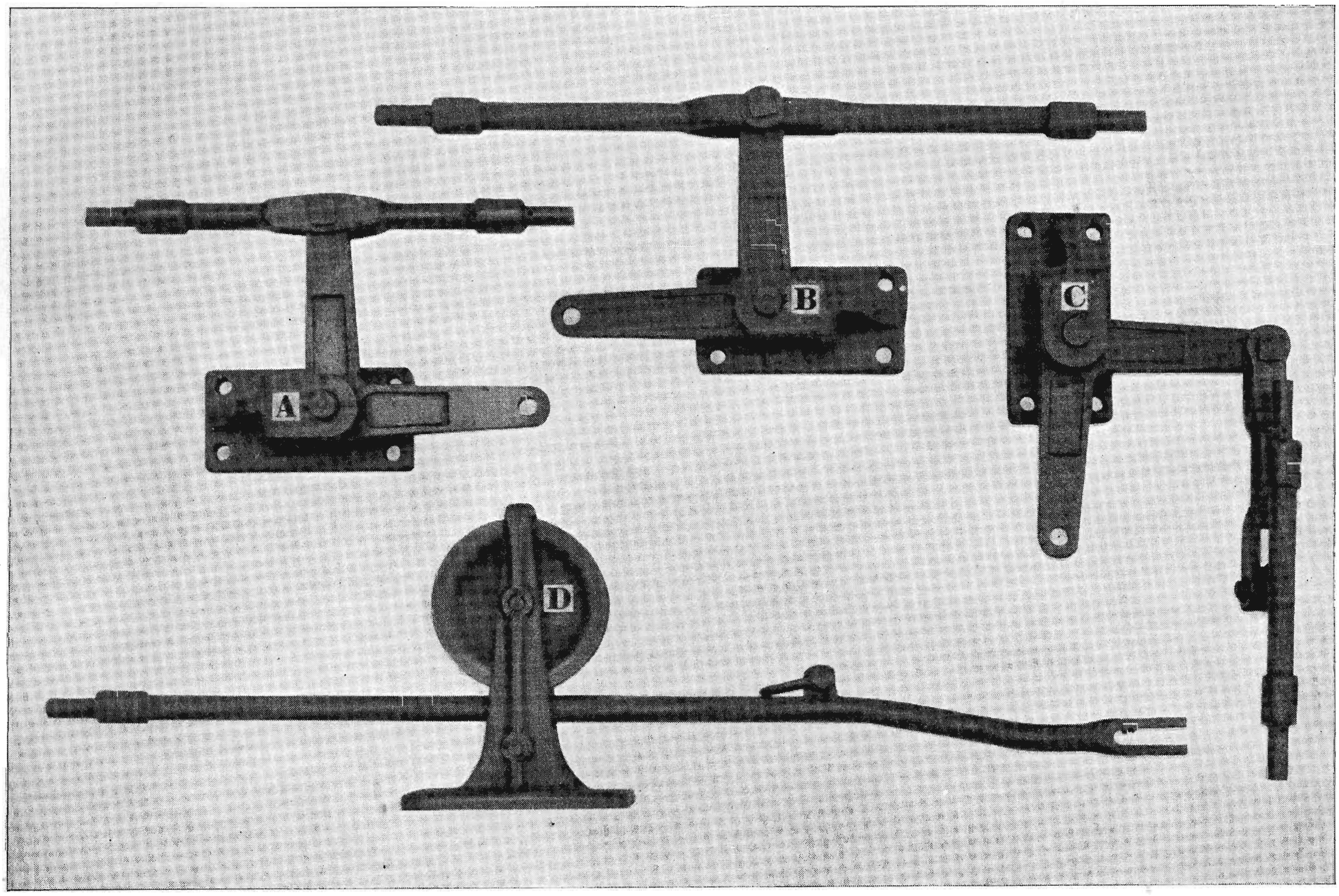
C. Crank Foundation.—2′ long, 10″ wide, 3′ 4″ deep.

D. Wheel Foundation.—2′ long, 10″ wide, 3′ 4″ deep.

E. Pipe Compensator Foundation.—3′ long, 10″ wide, 3′ 4″ deep.

F. Pipe Carrier Foundation.—Variable lengths (a 1-way is 12″ long, and they increase at the rate of 2¾″ for each way), 8″ wide, 24″ deep.

G. Wire Carrier Stake.—3″ x 4″ on top, 4′ long, pyramidal point.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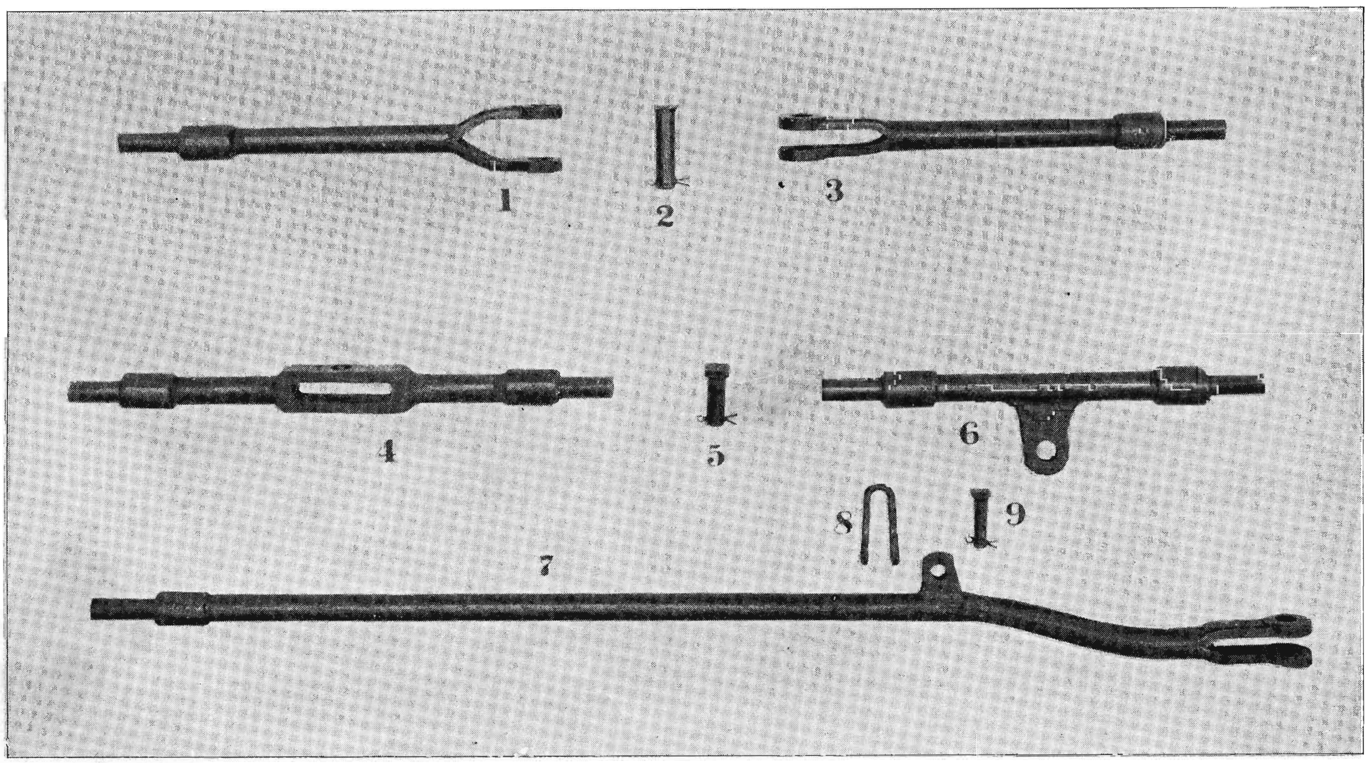
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Different Methods of Making an Intermediate Connection with a Line of Pipe, and a Means of Changing a Line from Pipe to Wire, or vice versa.

PLATE 33.

THE figures A, B, C, show only the application of the devices. If a crank is desired it must be specially ordered.

A. DOUBLE JAW.

B. WIDE JAW.

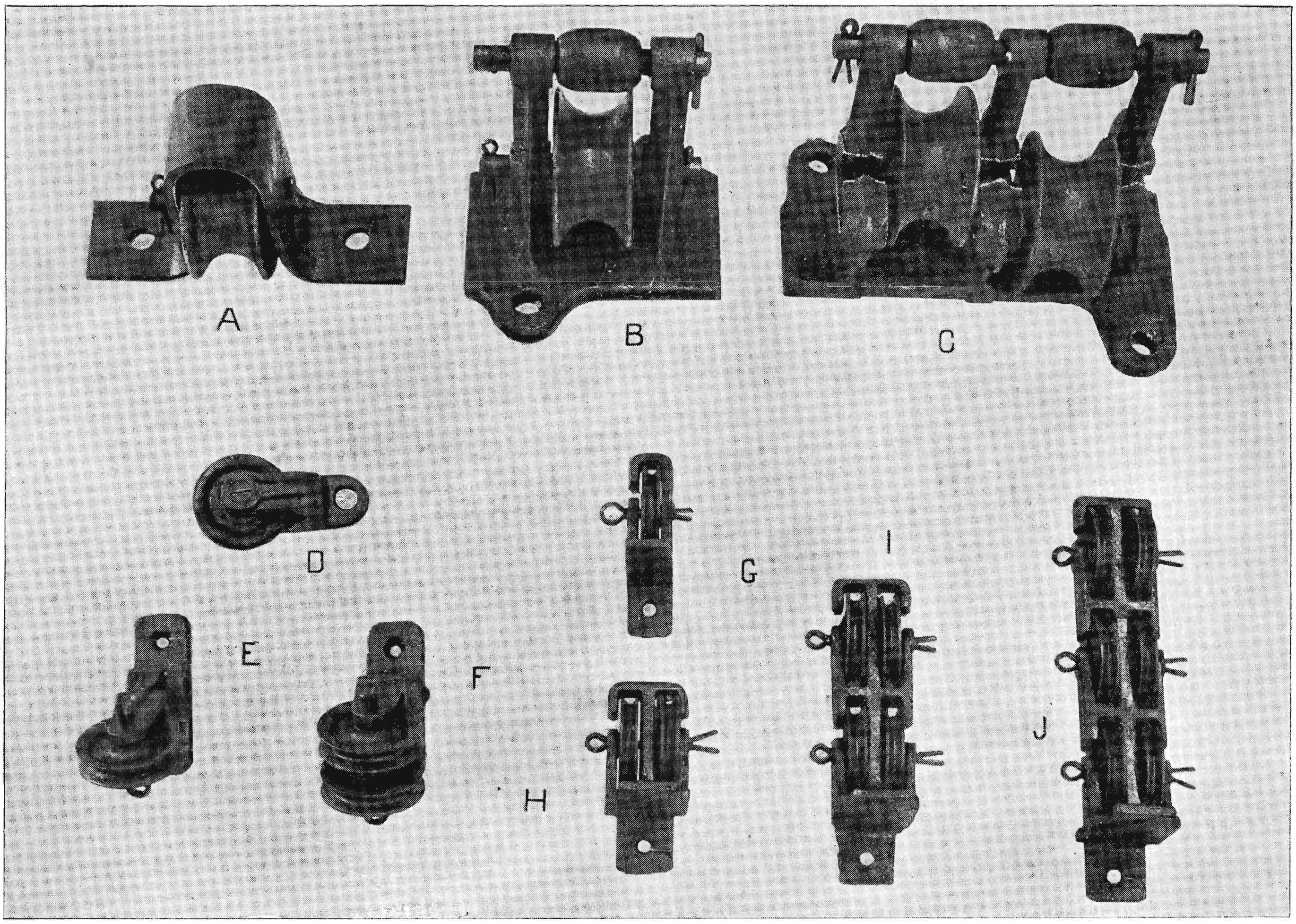
C. PIPE LUG.—The link which joins the crank and lug is formed of two plain jaws welded together. One of these jaws is sent with No. 6 (see below), the other with the crank.

D. WIRE LUG.—The application of this device will be seen on plate 10, where it is connected with a selector. It is also used at bridge couplers and wherever it is necessary to change from a pipe to a wire line. The vertical wheel forms a part of the device and is illustrated alone on Plate 41, Fig. A.

ORDER BY PLATE AND NUMBER.

No.

1. WIDE JAW.
2. TURNED PIN, 3¼″ long, for wide jaw.
3. STANDARD WROUGHT JAW.
4. DOUBLE JAW.
5. TURNED PIN, 2⅜″ long; for Nos. 4 and 6.
6. PIPE LUG.
7. WIRE LUG.
8. SHACKLE.
9. TURNED PIN, 2⅜″ long; for shackle No. 8.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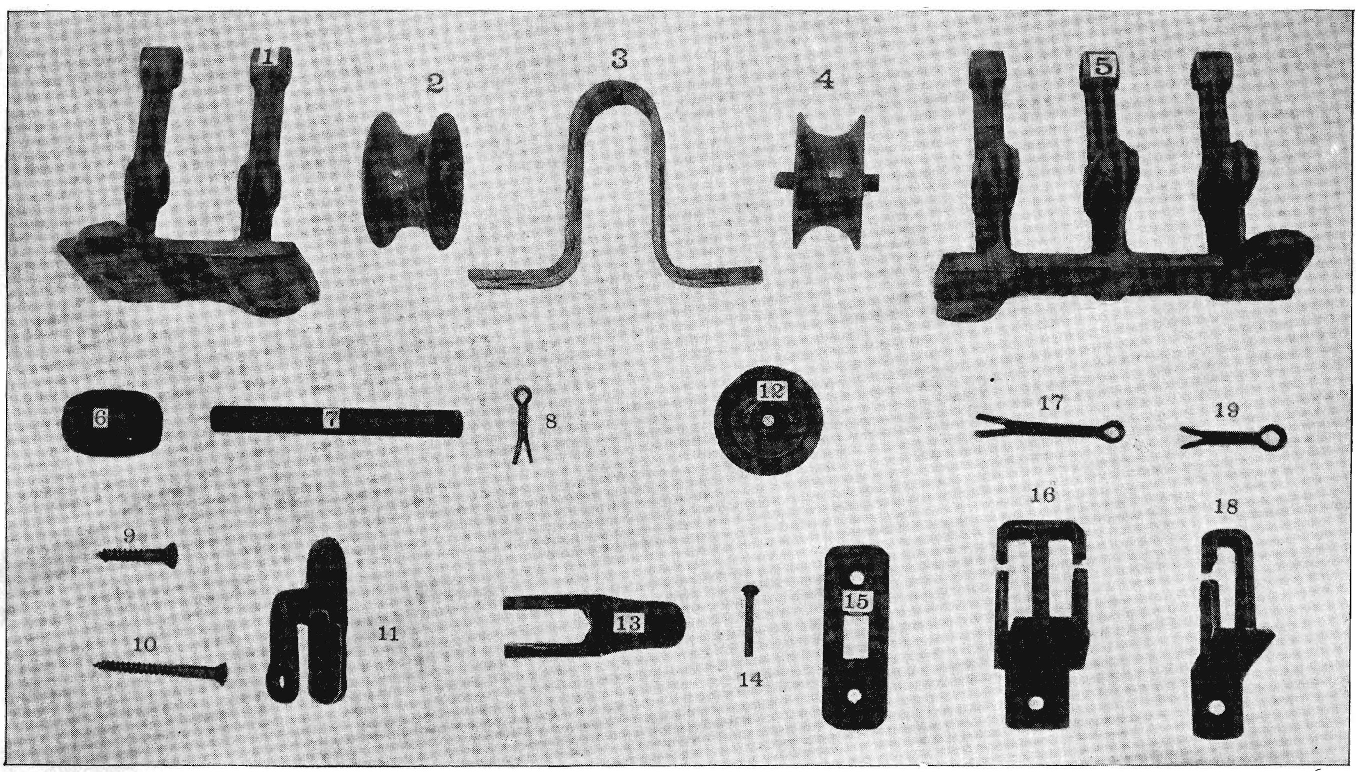
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Pipe and Wire Carriers.

PLATE 34.

PIPE CARRIERS.

A. Special Pipe Carrier.—It is used occasionally for short distances, and sometimes when pipes are run under tracks.

B. Plain Pipe Carrier.—In this device the main roller has only a rotary motion.

C. Anti-Friction Pipe Carrier.—Here the main roller has two motions; it revolves and it travels with the pipe in its bearing, which is slotted.

Note.—In the two forms, B and C, the main dimensions are the same, that is, the diameter of the pulleys, the distance between rods, center to center, and the distance between revolving centers.

WIRE CARRIERS.

D. Side Wire Carrier.—It is placed upon the side of a support, and its use should be restricted to perfectly straight lines of wire.

E. Angle Wire Carrier.—This is placed like the side wire carrier, on the side of a stake, but, unlike the side carriers, adjusts itself to the curve of the wire.

F. Two-way Angle Wire Carrier.—Constructed on the same principle as E.

G.
H.
I.
J. } Are respectively 1, 2, 4 and 6-way common wire carriers.

J is a recent design and secures, through its use, a considerable economy in the width of pipe carrier foundations and boxing. Its height is so great, however, that it should never be used except where the lines are entirely straight.

ORDER BY PLATE AND NUMBER.

No.

1. Stand, for plain pipe carrier; this is made in all sizes from a 1-way up; a 1-way is shown.
2. Bottom Roller, for plain and special pipe carriers.
3. Stand, for special pipe carrier.
4. Bottom Roller, for anti-friction pipe carrier.

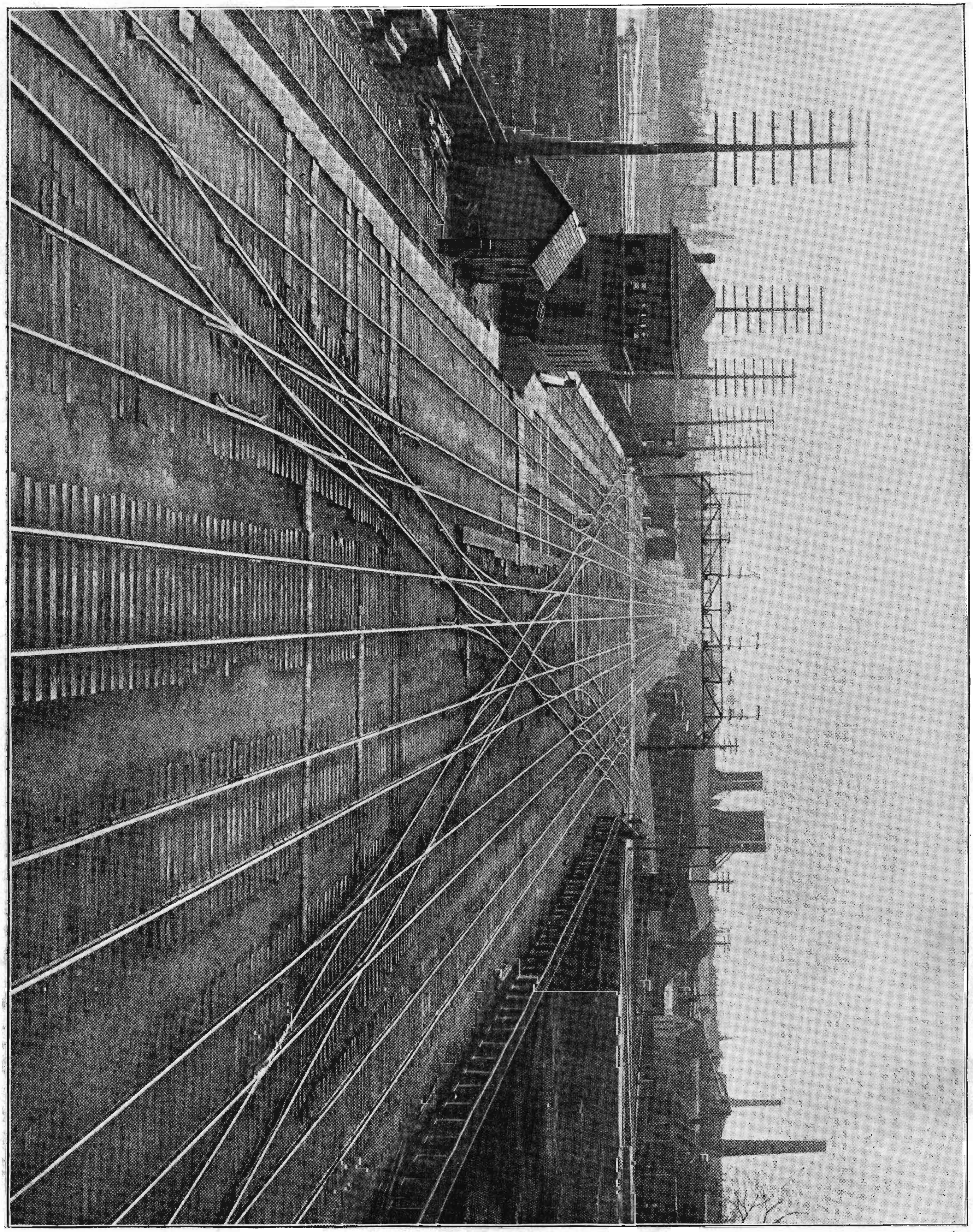
No. **PLATE 34.**

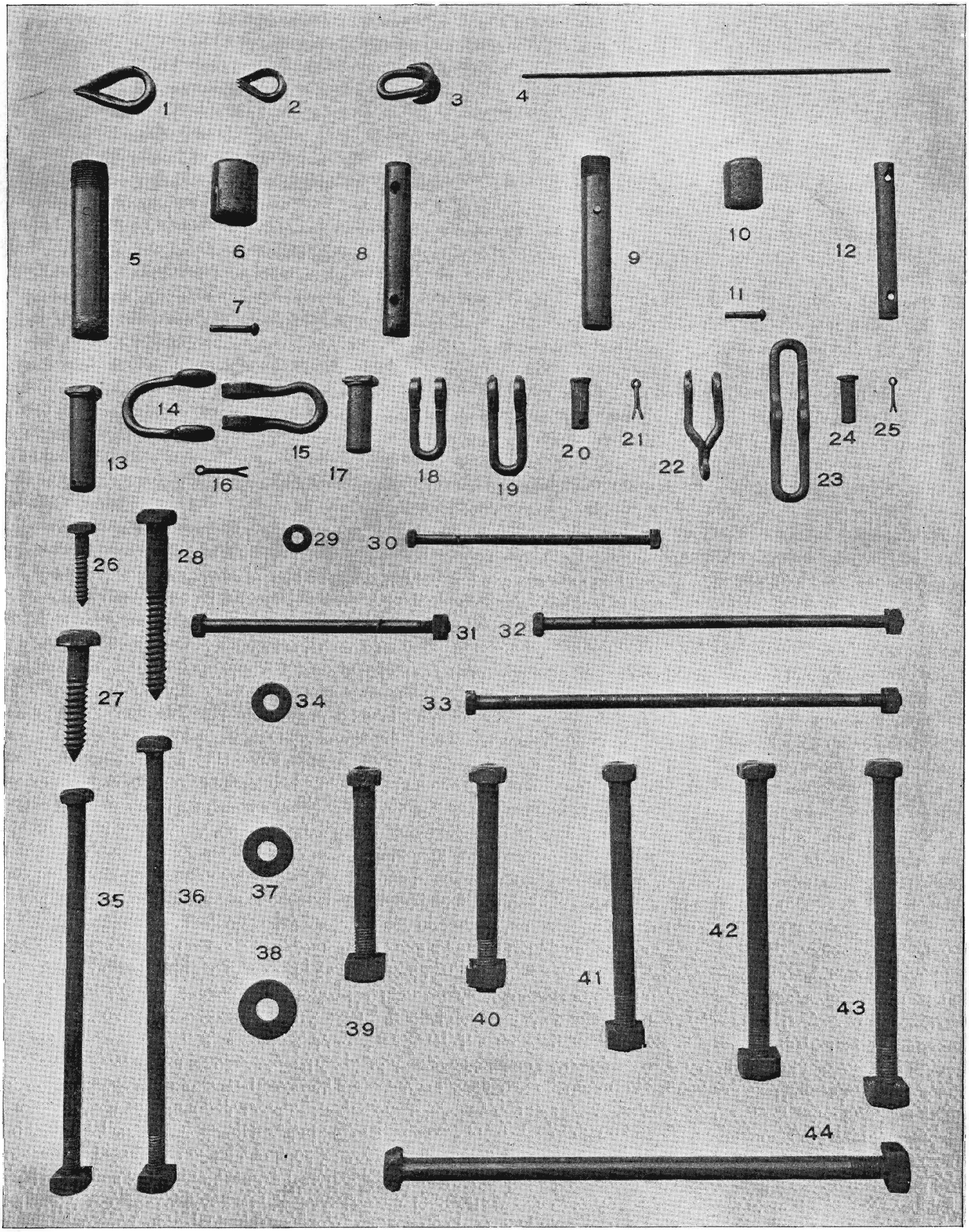
5. STAND, for anti-friction pipe carrier; this is also made in all sizes from a 1-way up; a 2-way is shown.
6. TOP ROLLER, for plain and anti-friction pipe carriers.
7. SHAFT, for top and bottom rollers; the length varies with the size of the pipe carrier.
8. SPLIT COTTER, $\frac{3}{16}$" x 1⅛", for roller shaft.
9. WOOD SCREW, #15. } For side wire carrier.
10. WOOD SCREW, #14. }
11. STAND, for side wire carrier.
12. WHEEL, for wire carriers.
13. STAND, for angle wire carrier; a 1-way is shown, but it is made also as a 2-way.
14. RIVET, $\frac{3}{16}$" x 1⅛", for angle wire carrier.
15. BASE, for angle wire carrier.
16. STAND, for common 2-way wire carriers; this is made also as a 4-way and 6-way.
17. SPLIT COTTER, ¼" x 2-½", serving as the shaft for the wheels in 2-way common and angle wire carriers, and in 4-way and 6-way common wire carriers.
18. STAND, for 1-way common wire carrier.
19. SPLIT COTTER, ¼" x 1-½", for 1-way angle and 1-way common wire carriers.

PLATE 35.

System of tracks and signals on the Michigan Central Railroad at Detroit, Mich. They are controlled by a Saxby & Farmer Improved Interlocking Machine.

Plate 4 gives another view of this place.

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Parts Relating to Pipe and Wire.

BOLTS AND LAG SCREWS.

PLATE 36.

ORDER BY PLATE AND NUMBER.

No.

1. Wire Eye, for use in connection with 7/8″ pin.
2. Wire Eye, for use in connection with No. 3.
3. Split Link.
4. Piece of #9 Signal Wire.
5. Piece of 1″ Pipe. This is drilled, plugged and threaded.
6. Sleeve, for No. 5.
7. Rivet, for joining Nos. 5 and 8.
8. Plug, for No. 5.
9. Piece of 3/4″ Pipe. This is drilled, plugged and threaded.
10. Sleeve, for No. 9.
11. Rivet, for joining Nos. 9 and 12.
12. Plug, for No. 9.
13. Turned Pin, 7/8″ x 3 3/8″, for No. 14.
14. Shackle. Used in connection with No. 15, making a double-hinged shackle.
15. Shackle. Used for connecting wire with an interlocking lever, and sometimes with No. 14, to form a double-hinged shackle.
16. Split Cotter, 3/16″ x 1 1/2″, for Nos. 13 and 17.
17. Turned Pin, 7/8″ x 2 3/8″, for No. 15.
18. Shackle, 1/2″ spread, for driving bar on one-arm dwarf signal; see Nos. 24 and 25 below.
19. Shackle, 1/2″ spread, for balance levers, etc.
20. Turned Pin, 5/8″ x 1 5/8″, for Nos. 19, 22 and 23.
21. Split Cotter, 3/16″ x 1 1/8″, for No. 20.
22. Shackle Hook. Used for fastening chain on selector hook bar.
23. Double Shackle. Used on dwarf signals and at other places where wire is to be run in two directions from a lever.
24. Turned Pin, 1/2″ x 1 3/4″, for No. 18.
25. Split Cotter, 5/32″ x 1″, for No. 24.
26. Lag Screw, 1/2″ x 2 1/2″, for fastening lamp brackets, selector bar guides, semaphore ladders, detector bar pipe guides, pipe carriers, dwarf-signal roller stands, vertical signal rod guides, etc.
27. Lag Screw, 3/4″ x 4″, for fastening selector, hook gear, motion plate, one half of compensator and crank stands, wheel and deflecting bar bases, dwarf signals, pot signals, slots, plates for detector bar, detector bar rocking-shafts, bolt locks, facing point lock castings, balance lever stands, ground lever switch stands, etc.
28. Lag Screw, 3/4″ x 6″, for fastening double and triple ground levers, box crank bases, legs of Stevens machine, etc.

No. **PLATE 36.**

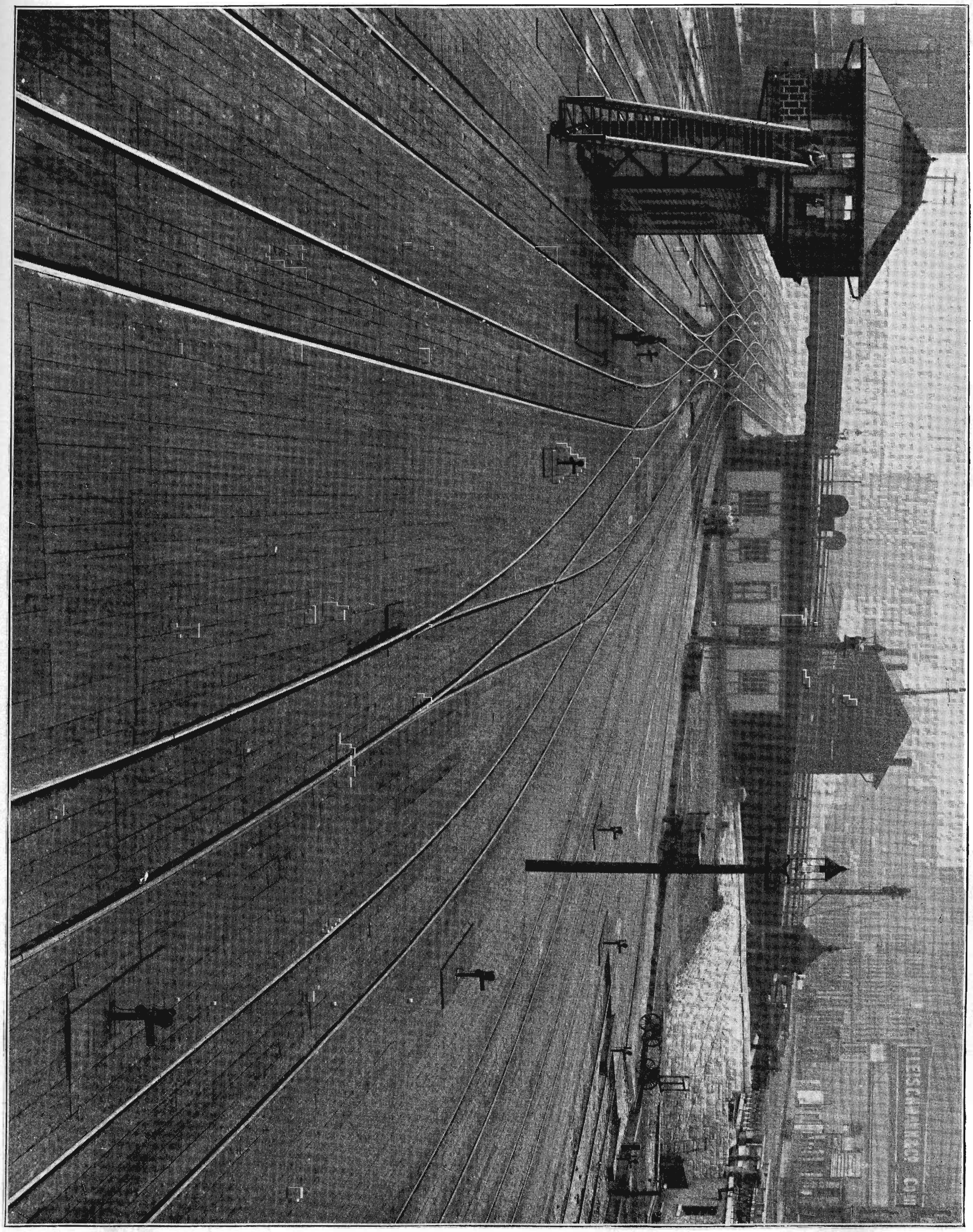
29. WASHER, 3/8", for No. 30.
30. BOLT AND NUT, 3/8" x 8½", for pipe carrier foundations.
31. BOLT AND NUT, ½" x 8½", for semaphore bearings. This is used where the post is 7" thick; if the post is thicker, the length of the bolt must be proportionately increased.
32. BOLT AND NUT, ½" x 12½", for wheel foundations.
33. BOLT AND NUT, ½" x 14½", for dwarf signal foundations.
34. WASHER, ½", for Nos. 31, 32 and 33.
35. BOLT AND NUT, 5/8" x 12¾", for crank and pipe-compensator foundations.
36. BOLT AND NUT, 5/8" x 14¾", for selector foundation.
37. WASHER, 5/8", for Nos. 35 and 36.
38. WASHER, ¾", for Nos. 39, 40, 41, 42, 43 and 44.
39. BOLT AND NUT, ¾" x 6", for fastening one half of compensator and crank stands, part of double point switch and lock movement, and lead-out shaft bearings.
40. BOLT AND NUT, ¾" x 7", for fastening leg of Saxby & Farmer machine to horizontal timber.
41. BOLT AND NUT, ¾" x 9", for fastening part of double point switch and lock movement.
42. BOLT AND NUT, ¾" x 10", for fastening a crank stand to a cross tie.
43. BOLT AND NUT, ¾" x 11", for fastening part of double point switch and lock movement.
44. BOLT AND NUT, ¾" x 17", for fastening leg of Saxby & Farmer machine to upright timber.

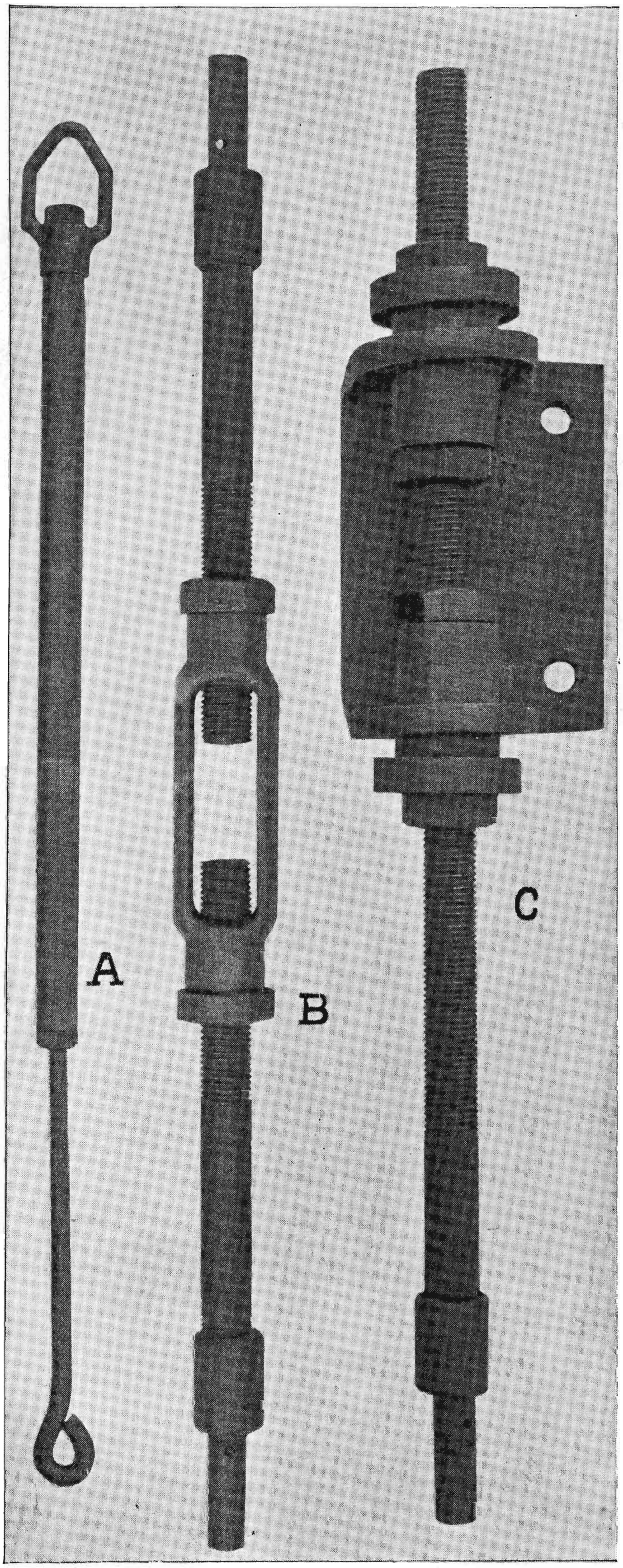
PLATE 37.

View of tracks and signals at the Union Station, Chicago.

This plant is a proof of the success that may attend the use of the One-Arm Dwarf Signal (shown on Plate 56), when used as a starting signal in places where there is not room for a main line semaphore. Although one of the busiest and most successfully-operated plants in this country, there is not a single high signal in the installation. At the other end of the station is another plant of like size and character.

PLATE 37.

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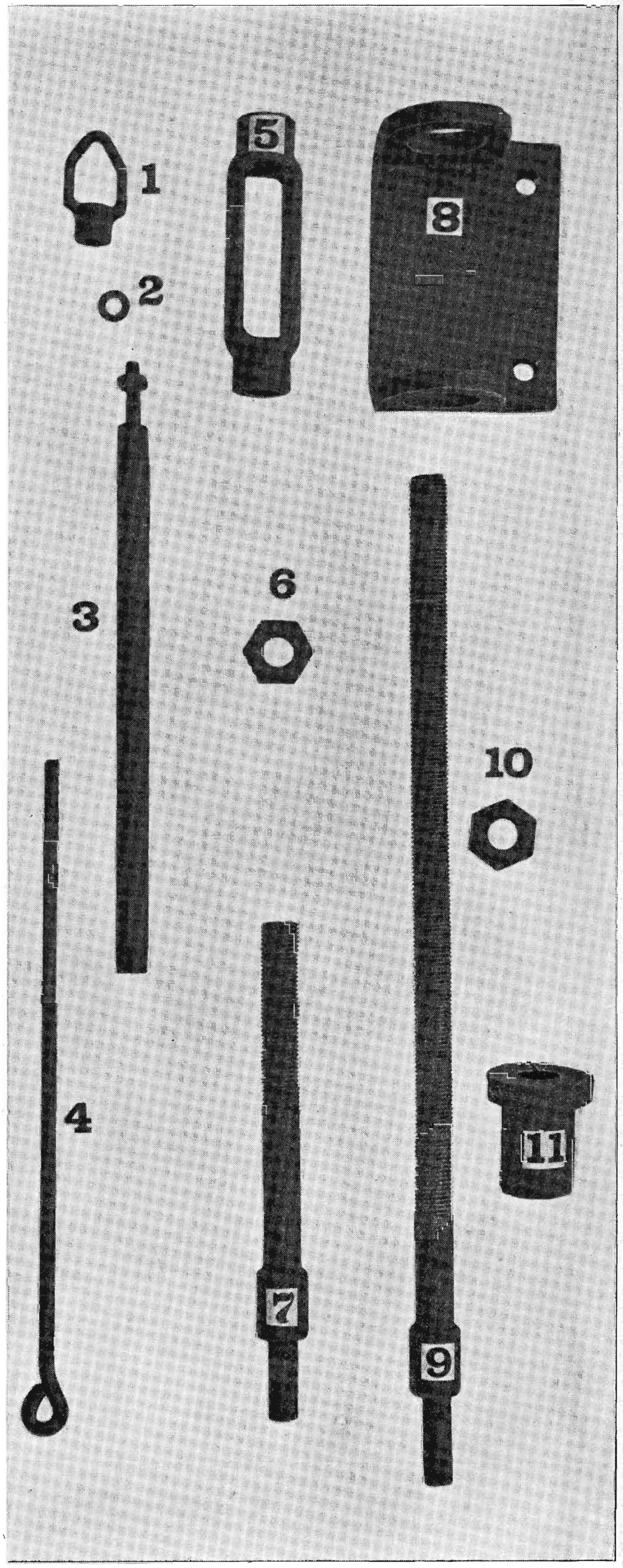
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Adjusting Screws for Pipe and Wire.

PLATE 38.

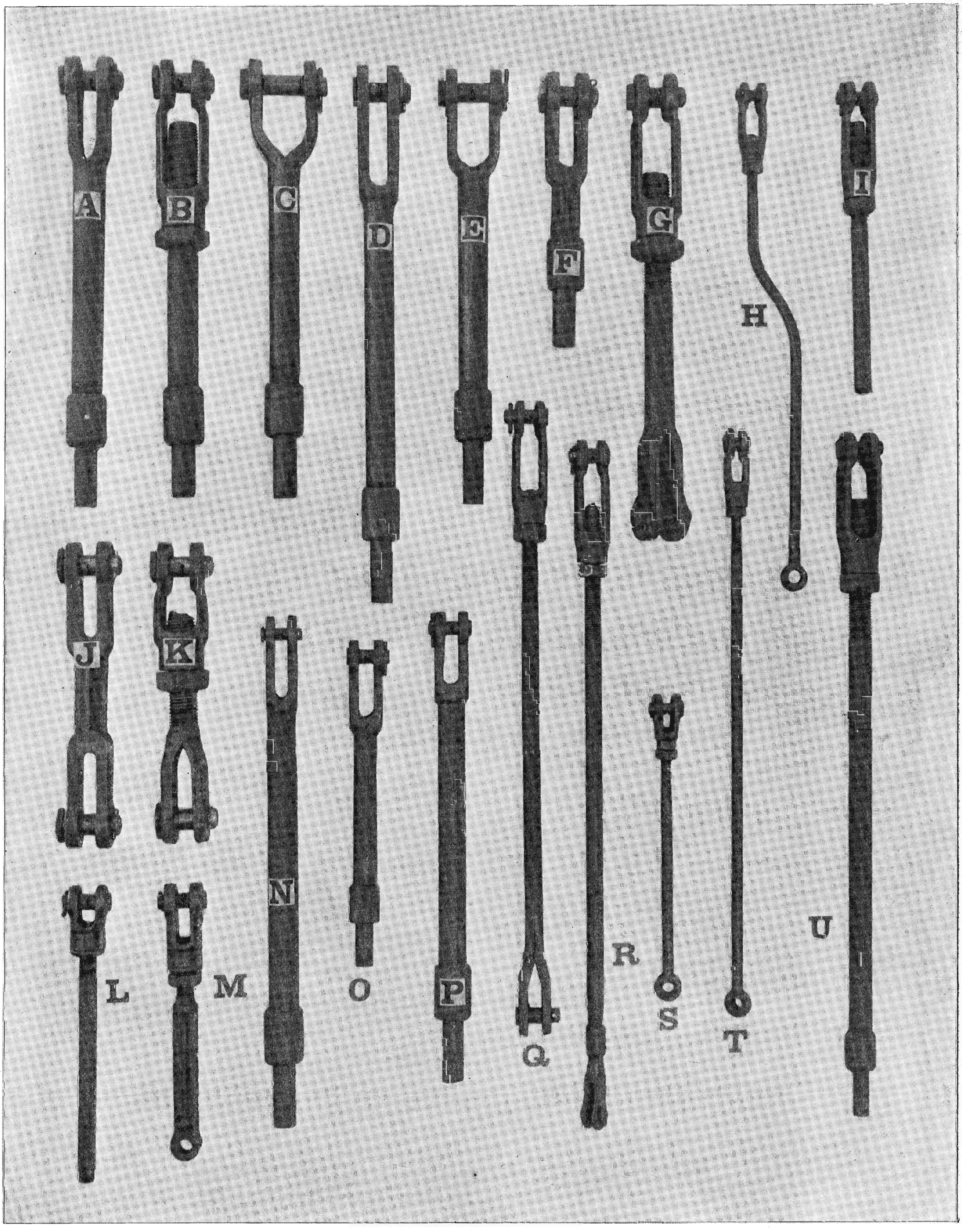
A. Wire Adjusting Screw.—This is also made as a turn-buckle like Fig. B.

B. Pipe Adjusting Screw, with a malleable iron turn-buckle; we can also furnish them with a wrought iron turn-buckle if it is desired.

C. Special Adjustment.—This is designed to be used at a switch and is riveted or bolted directly to the bridle rod; by bringing the two sleeves nearer together, or by further separating them, the throw of the switch is increased or diminished as desired.

ORDER BY PLATE AND NUMBER.

No.		
1.	Swivel, for Wire Adjusting Screw.	
2.	Washer, special ½″, for Wire Adjusting Screw.	
3.	Pipe Nut, for Wire Adjusting Screw.	
4.	Screw, for Wire Adjusting Screw.	
5.	Turn-Buckle, for Pipe Adjusting Screw.	
6.	Nut, for Pipe Adjusting Screw.	These are made with right and left-hand threads. In ordering specify which is wanted.
7.	Screw, for Pipe Adjusting Screw.	
8.	Bracket.	For Fig. C.
9.	Screw.	
10.	Nut, 1¼″.	
11.	Sleeve.	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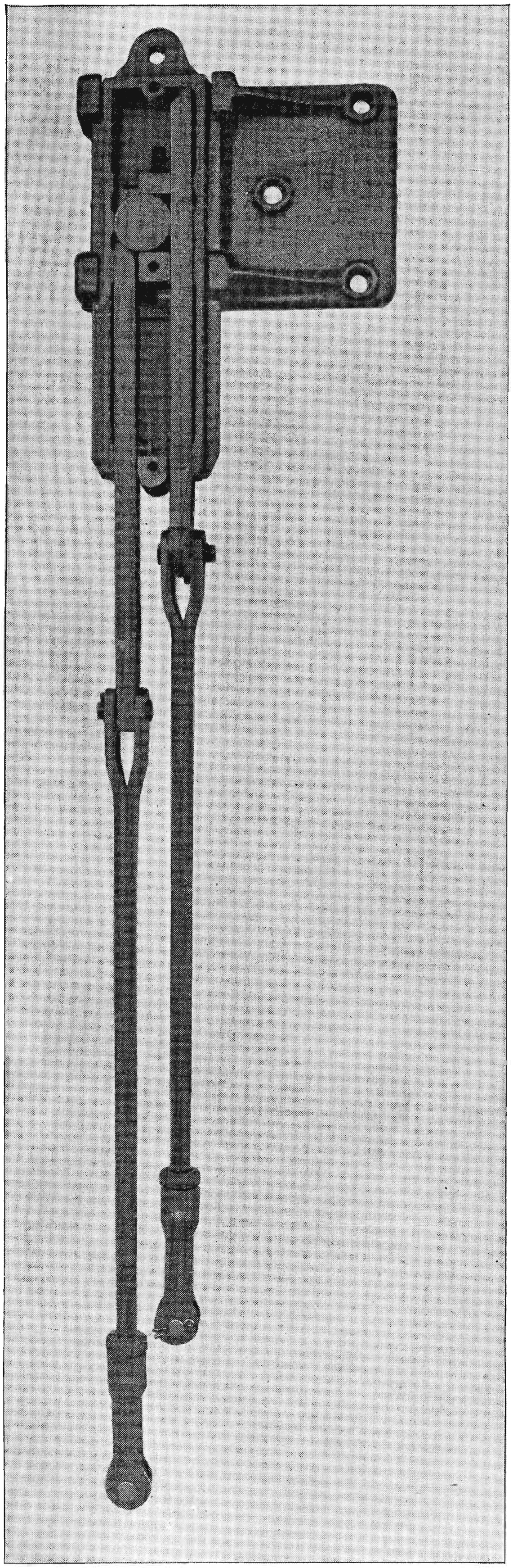
Jaws.

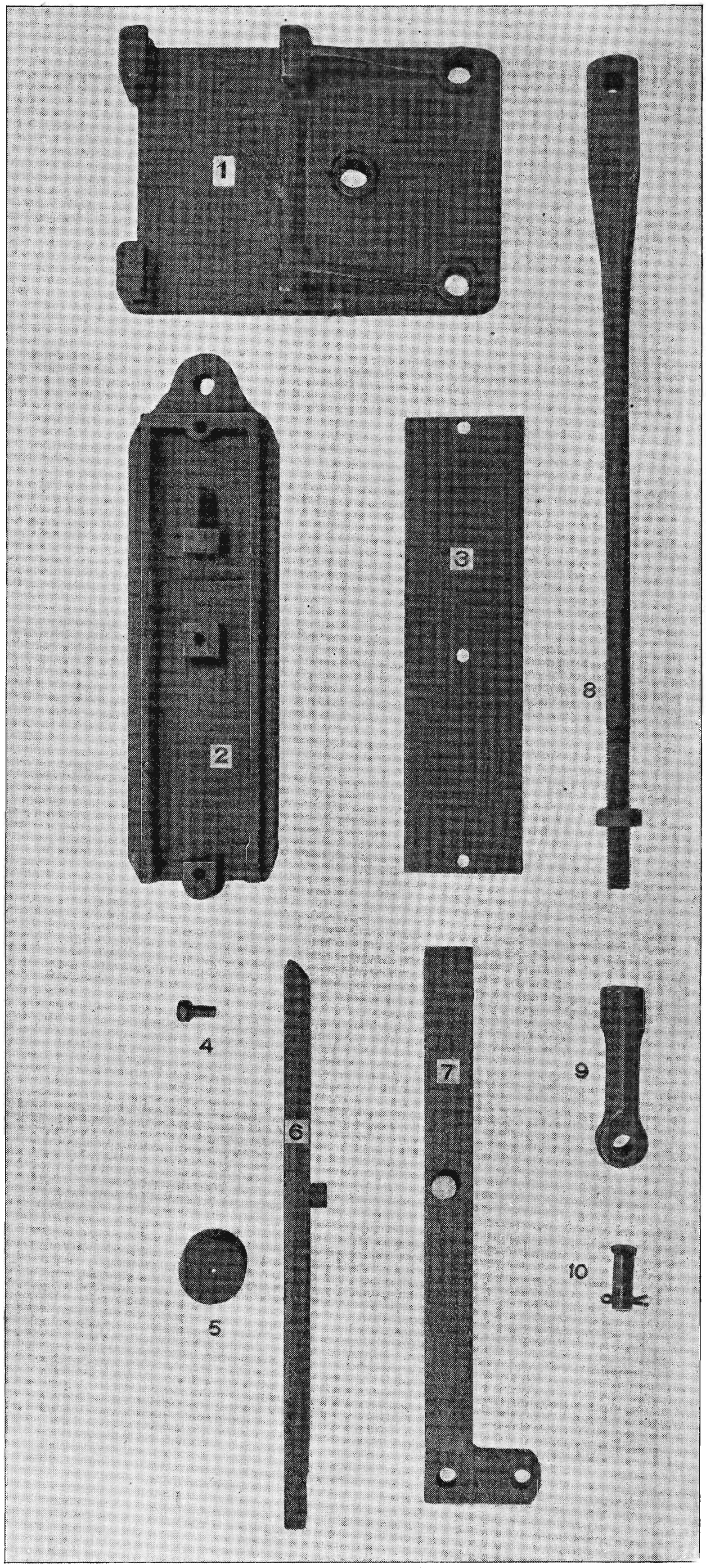
PLATE 39.

THIS page is offered as a convenient reference, and contains most of the jaws used and manufactured by us. There are, however, a few special forms not shown here, which will be found amongst the parts to which they relate.

ORDER BY PLATE AND LETTER.

A. Standard Wrought Jaw, 7/8" x 2 3/8" pin.
B. Standard Screw Jaw, 7/8" x 2 3/8" pin.
C. Standard Wide Jaw, 7/8" x 3 1/2" pin.
D. Slotted Jaw, for multiple bridge coupler, 7/8" x 2 1/2" pin.
E. Special Jaw, for scotch block, 7/8" x 3" pin.
F. Plain Malleable Jaw, 7/8" x 2 3/8" pin.
G. Adjustable Link, 18" long; made of a standard wrought and a standard screw jaw.
H. Vertical Rod, for the one-arm dwarf signal. See Plate 57, Nos. 73 and 74.
I. Screw Jaw, 3/4" rod, 5/8" x 1 5/8" pin.
J. Pipe Compensator Link, 7/8" x 2 3/8" pins.
K. Adjustable Link, 12" long, made of a standard wrought jaw and special screw-jaw, pins 7/8" x 2 3/8".
L. Jaw and Piston, for pneumatic signal cylinder, 5/8" x 1 7/8" pin.
M. Adjustable Malleable Link, for pneumatic signal post, 5/8" x 1 7/8" pin, 5/8" eye.
N. Special Jaw, 1 1/4" rod, for the pipe connected one-arm dwarf signal, 1/2" x 1 3/4" pin.
O. Special Jaw, for pipe connected block signals, 1" rod, 5/8" x 1 3/4" pin.
P. Special Jaw, for pipe connected interlocking signals, 1 1/4" rod, 5/8" x 1 3/4" pin.
Q. Adjustable Link, for a mechanical slot, 3/4" rod, 5/8" x 1 3/4" pins.
R. Adjustable Link, for main line indicator, 3/4" rod, screw jaw pin 5/8" x 1 3/4", small jaw pin 1/2" x 1".
S. Adjustable Link, for electric slots, 1/2" rod, 1/2" x 1 1/4" pin, 1/2" eye.
T. Adjustable Link, for pneumatic slots, 1/2" rod, 1/2" x 1 1/4" pin, 1/2" eye.
U. Screw Jaw for Signal Posts, 1" rod, 3/4" tang, 5/8" x 1 3/4" pin.

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The Mechanical Slot.

PLATE 40.

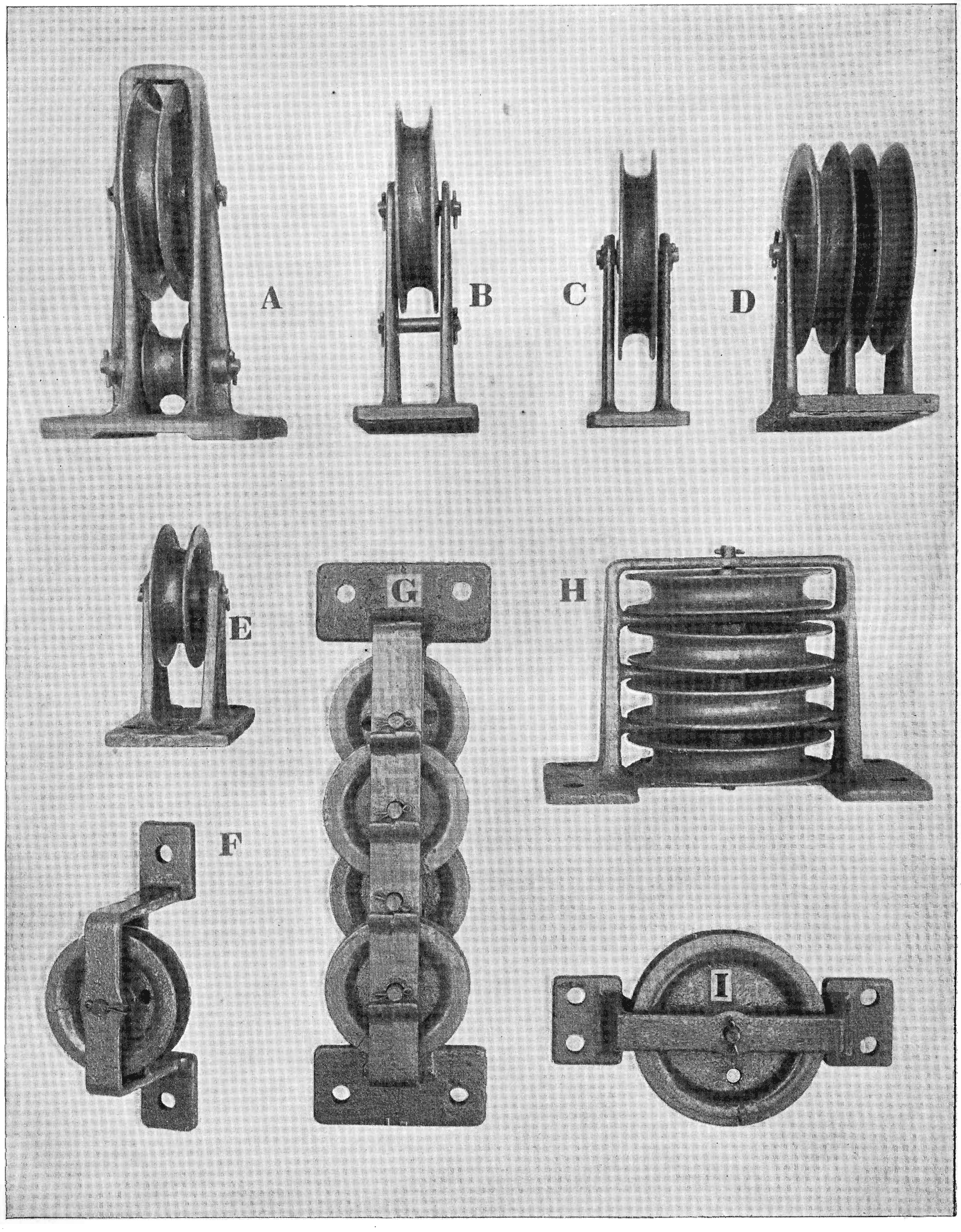
THIS device is for the purpose of placing a signal under the control of the operators in two separate cabins.

The base (No. 1) is usually placed upon a signal post, the signal to be controlled is fastened to the top of the case (No. 2), the levers in the two cabins are respectively connected with the rods (No. 6) that lie in the case. The operation is as follows: the reversing of either lever alone does not affect the position of the signal, but carries the rod to which that lever is connected to the top of the case, forcing the roller (No. 5) in front of and above the other rod; the situation is now like that shown in the illustration, the lever to which the right-hand rod is connected having been reversed. When the left-hand rod is pushed up, the case itself is forced to follow it, no other movement being possible, which results in the clearing of the signal. During the last action the roller has been slid along the side of the right-hand rod, and the bottom of the case has been brought up to the dog which is seen in profile on No. 6; a contrary effect is therefore secured in the return movement, for it is the first rod that is lowered which causes the signal to go to danger, while the lowering of the second rod accomplishes nothing but to restore it to its normal position.

On rare occasions it is desirable to control from two cabins a distant signal that is mounted on the same post with a home signal; for this purpose a special rod (No. 7) is provided.

ORDER BY PLATE AND NUMBER.

No.
1. Base.
2. Case.
3. Cover.
4. Tap Bolt, for cover.
5. Roller.
6. Ordinary Rod.
7. Special Rod.
8. Link.
9. Screw Jaw for Link.
10. Turned Pin and Cotter, for screw jaw.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Chain Wheels.

PLATE 41.

WE HAVE two standard sizes of wheels, a 6″ and an 8″; the 8″ wheels will fit only the large stands, but the 6″ wheel, which has the same thickness as the 8″, can be used in any stand.

A. VERTICAL 8″ WHEEL.—It has a pipe carrier at the bottom, and is used solely at those places where it is desired to change from a pipe to a wire line, as in the case of the back wire at the standard selector (see Plate 33), and at the abutments of drawbridges; it is made also as a 2-way.

B. STANDARD 1-WAY VERTICAL 8″ WHEEL, for the front wire in a cabin; it is made also as a 2-way.

C. STANDARD 1-WAY VERTICAL 8″ WHEEL, for the back wire in a cabin.

D. STANDARD 2-WAY VERTICAL 8″ WHEEL, for the back wire in a cabin.

E. LOW 6″ VERTICAL WHEEL, used for special purposes, as at dwarf signals with indicators.

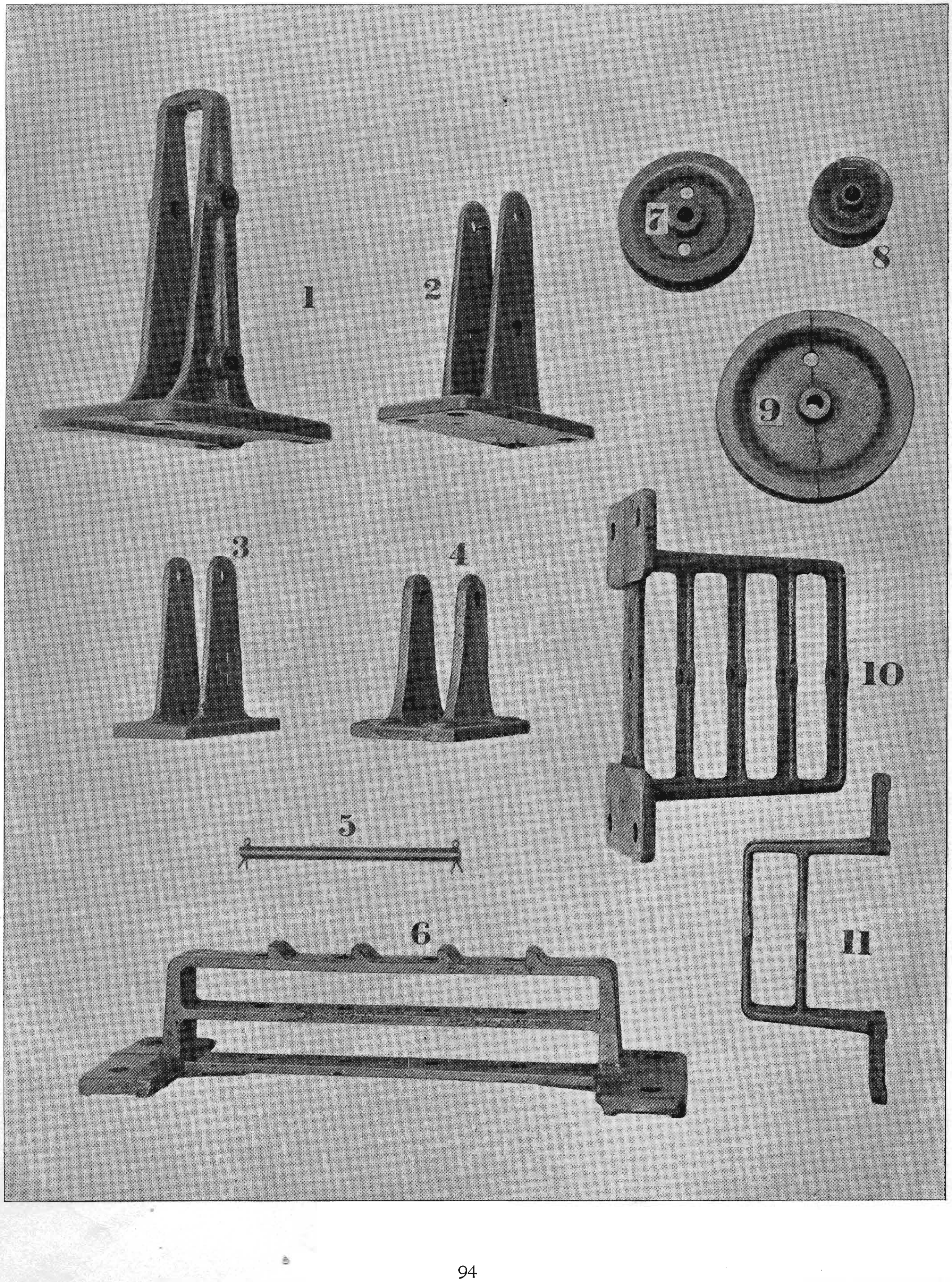
F. SPECIAL 6″ HORIZONTAL 1-WAY WHEEL, used particularly at the one-arm dwarf signal.

G. BOX (6″) WHEEL.—It is made as a 4-way, 6-way and 8-way; a 4-way is illustrated.

H. COMMON 4-WAY 8″ HORIZONTAL WHEEL.—This is made also as a 5-way, 3-way, 2-way and 1-way, which latter is shown in Fig. I.

I. TOP VIEW OF A COMMON 1-WAY 8″ HORIZONTAL WHEEL.—The 4-way of this style is shown in Fig. H.

The separate parts will be found upon Plate 42.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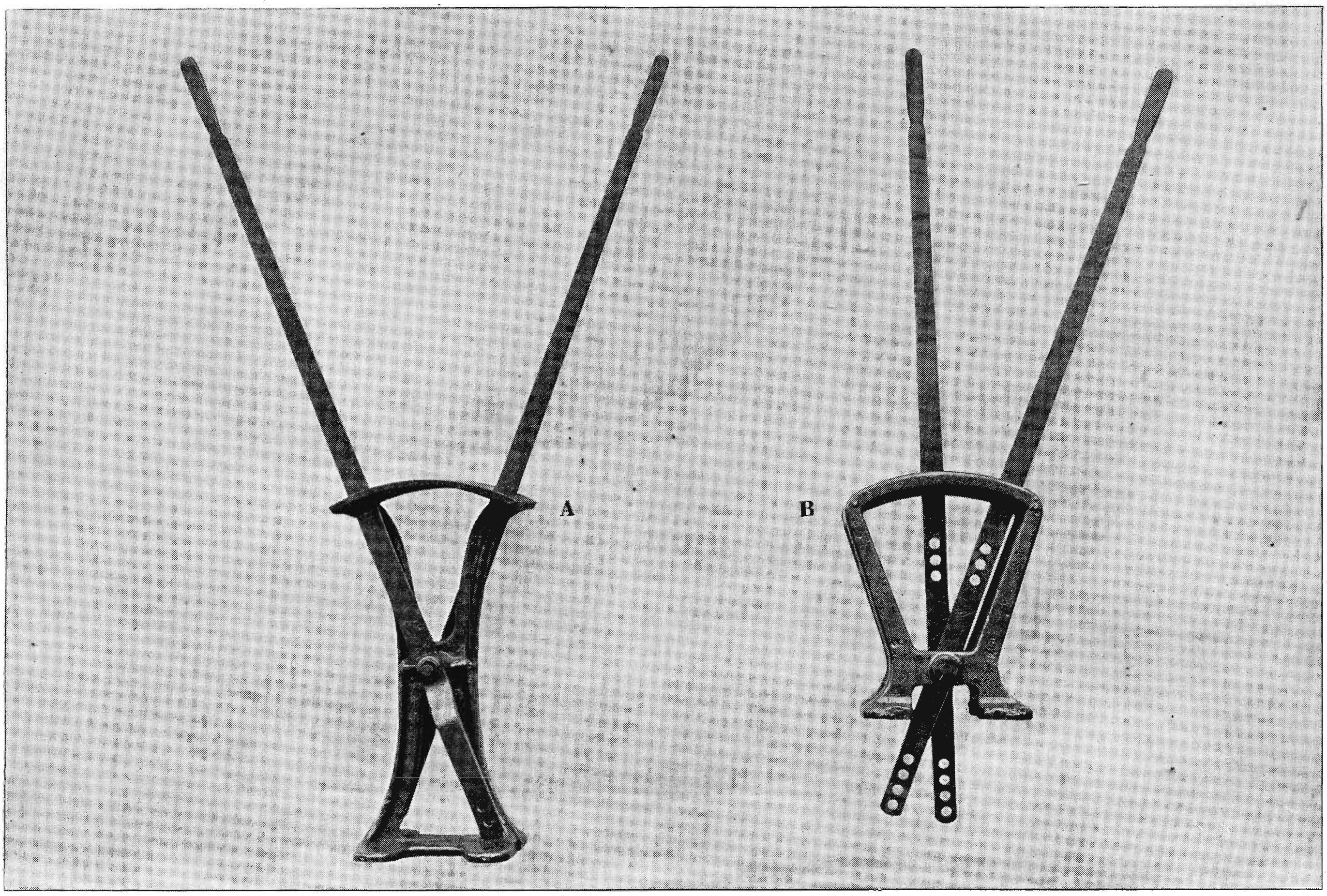
Chain Wheels.

PLATE 42.

ORDER BY PLATE AND NUMBER.

No.

1. WHEEL STAND, for transfer lug from pipe to wire; it is shown in position on Plate 10, attached to the selector. This is also made as a 2-way.
2. STAND, for front wire vertical 8″ wheel.
3. STAND, for back wire vertical 8″ wheel.
4. STAND, for vertical 6″ wheel.
5. SHAFT, 5/8″ diam., used for all wheels.
6. STAND, for 6″ box wheel, 4-way is shown; it is made also as a 6-way and 8-way.
7. ORDINARY 6″ wheel.
8. BOTTOM WHEEL, for stand No. 1.
9. ORDINARY 8″ WHEEL.
10. STAND, for 4-way horizontal 8″ wheel; made also as 1-way, 2-way, 3-way and 5-way.
11. STAND, for 1-way 6″ horizontal wheel. Used mostly in connection with the standard one-arm dwarf signal.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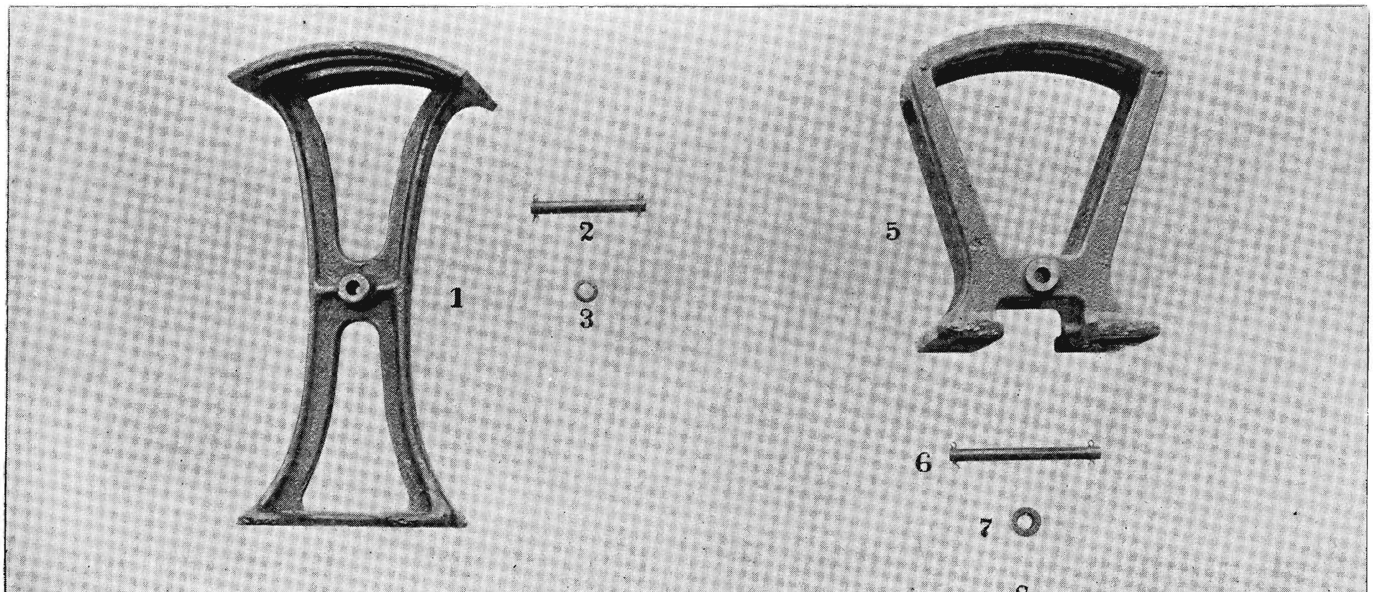
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Block Signal Stands.

PLATE 43.

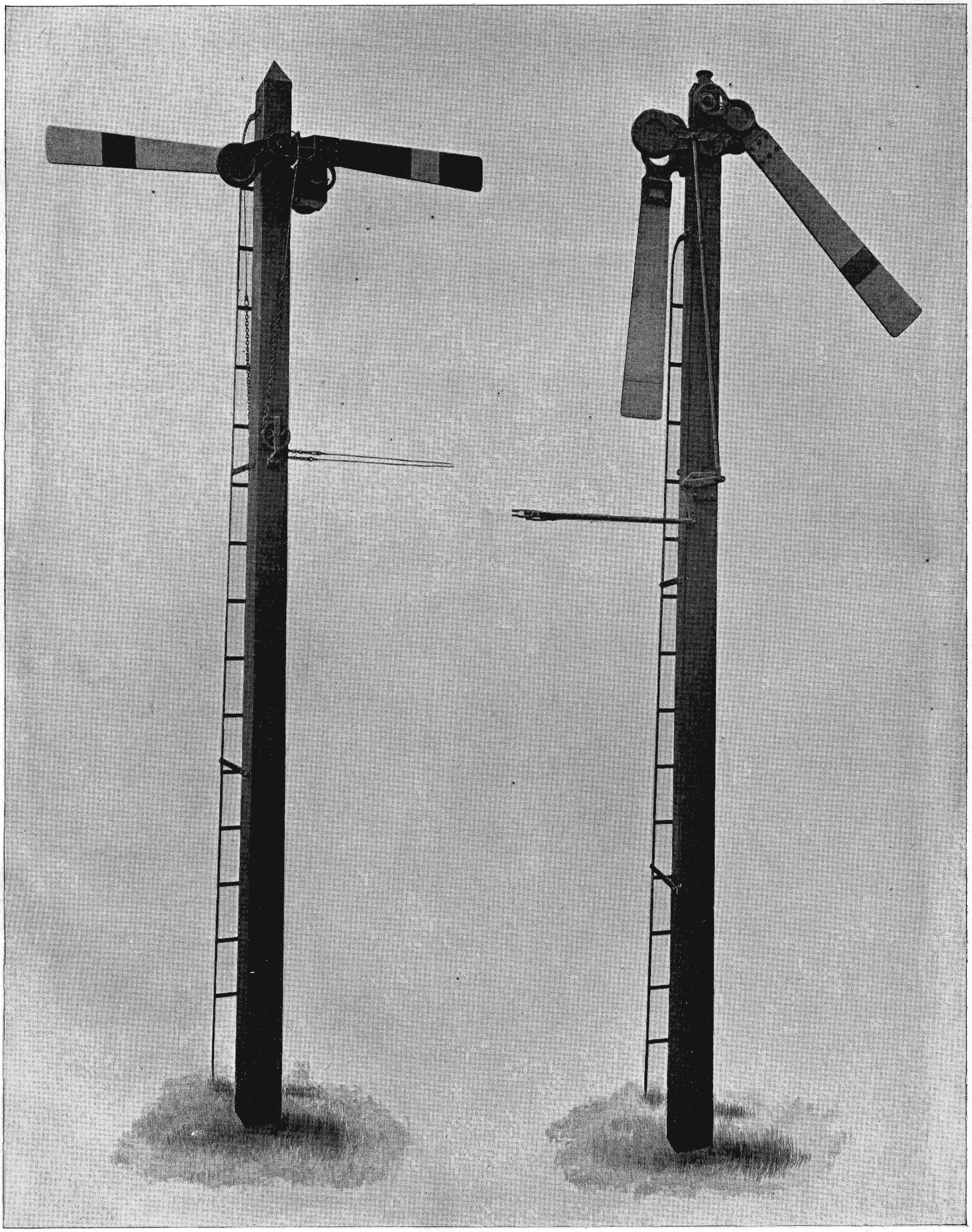
A. High Stand.—In this stand the levers are entirely above the floor line.

B. Low Stand.—Here the levers extend below the floor line and the signal connections may be placed either above or below.

Either of these stands may be arranged for a three-position signal if it is desired; therefore, please specify in ordering.

ORDER BY PLATE AND NUMBER.

	No.	
Parts Relating to "A" only.	1.	Stand.
	2.	Shaft, ¾″ diam., and cotters 1¼″ x $\frac{3}{32}$″, for No. 4.
	3.	Special Washer, ¾″, for No. 4.
	4.	Lever.
Parts Relating to "B" only.	5.	Stand.
	6.	Shaft, ¾″ diam., and cotters 1¼″ x $\frac{3}{32}$″, for No. 8.
	7.	Cast Washer for No. 6.
	8.	Lever.



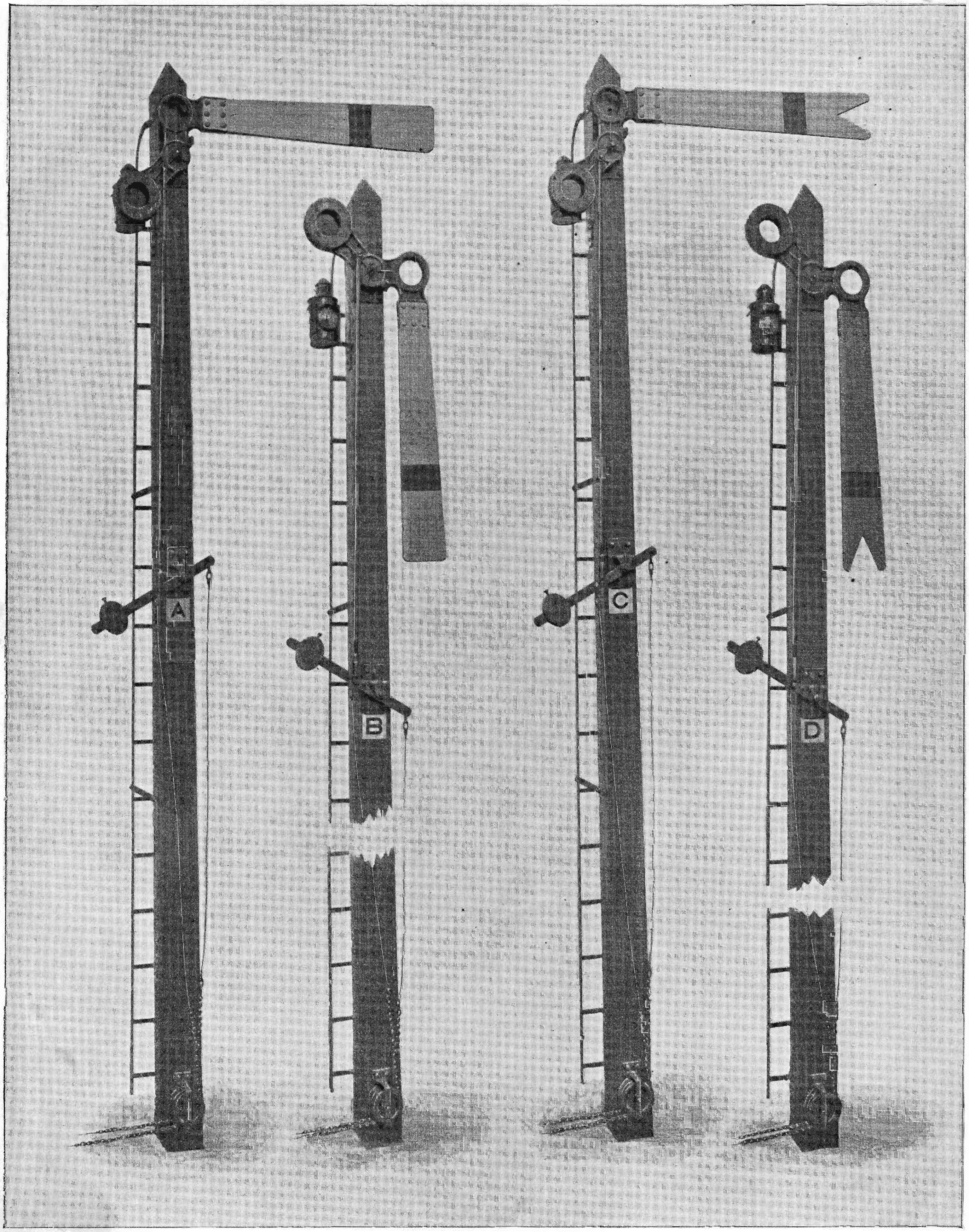
Station Block Signals.

PLATE 44.

THE figure on the left illustrates our standard form of block signal as it is arranged when placed in front of a telegraph office or block signal station. The two blades control trains running in opposite directions and by the use of semaphore casting No. 3, Plate 50, one lamp only is required. This signal may be operated either by pipe or wire, although when located near the cabin, wire is much the cheapest arrangement, and is quite strong enough.

On the right is illustrated the block signal in use on the Pennsylvania Lines West of Pittsburg. The blade pointing to the right occupies the cautionary position, which is made possible by the great angle (90°), which separates the danger (horizontal) and clear (vertical) positions. One lamp only is required with each of these double signals, since it is placed on top of the post and shines in both directions through the ring attached to the top of the semaphore casting. This signal is always operated by pipe in connection with one of the stands shown on Plate 43.

The parts may be found on Plates 49, 50 and 51.


A
B
C
D

Standard Semaphores of the Pennsylvania Lines West of Pittsburg.

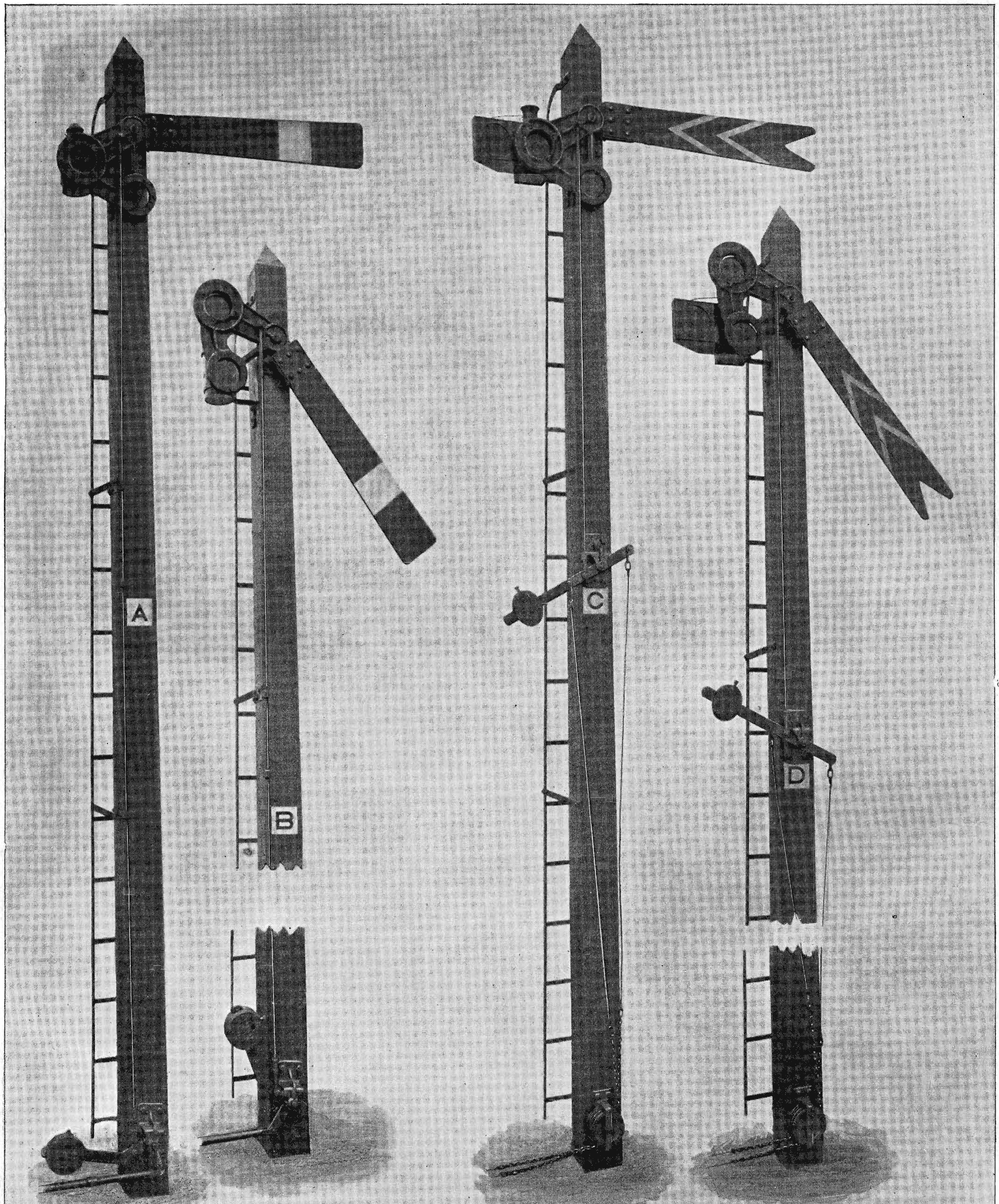
PLATE 45.

THE main objects of this system, which was designed by Mr. W. McC. Grafton, Signal Engineer of the above-named road, are: first, to secure a more consistent signal than the ordinary one, by painting the blades a negative color and depending for their identification solely on form, thus doing away with the contradiction incident to passing a clear signal that is painted red; second, to make a greater distinction between a danger and a clear signal, by increasing the arc through which the blade must travel.

The ordinary night signals, red for danger, green for caution, and white for safety, are retained.

The different parts are illustrated on Plates 49, 50 and 51.

On the previous page the application of this semaphore to block signaling is shown.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The Chicago & Northwestern R'y Standard Semaphores.

PLATE 46.

THESE semaphores are singular in the colors adopted for night signals, and in the fact that the home signals on this road are always operated by pipe; the distant signals, like those on almost all other roads, are operated by wire.

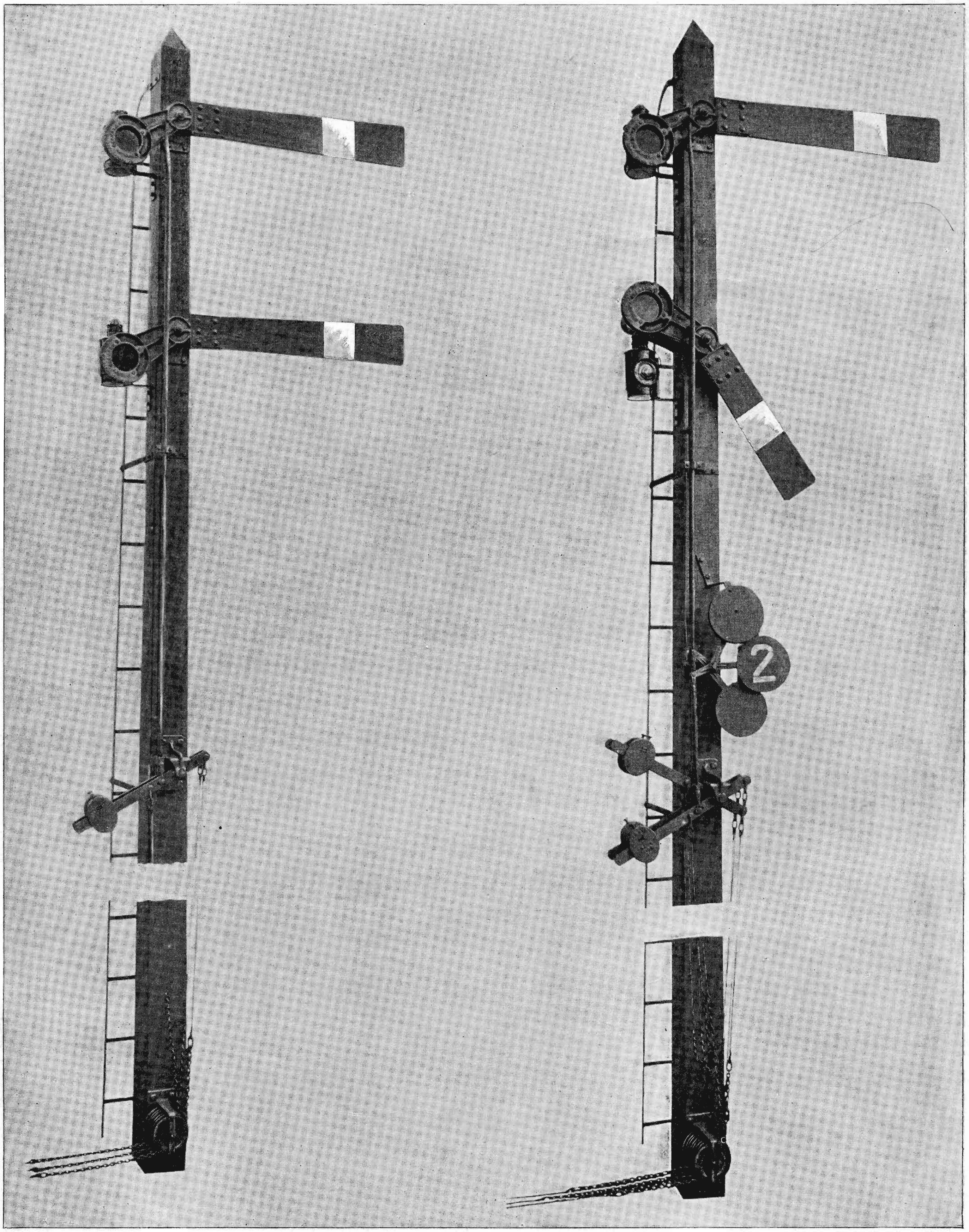
The home signal in the danger position exhibits a red light, while in the clear position a green light is shown.

The distant signal carries a peculiarly shaped lamp (Plate 59, Fig. C), which has on its face two openings; the one on the left is filled with a green glass, and is never obscured, while the opening on the right is protected with a white lens, which, however, is never visible. The upper hole in the distant signal semaphore casting carries a red glass, the lower a metallic shield; therefore, when a distant signal is in the danger position two lights are visible, a green and a red, but when the signal is in the clear position, only the green light is visible, owing to the presence of the metallic shield in front of the white lens.

The practical result of this method of lighting is an entire avoidance of the danger due to the breaking of the colored glasses ordinarily carried in semaphore castings, for in this system a white light is not construed as a signal at all.

This method was conceived by Mr. E. C. Carter, Principal Assistant Engineer of the Chicago & Northwestern R'y.

The parts of these signals are illustrated on Plates 49, 50 and 51.



2

Ordinary Two-Armed Straight Post, and Straight Post with Indicators.

PLATE 47.

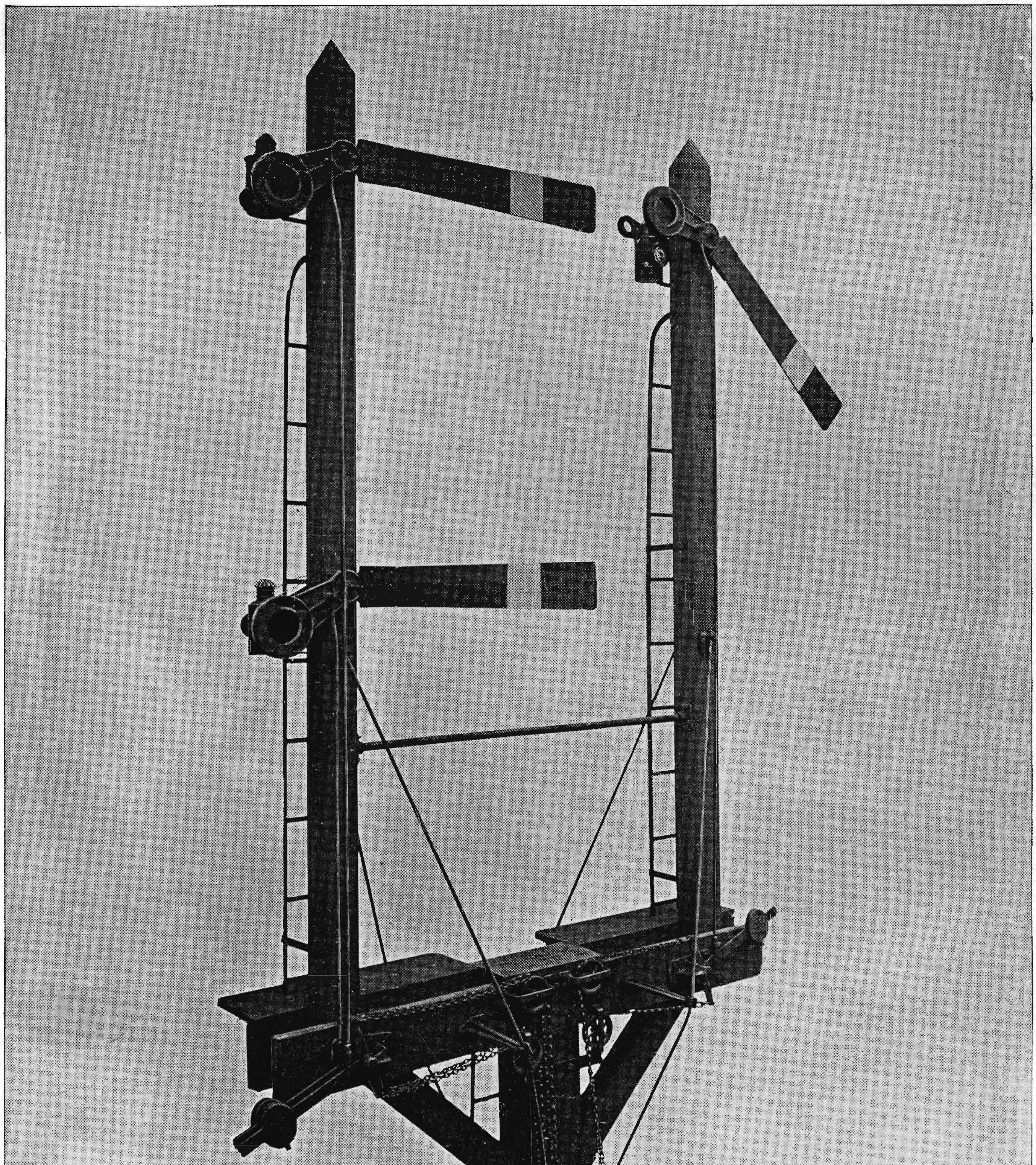
THE Two-Armed Straight Post illustrates the commonest form of main line signal. The usual height is about 20 feet from the ground level to the lower arm; one foot in the ground for every four feet above ground, and six feet between the centers of the arms. Except the last, these dimensions are variable and are often departed from when the circumstances warrant it.

This post may be built with any number of arms from one up to five or even more, although the practice is now quite general not to place more than two arms on each post, the upper one for the direct or fast route, the lower one for all divergent routes.

The Straight Post with Indicators is the type used on many of the New England railroads, where the practice noted above with regard to the use of not more than two arms on one post has not yet been adopted.

The indicators are a compromise between the two-armed post and the early practice of using as many arms as there were routes to be followed. In some cases a reflecting lamp, see Fig. M, Plate 59, which casts its light upon the face of the lower arm, is used instead of the lamp shown in the illustration, while still other roads use the illuminated blade, Plate 55; the last seems to give the best results, since it gives a better light than the reflecting lamp, and makes a distinction between the upper and lower arms which is unmistakable.

The parts of these posts will be found illustrated on Plates 49, 50 and 51.



The Bracket Post.

PLATE 48.

THIS style is used at places where the post cannot be located next to the track which it governs; the arrangement of the uprights determines as to what track or tracks the signals control, for a bracket post often relates to more than one track. The following diagram illustrates a few of the different arrangements of signals:

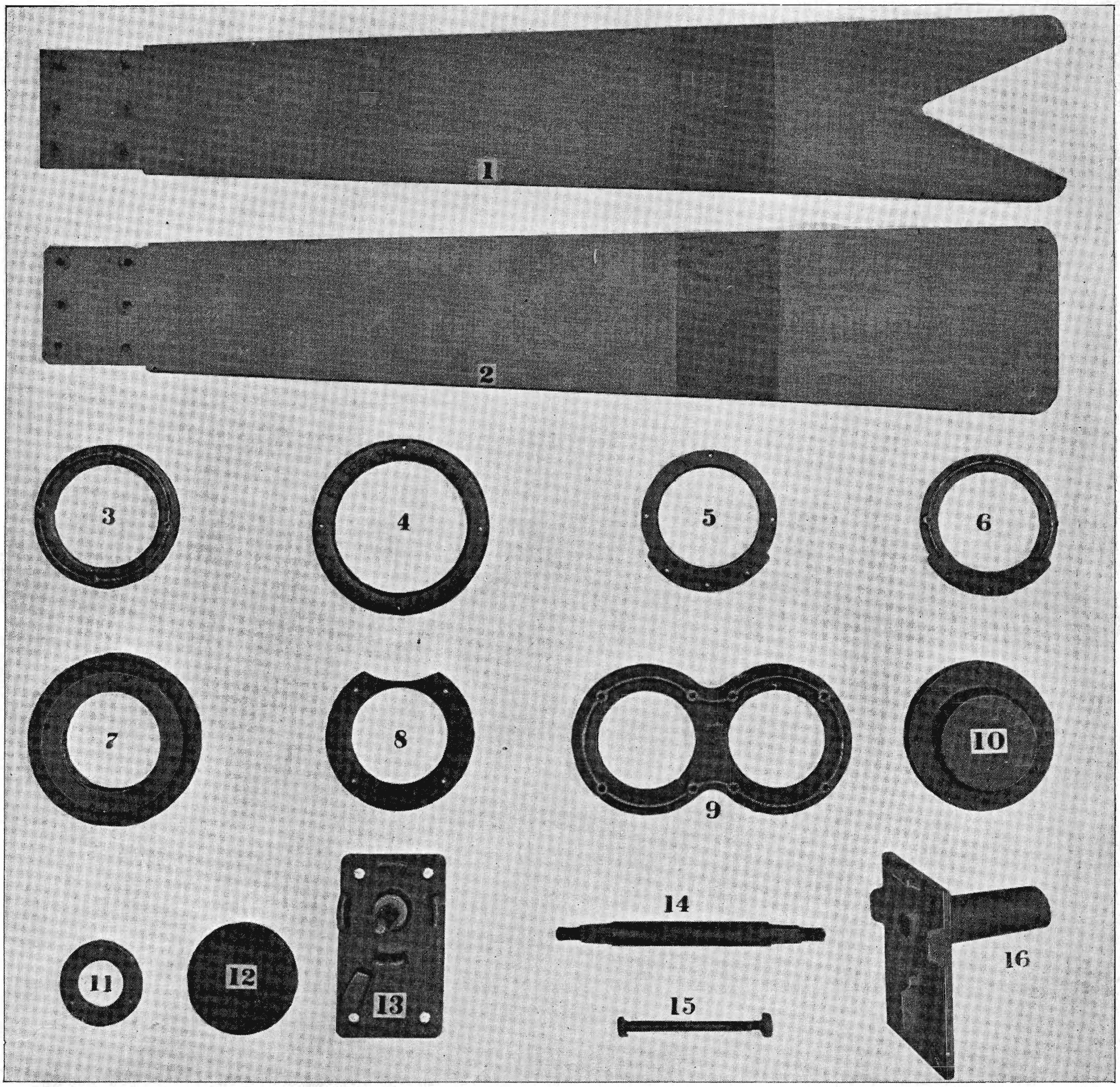
No. 1 would be placed next to a pair of tracks, on both of which trains running in the same direction are controlled.

No. 2 is that which is used where one track intervenes between the post and the track which is signaled; the dummy upright stands for the unsignaled track, and usually carries a blue light at night.

No. 3. Here three tracks are involved; the middle upright is a dummy for the middle track, while the outside uprights signal trains running in the same direction on the outside tracks.

No. 4. On this arrangement the dummy upright indicates that the track next to the post is not signaled while trains running in opposite directions on the other two tracks are signaled.

The parts of these posts are illustrated on Plates 49, 50 and 51.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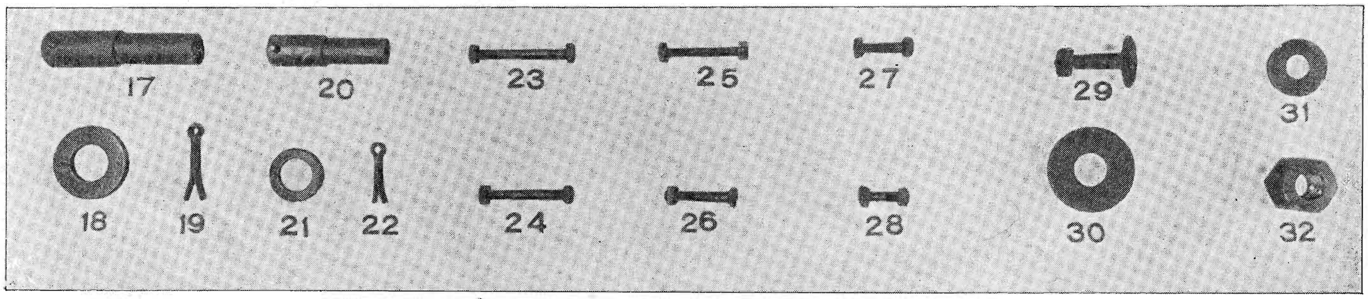
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Main Line Semaphore Fittings.

PLATE 49.

ORDER BY PLATE AND NUMBER.

No.

1. Distant Signal Blade. } In ordering state what casting on Plates 50 and 53 it is to fit.
2. Home Signal Blade. }

*3. Ring, for Nos. 1, 4, 7 and 8.

*4. Ring, for Nos. 2, 5 and 6.

*5. Plain Ring. } For No. 3.

*6. Filleted Ring. }

*7. Weighted Ring, for No. 4; used only when the casting is operated by wire.

*8. Plain Ring. } For No. 7, when used as a station block signal.

*9. Double Filleted Ring. }

*10. Weighted Ring. }

*11. Back Light Ring, for No. 9; give diameter of the glass which it is to cover.

*12. Piece of Glass, for any one of the castings; made in all sizes and colors.

*13. Semaphore Bearing, in ordering state which one of the castings it is to fit; used only when there is no back light.

14. Semaphore Shaft. } For No. 16.

15. Bolt and Nut, ½″ x 8″. }

*16. Semaphore Bearing, in ordering state which one of the castings it is to fit; used only in connection with a back light.

*17. Stud, ⅞″ x 3½″, for vertical signal rod on No. 7.

18. Washer, ⅞″. } For No. 17.

19. Split Cotter, $\frac{5}{32}$″ x 1½″. }

*20. Stud, ¾″ x 2¾″, for vertical signal rod on Nos. 1, 2, 3, 4, 5, 6 and 8.

21. Washer, ¾″. } For No. 20.

22. Split Cotter, $\frac{5}{32}$″ x 1¼″. }

*23. Bolt and Nut, ¼″ x 2″, for fastening ring to lower hole in No. 7.

*24. Bolt and Nut, ¼″ x 1⅞″, for fastening ring to No. 1, and to upper hole in No. 7.

*25. Bolt and Nut, ¼″ x 1⅝″, for fastening rings to upper holes on Nos. 5 and 6.

*26. Bolt and Nut, ¼″ x 1½″, for fastening rings to Nos. 2, 8, 9, and lower holes on Nos. 5 and 6.

27. Bolt and Nut, ¼″ x 1¼″, for joining Nos. 8 and 9.

28. Bolt and Nut, ¼″ x 1″, for joining Nos. 5 and 6.

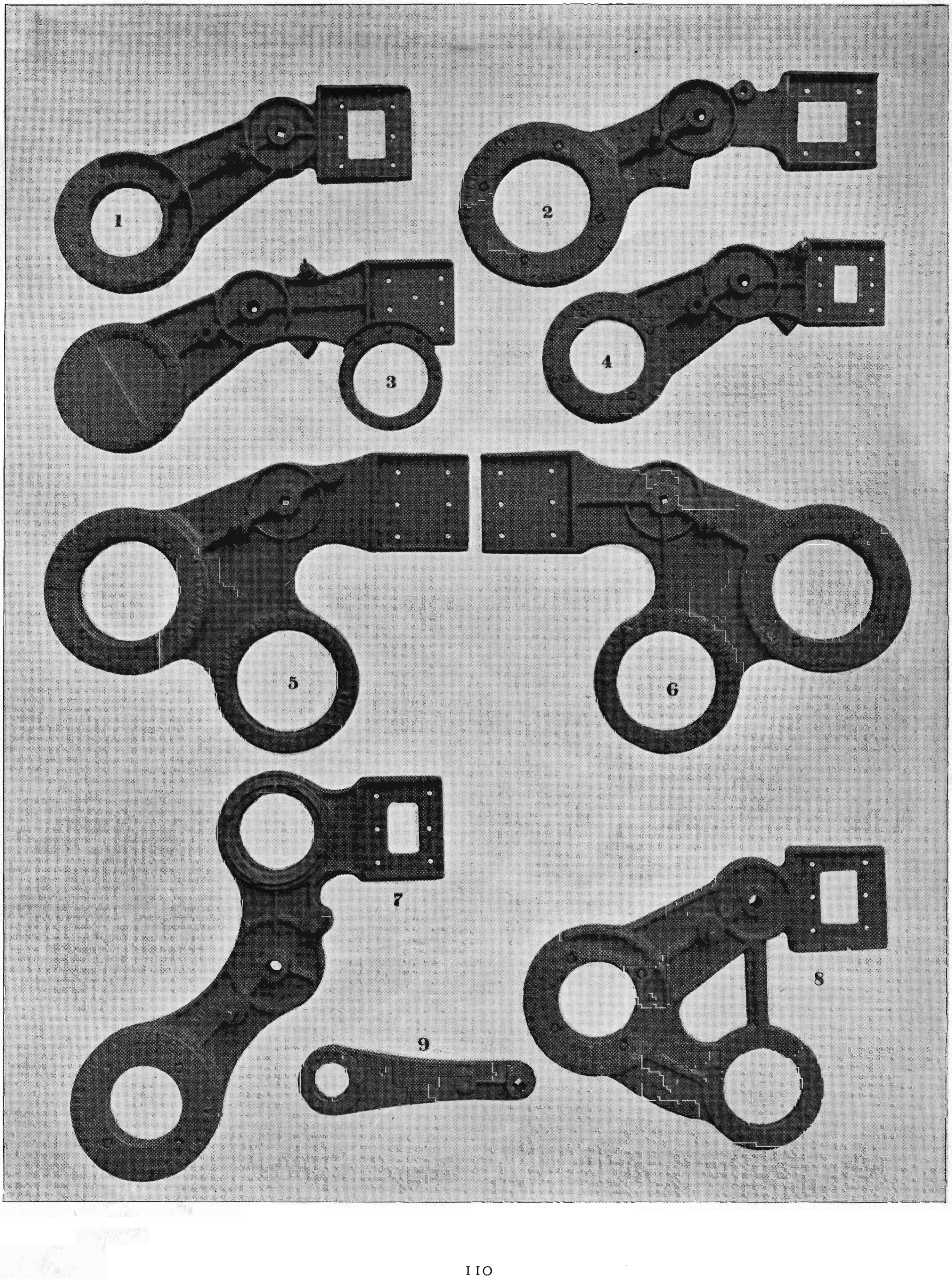
29. Bolt and Nut, ⅜″ x 1½″, for fastening Nos. 1 and 2.

30. Washer, ¾″, for No. 14.

31. Washer, ½″, for No. 15.

32. Nut, ¾″, for No. 14.

* The references in the text are to the semaphore castings on Plate 50.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Main Line Semaphore Castings.

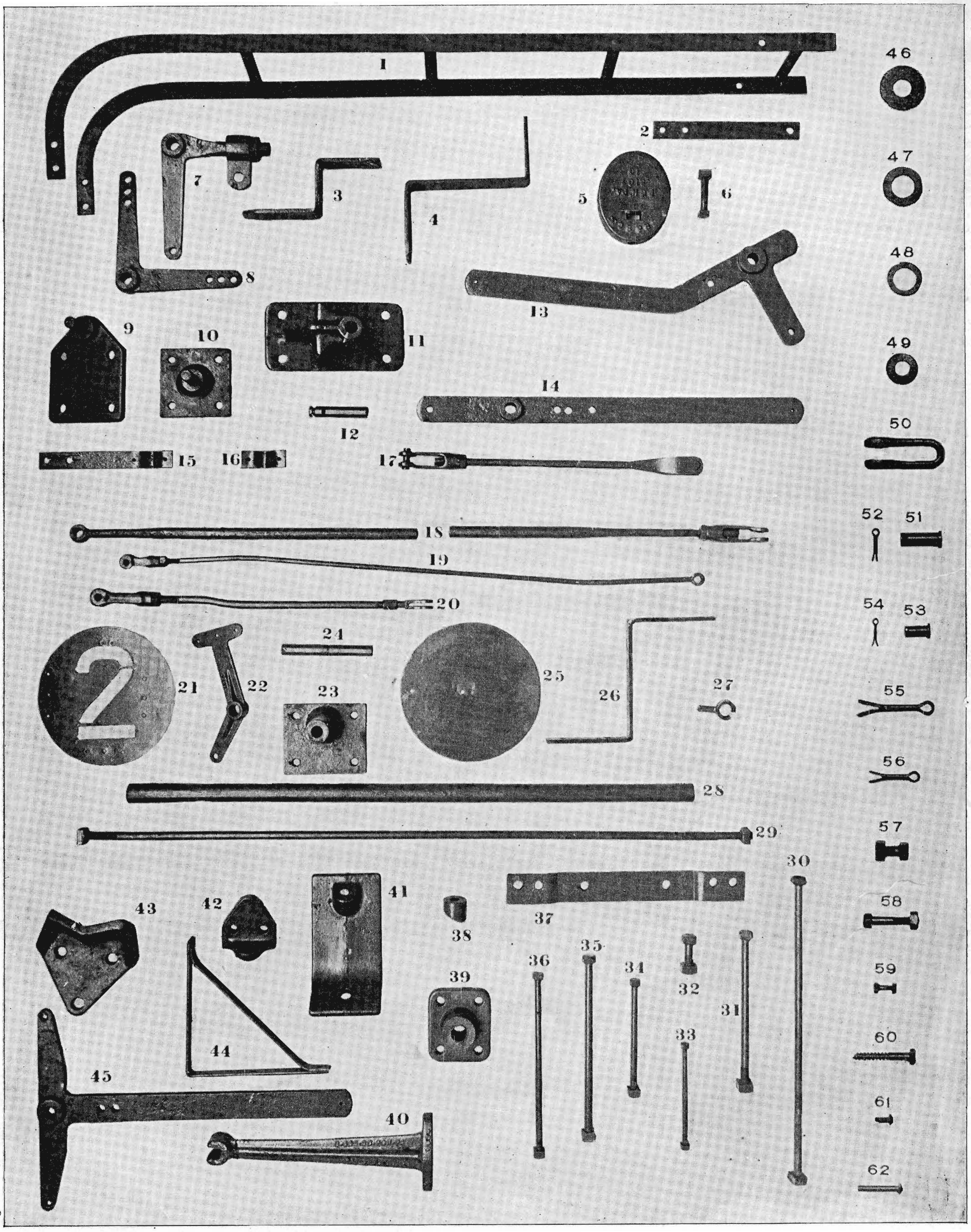
PLATE 50.

In ordering Nos. 1, 2, 4, 5, 6, 7 and 8, state whether a round or square shaft hole is required. For fittings see Plate 49.

ORDER BY PLATE AND NUMBER.

No.

1. Ordinary Single-Light Casting, 6½″ glass.
2. Special Single-Light Casting, 8⅜″ glass.
3. Block-Station Casting, with ring for glass. If the ring is wanted it must be ordered separately (see Nos. 5 and 6 Plate 49), 6½″ glass.
4. Block-Station Casting, 6½″ glass.
5. Right-Hand Two-Light Casting, 8⅜″ glass.
6. Left-Hand Two-Light Casting, 8⅜″ glass.
7. Pennsylvania Company Three-Position Casting (see Plate 45), 6½″ glass.
8. Chicago & Northwestern R'y Casting (see Plate 46), 6½″ glass.
9. Back-Light Casting. In ordering state which one of the above castings it is to be used with, and the size of the glass that it will require.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Main Line Semaphore Post Fittings.

PLATE 51.

ORDER BY PLATE AND NUMBER.

No.		
1.	Piece of Ladder.	Give length required.
2.	Ladder Stay.	
3.	Bracket, for semaphore lamp.	
4.	Bracket, for indicator lamp.	
5.	Counterweight. Give weight required.	
6.	Bolt and Nut, 5/8″ x 3 1/2″, for No. 5.	
7.	Adjustable.	Signal cranks.
8.	Right Angle.	
9. 10.	Bases, for Nos. 7 and 8.	
11.	Counterweight Lever Base, made in different sizes.	
12.	Pin, for No. 11.	
13.	Counterweight Lever, used with pipe connected signals.	
14.	Counterweight Lever, used with wire connected signals.	
15.	Guide, for vertical signal rod.	
16.	Clamp, for No. 15.	
17.	Link, adjustable, used with mechanical slot, jaw pins 5/8″ x 1 3/4″.	
18.	Vertical Signal Rod, jaw pin 5/8″ x 1 5/8″, eye 3/4″. Give length required.	
19.	Rod, for indicator lamp shield, jaw pin 1/2″ x 1″, eye 11/16″. Give length required.	
20.	Rod, for indicator, jaw pins 5/8″ x 1 5/8″ and 1/2″ x 1″. Give length required.	
21.	Indicator.	Relating to indicators only
22.	Arm.	
23.	Base.	
24.	Stud, for No. 23.	
25.	Shield, for indicators and for indicator lamp.	
26.	Bracket, for No. 25.	
27.	Trunnion, for raising lamp shield.	
28.	Hand Rail. (Give length required.)	Relating to Bracket Post only
29.	Guy Rod and Nuts. (Give length required.)	
30.	Bolt and Nut, 3/4″ x 25″. (For No. 41.)	
31.	Bolt and Nut, 3/4″ x 14 1/2″. (For No. 41.)	
32.	Bolt and Nut, 3/4″ x 2 1/2″ for No. 37.	
33.	Bolt and Nut, 1/2″ x 8″, for No. 39.	
34.	Bolt and Nut, 5/8″ x 9″, for No. 42.	

MAIN LINE SEMAPHORE POST FITTINGS.—(Continued.)

PLATE 51.

No.

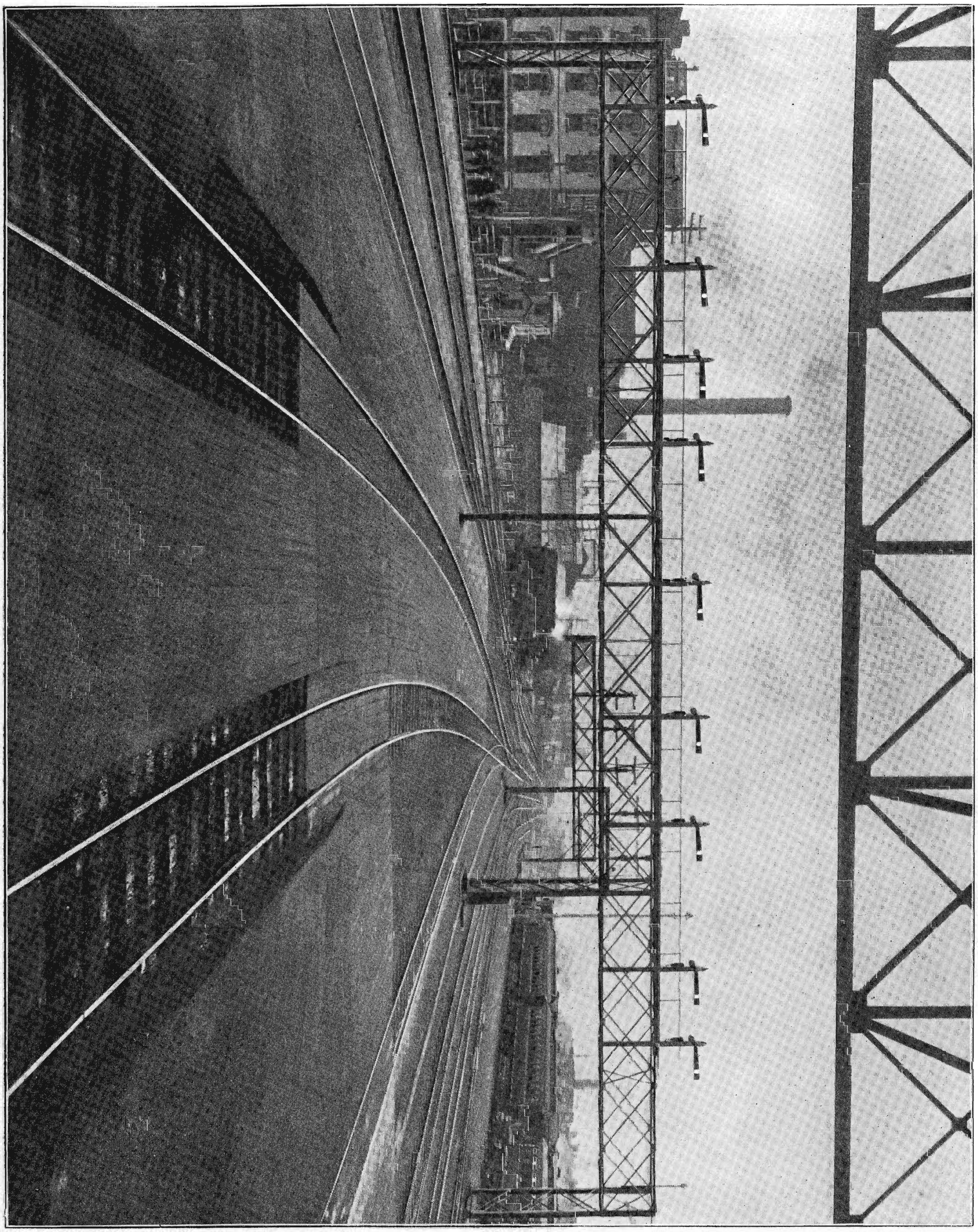
Nos. 35 to 45 inclusive: Relating to Bracket Post only.

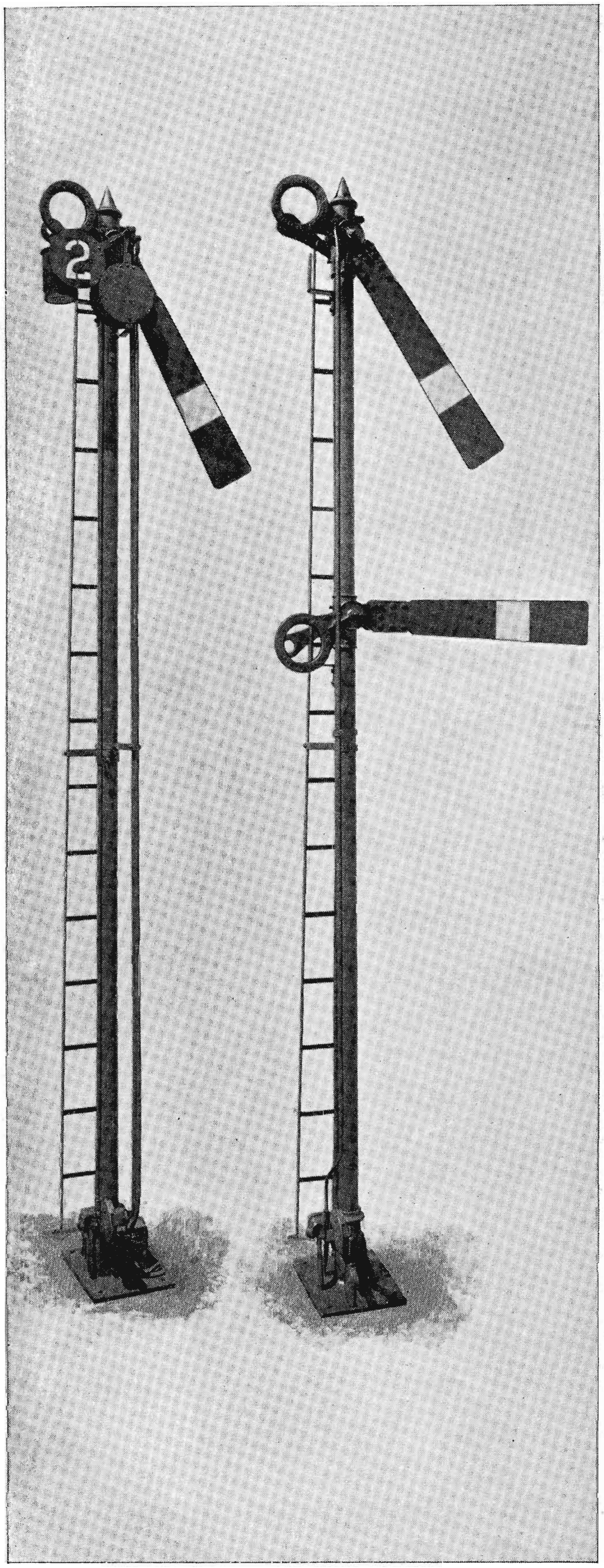
35. Bolt and Nut, 3/4″ x 13″, for corners of post and for No. 37.
36. Bolt and Nut, 5/8″ x 14 1/2″, for No. 40.
37. Brace, for chain wheel.
38. Wedge Washer.
39. Socket, for No. 28.
40. Strut, for No. 29.
41. Knee Brace.
42. Upper Fastening. (42 and 43: For No. 29.)
43. Lower Fastening.
44. Platform Bracket.
45. Balance Lever, for bracket post.
46. Washer, 3/4″, for Nos. 30 and 31.
47. Washer, 1″, for Nos. 9 and 10.
48. Washer, 1″ special, for No. 24.
49. Washer, 5/8″ special, for No. 27.
50. Shackle, 5/8″, for Nos. 14 and 45.
51. Turned Pin, 5/8″ x 1 5/8″, for jaws on No. 18 and left hand of No. 20 and for No. 50.
52. Split Cotter, 5/32″ x 1 1/4″ for Nos. 27 and 51.
53. Turned Pin, 1/2″ x 1″ for jaws on No. 19 and right hand end of No. 20.
54. Split Cotter, 3/32″ x 1″, for No. 53.
55. Split Cotter, 7/32″ x 2 1/2″, for No. 12.
56. Split Cotter, 3/16″ x 1 1/2″ for Nos. 9, 10 and 24.
57. Bolt and Nut, 1/2″ x 1″, for ladder end of No. 2.
58. Bolt and Nut, 3/8″ x 2 1/4″, for fastening platform to No. 44.
59. Bolt and Nut, 1/4″ x 3/4″, for ends of Nos. 13, 14 and 45, and for joining Nos. 15 and 16 and Nos. 25 and 26.
60. Lag Screw, 1/2″ x 2 1/2″, for fastening Nos. 1, 2, 3, 4 and 26 to post.
61. Rivet, 1/4″ x 3/8″, for joining Nos. 21 and 22.
62. Rivet, 1/4″ x 1 3/4″, for fastening No. 27 to No. 18.

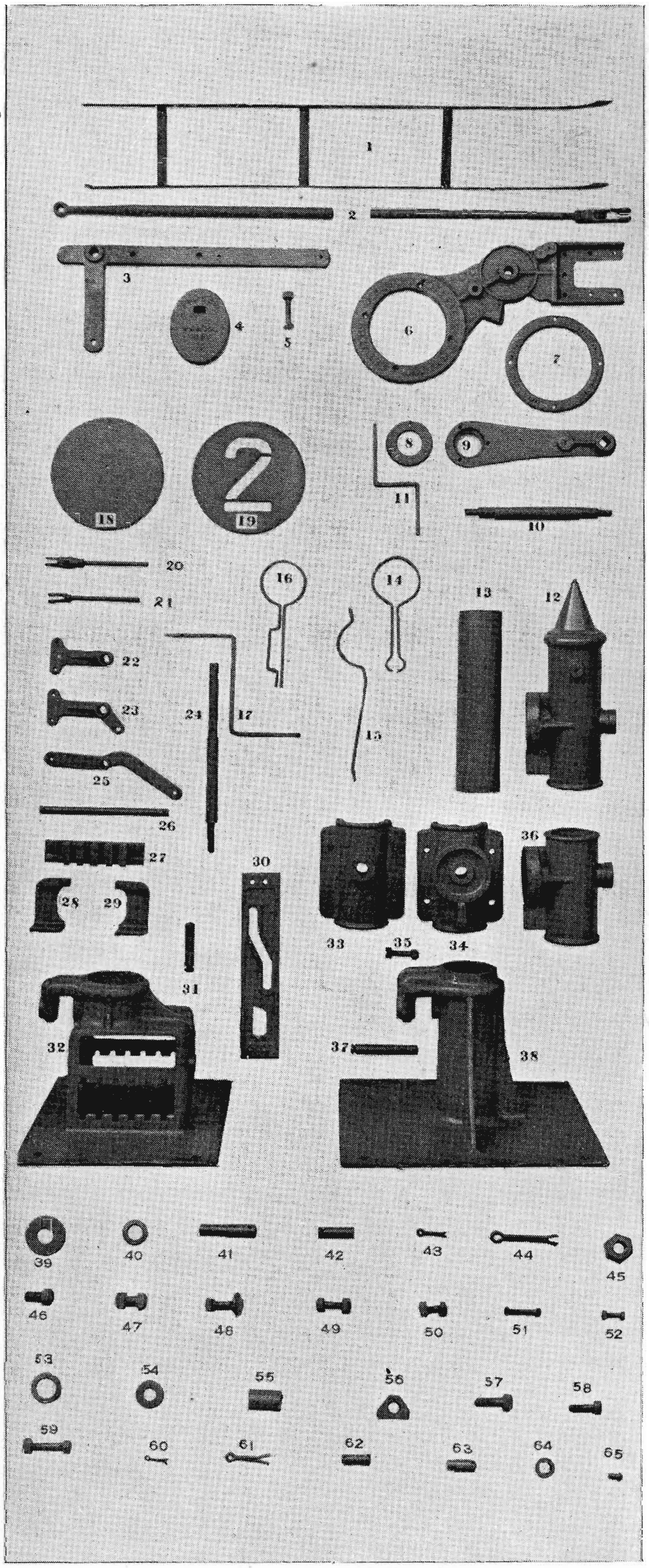
PLATE 52.

View of tracks and signals at the Jersey City Terminal of the Pennsylvania Railroad.

Particular attention is called to the location of the starting signals, each of which is placed directly over the track that it governs. Other views of this place are shown on Plates 67, 70, and 95.



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Iron Main Line Semaphores.

PLATE 53.

THESE posts are most frequently used on elevated tracks, but are adapted to almost any kind of work. The post, with indicators, may carry six indicators, as shown in the illustration, but by adding to the base (No. 32) a much larger number may be used.

The two-arm post may also be built with only one arm.

ORDER BY PLATE AND NUMBER.

No.

Large Parts Common to Both Signals.

1. Piece of Ladder.
2. Vertical Signal Rod. These two ends are joined by a piece of 3/4″ pipe.
3. Balance Lever.
4. Weight. In ordering, specify whether a 10, 14, 17, 20, 35 or 40 lb. weight is desired.
5. Bolt and Nut, 5/8″ x 3 1/2″, for fastening No. 4 to No. 3.
6. Semaphore Casting. For the wooden blade used with this casting see Plate 49.
7. Ring, for No. 6.
8. Ring, for No. 9.
9. Back Light Casting.
10. Semaphore Shaft. Used on a post without indicators.
11. Lamp Bracket.
12. Top Bearing.
13. Piece of 4″ Pipe, of which the post is formed.
14. Guide, for No. 2.
15. Ladder Stay.

Large Parts Relating to Signal with Indicator.

16. Indicator Rod Guide, for Nos. 20 and 21.
17. Bracket, for No. 18.
18. Indicator Shield.
19. Indicator.
20. Screw Jaw.
21. Rigid Jaw.

    When joined by a piece of 1/2″ pipe, Nos. 20 and 21 form the indicator rod.

22. Shield Arm.
23. Indicator Arm.
24. Semaphore Shaft. Made in different lengths, according to the number of Indicators.
25. Indicator Lever.
26. Shaft, for No. 25.
27. Locking Bracket.
28. Left-hand Stand.
29. Right-hand Stand.

    For No. 27.

30. Motion Plate.
31. Pin, for joining Nos. 3 and 32.
32. Base.

PLATE 53.

No.

LARGE PARTS RELATING TO TWO-ARM POST.

See No. 10.

33. BACK. } Intermediate bearing; used only in repairs.
34. FRONT. }
35. BOLT AND NUT, 5/8" x 2½", for joining Nos. 33 and 34.
36. INTERMEDIATE BEARING.
37. PIN, for joining Nos. 3 and 38.
38. BASE.
39. WASHER, ¾"–2", for Nos. 10 and 24.
40. WASHER, ¾"–1¼", for No. 41.
41. STUD, ¾" x 2¾", for connecting No. 2 to No. 6.
42. TURNED PIN, 5/8" x 15/8", for jaw on No. 2.
43. SPLIT COTTER, 3/16" x 1 1/8", for Nos. 41 and 42.
44. SPLIT COTTER, 5/16" x 2¾", for fastening Nos. 31 and 37.
45. NUT, ¾" diam., for end of Nos. 10 and 24.
46. BOLT, ½" x 1", for fastening No. 1 to No. 12, and for fastening Nos. 11, 12, 17, 33 and 36 to No. 13.
47. BOLT AND NUT, ½" x 1 1/8", for fastening end of No. 15 to No. 1.
48. CARRIAGE BOLT AND NUT, 3/8" x 1½", for fastening wooden blade to No. 6.
49. BOLT AND NUT, 3/8" x 1¼", for clamping No. 15.
50. BOLT AND NUT, 3/8" x 1", for clamping No. 16.
51. BOLT AND NUT, ¼" x 1½", for fastening No. 7 to No. 6, and No. 8 to No. 9.
52. BOLT AND NUT, ¼" x ¾", for fastening No. 17 to No. 18.
53. WASHER, 1"–1½", for No. 24.
54. WASHER, 5/8"–13/8", for No. 63.
55. FILLING PIECE, made of ¾" pipe, for taking up space on No. 26, where casting No. 32 is too wide for the indicators carried on the post.
56. LOCKING DOG. Fits into No. 27.
57. BOLT, ½" x 13/8", for fastening Nos. 28 and 29 to No. 32.
58. BOLT, 3/8" x 1¼", for fastening No. 27 to Nos. 28 and 29.
59. BOLT AND NUT, 3/8" x 2", for No. 16.
60. SPLIT COTTER, 1/8" x 1", for Nos. 62 and 63.
61. SPLIT COTTER, 7/32" x 1¾", for No. 24.
62. TURNED PIN, ½" x 1¼", for Nos. 20 and 21.
63. STUD, 5/8" x 13/8", for end of No. 25.
64. ROLLER, 5/8"–1", for No. 63.
65. RIVET, ¼" x ½", for fastening No. 18 to No. 22, and No. 19 to No. 23.

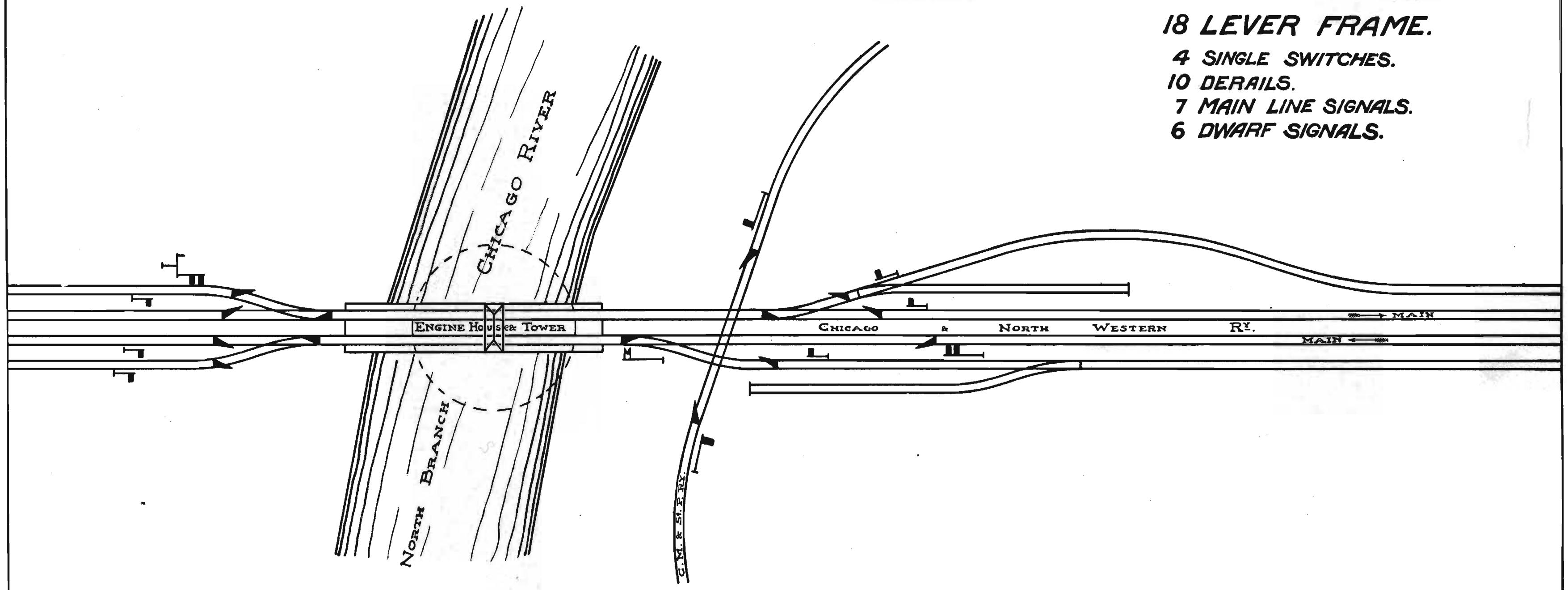
PLATE 54.

This plant forms a part of a large system of Electro-Pneumatic Interlocking and Block Signaling that has been recently put in service on the Chicago & Northwestern R'y.

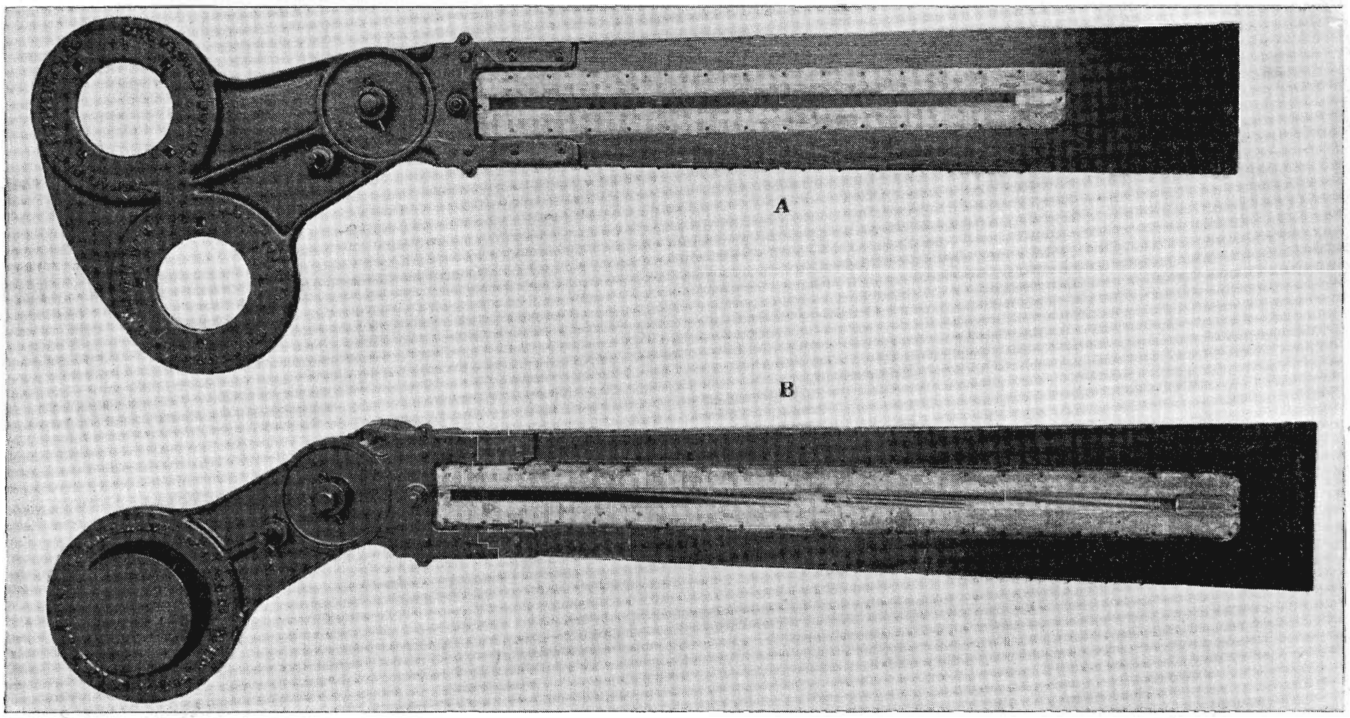
Draw Bridge & Signal Plant at Deering, Ill. near Chicago. C. & N. W. Ry.

—Not—to—scale.—

18 LEVER FRAME.
4 SINGLE SWITCHES.
10 DERAILS.
7 MAIN LINE SIGNALS.
6 DWARF SIGNALS.



This plan is presented in order to show that with the Pneumatic system many unusual advantages are present. Here there are switches and signals on each side of a draw bridge, all of them operated from the same inter-locking machine. THE DRAW OPERATING MACHINERY ITSELF IS DRIVEN BY COMPRESSED AIR. Without the use of Pneumatic power at this point it would be impossible, to operate the crossing track when the draw is open.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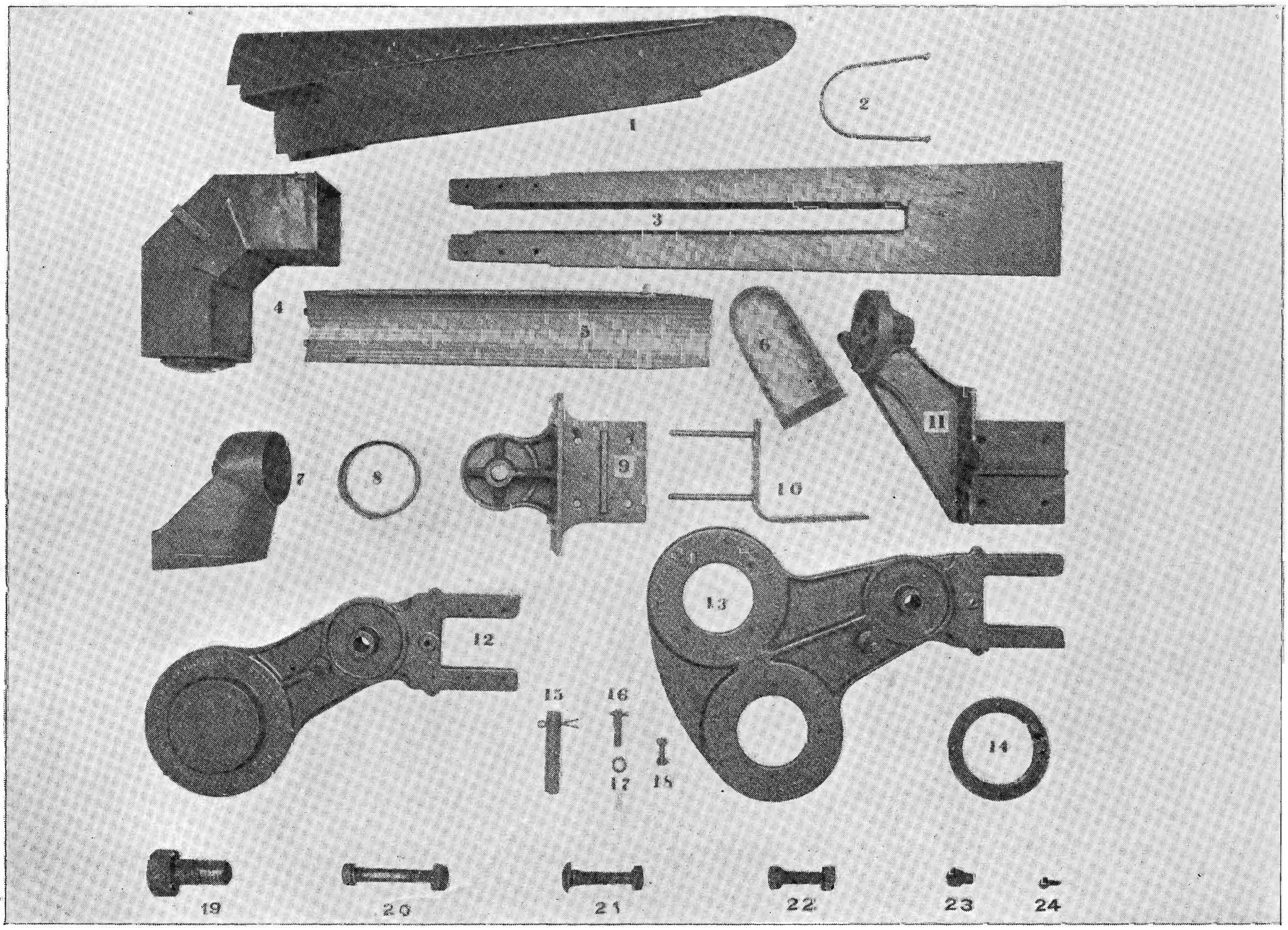
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Illuminated Semaphores.

PLATE 55.

THIS is a most excellent device, since by its use signaling is made perfectly consistent, and a position signal is provided both by night as well as by day. The lamp is placed on the post, back of the semaphore, from whence the rays of light are projected against the corrugated reflector (No. 5), and then out, approximately at right angles with the face of the blade, through the slender opening plainly visible in Figs. A and B. The result is a clear beam of light, which, unlike that of the ordinary night signals, cannot be confounded with anything else; and more important still, the color of the light does not change when the glass is broken.

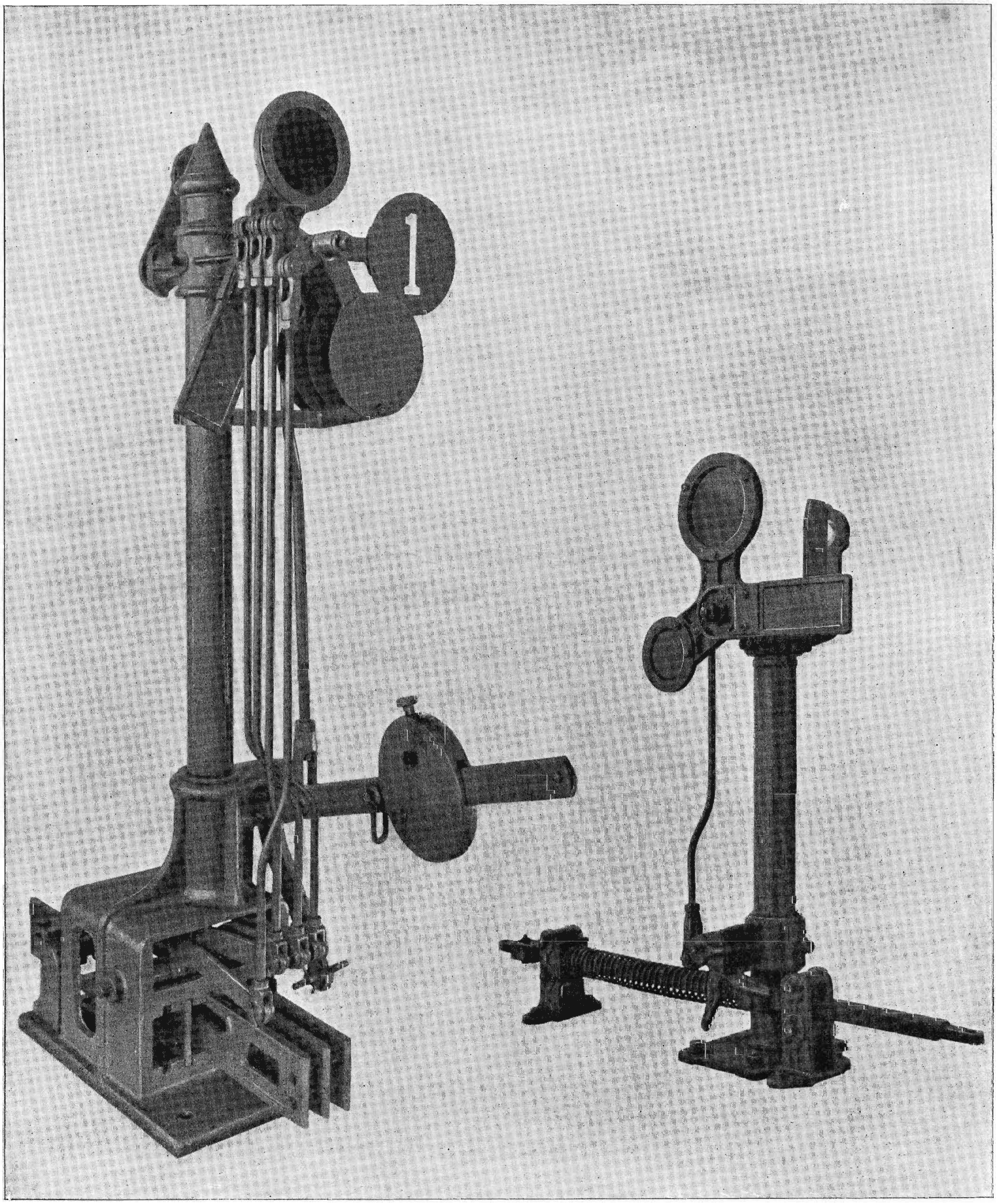
A. Combined Illuminated Semaphore, with ordinary glass in the casting. This may also be arranged with only one glass in the casting if so desired.

B. Plain Illuminated Semaphore.

ORDER BY PLATE AND NUMBER.

No.
1. Galvanized Iron Back.
2. Round Iron Clamp with Nuts, for joining Nos. 1 and 7 to No. 12 or No. 13.
3. Semaphore Blade.
4. Right Angle Reflector, for carrying light from lamp to glasses in No. 13.
5. Corrugated Reflector, for back of No. 3.
6. Plain Reflector, for No. 7.
7. Elbow.
8. Elbow Ring.
9. Semaphore Bearing, for Fig. B.
10. Lamp Bracket.
11. Semaphore Bearing, for Fig. A.
12. Semaphore Casting, for Fig. B.
13. Semaphore Casting, for Fig. A.
14. Ring, for No. 13.
15. Shaft and Cotter, for Nos. 9 and 11 (to support Nos. 12 and 13).
16. Shaft and Cotter, for Nos. 12 and 13 (to connect with vertical signal rod).
17. Washer, for No. 16.
18. Bolt and Nut, ½″ x 1¾″, for fastening No. 7 to Nos. 12 and 13.
19. Tap Bolt, ½″ x ⅞″, for joining Nos. 9 and 10.
20. Bolt and Nut, ¼″ x 1¾″, for joining Nos. 3 and 7 to No. 12 or No. 13.
21. Carriage Bolt and Nut, ¼″ x 1¼″, for fastening No. 3 to No. 12 or No. 13.
22. Bolt and Nut, ¼″ x ¾″, for fastening No. 14 to No. 13.
23. Machine Screw, ¼″ x 12–32, for fastening No. 8 to No. 7.
24. Wood Screw, #4, for fastening No. 1 to No. 3.

PLATE 56.



The Dwarf Signal with Indicators, and the One-Arm Dwarf Signal.

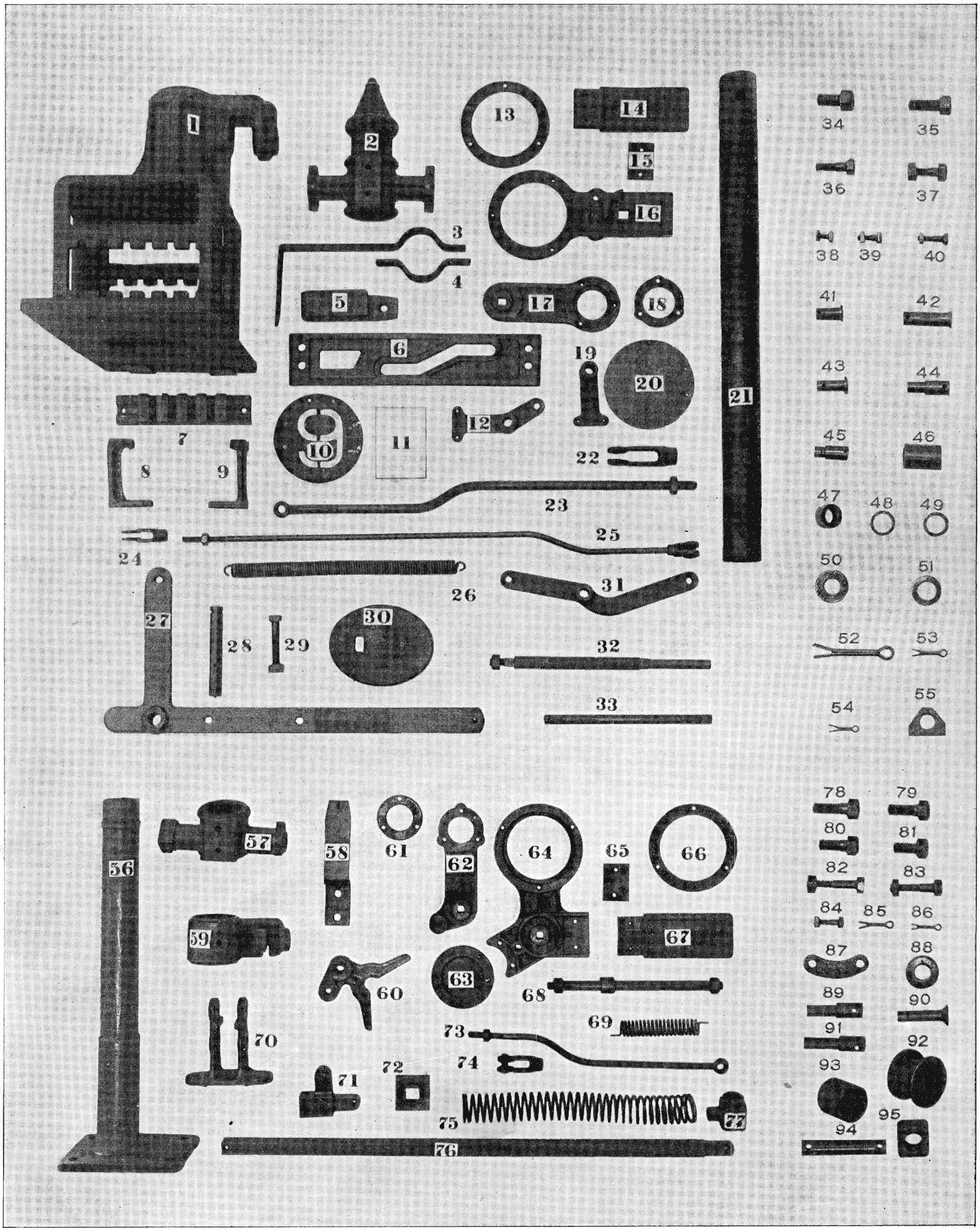
PLATE 56.

THE DWARF SIGNAL WITH INDICATORS is still in considerable use on the older roads in the New England States, and is therefore shown here as left-handed; we, however, make it right-handed as well. It is also made with any number of indicators up to and including 6. An ingenious arrangement in the base of this signal automatically locks all of the other indicators in their normal position when one of them is exposed.

THE ONE-ARM DWARF SIGNAL is now used almost universally and, owing to its simplicity, cheapness and reliability, bids fair to supplant all other kinds. It is very low, and since it always has applied to it the rubber blade and disc, may be placed at any point where two cars can pass, without being liable to damage. A concealed spring in the head will carry the arm to danger should any of the post connections be ruptured, while the horizontal spring below the post will perform the same office, almost always without aid from the back wire. By simply turning the head on the post, and connecting the vertical rod to the other side, the wires may be led up to the post from either of the four quarters.

We manufacture other styles of dwarf signals, but the ones shown we consider typical, and best adapted to the two principal systems of signaling which respectively use or dispense with route signals.

The parts of these two signals are illustrated on the following page.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Dwarf Signal with Indicators.

PLATE 57.

ORDER BY PLATE AND NUMBER.

No.

1. Base.
2. Bearing, for semaphore.
3. Brace, for shield.
4. Clamp, for shield support
5. Bracket, for lamp.
6. Motion Plate.
7. Lock Casing.
8. Leg, left-hand, for lock casing.
9. Leg, right-hand, for lock casing.
10. Indicator.
11. Opal Glass, for indicator.
12. Arm, for indicator.
13. Semaphore Ring.
14. Semaphore Blade (rubber).
15. Clip, for blade.
16. Semaphore Casting.
17. Backlight Casting.
18. Ring, for backlight casting.
19. Arm, for shield.
20. Shield, for indicator.
21. Signal Post, 2½″ pipe.
22. Screw Jaw, ⅝″ x 1⅝″ pin, for semaphore rod.
23. Vertical Rod, ¾″ diam., eye ⅝″, for semaphore.
24. Screw Jaw, ½″ x 1″ pin, for indicator rod.
25. Rod, ½″ diam., small jaw ½″ x 1⅛″ pin, for indicator.
26. Spring, for motion plate.
27. Balance Lever.
28. Pin, 1″ x 7″, for balance lever.
29. Bolt and Nut, ⅝″ x 3½″, for counter weight.
30. Counterweight, 10 lbs.
31. Lever, for indicator.
32. Semaphore Shaft, varies in length according to the number of indicators.
33. Shaft, ¾″ diam., for indicator levers.
34. Tap Bolt, ½″ x ⅞″, for lamp bracket.
35. Tap Bolt, ½″ x 1½″, for fastening lock casing legs.

No. PLATE 57.

36. Tap Bolt, $\frac{3}{8}'' \times 1\frac{1}{4}''$, for fastening lock casing.
37. Bolt and Nut, $\frac{3}{8}'' \times 1\frac{1}{2}''$, for fastening shield support and clamp.
38. Bolt and Nut, $\frac{1}{4}'' \times \frac{3}{4}''$, for stopping counterweight.
39. Bolt and Nut, $\frac{1}{4}'' \times \frac{7}{8}''$, for fastening back light ring.
40. Bolt and Nut, $\frac{1}{4}'' \times 1''$, for fastening semaphore ring.
41. Pin, $\frac{1}{2}'' \times 1''$, for screw jaw No. 24.
42. Pin, $\frac{5}{8}'' \times 1\frac{5}{8}''$, for screw jaw No. 22.
43. Pin, $\frac{1}{2}'' \times 1\frac{1}{8}''$, for jaw No. 25.
44. Pin, $\frac{5}{8}'' \times 1\frac{3}{4}''$, for driving semaphore casting No. 16.
45. Pin, $\frac{5}{8}'' \times 1\frac{1}{2}''$, for indicator lever No. 31.
46. Bushing, $\frac{3}{4}''$ diam., for indicator shaft No. 33; this varies in length, depending on the number of indicators.
47. Roller, $\frac{9}{16}'' \times 1''$, for lever pin No. 45.
48. Bushing, $\frac{3}{4}'' \times \frac{1}{4}''$, for separating indicator arms No. 12.
49. Bushing, $\frac{3}{4}'' \times \frac{3}{8}''$, for separating indicator arm No. 12 from semaphore casting No. 16.
50. Washer, $\frac{5}{8}''$, for pins No. 44 and 45, and semaphore shaft No. 32.
51. Washer, $\frac{3}{4}''$ special, for semaphore shaft No. 32.
52. Split Cotter, $\frac{5}{16}'' \times 3''$ for balance lever pin No. 28.
53. Split Cotter, $\frac{1}{8}'' \times 1\frac{1}{4}''$, for pins Nos. 42 and 44, and for shafts Nos. 32 and 33.
54. Split Cotter, $\frac{3}{32}'' \times 1''$, for pins Nos. 41, 43 and 45.
55. Lock Piece.

Single Arm Dwarf Signal.

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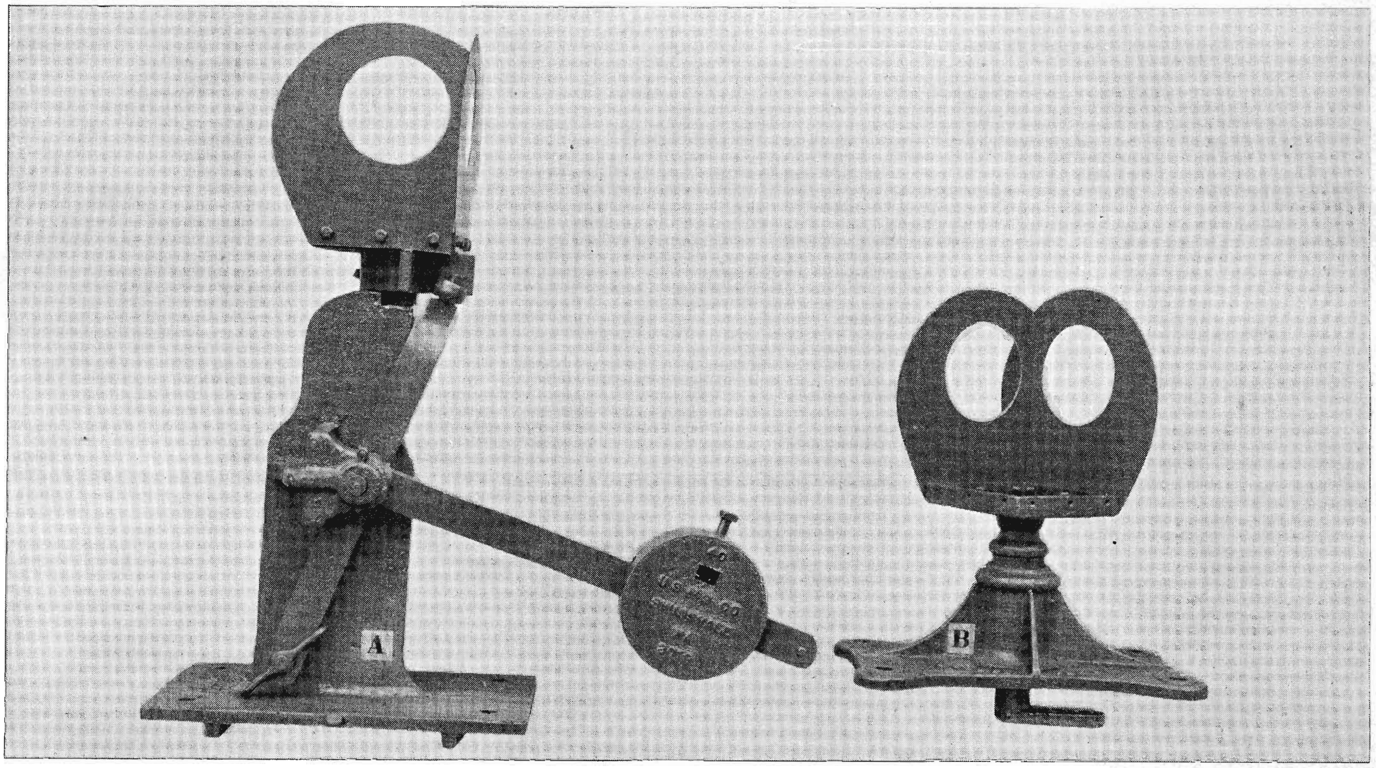
56. Combined Base and Post Casting.
57. Bearing, for semaphore.
58. Lamp Bracket.
59. Bearing, for crank.
60. Crank.
61. Backlight Ring.
62. Backlight Casting.
63. Rubber Disc.
64. Semaphore Casting.
65. Clip, for blade.
66. Semaphore Ring.
67. Semaphore Blade (rubber.)

No. PLATE 57.

68. SEMAPHORE SHAFT.
69. SPRING, for semaphore shaft.
70. ROLLER STAND.
71. DOUBLE LUG, for motion rod.
72. SPRING PLATE, for motion rod.
73. VERTICAL ROD, ½″ diam., ⅝″ eye, for semaphore.
74. SCREW JAW, ½″ x 1¼″ pin, for semaphore rod.
75. SPRING, for motion rod.
76. MOTION ROD.
77. DRIVING PIN, for motion rod.
78. TAP BOLT, ½″ x 1½″, for bottom of lamp bracket.
79. TAP BOLT, ½″ x 1⅛″, for top of lamp bracket.
80. TAP BOLT, ½″ x 1″, for fastening crank bearing.
81. TAP BOLT, ½″ x ⅞″, for setting crank bearing.
82. BOLT AND NUT, ⅜″ x 2″. } For double lug No. 71.
83. BOLT AND NUT, ⅜″ x 1¾″. } For double lug No. 71.
84. BOLT AND NUT, ¼″ x 1″, for fastening semaphore and backlight rings and rubber blade and disc.
85. SPLIT COTTER, ⅛″ x 1⅛″, for semaphore pin, backlight pin and roller shaft.
86. SPLIT COTTER, $\frac{3}{32}$″ x 1″, for screw jaw.
87. CLIP, for rubber disc.
88. WASHER, special, ⅝″, for semaphore and backlight pins.
89. SEMAPHORE PIN.
90. RIVET, ½″ x 2⅛″, for driving pin No. 77.
91. BACKLIGHT PIN.
92. BOTTOM ROLLER, for stand.
93. TOP ROLLER, for stand.
94. SHAFT, ⅝″ x 3½″, for roller stand.
95. TORSION BLOCK, for semaphore spring.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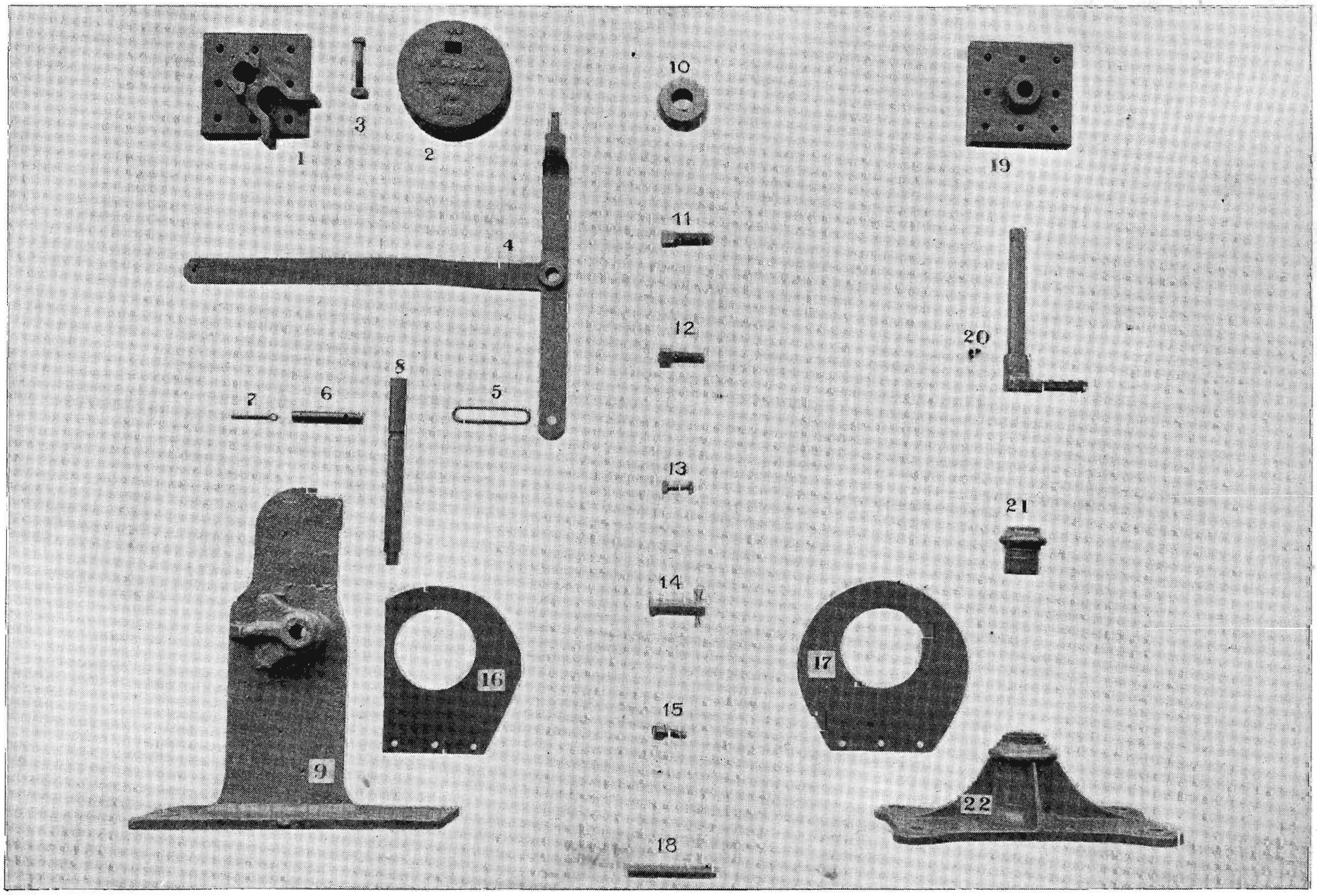
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Self Compensating Pot Signal and Low Pot Signal.

PLATE 58.

A. Self Compensating Pot Signal.—This signal has in times past been widely used, and there is still some call for it; there is no direct connection between the head and the counterbalance lever which operates it, and a considerable latitude is therefore possible in the stroke of the mechanism. This fact renders it possible to operate the signal by wire.

B. Low Pot Signal.—It is intended that this signal shall be connected directly with a side track switch or derail where the unimportant character of the location does not seem to warrant the expense of a separately controlled signal. It is the smallest of all signals as shown, but may be built higher if desired.

ORDER BY PLATE AND NUMBER.

	No.	
Parts Relating to A, only.	1.	Head.
	2.	Weight.
	3.	Bolt and Nut, 5/8" x 3 1/2", for fastening weight to counterbalance lever.
	4.	Counterbalance Lever.
	5.	Double Shackle.
	6.	Turned Pin, 1" x 5", for supporting counterbalance lever.
	7.	Split Cotter, 1/4" x 2 1/2", for fastening pin No. 6.
	8.	Steel Shaft, 1 3/8" x 14 1/2", on which head No. 1 is supported.
	9.	Base.
	10.	Roller.
	11.	Set Screw, 1/2" x 1", for fastening head No. 1 to shaft No. 8.
	12.	Tap Bolt, 1/2" x 1", for holding shaft No. 8 in place.
	13.	Bolt and Nut, 1/4" x 3/4", for end of counterbalance lever.
	14.	Turned Pin, 5/8" x 1 5/8", and cotter, 3/16" x 1 1/8", for fastening double shackle.
Parts Common to Both.	15.	Tap Bolt, 3/8" x 3/4", for fastening vanes to heads.
	16.	Inside Vane.
	17.	Outside Vane.
Parts Relating to B, only.	18.	Dowel Pin, 1/2" x 2 1/2", for fastening head No. 19 to shaft No. 20.
	19.	Head.
	20.	Shaft.
	21.	Cast Iron Bearing, for shaft No. 20.
	22.	Base.


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Lamps.

PLATE 59.

ORDER BY PLATE AND LETTER.

A. Square Semaphore Lamp, N. Y. C. & H. R. R. R.

B. Round Semaphore Lamp, one of the styles used on the Pennsylvania R. R.

C. Distant Signal Lamp, Chicago & Northwestern R'y.

D. Semaphore Lamp, 7″ x 7″ square, left-hand.

E. Square Semaphore Lamp, sliding door.

F. Square Semaphore Lamp, swing door.

G. Round Semaphore Lamp, sliding door.

H. Round Semaphore Lamp, swing door.

I. J. These lamps are used either for switch targets or for our Electric Banner Signal. They are interchangeable and have the same socket.

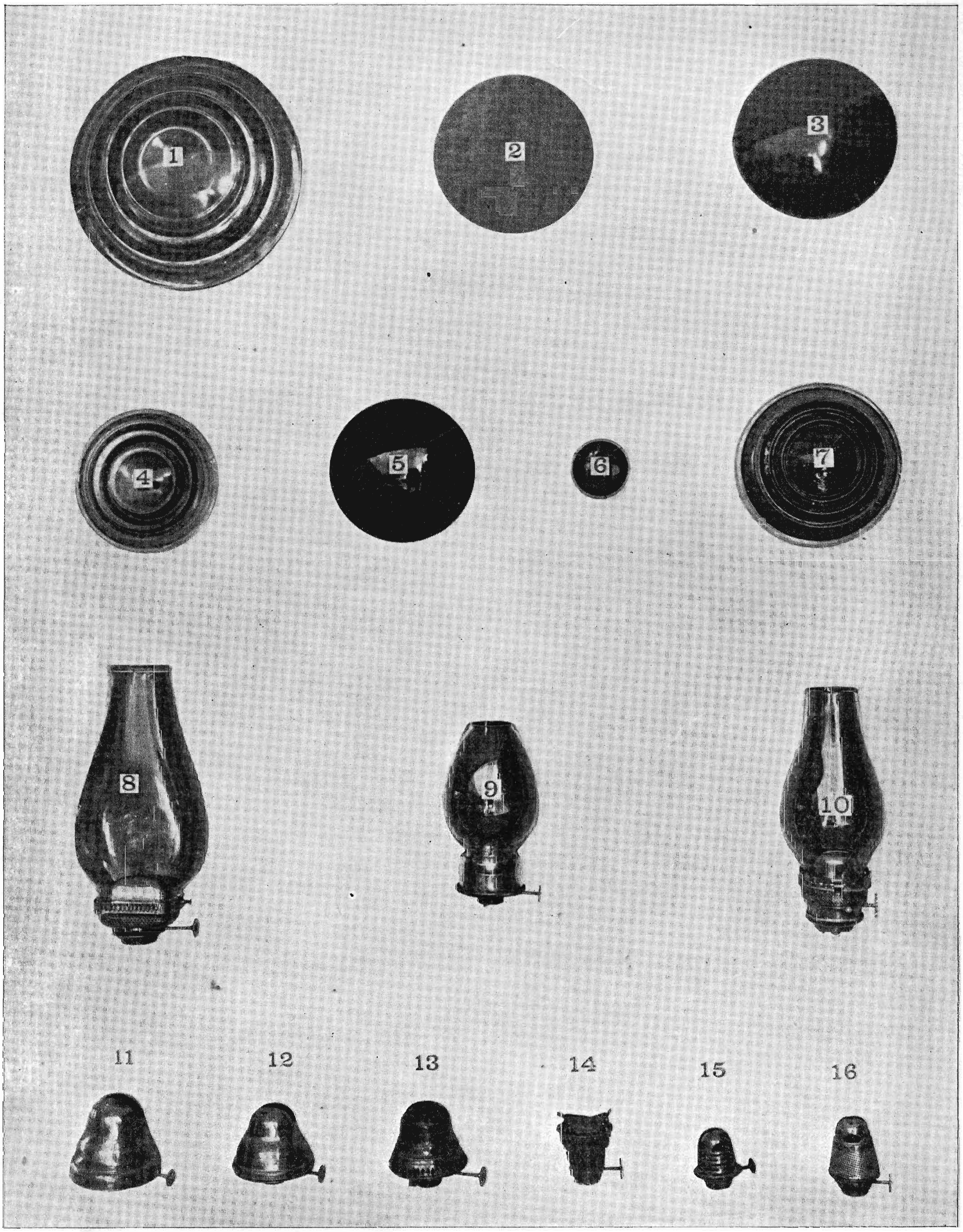
K. L. Pot Signal Lamps.—They differ principally in the method of fastening them to the pot signal.

M. Main Line Semaphore Reflecting Lamp.

N. Dwarf Signal Reflecting Lamp.

O. Indicator Lamp.

P. Illuminated Semaphore Lamp.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Lenses and Burners.

PLATE 60.

ORDER BY PLATE AND NUMBER.

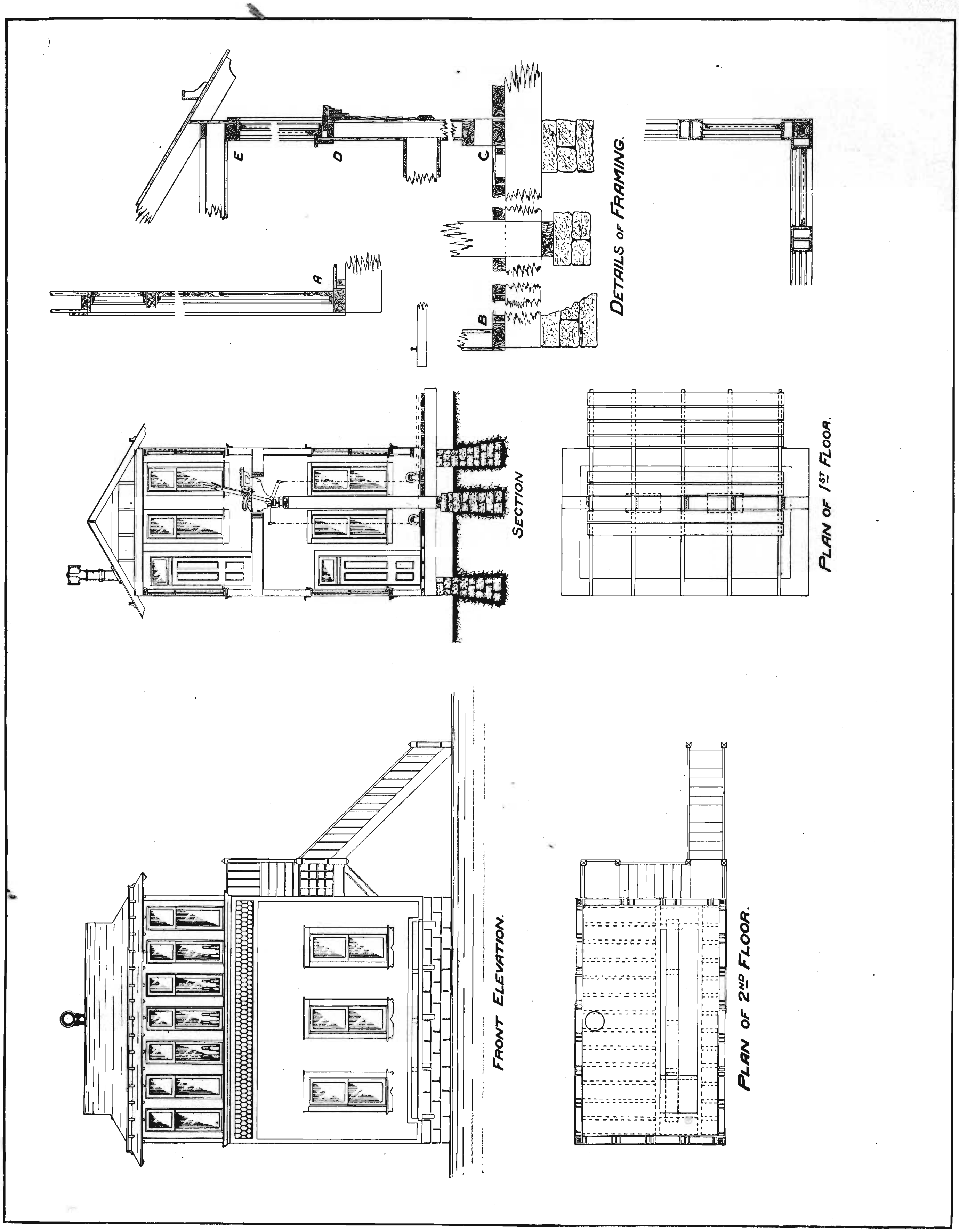
No.

1. Concave Corrugated Lens, 8″ diam.
2. Plain Glass, made in all sizes and colors.
3. Concave Corrugated Lens, 5¼″ diam.
4. Flat Corrugated Lens, 5″ diam.
5. Concave Corrugated Lens, 5″ diam.
6. Bull's Eye, 2″ diam.
7. Convex Corrugated Lens, 5⅜″ diam.

In ordering state the color that is required.

8. The Leader Burner and Chimney, 1⅜″ wick.
9. The X. L. Burner and Chimney, ⅝″ wick.
10. Perfection Burner and Chimney, 1″ wick.
11. Zenith No. 2 Burner, 1″ wick.
12. Zenith No. 1 Burner, ⅝″ wick.
13. American Diamond Burner, ⅝″ wick.
14. Dressel Burner, ⅝″ wick.
15. Collender Burner, ⅝″ wick.
16. Savage No. 1 Burner, ⅝″ wick.

No chimney.



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DETAILS OF FRAMING.
SECTION
PLAN OF 1ST FLOOR.
FRONT ELEVATION.
PLAN OF 2ND FLOOR.

Standard Cabin for Saxby & Farmer Improved Interlocking Machine.

PLATE 61.

THIS style of cabin is the result of many years practical experience in the interlocking field; it combines cheapness with convenience, stability and appearance. By the use of the outside stairway the available space both on the first and second floors is greatly increased, while the outside door of the lower floor may be kept locked, and the room used as a store-room. The foundation timbers of the "lead-out" here form the first floor, and since no trap doors are possible or necessary the parts directly beneath the machine are always open to inspection and adjustment.

A. Vertical Section through the lower door.
B. Vertical Section through the lower rear corner.
C. Vertical Section through the lower front corner.
D. Vertical Section through the upper floor and lower part of upper windows.
E. Vertical Section through the eaves.
F. Horizontal Section through the upper windows and corner post.

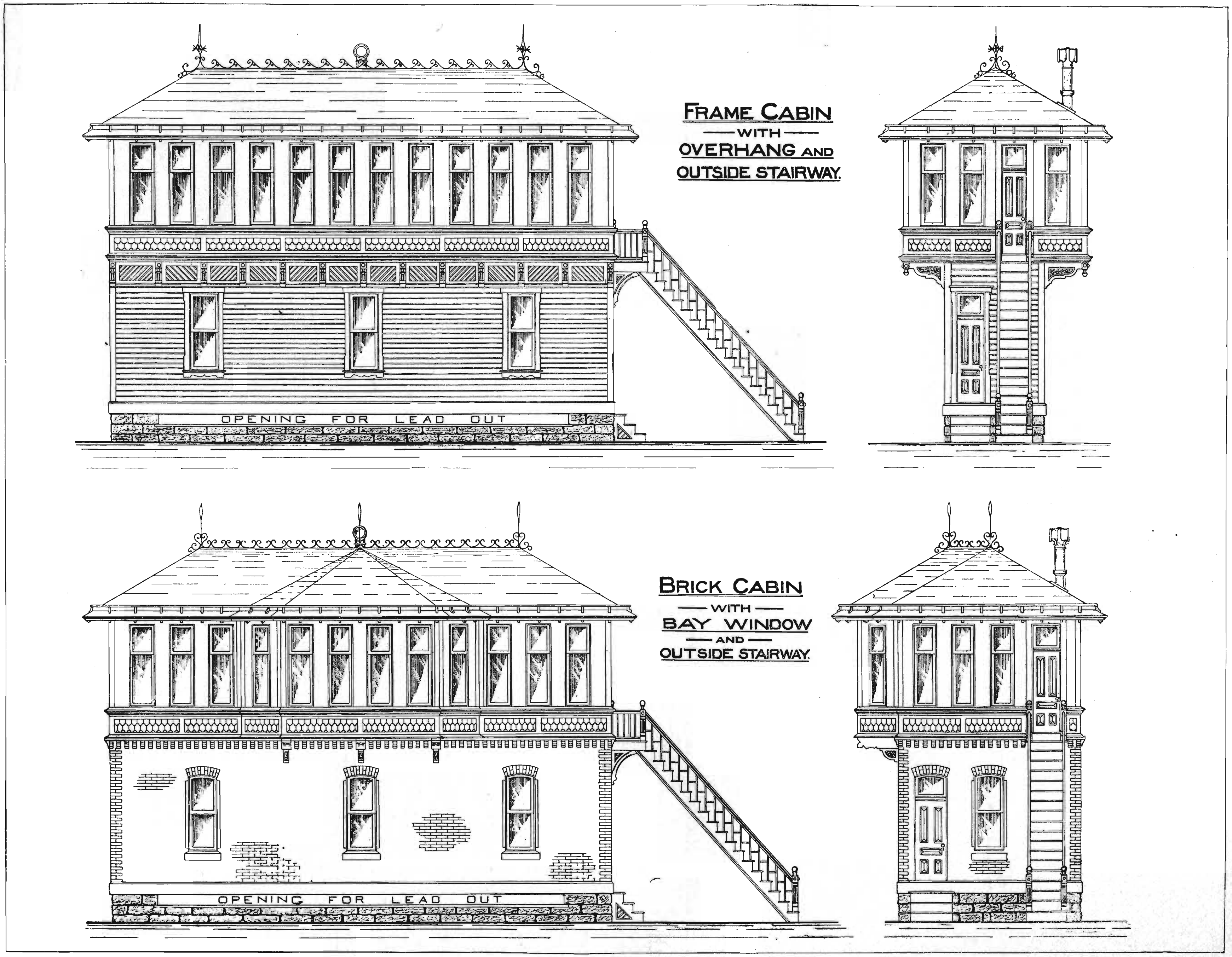

FRAME CABIN
WITH
OVERHANG AND
OUTSIDE STAIRWAY.
OPENING FOR LEAD OUT
BRICK CABIN
WITH
BAY WINDOW
AND
OUTSIDE STAIRWAY.
OPENING FOR LEAD OUT

PLATE 62.

Two Special Forms of Cabins.

PLATE 62.

THESE cabins are intended for large plants, and may either of them be built of wood, iron, brick or stone.

The overhanging cabin is intended to be placed between tracks where the space is limited; such a cabin may be seen on Plate 37.

The bay window provides a place for the train director of a large terminal, who is surrounded by his instruments, and is enabled to see in each direction. An application of this idea will be found on Plates 67 and 120.

PART II.

Table of Contents.

PART II.

THERE IS AN ALPHABETICAL INDEX IN THE BACK OF THE BOOK.

How to Order.

IN ORDERING material for repairs, if single parts only are needed, they will be found illustrated on the Plate devoted to the arrangement to which they belong, while on the page or pages following a descriptive list is given If a stuffing-box for the Electro-Pneumatic Interlocking Switch Cylinder is wanted, it should be ordered as "No. 4, Plate 71," which is all the description that is needed, since only one kind of stuffing-box is made for the Switch Cylinder. A Main Cylinder, however (see the note at the top of page 161), is made in several sizes, and the order in that case must read "No. 1, Plate 71, 6″ inside diameter," or whatever size is needed.

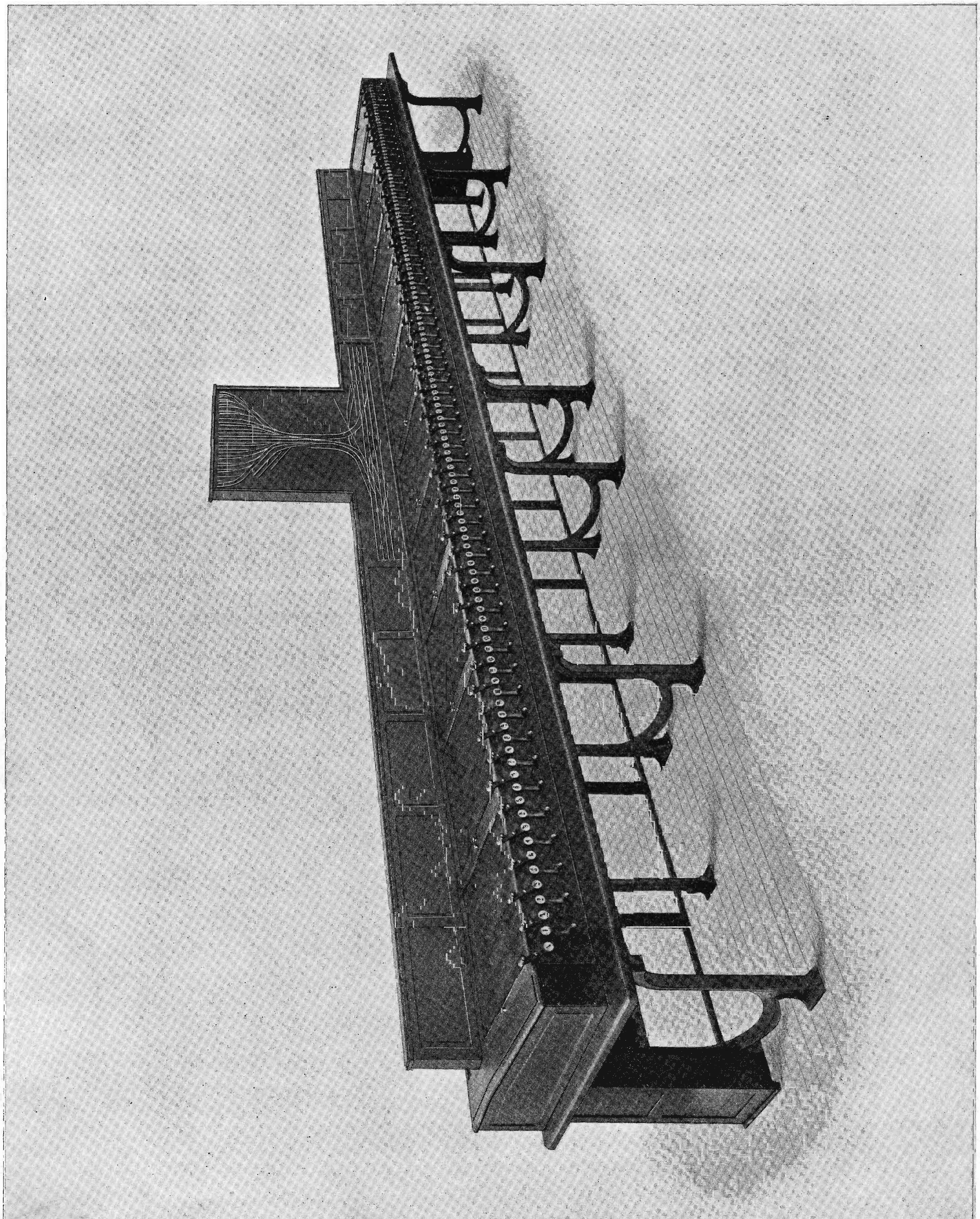
It would have been impossible to describe all of the combinations of parts, but we are able to promise that anyone wishing to order certain assemblages, such as an "Electro-Pneumatic Interlocking Switch Cylinder with valves complete" may do so in the confidence that all of the parts naturally belonging to that combination will be sent.

To order successfully, state the number of the part, the Plate on which it is illustrated, and, if it is made in more than one form, give the particular kind that is wanted; also state whether the shipment is to be made by express or freight.

In a field so new as signaling is in this country, it follows that a considerable amount of experimenting will be done, and during the life of The Union Switch & Signal Company many devices have been tested, which, on experience, have been considerably altered or abandoned for something better. We do not illustrate or describe any of these original forms, but beg to assure our patrons that the patterns are kept in stock and that we shall take pleasure in filling orders for any broken or worn-out parts, upon being furnished with an adequate description, or the part which it is desired to replace.

Our facilities for shipment are unusually complete, owing partly to our location, which is eight miles east of Pittsburg, directly on the line of the Pennsylvania Railroad and in close proximity to the Baltimore & Ohio and Pittsburg & Lake Erie Railroads.

We have a private telegraph office in our works, the address of which is SWISSVALE, PA.



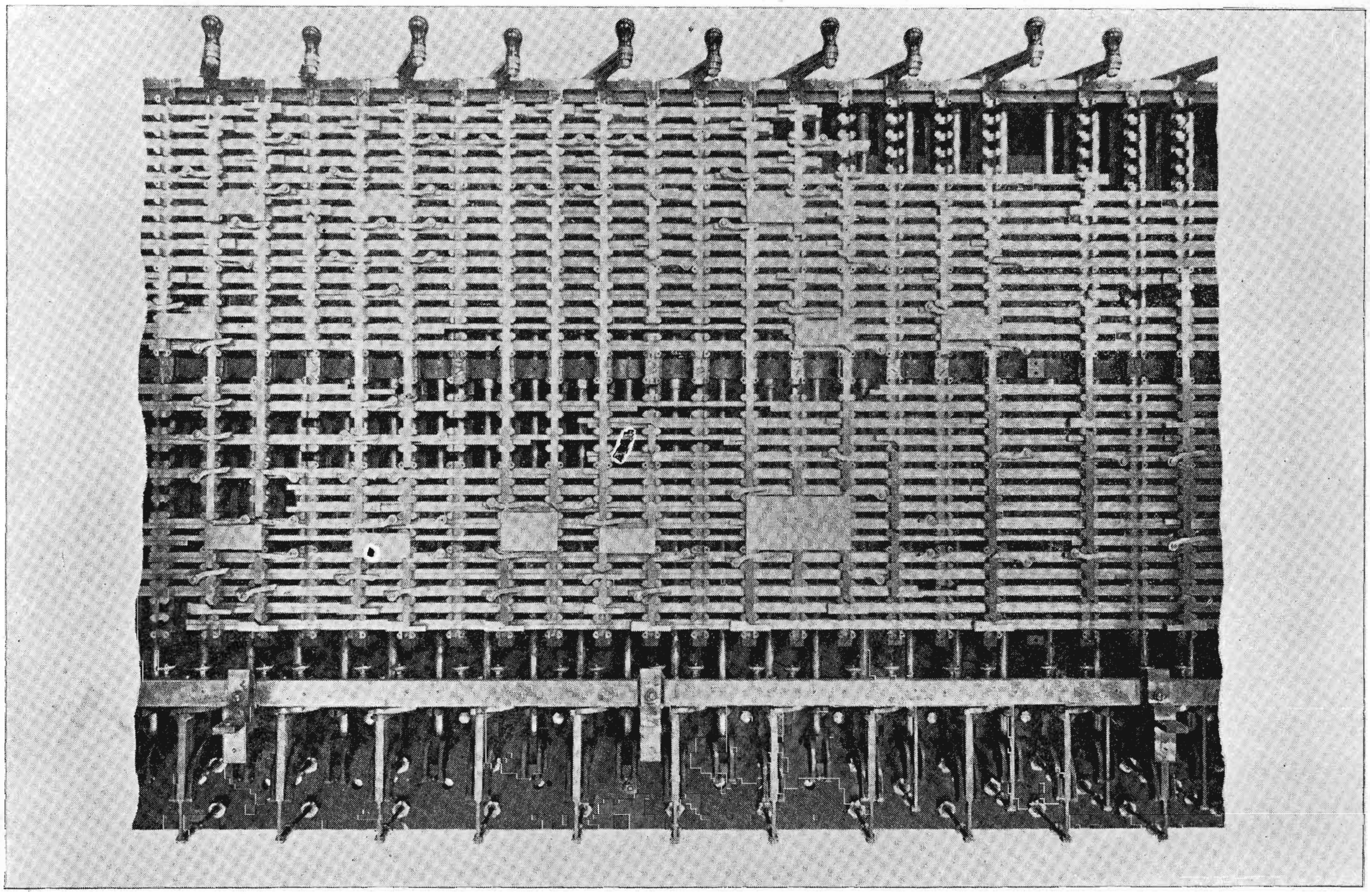
The Electro-Pneumatic Interlocking Machine.

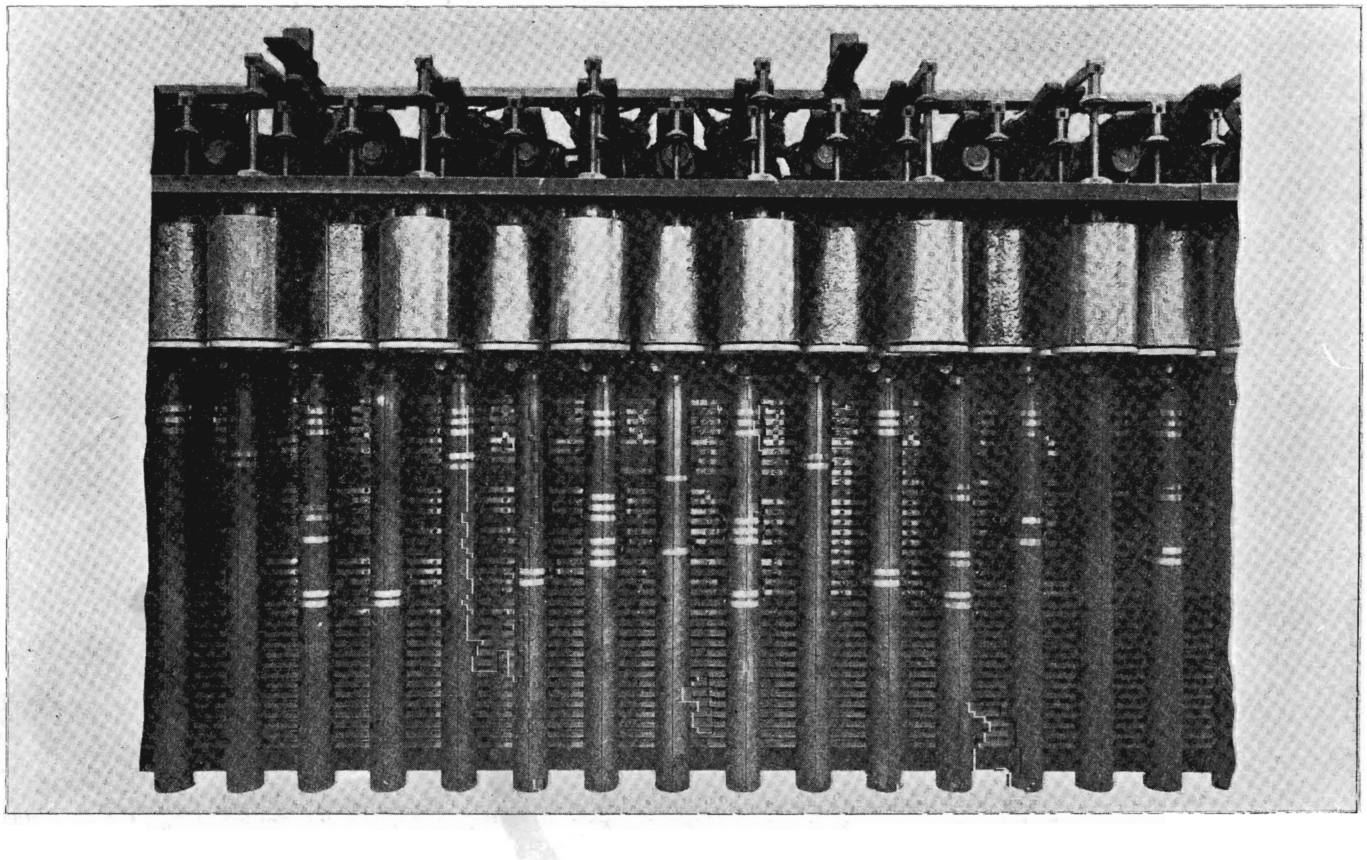
PLATES 63 AND 64.

THE forces at work in the electro-pneumatic interlocking system are, as the name implies, electricity and compressed air, the former being used to control the latter, which is derived from compressors that are located at some convenient point. The external appearance of the machine that contains the levers is shown on Plate 63*, a view looking directly down upon the machine on the upper part of Plate 64, and a rear elevation of the machine showing what is commonly called the spring combination on the lower part of Plate 64.

The row of upper levers that appear in elevation on Plate 63, and in plan on the upper half of Plate 64, are called the switch levers, and serve to make and break the circuits that connect the main battery with the switch valves (described on page 157). The row of lower levers are called the signal levers, and make and break the circuits that connect the main battery with the signal valves (described on page 173). Both the switch and signal levers move from left to right and vice versa; but the switch levers have only two positions, the one on the left being called normal, the one on the right, reversed; the normal position of the switch levers corresponds to the position of the switches as shown on the plans of tracks, Plate 110, etc.; the reversed position of a lever, to the other position of a switch. As regards the signal levers the case is quite different, for each of these levers has three positions, the one in the centre being normal and both of the others reversed. It is therefore possible to operate several signals which may govern trains running in different directions, from the same lever, with a considerable reduction in the number of levers in a machine as the result; the normal position of the signal lever, which is vertical, corresponds to the horizontal (danger) position of the signal, while a signal lever which has completed its movement either to the right or the left will be followed by an inclined (safety) semaphore on one of its respective signal posts. Connected with each signal and switch movement is a circuit breaker, from which wires are run, each to a magnet (No. 47, Plate 66), which by means of its armature stem, operates the latches (Nos. 30, 31, 32, Plate 66). The function of these latches is to delay the final completion of a lever's throw until after the signal or switch shall have reached its extreme position; their application may be seen on the bottom and top edges respectively of the upper and lower halves of Plate 64; the method of placing the switch indication box is shown on Plate 72 (see also Nos. 36 and 37, Plate 73), and of the signal circuit breaker on Plate 75 (see also Plate 100).

* This machine is located at the Union Station, St. Louis, Mo.





By preventing a lever from reaching its extreme position until the switch or signal that it controls has previously completed its movement, the interferences established by the interlocking are maintained and all of the other levers involved in the combination are kept locked fast until such time as the lever that is being moved has completed its course. To each of the levers is attached one end of a horizontal shaft, which runs from the front to the back of the machine, and has fastened to its other end, first a beveled gear, that engages with another beveled gear, fastened to the upper end of a vertical shaft on the back of the machine; and, second, the quadrant which engages with the indication latch above mentioned; the quadrants and beveled gears are illustrated on Plate 66, Nos. 20 to 25, where it will be seen that, in the case of the signal levers, the quadrant and beveled gear form two pieces, while with the switch levers these parts are combined in one piece. Upon the horizontal shafts are also mounted small pinions, which work in racks formed on the under side of the interlocking bars and drive the bars back and forth with the movement of a lever; just above the lever shafts are placed the brackets that contain the cross locks, as well as the interlocking bars, both of which lie in the same horizontal plane.

We shall not give a detailed description of the work performed by the interlocking (which, except that it is only half the size, is exactly the same as that used upon the Saxby & Farmer Improved Machine), but must content ourselves with saying that its object is to prevent the movement of any lever until certain other levers are in certain specified positions. The relation which exists between the indication latches, the levers and the interlocking is now established, since they depend upon the same shaft, and any movement of it will involve all three.

The vertical shafts, No. 59, Plate 66, are encased in hard rubber rollers that bear on their surfaces the semi-circular contact bands, No. 109, Plate 68; on a hard rubber base, No. 11, Plate 66, are mounted the angular contact springs, Nos. 110 to 115, Plate 68, whose ends project outward, and depending on the position of the rollers, touch either their surfaces or the various semi-circular bands that they carry. The appearance of this part of the machine may be seen on the lower half of Plate 64. At one end of the machine the angular springs are all connected with the main battery; at the other end they separate and go to the several switch, lock and signal magnets. If now, in any combination, one of the rollers should happen to be in the wrong position, the contact between the semi-circular and angular springs would be broken and no current would reach the magnet of that line from the battery; this provides a perfect check on the action of the mechanical interlocking which has been described as controlling the movement of the levers, and these two features form a remarkable safeguard against any troubles which might arise from ignorant or careless interference.

We have now given a general description of this machine, which the space at our disposal forbids us from extending, but it would not be well to dismiss the subject entirely without calling attention to some of the extraordinary results that have been secured by its use. It is economical in the highest degree from a maintenance stand-point, since even with the largest machines, such as those illustrated on Plates 63, 67 and 126, it has never been necessary to employ more than one leverman at a time, and in no case has this man ever been pushed to an extremity. This arises from the very slight exertion required to move the levers, and the promptness with which the apparatus at the switches and signals responds to the impulses that are transmitted to it from the main battery, a promptness which it will be easily seen is not affected by the distance from the cabin at which these parts may be stationed. This makes it possible to operate signals and switches at any convenient distance, since the effort required to move a lever does not vary with the amount of apparatus connected with it, as is the case with ordinary mechanical machines. The reduced size and weight of the machine also recommends it for use at large terminals where the available space is apt to be limited.

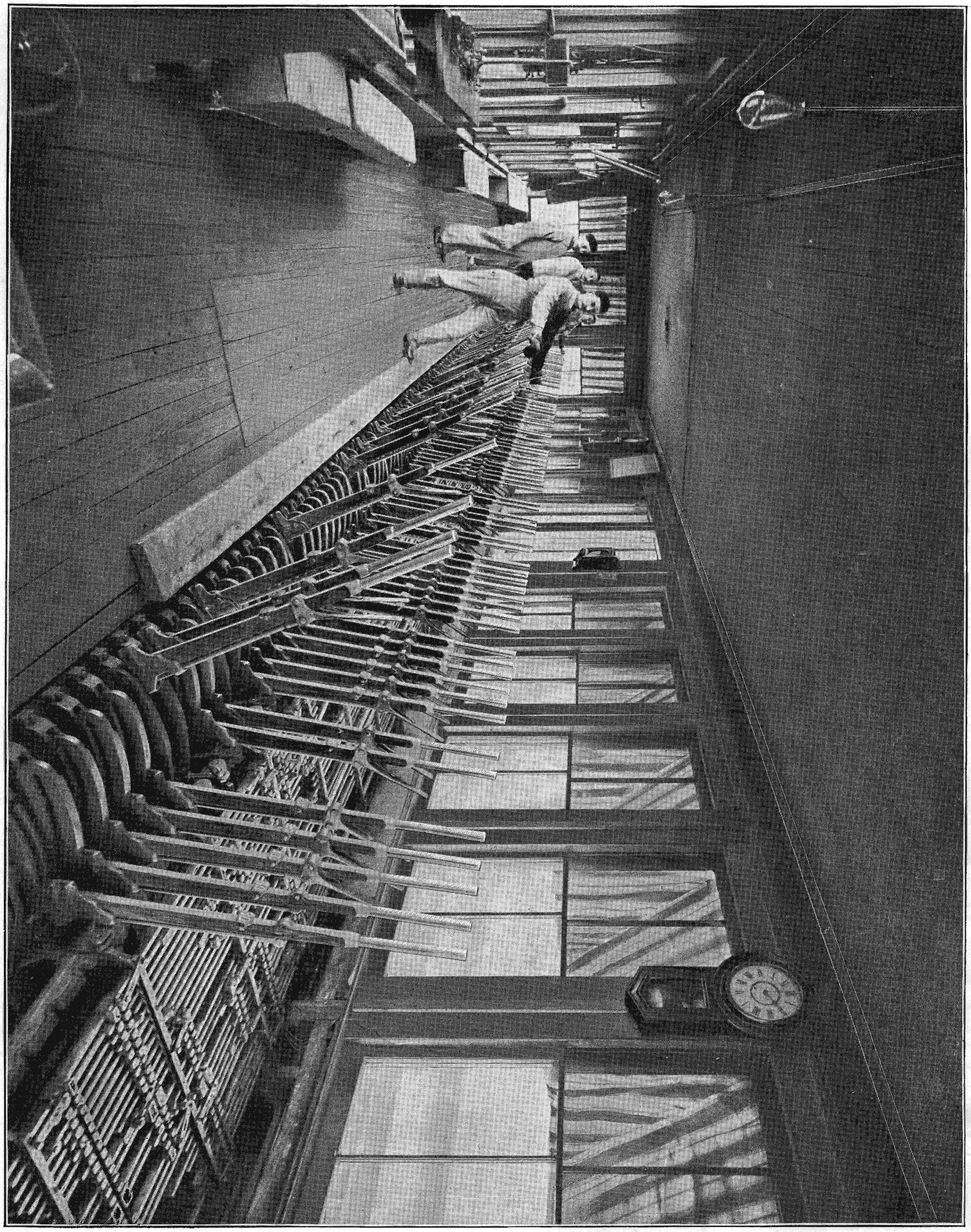
The separate parts are illustrated on Plates 66 and 68.

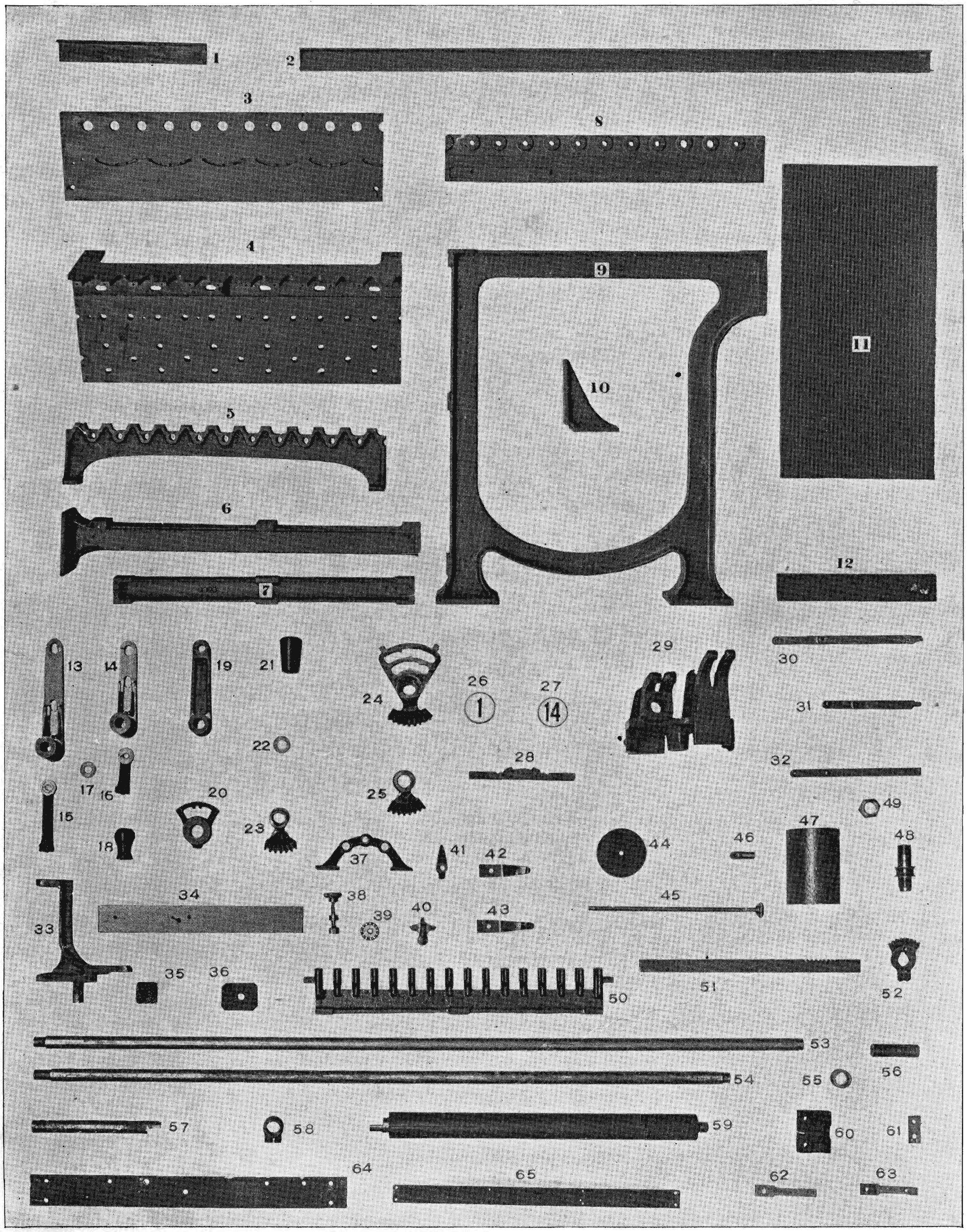
PLATE 65.

This Plate illustrates the usual internal appearance of a cabin that contains a mechanical lever machine of large size. From four to six men at a time are necessary for throwing the levers, and they, as may be seen, are dressed in overalls and wear heavy leather mittens. Compare this Plate with Plate 67, which is from a photograph of an Electro-Pneumatic Machine that performs about the same amount of work, and is operated by one leverman.

The difference in the kind and amount of labor performed by the operators is very apparent.

PLATE 65.

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Electro-Pneumatic Interlocking Machine.

LARGE PARTS.

PLATE 66.

ORDER BY PLATE AND NUMBER.

No.

1. Angle Iron (different lengths), for joining the legs No. 9 longitudinally.
2. Channel Iron (different lengths), for supporting the rubber plate, No. 11.
3. Front Plate.
4. Back Plate.
5. Middle Bearing.
6. Column.
7. Intermediate Bar, for stiffening machine transversely.
8. Rubber Roller Bearing.
9. Leg.
10. Table Bracket.
11. Rubber Plate, for contact strips.
12. Binding Post Board.
13. Long Switch Lever.
14. Short Switch Lever.
15. Latch, for long switch lever.
16. Latch, for short switch lever.
17. Brass Washer, for No. 18.
18. Switch Lever Handle.
19. Signal Lever.
20. Signal Quadrant.
21. Signal Lever Handle.
22. Brass Washer, for No. 21.
23. Mitre Gear, for signal shaft No. 53.
24. Switch Quadrant and Mitre Gear.
25. Mitre Gear, for No. 57. It runs in Nos. 23 and 24.
26. Switch Lever Number. Black figure.
27. Signal Lever Number. Red figure.
28. Switch Lever Segment.
29. Indication Latch Bracket.
30. Long Switch Indication Latch.
31. Short Switch Indication Latch.
32. Signal Indication Latch.
33. Support, for track model.
34. Circuit Shifter Bar, extends the whole length of the machine.

No. PLATE 66.

35. Mica Insulation. } For No. 34.
36. Fibre Insulation. } For No. 34.
37. Circuit Shifter Base.
38. Binding Post. } For No. 37.
39. Phosphor Bronze Contact Disc. } For No. 37.
40. Circuit Shifter Crank. } For No. 37.
41. Circuit Shifter Arm, with fibre point. } For No. 37.
42. Short Spring. } For No. 37.
43. Long Spring. } For No. 37.
44. Armature.
45. Armature Stem and Nut. This piece is made in three lengths to go with either Nos. 30, 31 or 32.
46. Jaw, for joining No. 45 to either Nos. 30, 31 or 32.
47. Magnet.
48. Magnet Bushing.
49. Nut, for No. 48.
50. Locking Bar Bracket.
51. Locking Bar (made in different lengths).
52. Locking Driver.
53. Signal Lever Shaft.
54. Switch Lever Shaft.
55. Collar, for No. 54.
56. Support, for No. 11.
57. Extension Piece, for No. 59.
58. Collar Clamp, for joining Nos. 57 and 59.
59. Rubber Roller and Shaft.
60. Rubber Base, for signal circuit breaker. } These are made both as a 1-way and 5-way. A 1-way is shown.
61. Brass Ground Strip, for No. 60. } These are made both as a 1-way and 5-way. A 1-way is shown.
62. Phosphor-Bronze Contact Spring, Platinum Point. } For No. 60.
63. Phosphor-Bronze Contact Spring, Platinum Disc. } For No. 60.
64. Iron Strip, for supporting No. 12.
65. Cover, for No. 50.

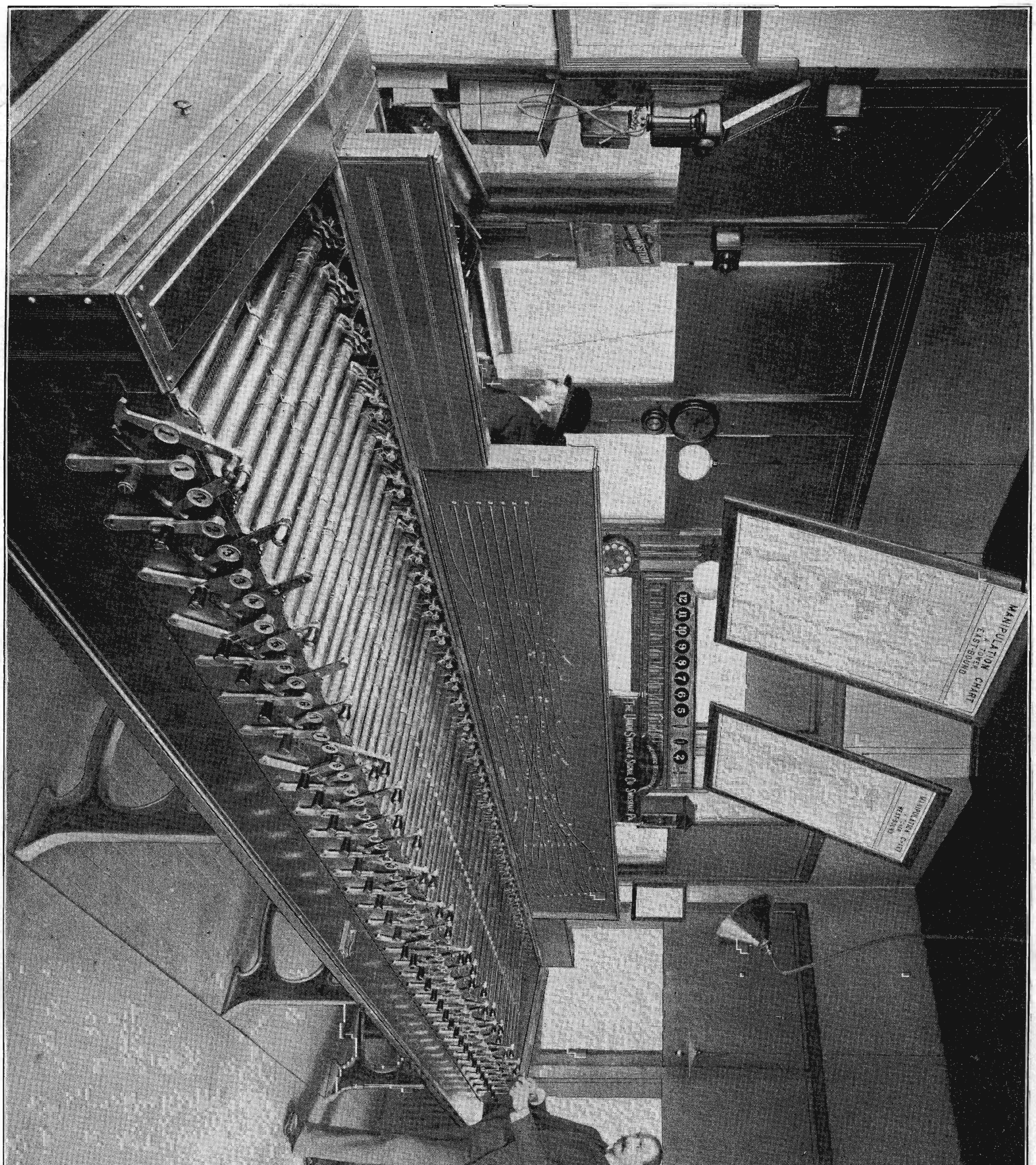
PLATE 67.

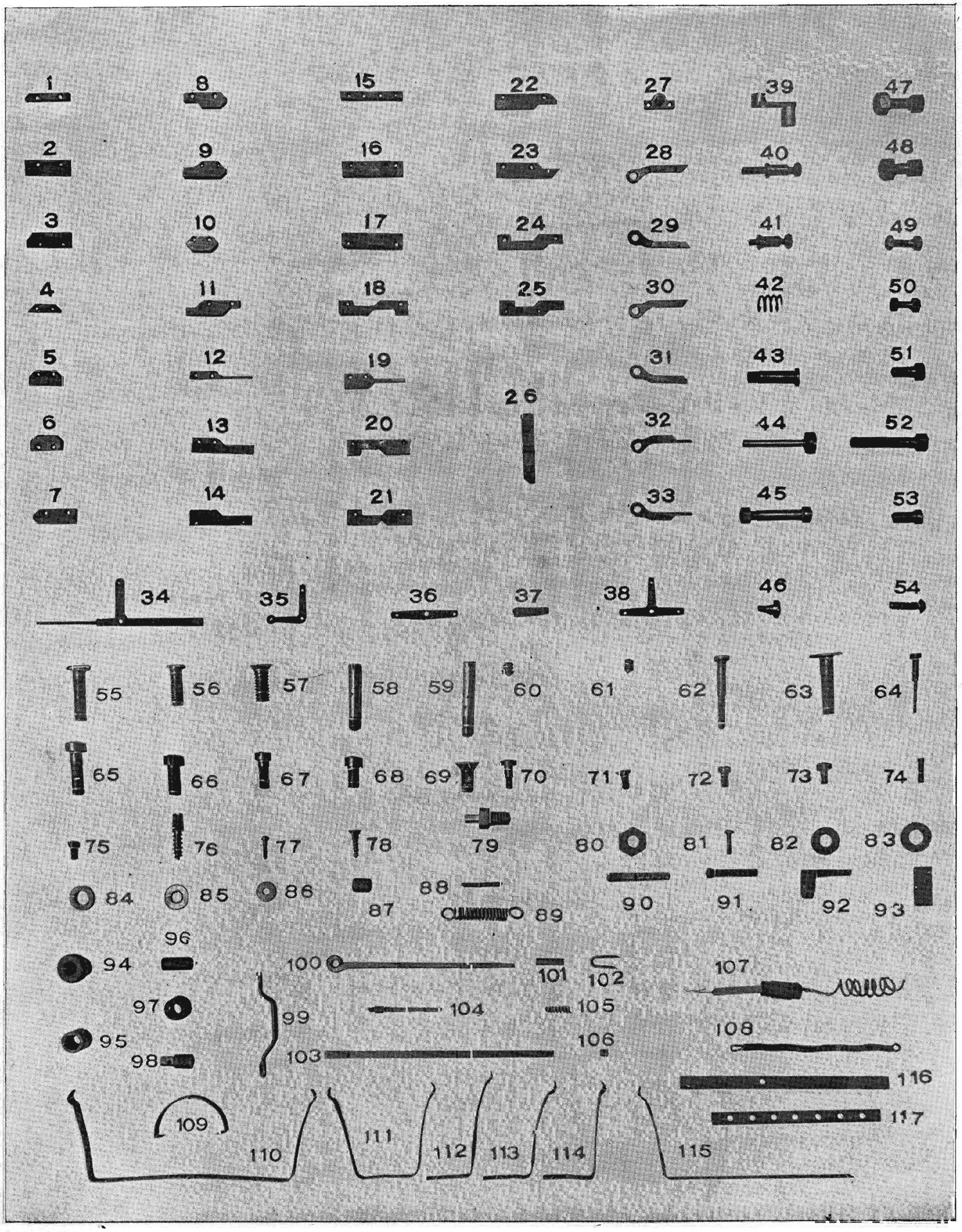
A view of the Electro-Pneumatic Machine in service at the Terminal of the Pennsylvania Railroad at Jersey City. One man only is required to operate this machine.

A train director sits in the bay window surrounded by his instruments.

Other views of this place are shown on Plates 52, 70 and 95.

PLATE 67.

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Electro-Pneumatic Interlocking Machine.

SMALL PARTS.

PLATE 68.

NOTE.— Where no particular reference is made to any Plate in the text below it is to be understood that Plate 68 is intended.

ORDER BY PLATE AND NUMBER.

No.

1 to 25 inclusive. Different forms of LOCKING DOGS. In ordering, state whether they are to be 3/8″ or 3/16″ thick.

26. SAMPLE CROSS LOCK, 3/8″ x 3/8″. This part must usually be specially made for the place it is to fit.

27. TRUNNION. State whether it is to carry one or two tappets.

28 to 33 inclusive. Different forms of TAPPETS.

34. END LEVER, for transmitting the motion from the switch lever quadrant to the track model.

35 to 38 inclusive. Different forms of LEVERS, for track model connections.

39. BINDING POST, for main controlling circuits. It fits onto No. 12, Plate 66.

40. BINDING POST AND SCREW. (This was formerly used in the place of No. 39. It should be ordered only for repairs of machines built previous to January, 1894.)

41. BINDING POST AND SCREW, for Nos. 34 and 60, Plate 66.

42. SPRING, for No. 43.

IRON.

43. SLEEVE, for No. 19, Plate 66.

44. PIN, for No. 43.

45. PIN AND NUT, for Nos. 13 and 14, Plate 66.

46. GUIDE SCREW, for Nos. 15 and 16, Plate 66.

47. CAP SCREW AND NUT, 3/8″ x 1 1/4″, for fastening No. 7 to No. 5, and No. 7 to No. 9, Plate 66.

48. CAP SCREW AND NUT, 3/8″ x 1″, for fastening No. 2 to No. 9, Plate 66.

49. CAP SCREW AND NUT, 1/4″ x 1″, for clamping No. 58, Plate 66.

50. CAP SCREW AND NUT, 1/4″ x 3/4″, for clamping No. 52, Plate 66.

51. CAP SCREW, 3/8″ x 3/4″, for fastening No. 1 to No. 9, and No. 2 to No. 8, Plate 66.

52. CAP SCREW, 3/8″ x 2 1/4″, for fastening No. 29 to No. 4, Plate 66.

53. MACHINE SCREW, 3/8″ x 3/4″, for fastening Nos. 3 and 4 to No. 7, Plate 66.

54. RIVET, 1/4″ x 7/8″, for fastening No. 64 to No. 2, and for joining two pieces of No. 1, Plate 66. Rivets are used on one end of a piece, and screws on the other. (See No. 57.)

55. MACHINE SCREW, 3/4″ x 12–32, for fastening No. 12 to No. 64, Plate 66.

56. MACHINE SCREW, 5/8″ x 10–24, for fastening No. 92, Plate 68, to No. 52, Plate 66.

No. **PLATE 68.**

IRON.

57. MACHINE SCREW, 5/8″ x 1/4″–20, for joining two pieces of No. 1, Plate 66. Screws are used on one end of a piece and rivets on the other. (See No. 54.)

58. TAPER SCREW, 1 1/8″ x 12–32, for fastening Nos. 23 and 25 to Nos. 53 and 57, Plate 66.

59. TAPER SCREW, 1 3/8″ x 12–32, for fastening No. 20 to No. 53, and No. 24 to No. 54, Plate 66.

60. SET SCREW, 1/4″ x 10–24, for fastening No. 55 to No. 54, Plate 66.

61. SET SCREW, 1/4″ x 8–32, for fastening No. 43, Plate 68, to No. 19, Plate 66, and No. 21, Plate 66, to No. 44, Plate 68.

BRASS.

62. MACHINE SCREW, 1 1/8″ x 6–32, for fastening Nos. 30, 31 and 32 to No. 29, Plate 66.

63. MACHINE SCREW, 1″ x 12–32, for fastening track model board to No. 33, Plate 66.

64. MACHINE SCREW, 7/8″ x 2–60, for fastening No. 103, Plate 68, to track model board.

65. MACHINE SCREW, 3/4″ x 12–32, for fastening No. 11 to No. 2, Plate 66.

66. MACHINE SCREW, 1/2″ x 12–32, for fastening No. 28 to No. 3, Plate 66.

67. MACHINE SCREW, 1/2″ x 10–32, for fastening No. 37 to No. 34, Plate 66.

68. MACHINE SCREW, 3/8″ x 12–32, binding screw for No. 39, and for fastening No. 56 to No. 11, Plate 66.

69. MACHINE SCREW, 1/2″ x 12–32, for fastening No. 50 to Nos. 3, 4 and 5, Plate 66.

70. MACHINE SCREW, 3/8″ x 6–32, for fastening No. 46 to Nos. 30, 31 and 32, Plate 66.

71. MACHINE SCREW, 5/16″ x 6–32, for fastening Nos. 61 and 63 to No. 60, Plate 66.

72. MACHINE SCREW, 1/4″ x 6–32, for fastening No. 65 to No. 50, and for clamping No. 41, Plate 66.

73. MACHINE SCREW, 1/4″ x 4–52, for fastening Nos. 99 and 100 to Nos. 34, 35, 36, 37 and 38.

74. MACHINE SCREW 3/8″ x 4–40, for lug on No. 24, Plate 66.

75. MACHINE SCREW, 1/4″ x 4–40, for setting Nos. 35, 36, 37 and 38 on No. 104, also for top of Nos. 79 and 98.

76. WOOD SCREW, 3/4″–#9, guide for spring on No. 34.

77. WOOD SCREW, 3/8″–#3, for fastening Nos. 109, 110, 111, 112, 113, 114, 115, 116 and 117 to No. 11, Plate 66.

78. WOOD SCREW, 1/2″–#6, for fastening No. 39.

79. SCREW PIVOT, for Nos. 34, 35, 36 and 38.

80. NUT, 1/4″–32, for No. 38, Plate 66, and No. 40, Plate 68.

81. RIVET, 1/16″ x 3/8″, for No. 89.

82. WASHER, 7/16″–7/32″ for No. 39.

83. WASHER, 1/2″–1/4″, for No. 38, Plate 66, and No. 40, Plate 68.

84. WASHER, 7/16″–1/4″, for No. 38, Plate 66.

85. WASHER, 7/16″–3/16″, for No. 38, Plate 66.

86. COPPER WASHER, 11/32″–1/8″, for No. 75.

ELECTRO-PNEUMATIC INTERLOCKING MACHINE, SMALL PARTS.—(Continued.)

No. PLATE 68.

87. BRASS ROLLER, for No. 40, Plate 66.

88. PIN, for Nos. 87 and 93, Plate 68. (Used also as a key for Nos. 40 and 41, Plate 66.)

89. SPRING, for Nos. 15 and 16, Plate 66.

90. PIN, for Nos. 13, 14 and 25, Plate 66.

91. RIVET, for Nos. 1 to 25 inclusive, and for No. 27.

92. KEY, for No. 52, Plate 66.

93 KEY, for Nos. 15 and 16, Plate 66.

94. RUBBER BUSHING, $\frac{11}{32}''-\frac{1}{2}''$, for No. 33, Plate 66.

95. RUBBER BUSHING, $\frac{1}{4}''-\frac{3}{8}''$, for No. 37, Plate 66.

96. RUBBER POINT, $\frac{1}{4}'' \times \frac{1}{2}''$, for No. 63, Plate 66.

97. RUBBER BUSHING, $\frac{1}{4}''-\frac{3}{8}''$, for No. 98.

98. BINDING POST, for No. 47, Plate 66.

99. }
100. } Connecting rods (any length), for Nos. 34, 35, 36, 37 and 38.

101. SLEEVE, for joining two pieces of No. 100.

102. STAPLE, for guiding Nos. 99 and 100.

103. PIECE OF TRACK USED ON MODEL. If the part wanted is to be movable a special hole must be drilled in the end to receive No. 104.

104. SHAFT, on which is mounted a piece of No. 103, and either of Nos. 35, 36, 37 or 38.

105. SPRING, for No. 104.

106. SUPPORT, for fixed pieces of No. 103: mounted on No. 64.

107. RESISTANCE COIL, made with resistance = $\frac{1}{2}$, 1 or 2 ohms, therefore specify which is required.

108. COPPER WIRE, in gutta-percha insulation; any length.

PARTS RELATING TO THE SPRING COMBINATION.

109. BAND, for No. 59, Plate 66.

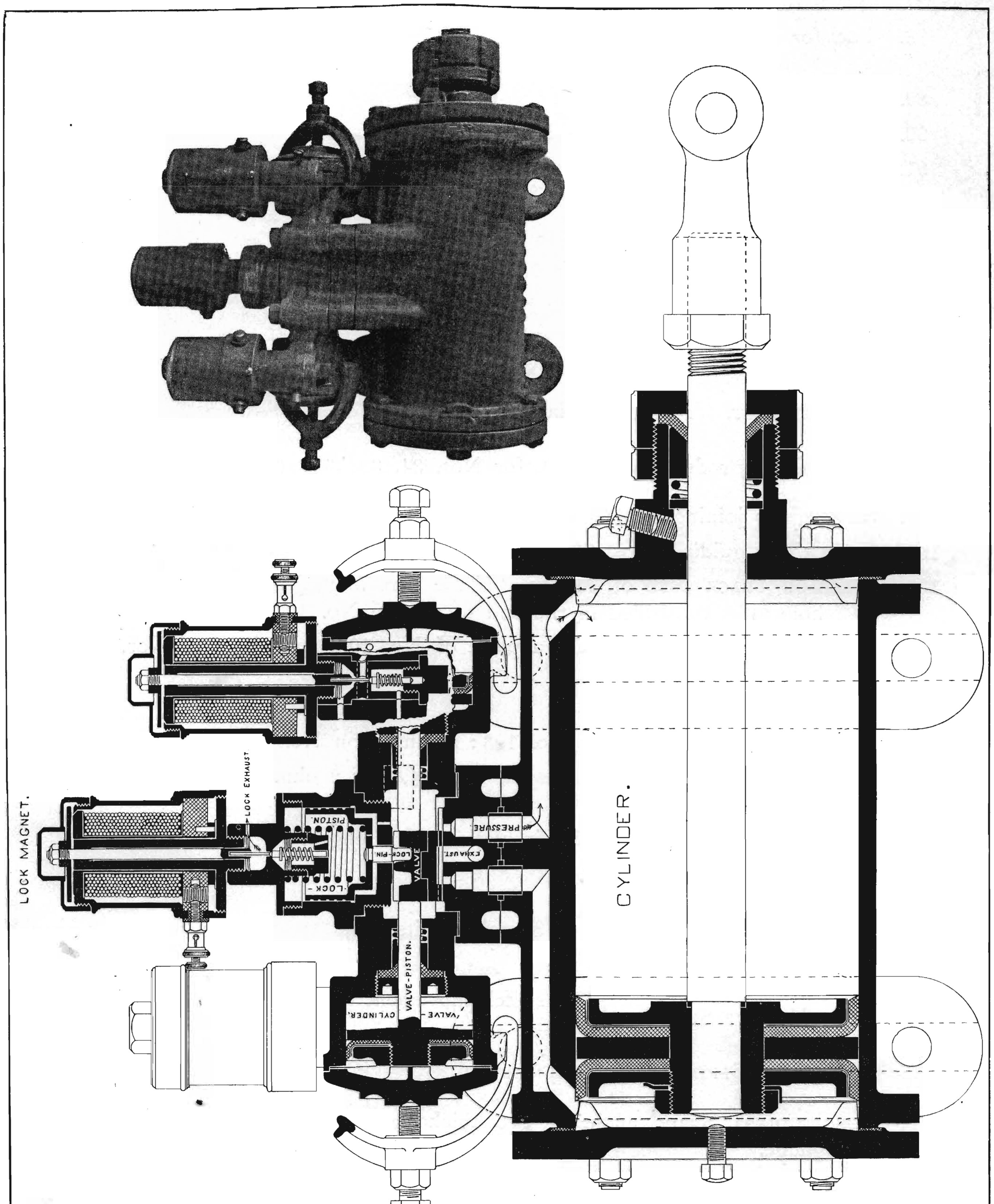
110. SPRING, for alternate rollers. }
111. SPRING, for adjacent rollers. } Signal circuits.

112. VALVE MAGNET SPRING. }
113. LOCK MAGNET SPRING. } For switch movement circuit.

114. }
115. } FORMS OF SPRINGS, for signal circuits.

116. LONGITUDINAL STRIP, made in two thicknesses, #21 and #24, Brown & Sharpe gauge.

117. CROSS STRIP.


LOCK MAGNET.
LOCK EXHAUST
LOCK-PISTON.
LOCK-PIN.
VALVE
PRESSURE.
EXHAUST.
VALVE-PISTON.
VALVE-CYLINDER.
CYLINDER.

Electro-Pneumatic Interlocking Switch Valve and Cylinder.

PLATE 69.

THE arrangement illustrated in section and plan on the opposite page is the medium through which a switch or movable frog is controlled and operated from an Electro-Pneumatic Interlocking Machine. The device is connected with the machine by three electric wires, one going to each of the magnets; the pressure, which is constant in the valve chamber, is derived from the main air pipe through a branch ¾″ pipe, while its presence on one side or the other of the main cylinder is directed by the relative positions of the two outside magnets, which lie upon either side of the lock magnet.

The lock magnet acts as a check upon the performance of the outside or valve magnets; the valve is an entirely independent part, which is always touched by, but not fastened to, the valve pistons on each side of it.

The operation is briefly as follows, the lever of the interlocking machine being in one of its extreme positions:

A slight movement of the lever forms an electric circuit through the lock magnet, which when excited opens the lock exhaust, and permits the air pressure to raise the lock piston, and consequently the lock pin from its seat on the valve. When the lock-exhaust port is closed the pressure remains the same on each side of the lock piston, since there is an uninterrupted passage from the valve chamber to the inside of the lock piston; but the opening in the face of the lock piston is much smaller than the exhaust port or the one connecting the valve chamber with the lock cylinder, therefore, when the lock-exhaust port is opened the escape of the pressure is more rapid from the inside of the lock piston than its admission, which results in a preponderance of pressure on the face of the lock piston, that overcomes the action of the large spring contained in the lock piston, and continues so long as the lock-exhaust remains open; the valve is now released, and susceptible of being acted upon by the valve piston. As was previously stated, the pressure is constant in the valve chamber; it is also constant in the passage from the valve chamber to the small space which contains a spring, shown in section directly beneath the magnet on the right. From this space the air is admitted to the valve cylinder by a small pin valve, which also controls the exhaust, and is the extension of the armature stem.

To return to the interlocking machine; a further movement of the lever discharges one of the valve magnets, permitting the escape of the pressure from

PLATE 69.

its relative valve cylinder, and excites the other valve magnet, admitting the pressure to the valve cylinder on that side; this operation results in the shifting of the valve. During this part of the lever's movement the lock pin has been raised, but upon a further progress of the lever the lock magnet is discharged, the lock pin is forced out by the strong spring contained in the lock piston, and upon the completion of the valve's journey, seats itself upon the other side, there to remain until the whole process is repeated in the other direction.

The object of this combination is to hold the valve in a certain position until all of the conditions are secured which make it proper that a change shall take place; in short, no movement of the valve can occur unless the lock magnet is held charged through the electric contact on the interlocking machine.

The shifting of the valve results in alternately connecting the valve chamber with one of the passages to the main cylinder, and in connecting the other passage with the common exhaust.

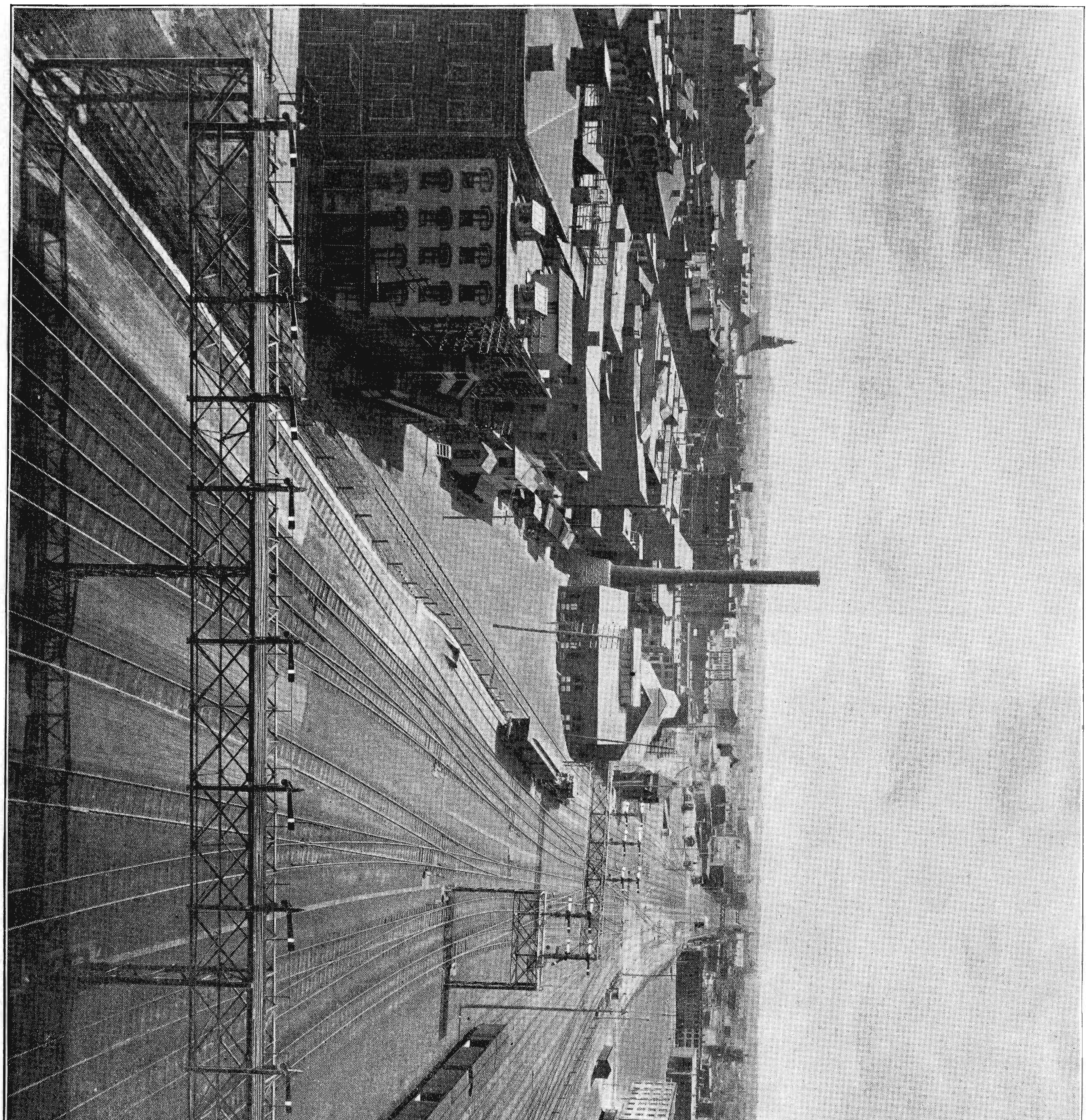
The relation between the main piston and the device which is connected with the track itself is illustrated on Plate 72.

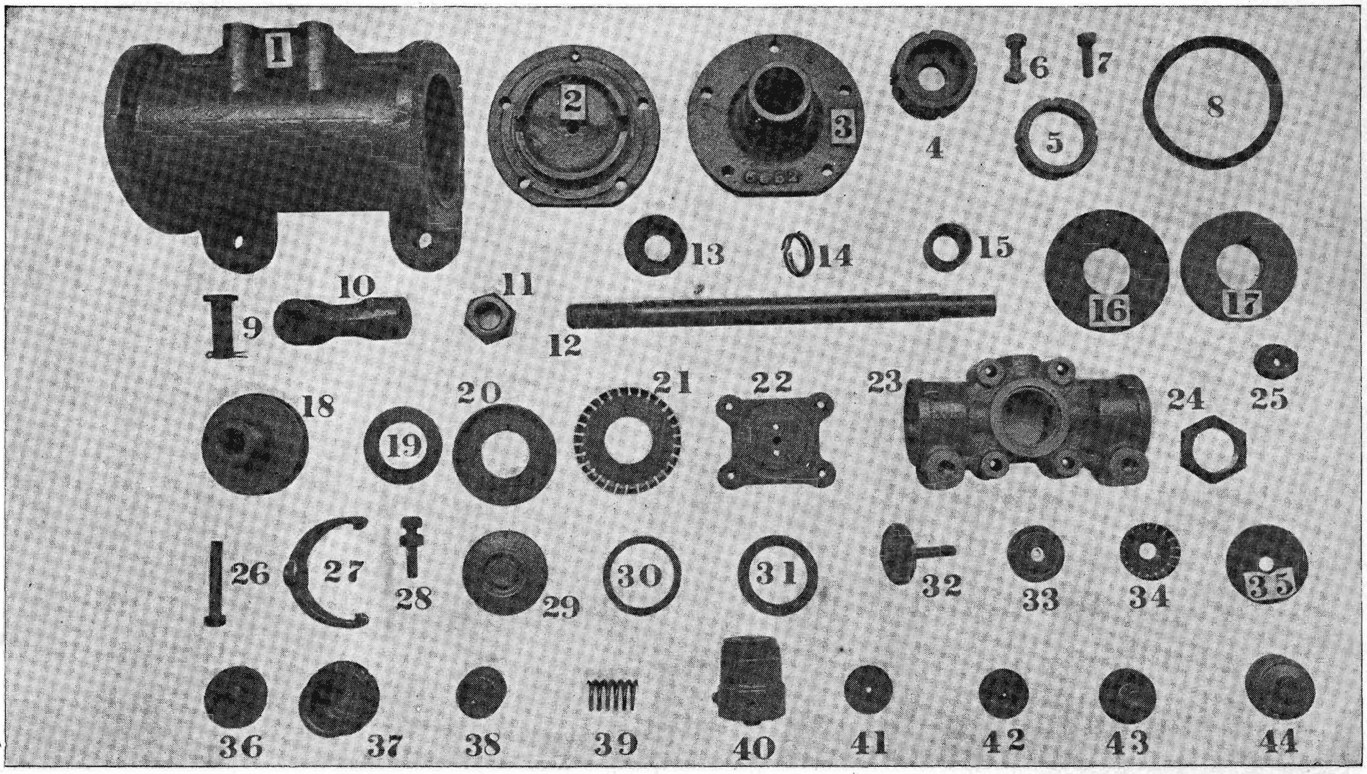
The separate parts of the valve and cylinder are shown on Plate 71.

PLATE 70.

A general view of the tracks and signals controlled by cabins 1, 2 and 3 of the Pennsylvania Railroad at Jersey City.

This is an Electro-Pneumatic plant, and comprises both interlocking and automatic block signals. Other views of the same installation are shown on Plates 52, 67 and 95.

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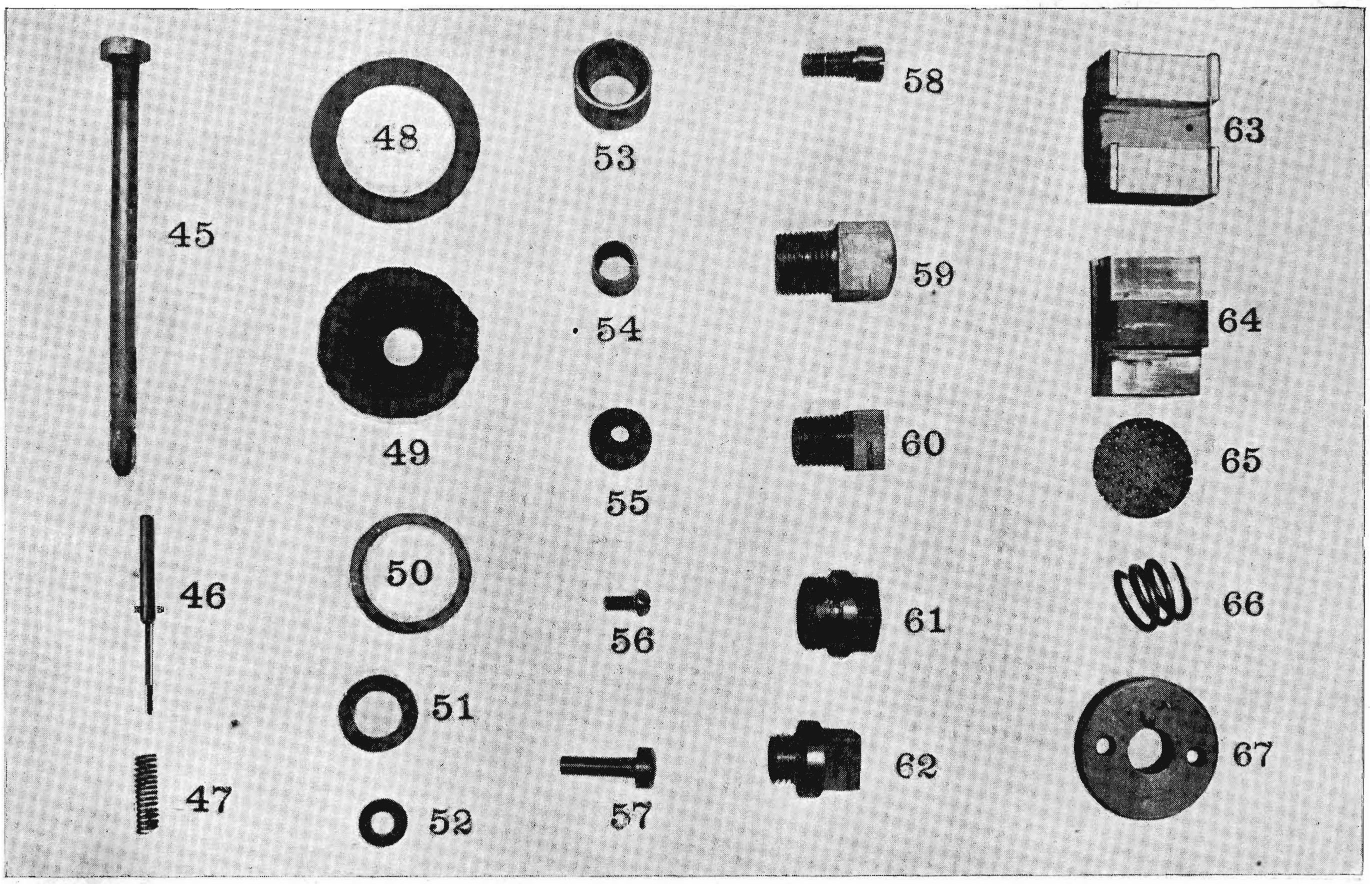
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Electro-Pneumatic Interlocking Switch Valve and Cylinder.

PLATE 71.

CYLINDERS are made 5″, 6″ and 6½″ inside diameter, therefore in ordering Nos. 1, 2, 3, 8, 16, 17, 18, 20 and 21 give the diameter of cylinder which they are to fit.

ORDER BY PLATE AND NUMBER.

No.

1. MAIN CYLINDER.
2. BACK CYLINDER HEAD.
3. FRONT CYLINDER HEAD.
4. STUFFING BOX.
5. JAM NUT, for stuffing box.
6. T HEAD BOLT AND NUT, ½″ x 1¾″ } For fastening cylinder heads to cylinder.
7. TAP BOLT, ½″ x 1½″ } For fastening cylinder heads to cylinder.
8. FIBRE GASKET, for cylinder heads.
9. TURNED PIN, for jaw No. 10.
10. SCREW JAW, for piston rod No. 12.
11. JAM NUT, for screw jaw No. 10.
12. PISTON ROD.
13. LEATHER PACKING. } For stuffing box.
14. SPRING. } For stuffing box.
15. CAST IRON BUSHING. } For stuffing box.
16. LEATHER PACKING, for main piston No. 18.
17. MAIN PISTON RING.
18. MAIN PISTON.
19. SHEET IRON WASHER, for main piston.
20. MAIN PISTON FOLLOWER.
21. STEEL SPRING FOLLOWER, for main piston.
22. SWITCH VALVE SEAT.
23. SWITCH VALVE BODY.
24. BRASS HEX. NUT, for main piston head, No. 18.
25. AIR INLET.
26. TAP BOLT, ½″ x 3½″, for joining Nos. 1, 22 and 23.
27. YOKE.
28. TAP BOLT AND JAM NUT, ½″ x 2¼″, for No. 27.
29. HEAD, for valve body No. 23.
30. FIBRE GASKET, for end of valve body.

ELECTRO-PNEUMATIC INTERLOCKING SWITCH VALVE AND CYLINDER.—(Continued.)

No. **PLATE 71.**

31. FIBRE GASKET, for packing valve seat and valve body Nos. 22 and 23.
32. VALVE PISTON.
33. BRASS FOLLOWER.
34. STEEL SPRING FOLLOWER. For valve piston.
35. LEATHER PACKING.
36. CAP, for lock cylinder No. 37.
37. LOCK CYLINDER.
38. LOCK PISTON.
39. SPRING, for lock cylinder.
40. MAGNET.
41. MAGNET SHIELD.
42. ARMATURE.
43. INSIDE MAGNET CAP.
44. OUTSIDE MAGNET CAP.

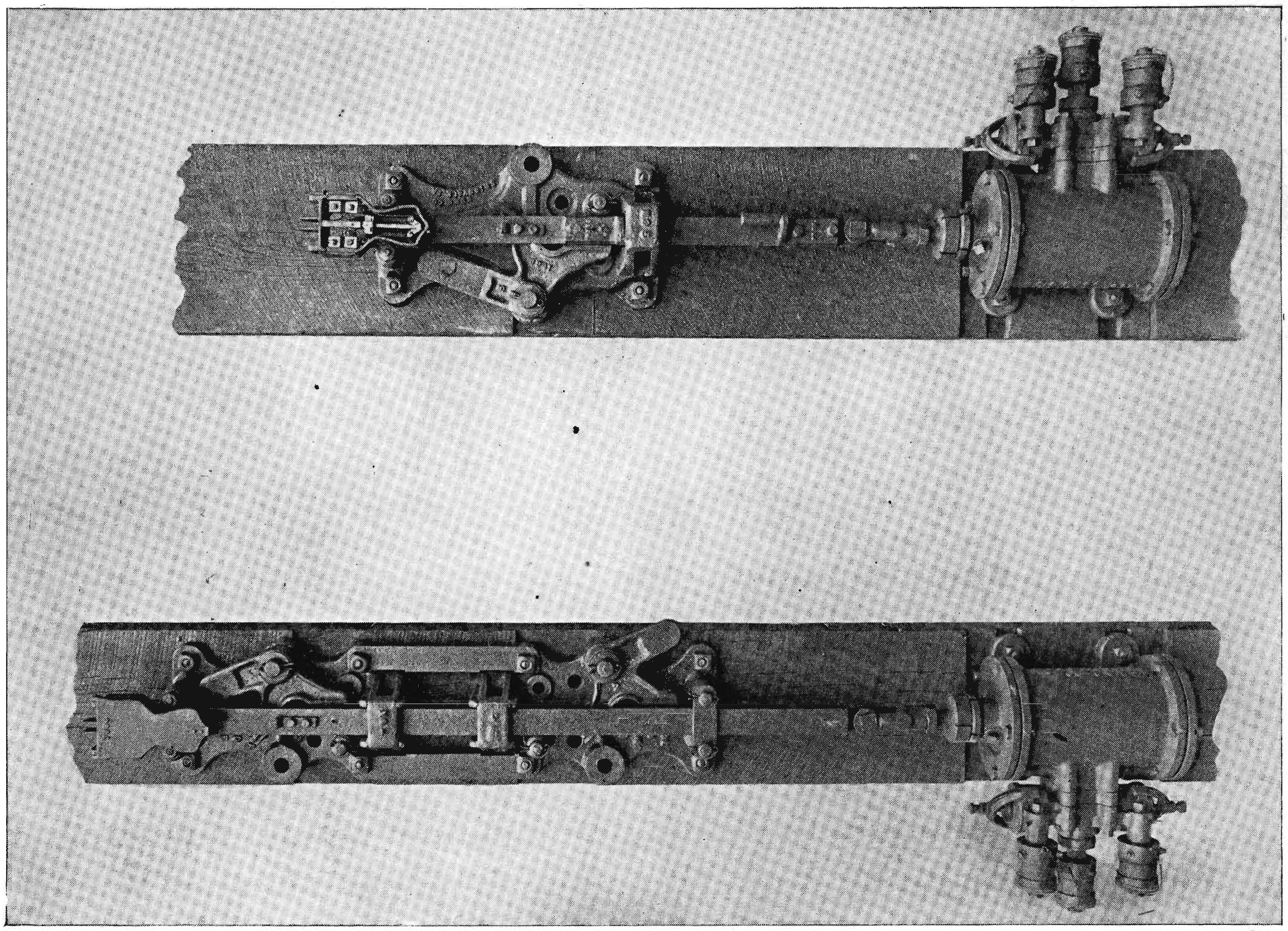
Numbers 45 to 67 are much exaggerated in size when compared with numbers 1 to 44.

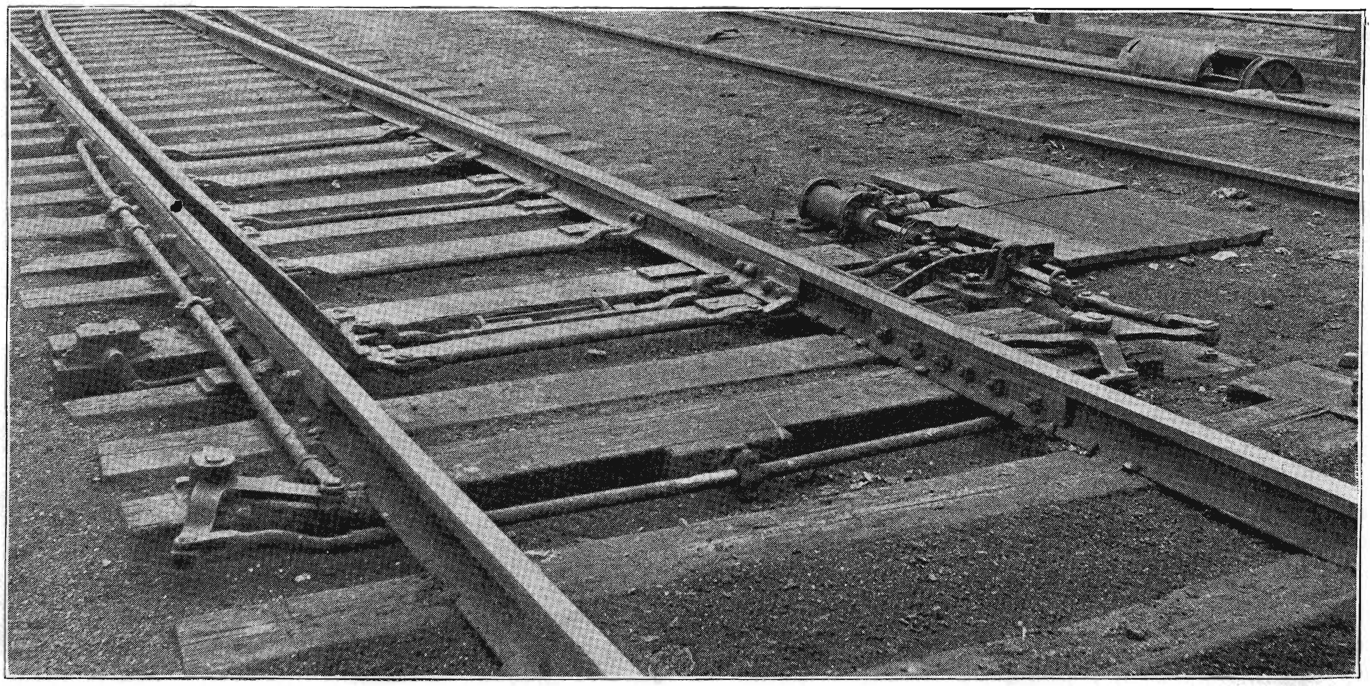
45. ARMATURE STEM.
46. PIN VALVE.
47. SPRING, for pin valve.
48. FIBRE GASKET, for air inlet No. 25.
49. LEATHER PACKING, for inside of valve body No. 23.
50. LEAD GASKET, for piston rod No. 12.
51. LEAD GASKET, for ports in main cylinder No. 1.
52. BRASS WASHER, $\frac{1}{4}''-\frac{1}{2}''$, for binding screw No. 57.
53. STUFFING BOX BUSHING, for valve body No. 23.
54. BRASS BUSHING, for air ports in main cylinder No. 1.
55. RUBBER BUSHING, for binding screw No. 57.
56. IRON MACHINE SCREW, $\frac{3}{8}''$ x 8–32, for magnet case No. 40.
57. BINDING SCREW, $\frac{13}{16}''$ x 12–32, for magnet No. 40.
58. BRASS TAPER SCREW, $\frac{1}{2}''$ x $\frac{1}{4}''$–24, for plugging construction holes in valve body No. 23.
59. BRASS TAPER SCREW, square head, $\frac{5}{8}''$ x $\frac{3}{8}''$–18, for plugging oil hole in No. 2.
60. BRASS TAPER SCREW, square head, $\frac{9}{16}''$ x $\frac{9}{16}''$–18, for plugging oil hole in No. 3.
61. BRASS SCREW HEX. HEAD, guide for pin valve of cap No. 36.
62. BRASS SCREW, SQUARE HEAD, guide for side pin valves.
63. SADDLE. For valve seat No. 22.
64. SLIDE VALVE.
65. DUST STRAINER, for air inlet in valve body No. 23.
66. BRASS SPRING, for stuffing box bushing No. 53.
67. PACKING NUT, for valve body No. 23.

Patents Relating to the Electro-Pneumatic System.

NAME.	DATE.	NUMBER.
GEO. WESTINGHOUSE, JR.,	FEBRUARY 1, 1881,	237,149
H. TILDEN AND F. S. GUERBER,	FEBRUARY 15, 1881,	237,787
H. TILDEN,	APRIL 12, 1881,	240,054
GEO. WESTINGHOUSE, JR.,	APRIL 26, 1881,	240,628
GEO. WESTINGHOUSE, JR.,	APRIL 26, 1881,	240,629
GEO. WESTINGHOUSE, JR.,	AUGUST 2, 1881,	245,108
GEO. WESTINGHOUSE, JR.,	AUGUST 9, 1881,	245,592
GEO. WESTINGHOUSE, JR.,	AUGUST 23, 1881,	246,053
O. GASSETT,	OCTOBER 31, 1882,	266,957
O. GASSETT, Re-issue,	JANUARY 8, 1884,	10,434
O. GASSETT, Re-issue,	JANUARY 8, 1884,	10,435
F. S. GUERBER,	MARCH 6, 1883,	273,680
F. S. GUERBER,	JANUARY 29, 1884,	292,748
GEO. WESTINGHOUSE, JR.,	FEBRUARY 1, 1887,	357,109
GEO. WESTINGHOUSE, JR.,	FEBRUARY 8, 1887,	357,296
GEO. WESTINGHOUSE, JR.,	MARCH 1, 1887,	358,518
GEO. WESTINGHOUSE, JR.,	MARCH 1, 1887,	358,519
GEO. WESTINGHOUSE, JR.,	MARCH 1, 1887,	358,520
GEO. WESTINGHOUSE, JR.,	MARCH 1, 1887,	358,521
GEO. WESTINGHOUSE, JR.,	MARCH 1, 1887,	358,713
GEO. WESTINGHOUSE, JR.,	MARCH 15, 1887,	359,303
GEO. WESTINGHOUSE, JR.,	APRIL 5, 1887,	360,638
GEO. WESTINGHOUSE, JR.,	NOVEMBER 27, 1888,	393,596
J. G. SCHREUDER,	JANUARY 15, 1889,	396,239
J. G. SCHREUDER,	DECEMBER 9, 1890,	442,339
GEO. WESTINGHOUSE, JR., AND J. G. SCHREUDER,	FEBRUARY 10, 1891,	446,159
J. G. SCHREUDER,	JULY 19, 1892,	479,225
J. G. SCHREUDER,	JULY 26, 1892,	479,666
JOHN P. COLEMAN,	SEPTEMBER 18, 1894,	526,179
JENS G. SCHREUDER,	SEPTEMBER 18, 1894,	526,328

AND OTHERS.





The Double Point Switch and Lock Movement.

PLATE 72.

THE two arrangements illustrated on the upper portion of Plate 72 are the same in principle but differ in appearance, from the fact that the top one is used at switches, and is a "simple" movement, while the bottom one, which is designed for operating movable frogs, is what is known as a "tandem" movement. The method of locking the simple movement is quite plainly shown in the part of the plate already referred to, and in the lower part of the plate, which gives a general idea of how the movement is located at a switch, and also shows the appearance, in the upper right hand corner of the cover, that is used to protect the movement from snow and dirt. The locking of the tandem movement is concealed from view, but may be understood by referring to Nos. 30 and 31, Plate 73, which are built upon the slide bars, and when the movement is in one of its extreme positions, enter slots that are cut out of the lock bar.

The method of making the detector-bar connections is also shown on the lower part of Plate 72.

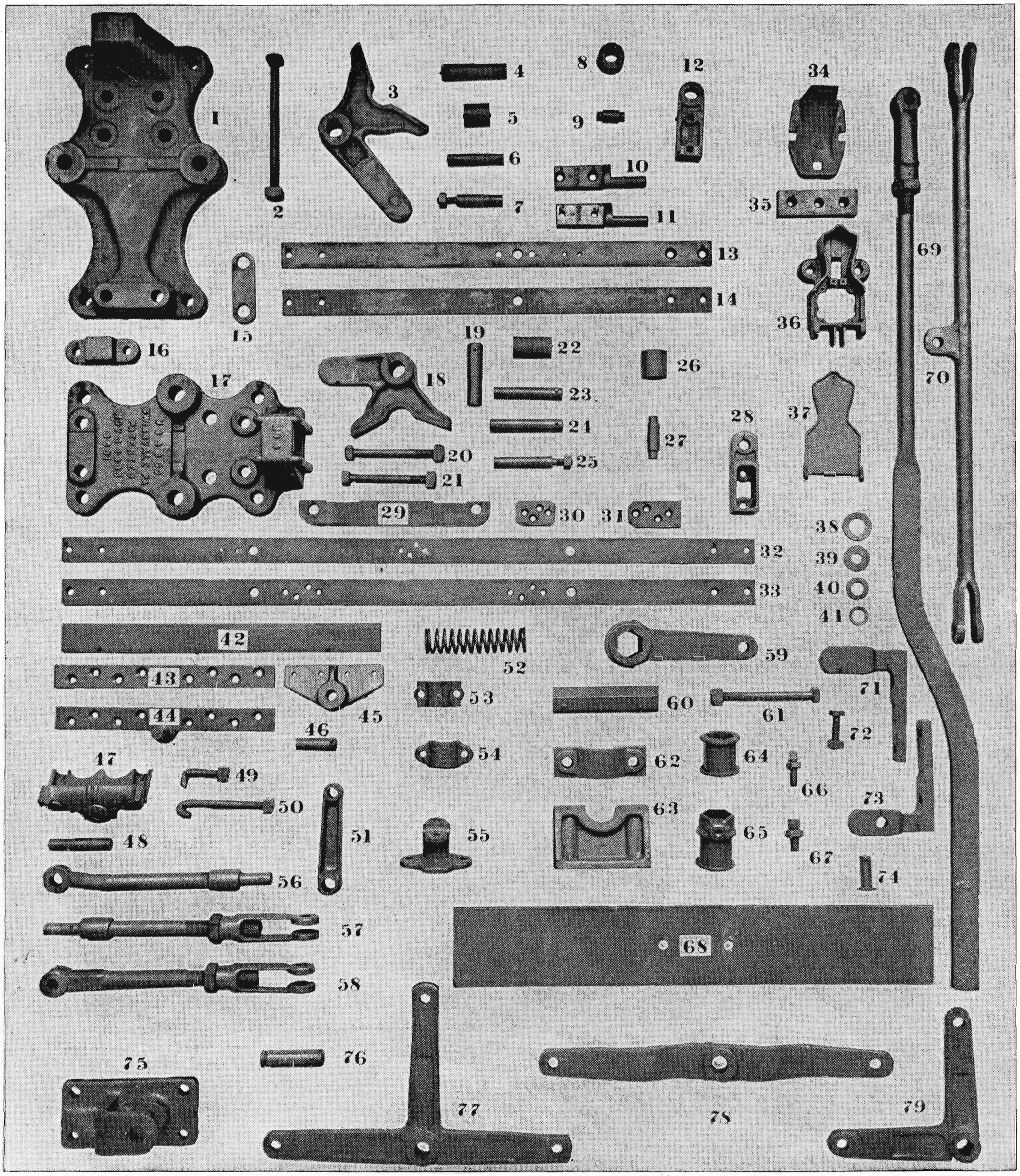
The mode of operation is as follows: with the movement in its normal or reversed position the detector bar will be lowered, the switch will be locked and the roller No. 8, Plate 73, which is supported between the slide bars will rest at the end of one of the surfaces on the crank No. 3, Plate 73. Upon a movement of the slide bars the roller will at first be carried along the surface of the crank without any effect upon the position of the switch; at the same time the detector bar will begin to rise and the lock will be withdrawn. As soon as the switch is unlocked it will begin to move and upon the completion of its journey will be again locked, while the detector bar will have been lowered to its position of rest at the other extremity of its stroke; the return passage of the movement takes place in exactly the same sequence.

Both the simple and tandem movements are permanently connected with the rails by a tie plate No. 11, Plate 74.

The indication box, Nos. 36 and 37, Plate 73, which is referred to in the description of the Electro-Pneumatic Machine, is shown on one end of each of the movements on Plate 72. It is operated by a small dog, No. 80, Plate 73, which is fastened to the upper slide bar of the movement, and which upon the completion of its passage in either direction strikes a projection that is built upon the indication box slide bar, No. 108, Plate 73, forcing it along and making the temporary contact necessary to operate the indication latches in the machine. An arrangement of springs and levers in the indication box prevents any movement of its parts except when it is actuated by the dog, as above described.

A list of the parts will be found upon Plates 73 and 74.

PLATE 73.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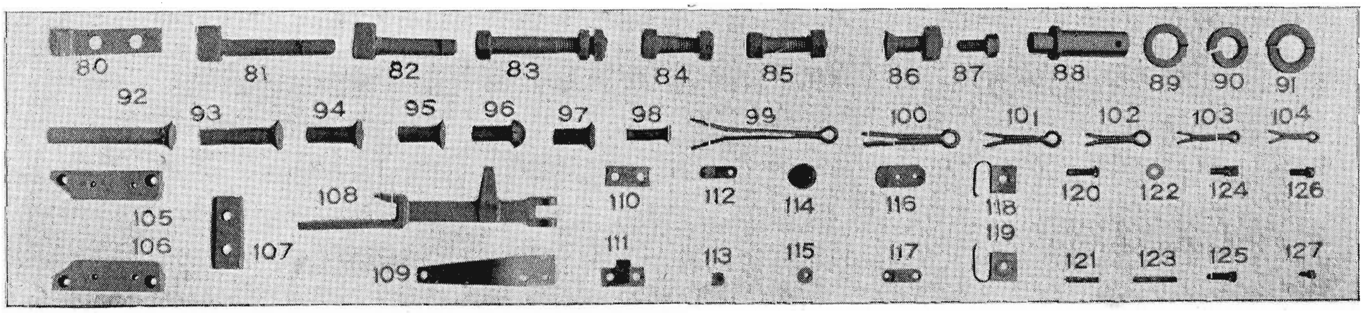
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Double Point Switch and Lock Movement and Relative Parts.

PLATE 73.

SMALL PARTS.

ORDER BY PLATE AND NUMBER.

No.

PARTS RELATING TO SIMPLE MOVEMENT.

1. BASE.
2. BOLT AND NUT, ¾″ x 10″, for fastening No. 1, Plate 73, to No. 1, Plate 74.
3. SWITCH CRANK.
4. SWITCH CRANK STUD.
5. SIDE ROLLER.
6. STUD, for No. 5; used at locking end of No. 1.
7. STUD, for No. 5; used at indication end of No. 1.
8. OPERATING ROLLER; bears against No. 3, and is placed between Nos. 13 and 14.
9. STUD, for No. 8.
10. LOCK PIN, with countersunk holes; placed in center of No. 13.
11. LOCK PIN, with plain holes; placed at end of No. 13.
12. LUG. Placed between and at each end of Nos. 13 and 14.
13. TOP SLIDE BAR.
14. BOTTOM SLIDE BAR.
15. STRAIGHT CAP. Placed on indication end of No. 1, when no indication box is used, and on one of the bases, No. 17, in a tandem arrangement.

PARTS RELATING TO TANDEM MOVEMENT.

16. OFFSET CAP. Placed on indication end of one of the bases, No. 17, in a tandem arrangement, when no indication box is used with the tandem.
17. BASE.
18. SWITCH CRANK.
19. SWITCH CRANK STUD.
20. BOLT AND NUT, ¾″ x 6½″, for fastening locking end of No. 17, Plate 73, to timber No. 1, Plate 74.
21. BOLT AND NUT, ¾″ x 6″, for fastening indication end of No. 17, Plate 73, to timber No. 1, Plate 74.
22. SIDE ROLLER.

23.	STUDS, for No. 22.	Used at locking end of No. 17.
24.		Used at indication end of No. 17, in connection with No. 15.
25.		Used at indication end of No. 17, in connection with No. 16 or No. 36.

26. OPERATING ROLLER; bears against No. 18, and placed between Nos. 32 and 33.
27. STUD, for No. 26.
28. LUG. Placed at each end of and between Nos. 32 and 33.
29. STRIP, for joining locking ends of two Nos. 17, in order to form a tandem.
30. UPPER LOCKING PLATE. Placed on No. 32.
31. LOWER LOCKING PLATE. Placed on No. 33.
32. UPPER SLIDE BAR.
33. LOWER SLIDE BAR.

No. **PLATE 73.**

34. RAIL BRACE. Made in many different sizes to suit the kind of rail.

35. RAIL BRACE PLATE. Placed on the tie plate, No. 11, Plate 74, back of No. 34, Plate 73.

36. INDICATION BOX.

37. COVER, for No. 36.

38. WASHER, for Nos. 4 and 19.

39. WASHER, for Nos. 2, 20 and 21.

40. WASHER, for No. 46.

41. WASHER, for Nos. 6, 23, 24 and 48.

PARTS RELATING TO THE DETECTOR BAR.

42. PIECE OF DETECTOR BAR.

43. SPLICE.
44. SPLICE AND DRIVING PIECE COMBINED.
} 4 bolts and 4 rivets are used in each of these. (See Nos. 86 and 95.)

45. DRIVING PIECE.

46. STUD, for No. 45.

47. RAIL CLIP. This is made in many different sizes to suit the section of rail.

48. STUD.
49. SHORT HOOK BOLT AND NUT.
50. LONG HOOK BOLT AND NUT.
} For No. 47.

51. LINK.

52. SPRING.

53. SPRING CLAMP. (One half only is shown.)

54. CAP, for No. 55.

55. PIPE GUIDE.

56. EYE ROD.
57. SCREW JAW.
} The driving rod is formed of these two parts joined by a piece of 1″ pipe.

58. ADJUSTABLE LINK. This is used to connect the movement with the switch and with the detector bar.

PARTS RELATING TO THE ROCKING SHAFT.

59. ROCKING SHAFT ARM.

60. PIECE OF HEXAGONAL ROCKING SHAFT.

61. BOLT AND NUT, $\frac{3}{4}'' \times 7''$, for joining Nos. 62, 63 and 68.

62. CAP, for No. 63.

63. JOURNAL BOX.

64. INTERMEDIATE JOURNAL.

65. END JOURNAL.

66. SET SCREW AND JAM NUT, for No. 65.

67. SET SCREW AND JAM NUT, for No. 59.

68. PLATE, for No. 63.

69. LOCKING BAR, with adjustable jaw.

DOUBLE POINT SWITCH AND LOCK MOVEMENT AND RELATIVE PARTS.—(Continued.)

No. **PLATE 73.**

70. FRONT ROD.
71. LEFT-HAND FOOT.
72. BOLT AND NUT, 5/8" x 2 3/8", for fastening Nos. 71 and 73 to switch rail.
73. RIGHT-HAND FOOT.
74. TURNED PIN, for Nos. 57, 58, 69 and 70.
75. CRANK STAND.
76. PIN, for No. 75.
77. "T" CRANK.
78. COMPENSATING LEVER.
79. BELL CRANK.

(77–79) In ordering either of Nos. 77, 78 and 79, give the distance from end holes to center holes.

80. DOG, for operating No. 108, bolted to Nos. 13 and 32.
81. SQUARE HEAD RIVET, for indication end of Nos. 32 and 33.
82. SQUARE HEAD RIVET, for indication end of Nos. 13 and 14.
83. BOLT AND NUTS, 1/2" x 3 1/4", for locking end of Nos. 13 and 14.
84. BOLT AND NUT, 1/2" x 1 1/2", for joining Nos. 54 and 55.
85. BOLT AND NUT, 1/2" x 1 5/8", for joining two pieces of No. 53.
86. BOLT (RIVET HEAD) AND NUT, for fastening one half of Nos. 43 and 44 to No. 42 (see No. 95).
87. TAP BOLT, 3/8" x 3/4", for No. 80.
88. STUD, for connecting No. 51 to No. 42.
89. WASHER, 3/4"–1 1/4", for No. 88.
90. NUT LOCK, for Nos. 49, 50 and 72.
91. NUT LOCK, for No. 61.
92. RIVET, 1/2" x 3 1/2", for joining Nos. 28, 32 and 33.
93. RIVET, 1/2" x 2 1/4", for joining Nos. 12, 13 and 14.
94. RIVET, 1/2" x 1 1/2", for fastening No. 35, Plate 73, to No. 11, Plate 74.
95. RIVET, 1/2" x 1 1/4", for fastening one half of Nos. 43 and 44 to No. 42 (see No. 86).
96. RIVET (BUTTON HEAD), 1/2" x 1 1/4", for fastening No. 45 to No. 42.
97. RIVET, 1/2" x 1 1/8", for fastening No. 10 to No. 13.
98. RIVET, 3/8" x 1 1/4", for fastening Nos. 30 and 31 to Nos. 32 and 33, and for fastening (Plate 74), No. 10 to No. 11.
99. SPLIT COTTER, 3/16" x 4", for fastening No. 76 into No. 75.
100. SPLIT COTTER, 9/32" x 2 1/4", for Nos. 4 and 19.
101. SPLIT COTTER, 3/16" x 1 3/4", for Nos. 6, 23 and 24.
102. SPLIT COTTER, 3/16" x 1 3/8", for Nos. 46 and 48.
103. SPLIT COTTER, 3/32" x 1 1/2", for No. 74.
104. SPLIT COTTER, 3/32" x 1 1/8", for No. 88.

DOUBLE POINT SWITCH AND LOCK MOVEMENT AND RELATIVE PARTS.— Continued.)

PLATE 73.

Small Parts Relating to Indication Box, Only. See Nos. 36 and 37.

No.

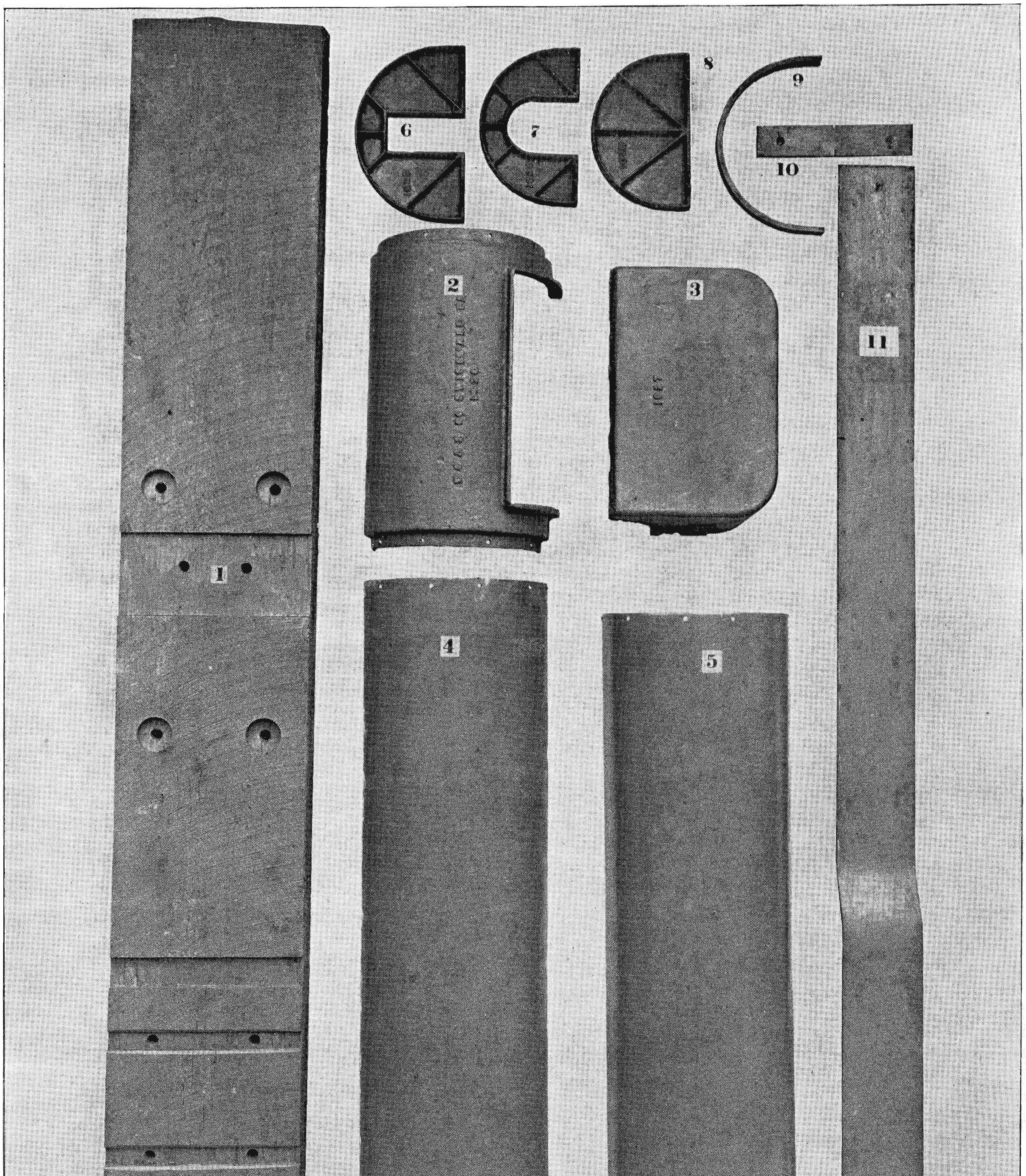
105. Right-Hand Rubber Block, for contact spring.
106. Left-Hand Rubber Block, for contact spring.
107. Rubber Block, for wire inlet.
108. Slide Bar.
109. Side Spring, for No. 108.
110. Top Plate.
111. Securing Strip, for No. 110.
112. Center Jaw, for No. 108.
113. Side Jaw, for No. 109.
114. Contact Roller, with rubber bushing.
115. Brass Hex. Nut, 10-32, for No. 123.
116. Hasp, for No. 37
117. Link. Fits into Nos. 108 and 112.
118. Right-Hand Contact Spring.
119. Left-Hand Contact Spring.
120. Rivet, $\frac{3}{16}''$ x $\frac{7}{8}''$, for joining Nos. 36 and 37.
121. Dowel Pin, for joining Nos. 112 and 117 to No. 108.
122. Brass Washer, $\frac{7}{32}''$–$\frac{7}{16}''$, for No. 126.
123. Stud, for fastening No. 114 to No. 108.
124. Square Head Screw, $\frac{1}{2}''$ x 12–32, for No. 110.
125. Machine Screw, $\frac{5}{8}''$ x 12–32, for fastening Nos. 105 and 106 to No. 36.
126. Machine Screw, $\frac{1}{2}''$ x 12–24, for fastening Nos. 118 and 119.
127. Machine Screw, $\frac{5}{16}''$ x 8–32, for fastening No. 109.

LARGE PARTS.

PLATE 74.

No.

1. Oak Plank, 4″ x 12″, for supporting movement. State whether wanted for a simple or tandem movement.
2. Cylinder Cover.
3. Lid, for No. 2.
4. Cover, for tandem movement.
5. Cover, for simple movement.
6. Casting, for lower end of Nos. 4 and 5.
7. Casting, for end of No. 2 that is joined to Nos. 4 and 5.
8. Casting, for upper end of No. 2.
9. Rim, for end of Nos. 4 and 5 that is joined to No. 2.
10. Switch Rail Slide Plate.
11. Tie Plate.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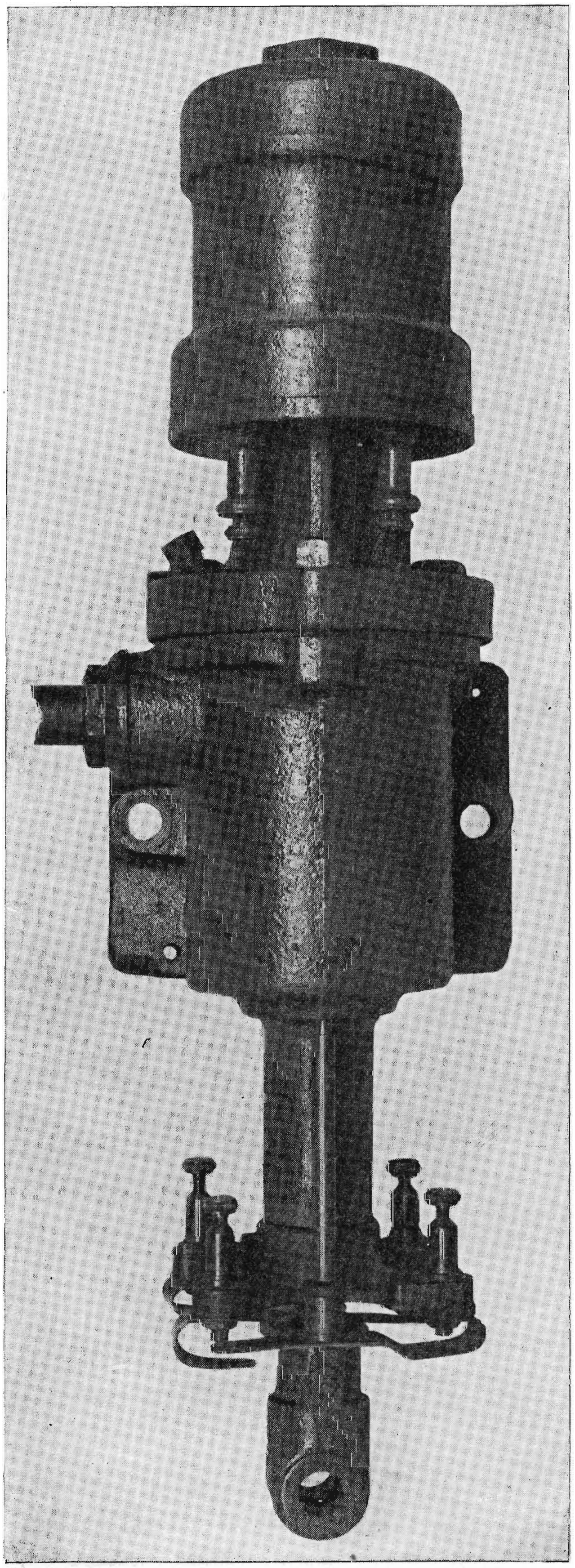
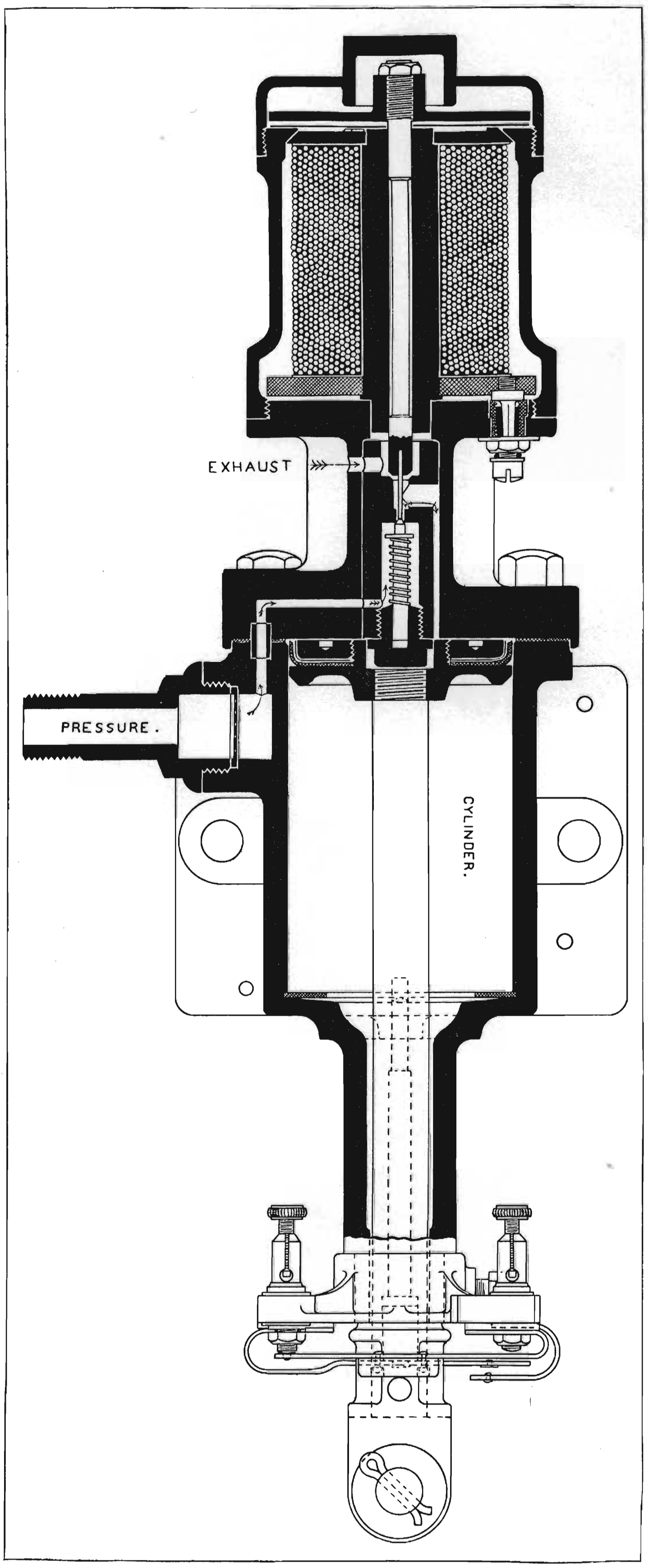



EXHAUST
PRESSURE.
CYLINDER.

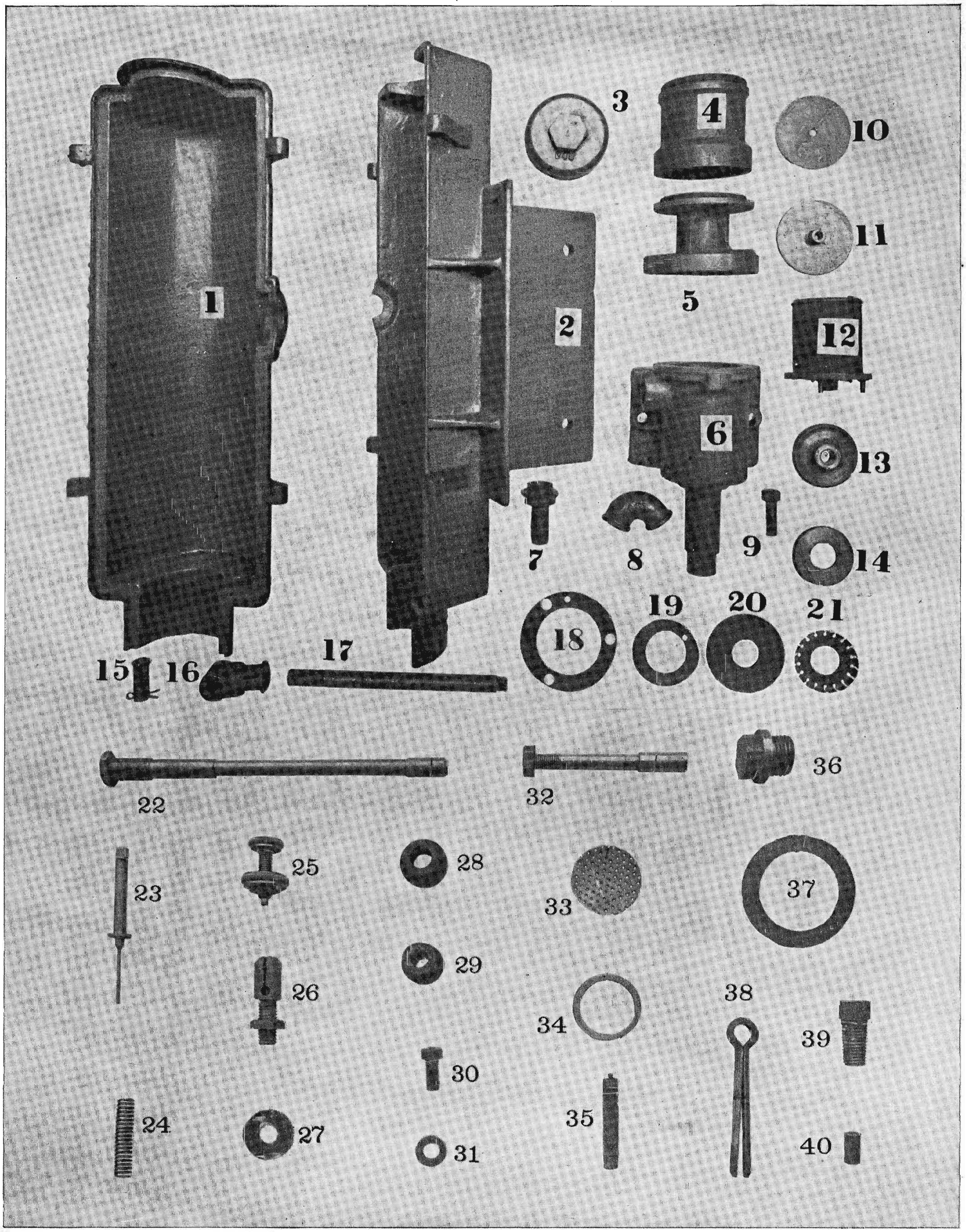
The Electro-Pneumatic Signal Valve and Cylinder.

PLATE 75.

THE arrangement shown here is extremely simple, and is the one most commonly used on all main line semaphore posts, whether for interlocking or block signaling, when the operating force is compressed air. In the case of interlocking, the magnet is connected with the lever of an Electro-Pneumatic Machine, see page 143 depending upon the position of which it is excited or discharged. With a block signaling plant the home signal magnet is connected with the track relay (see description attending Fig. D, Plate 103), which performs the office of making or breaking the circuit through the signal battery.

The air from the compressors passes through the pipe marked "pressure," following the course shown by the arrows until it reaches the chamber that encloses a spiral spring, where it remains constant; from this point its course is controlled by the position of the armature stem, which, when the magnet is excited, closes the opening at its lower end, just below the passage marked exhaust; at the same time it opens the port just above the spring and permits the air to follow the passage on the right, downward, where it enters the cylinder and acts upon the piston, that, through its rod overcomes the force exerted by the counterweight and its lever (see Plate 78), and clears the signal. The discharge of the magnet reverses the position of the valves, upon which the counterweight forces the piston up and the air out through the exhaust passage with a danger signal as the result. It is evident from this that a failure of the current or the pressure must have as its effect a constant danger signal.

A list of the separate parts will be found upon page 175.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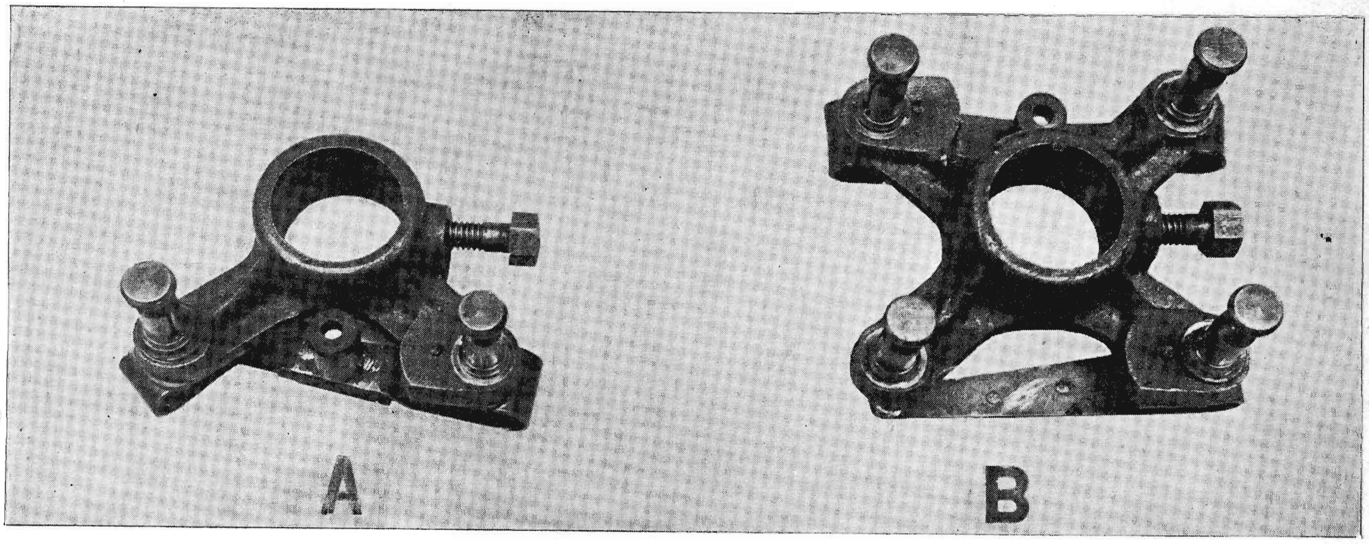
Parts of Electro-Pneumatic Signal Cylinder.

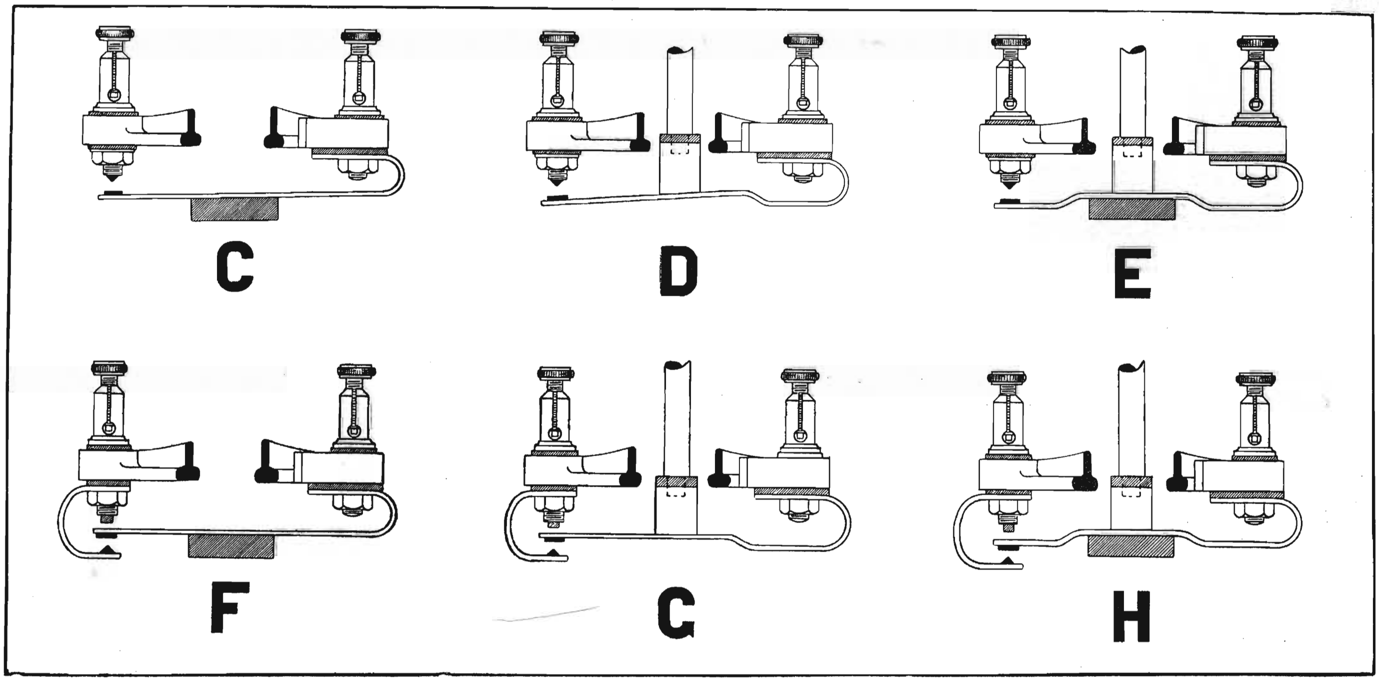
PLATE 76.

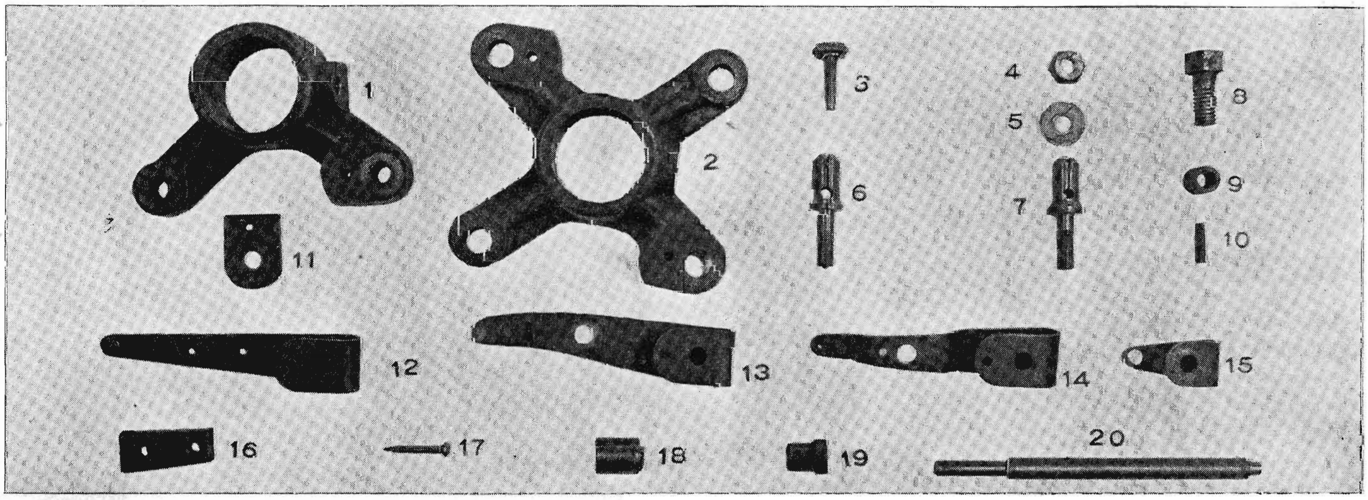
ORDER BY PLATE AND NUMBER.

No.
1. Door.
2. Case.
3. Magnet Cap.
4. Magnet Cover.
5. Valve Body.
6. Cylinder.
7. Air Inlet.
8. Elbow, Sixty Degrees.
9. Tap Bolt, ½″ x 1½″, for joining cylinder to case and valve body to cylinder.
10. Magnet Shield.
11. Armature.
12. Magnet.
13. Piston Head.
14. Piston Follower.
15. Turned Pin, ⅝″ x 1⅞″, for jaw No. 16.
16. Jaw, for piston rod.
17. Piston Rod.
18. Fibre Gasket, for cylinder.
19. Rubber Gasket, for lower inside face of cylinder.
20. Leather Piston Packing.
21. Steel Spring Follower.
22. Armature Stem and Nut.
23. Pin Valve.
24. Brass Spring, for pin valve.
25. Binding Post Screw and Jam Nut.
26. Binding Post and Nut.
27. Brass Washer, $\frac{5}{16}$″–⅝″, for binding post.
28. Rubber Bushing, for wire holes in case.
29. Rubber Bushing, for binding post.
30. Machine Screw, ½″ x 12–32, for ground wires on cylinder.
31. Brass Washer, ¼″–½″, for screw No. 30.
32. Circuit Breaker Pin and Nut, for jaw No. 16.
33. Dust Strainer, for air inlet.
34. Brass Ring, for dust strainer.
35. Dowel Pin, used between cylinder and case.
36. Valve Plug.
37. Fibre Ring, for air inlet.
38. Split Cotter, $\frac{7}{32}$″ x 2″, for joining cover with case.
39. Brass Oil Plug.
40. Brass Air Bushing, for valve body.

PLATE 77.







Electro-Pneumatic Signal Circuit Breakers.

PLATE 77.

A. SINGLE CIRCUIT BREAKER.

B. DOUBLE CIRCUIT BREAKER.

C–H. SIX DIFFERENT ARRANGEMENTS OF CONTACT SPRINGS.

Figures A and B are placed upon the bottom part of the cylinder of an electro-pneumatic semaphore signal, as may be seen by referring to Plate 75; they perform substantially the same office as does Fig. C, Plate 100, when used in connection with the electro-pneumatic home signal.

ORDER BY PLATE AND NUMBER.

No.

1. BASE, for Fig. A.
2. BASE, for Fig. B.
3. THUMB SCREW, ¾″ x 10–32.
4. NUT, ¼″–32.
5. WASHER, ¼″–½″.

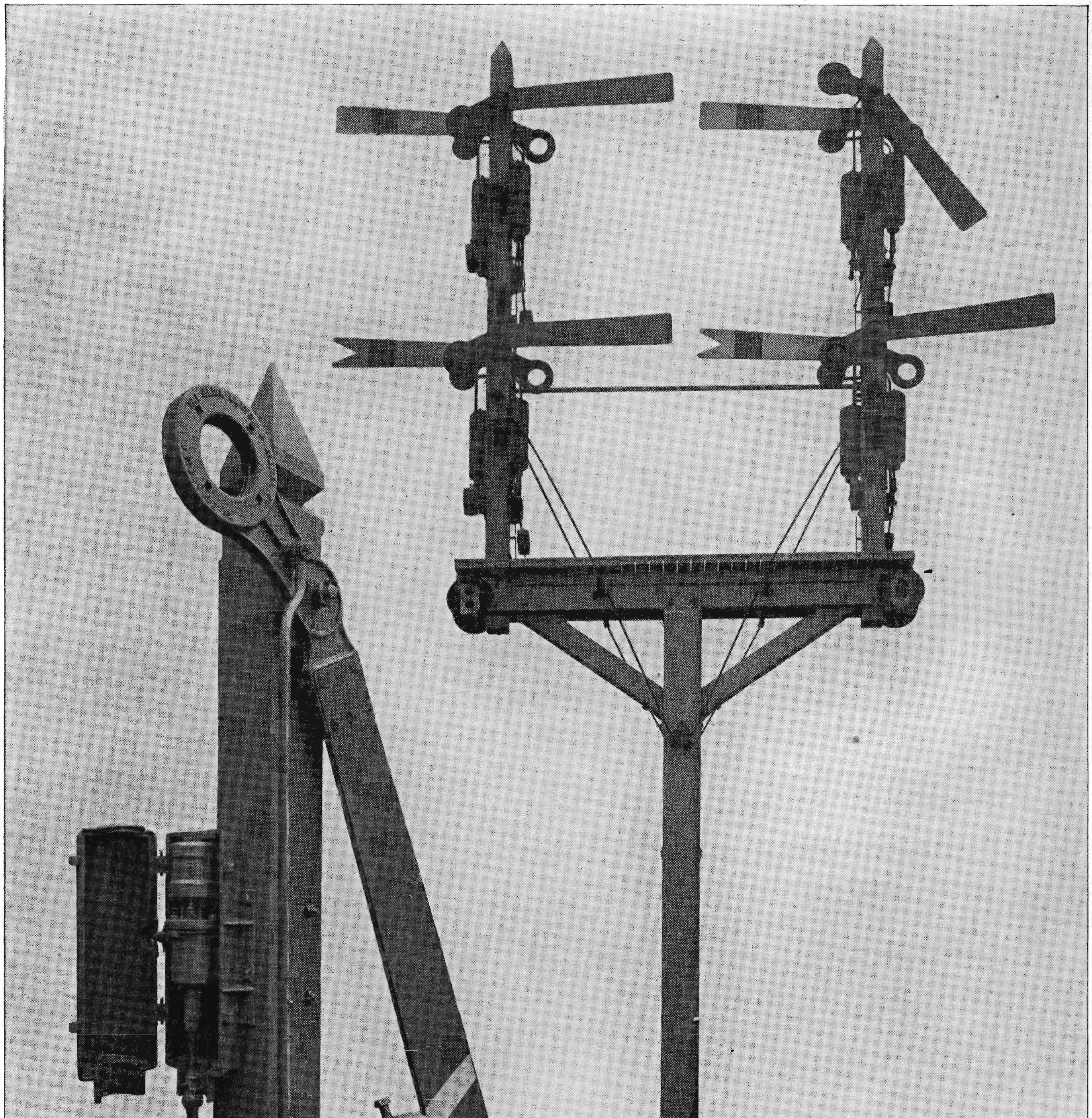
   (Nos. 3–5:) For Nos. 6 and 7.

6. BINDING POST, with platinum contact point; seen on left-hand in Figs. C, D and E.
7. BINDING POST, without contact point; seen in Figs. F, G and H.
8. CAP SCREW, ¾″ x $\frac{5}{16}$″–18, for setting Nos. 1 and 2.
9. RUBBER BUSHING, ¼″–⅜″, for openings in legs of Nos. 1 and 2.
10. RUBBER DOWEL PIN, for adjustment of Nos. 11, 12, 13 and 14, to the legs of Nos. 1 and 2.
11. FIBRE INSULATION, placed between the legs of Nos. 1 and 2 and Nos. 12, 13 and 14.
12. Shown in Figs. C and F.
13. Shown in Figs. D and G.
14. Shown in Figs. E and H.

    (Nos. 12–14:) Different forms of PHOSPHER BRONZE CONTACT SPRINGS; in ordering state whether or not it is to be used with the loop No. 15.

15. Shown in Figs. F, G and H; PHOSPHER BRONZE LOOP.
16. FIBRE INSULATION, for bottom of Nos. 12 and 14.
17. ESCUTCHEON PIN, for fastening No. 16.
18. SOCKET, for top of Nos. 13 and 14.
19. BUSHING, for No. 18.
20. ROD that extends from the signal cylinder down to Nos. 13 and 14.

    (Nos. 18–20:) See Figs. D, E, G and H.



Electro-Pneumatic Semaphore Signals.

PLATE 78.

THERE is here illustrated on a large and small scale the general method of applying the signal cylinder, see Plate 75, and of connecting it with the semaphore blade.

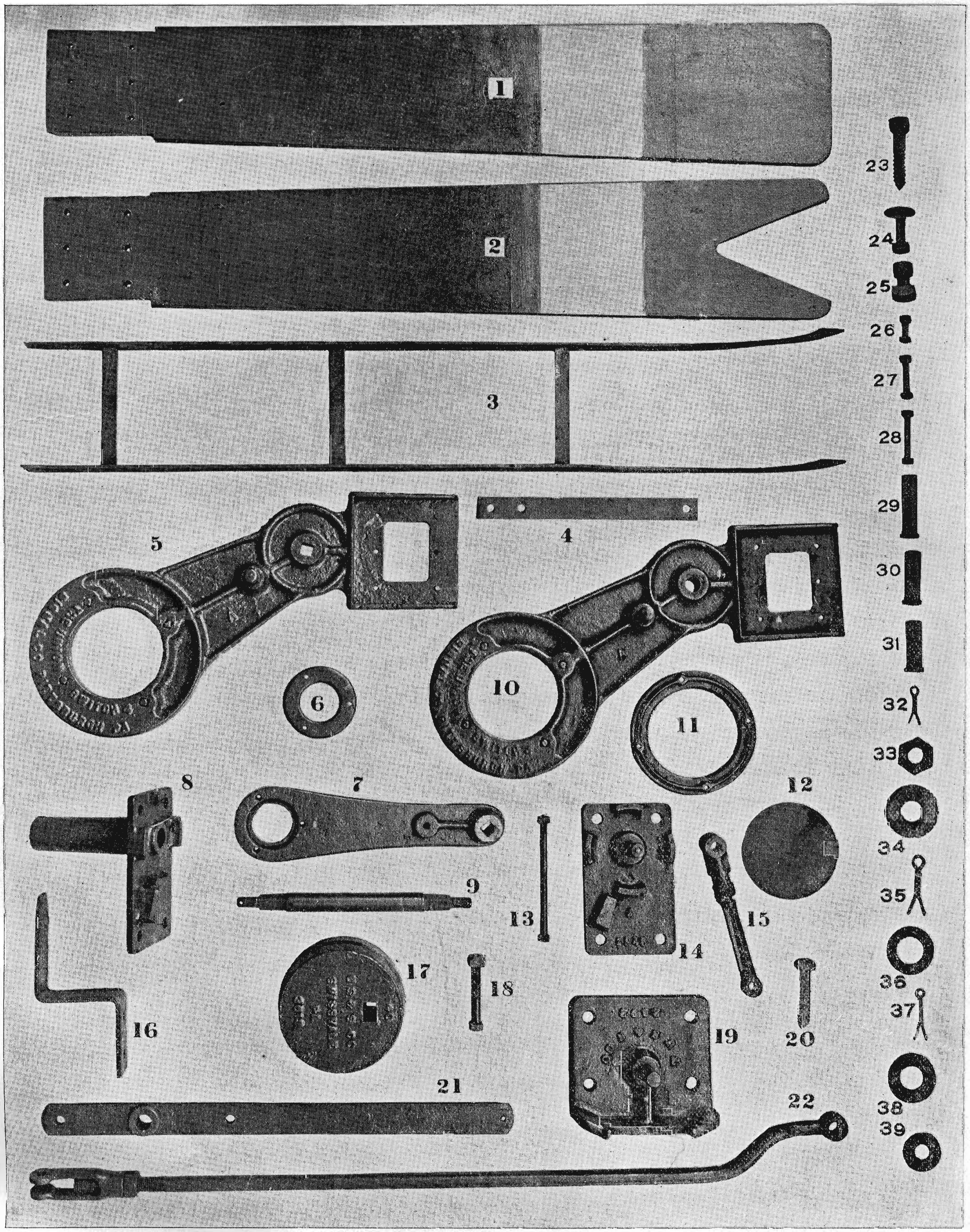
There are three general methods of mounting these signals, any one of which is equally applicable to block signaling or interlocking plants: First, on a straight post, as shown by the figure on the left; next, on a bracket post, as shown by the figure on the right, and, lastly, on a bridge which spans several tracks, and on which each post is supported directly over the track which it governs.

From an inspection of the bracket post it is evident that the cylinders do not occupy any room which might be needed for other purposes, and it is therefore possible to increase the number of signals on a post to an indefinite extent by simply adding 7 feet to the length of the post for each additional signal.

A new form of iron signal post is described on page 185.

The signal cylinder is described on page 173, a list of its parts is given on page 175, and the post fittings are given on page 181.

PLATE 79.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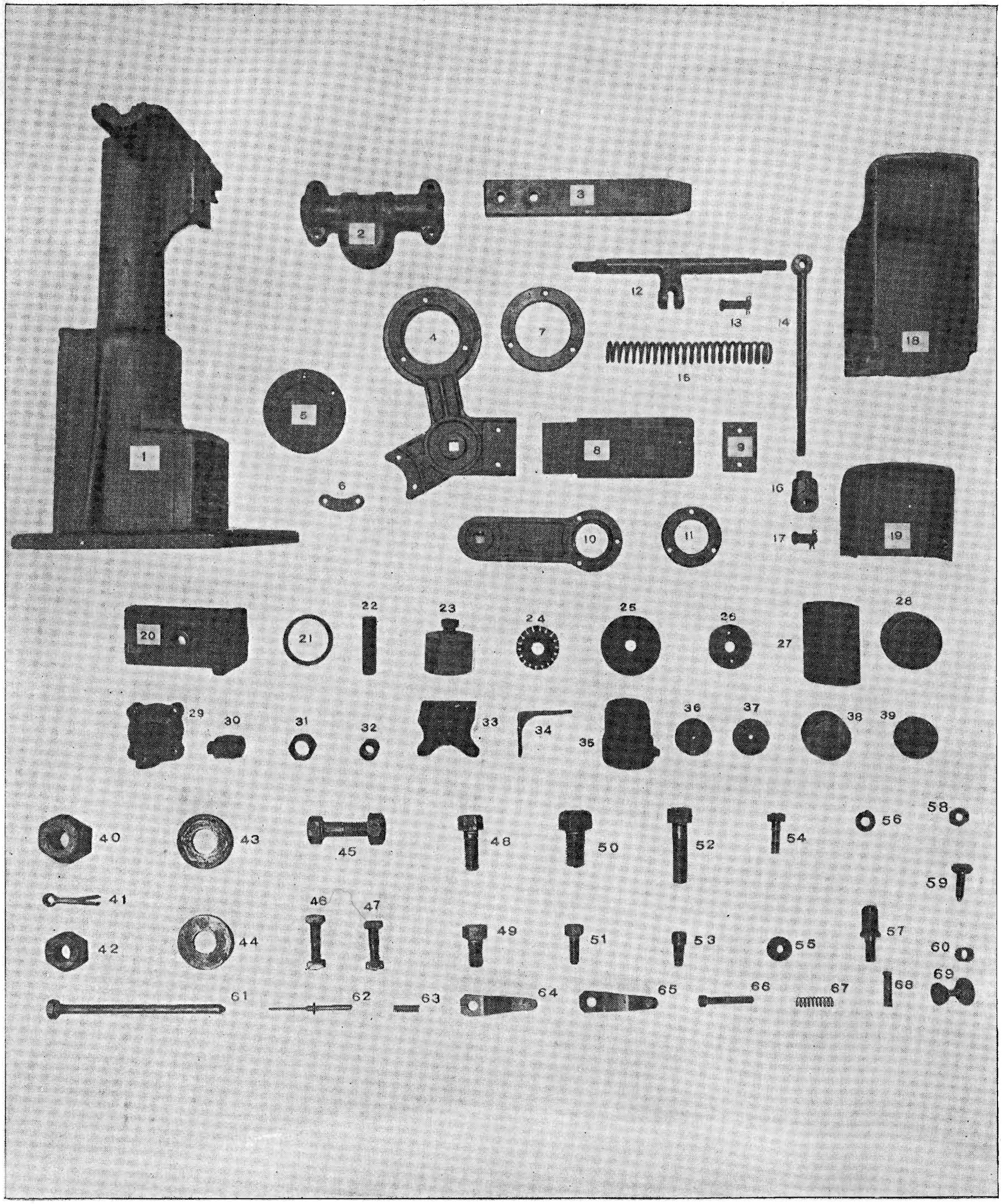
Semaphore Post Fittings for Electro-Pneumatic Main Line Signals.

PLATE 79.

ORDER BY PLATE AND NUMBER.

No.

1. Home Signal Blade (Ash).
2. Distant Signal Blade (Ash).
3. Piece of Ladder.
4. Ladder Stay (different lengths).
5. Semaphore Casting (used in connection with a back light).
6. Back Light Ring.
7. Back Light Casting.
8. Bearing, for shaft No. 9.
9. Shaft, for Nos. 5 and 7.
10. Semaphore Casting (used when no back light is required).
11. Ring, for Nos. 5 and 10.
12. Plain Glass, for Nos. 5, 7 and 10; made in different sizes and colors.
13. Bolt and Nut, $\frac{1}{2}'' \times 8''$, for fastening Nos. 8 and 14 to semaphore post.
14. Bearing with Fixed Pin, for No. 10.
15. Link with Screw Jaw, for connecting No. 21 to signal cylinder piston; see No. 16, Plate 76.
16. Lamp Bracket.
17. Counterweight. This is made both as a 40-lb. and 56-lb. weight.
18. Bolt and Nut, $\frac{5}{8}'' \times 4''$, for fastening No. 17 to No. 21.
19. Counterweight Lever Stand.
20. Lag Screw, $\frac{3}{4}'' \times 4''$, for fastening No. 19 to semaphore post.
21. Counterweight Lever.
22. Vertical Signal Rod with Screw Jaw; in ordering give distance between centres of holes.
23. Lag Screw, $\frac{1}{2}'' \times 2\frac{1}{2}''$, for fastening Nos. 4 and 16 to semaphore post.
24. Bolt and Nut, $\frac{3}{8}'' \times 1\frac{1}{2}''$, for fastening Nos. 1 and 2 to Nos. 5 and 10.
25. Bolt and Nut, $\frac{1}{2}'' \times 1''$, for joining Nos. 3 and 4.
26. Bolt and Nut, $\frac{1}{4}'' \times \frac{3}{4}''$, for end of No. 21.
27. Bolt and Nut, $\frac{1}{4}'' \times 1\frac{1}{2}''$, for fastening No. 6 to No. 7.
28. Bolt and Nut, $\frac{1}{4}'' \times 1\frac{7}{8}''$, for fastening No. 11 to Nos. 5 and 10.
29. Turned Pin, $\frac{5}{8}'' \times 2\frac{5}{16}''$, for screw jaw on No. 22; used in connection with link (No. 42, Plate 100), of signal circuit breaker.
30. Turned Pin, $\frac{5}{8}'' \times 1\frac{7}{8}''$, for jaw of No. 15.
31. Turned Pin, $\frac{5}{8}'' \times 1\frac{3}{4}''$, for screw jaw on No. 22; used only when no circuit breaker is connected with signal.
32. Split Cotter, $\frac{5}{32}'' \times 1\frac{1}{4}''$, for Nos. 29, 30, 31 and ends of No. 9.
33. Nut, $\frac{3}{4}''$. } For ends of No. 9.
34. Washer, $\frac{3}{4}''$. }
35. Split Cotter, $\frac{7}{32}'' \times 2''$. } For pins on Nos. 14 and 19.
36. Washer, $1''$. }
37. Split Cotter, $\frac{5}{32}'' \times 1\frac{1}{2}''$. } For pins on Nos. 5 and 10.
38. Washer, $\frac{7}{8}''$. }
39. Washer, $\frac{1}{2}''$, for No. 13.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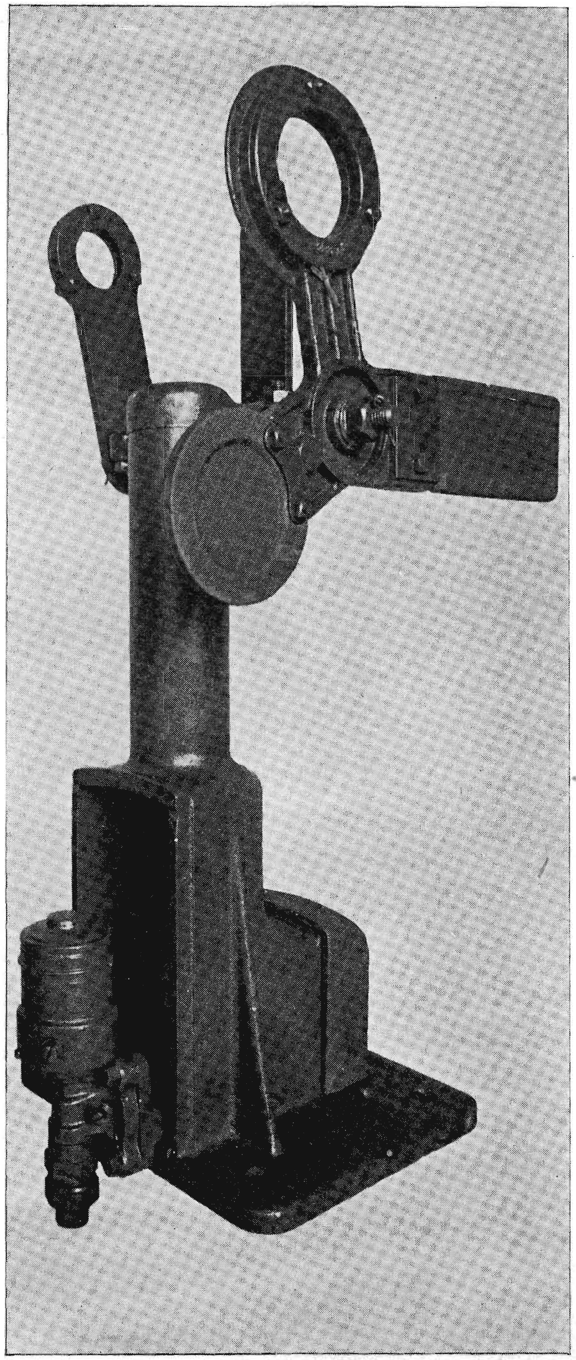


PLATE 80.

Electro-Pneumatic Dwarf Signal.

PLATE 80.

THIS signal bears a strong external resemblance to our mechanical dwarf signal.

In the illustration the valve cover has been removed, exposing to view the valve, the magnet, and the air-pipe connection.

The whole arrangement is remarkable for its compactness, and for the fact that the piston is fixed, while the cylinder itself performs the movement.

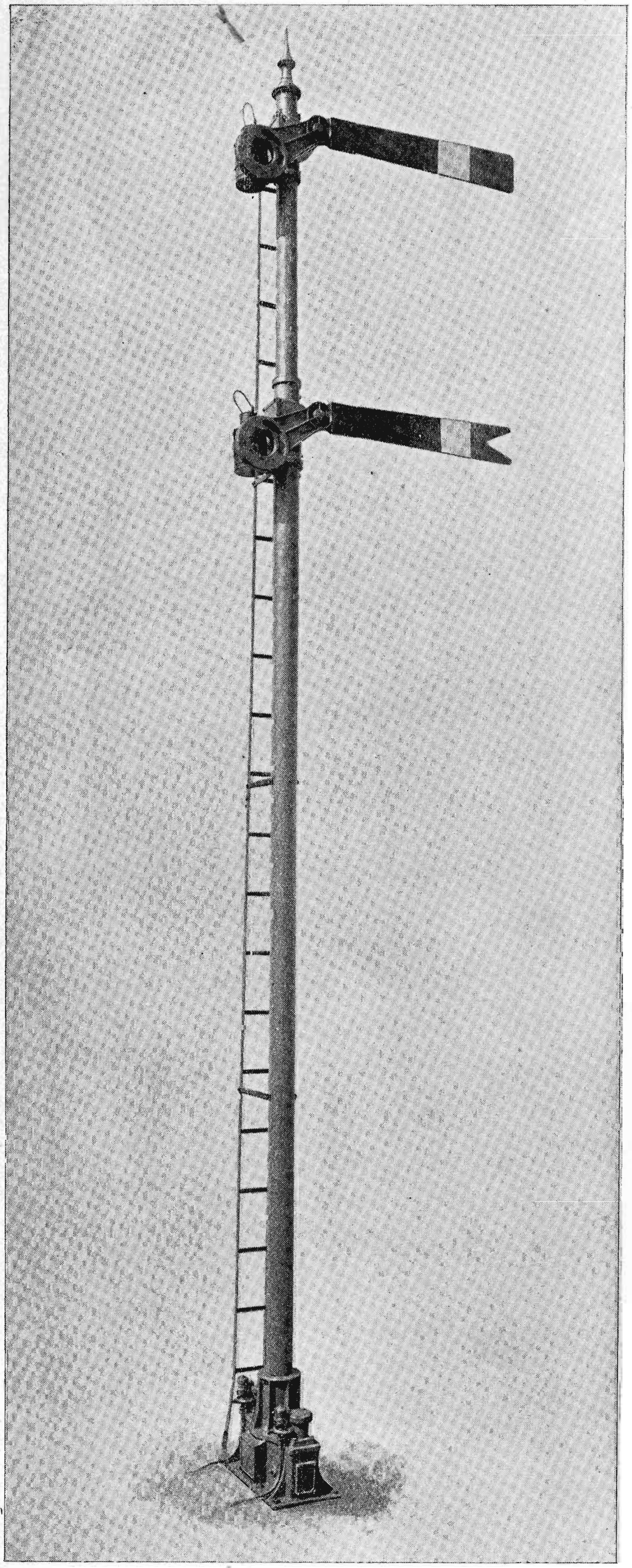
ORDER BY PLATE AND NUMBER.

No.

1. Post.
2. Cap.
3. Lamp Bracket.
4. Semaphore Casting.—This is the common form; there are several others to suit special R. R. standards.
5. Rubber Semaphore Disc.
6. Iron Plate, for No. 5.
7. Semaphore Ring, for holding glass.
8. Rubber Blade.
9. Iron Plate, for No. 8.
10. Back Light Casting.
11. Back Light Ring.
12. Semaphore Shaft.
13. Turned Pin, ½″ x 1⅝″, and cotter ⅛″ x ¾″, for joining Nos. 12 and 14.
14. Vertical Signal Rod.
15. Main Spring; it encircles No. 14.
16. Screw Jaw, for No. 14.
17. Turned Pin, ½″ x 1¼″, and cotter ⅛″ x ¾″, for joining Nos. 16 and 28.
18. Valve Cover.
19. Circuit Breaker Cover.
20. Base, for magnet and valve.
21. Fibre Gasket, for packing Nos. 20 and 29, and Nos. 27 and 28.
22. Gas Pipe, ½″ x 3¼″, for joining Nos. 20 and 23.
23. Piston and Follower Nut.
24. Spring Follower.
25. Leather Packing.
26. Piston Follower.
27. Cylinder.
28. Cylinder Head.
29. Valve Body.
30. Union.

No. PLATE 80.

31. Union Nut.
32. Union Swivel.
33. Circuit Breaker Base.
34. Circuit Breaker Lever.
35. Magnet.
36. Armature.
37. Magnetic Shield.
38. Outside Magnet Cover.
39. Inside Magnet Cover.
40. Hex Nut, 5/8″, for end of No. 12.
41. Split Cotter, 3/16″ x 1 1/4″, for ends of No. 12.
42. Hex Nut, 1/2″, jam nut for Nos. 14 and 16.
43. Washer, 5/8″, for No. 40.
44. Washer, 1/2″, for No. 42.
45. Bolt and Nut, 3/8″ x 1 1/2″, for joining Nos. 1 and 2.
46. Bolt and Nut, 1/4″ x 1 1/4″, for joining Nos. 4, 5 and 6; Nos. 4 and 7; Nos. 4, 8 and 9.
47. Bolt and Nut, 1/4″ x 1″, for joining Nos. 10 and 11.
48. Cap Screw, 3/8″ x 1 1/4″, for joining Nos. 20 and 29, upper holes.
49. Cap Screw, 3/8″ x 3/4″, for joining Nos. 20 and 33.
50. Tap Bolt, 1/2″ x 1″, for joining Nos. 1 and 3.
51. Cap Screw, 1/4″ x 3/4″, for joining Nos. 1, 18 and 19.
52. Cap Screw, 3/8″ x 1 1/2″, for joining Nos. 1, 20 and 27, lower holes.
53. Taper Machine Screw, 5/8″ x 5/16″–24, for oil hole in No. 28.
54. Binding Screw, 13/16″ x 12–32, for No. 35.
55. Rubber Bushing, 7/32″ x 3/8″, for No. 54.
56. Brass Washer, 7/32″ x 1/2″, for No. 54.
57. Binding Post, for No. 33.
58. Binding Post Nut, 1/4″–32.
59. Binding Post Screw, 7/8″ x 10–32.
60. Rubber Bushing, 1/4″ x 3/8″, for No. 57.
61. Armature Stem and Nut.
62. Pin Valve.
63. Spring for No. 62.
64. Contact Spring, platinum point, for circuit breaker.
65. Contact Spring, platinum disc, for circuit breaker.
66. Machine Screw, 1 1/4″ x 10–32; stop for No. 34.
67. Spring; it encircles No. 66.
68. Shaft, for joining Nos. 33 and 34.
69. Adjusting Screw and Nut, for No. 34.

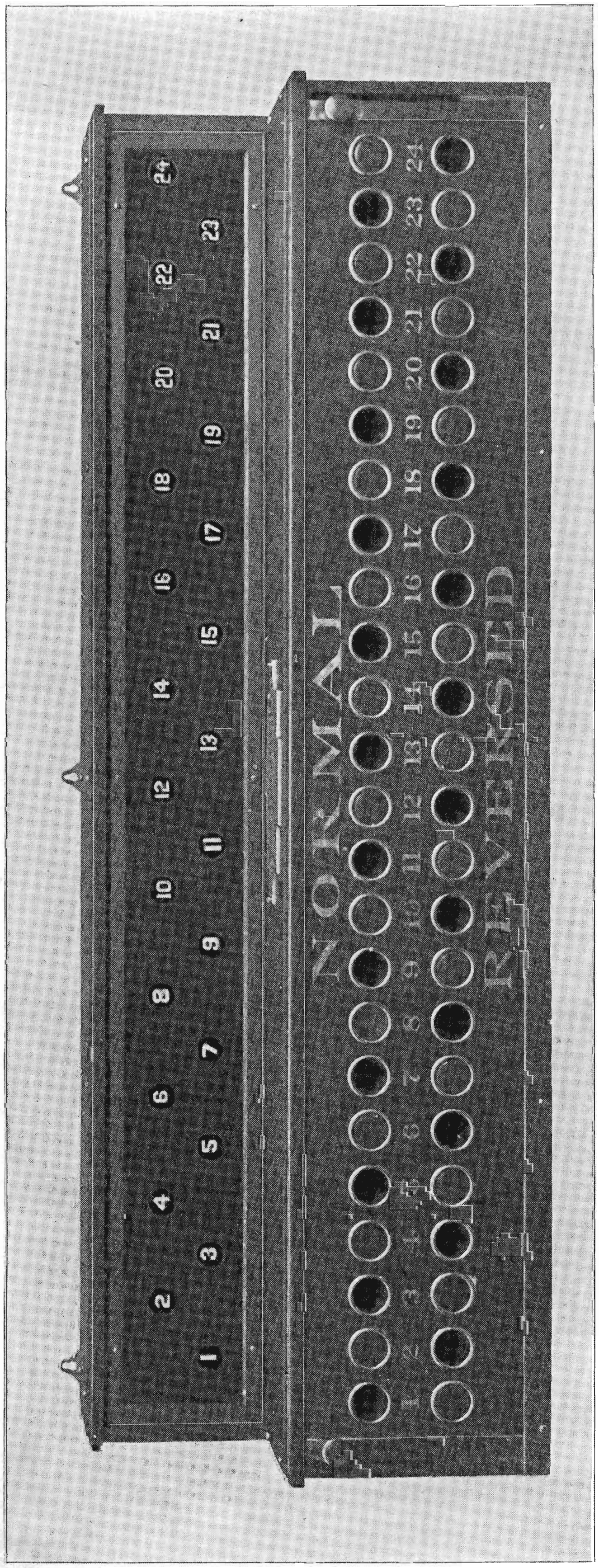


The Electro-Pneumatic Iron Main Line Semaphore Post.

PLATE 81.

THIS post is intended to provide a more permanent arrangement than can be secured by means of the wooden post that is now in general use. The valves and cylinders are placed at the bottom of the post, and are connected to the semaphore castings by means of vertical rods that are enclosed in the post itself; these rods not only serve to force the signals to the clear position but assist the counterweight in restoring them to the danger position. All of the moving parts are enclosed, and are thoroughly protected from frost and dust.

The external appearance of this post speaks for itself.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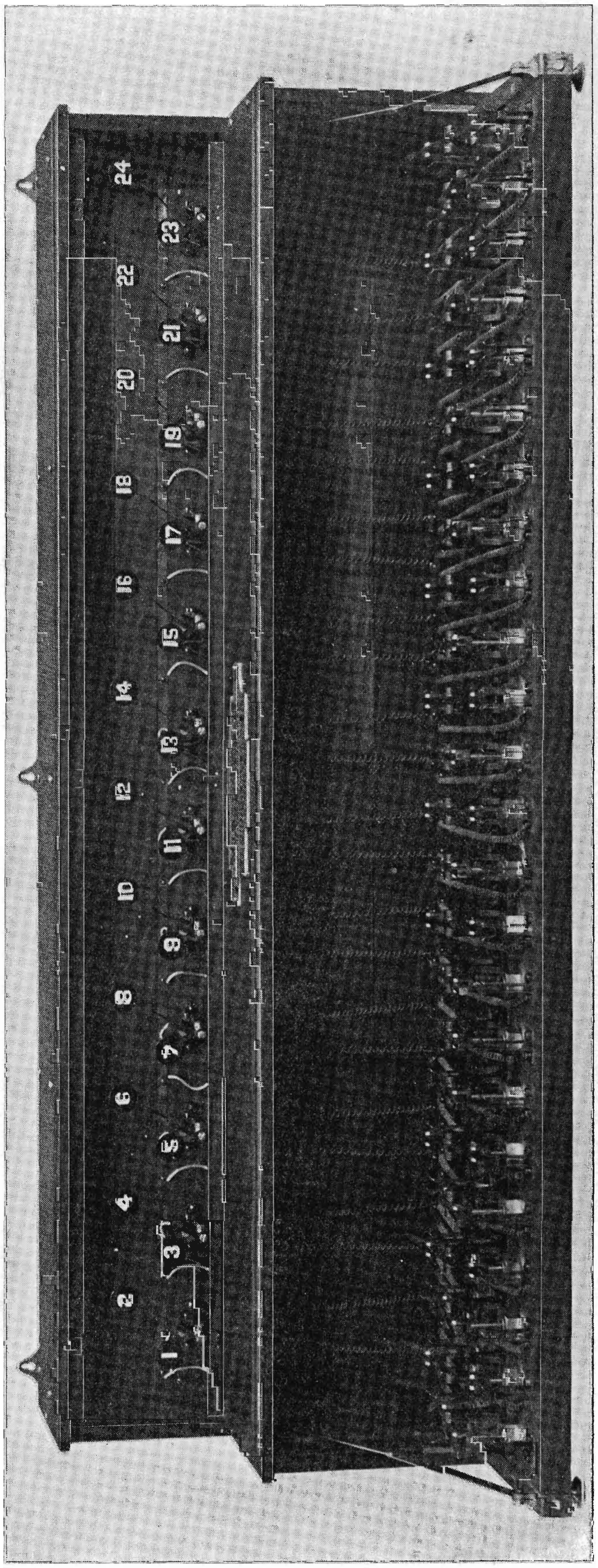


The Electro-Pneumatic Push-Button Machine.

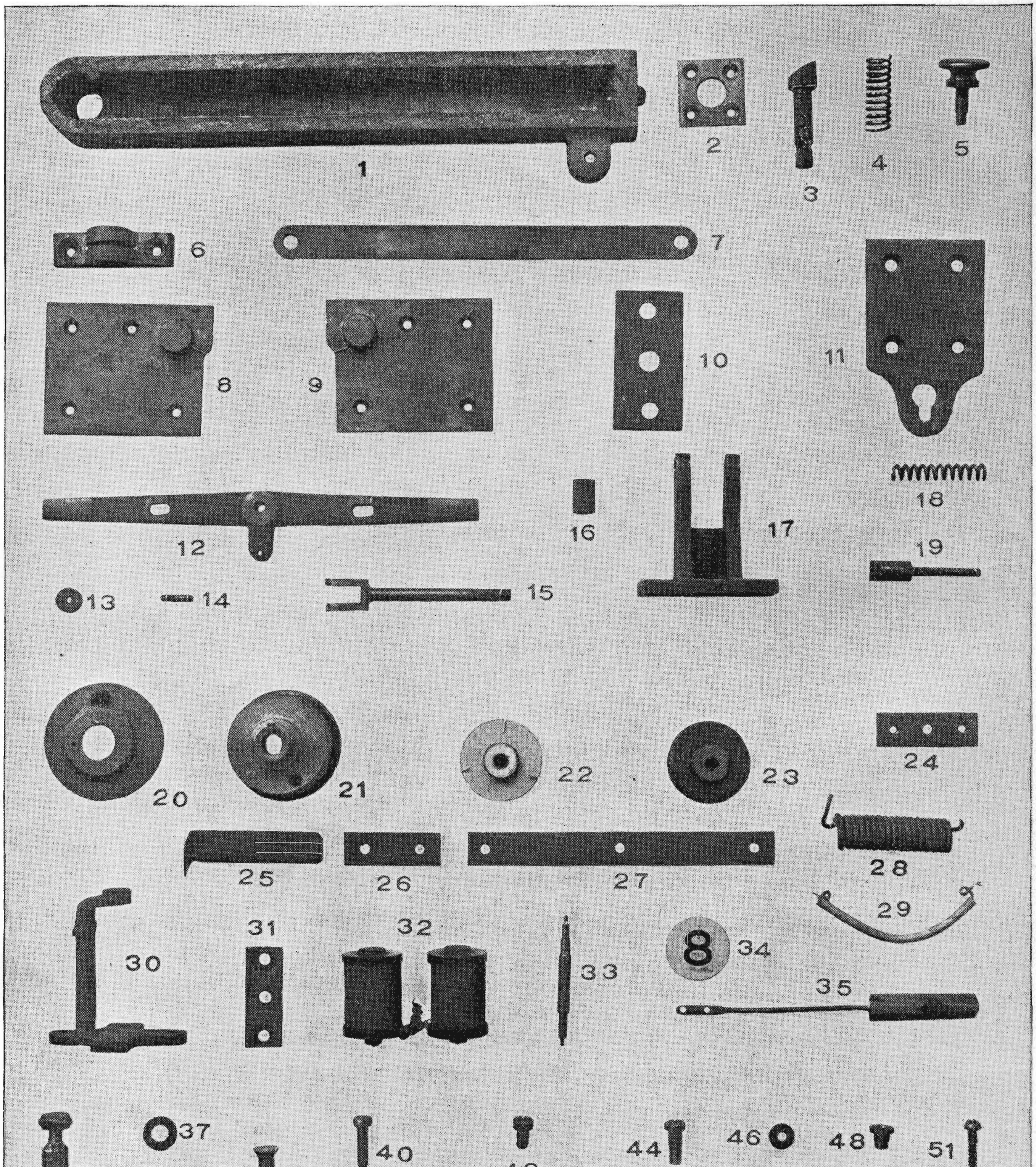
PLATE 82.

THIS device is intended for work in connection with distributing yards where interlocking is not required, but where a large number of movements must be performed in rapid succession. The two rows of buttons called respectively NORMAL and REVERSED correspond with the levers of an interlocking machine and are connected, each one, with one of the valve magnets shown on Plate 85. Through pressing a button on the upper or normal row the switch is made to change its position, first, by discharging the opposite valve magnet, at the same time opening the exhaust on that side of the piston; and, second, by charging the valve magnet with which the button is connected, thus admitting the pressure to that side of the piston. Pressing in a normal button on the machine forces out its corresponding reversed button, and vice versa, since the two buttons, relating to a switch are joined at the back of the front board by a walking beam, which is pivoted at its centre.

The row of indicators which appear above the push buttons are in electric communication with the switches and the surrounding track; the appearance of an indicator informs the operator either that the switch has not completed its throw or that the neighboring track is occupied by a car. Since in practice the operator is provided with a schedule of the movements that will be required to distribute a train, he is able to follow the course of the different cars by the successive appearance and disappearance of the indicators.

Of the two figures on Plate 82, the upper one illustrates the machine closed up as it appears when ready for use; the lower one shows the glass front removed from before the indicators and the push-button board lowered.

A list of the parts will be found on page 189.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Parts of Electro-Pneumatic Push Button Machine.

PLATE 83.

ORDER BY PLATE AND NUMBER.

No.		
1.	END BEARING, for lid; made both as a right and left-hand, a left-hand is shown.	
2.	GUIDE, for No. 3.	
3.	LOCK PIN.	
4.	SPRING.	For No. 3.
5.	KNOB.	For No. 3.
6.	BRACKET, for No. 7.	
7.	SUPPORTING STRIP, for lid.	
8.	LEFT-HAND SWIVEL PLATE.	Fits into No. 1.
9.	RIGHT-HAND SWIVEL PLATE.	Fits into No. 1.
10.	PIECE OF GROUND STRIP, for No. 17.	
11.	HANGING PIECE, for supporting case.	
12.	WALKING BEAM.	
13.	ROLLER for No. 12.	
14.	DOWEL PIN, for No. 13.	
15.	JAW, fits into No. 21 and connects with No. 12.	
16.	RUBBER BUSHING, for No. 15.	
17.	BRACKET, for No. 12.	
18.	SPRING, for No. 19.	
19.	STOP PIN, for No. 12.	
20.	CAP, for No. 21.	
21.	CYLINDER, for Nos. 22 and 23.	
22.	CELLULOID PUSH BUTTON.	
23.	HARD RUBBER PUSH BUTTON.	
24.	CONNECTING BAR, for line wires.	
25.	CONTACT SPRING.	
26.	STRIP, for joining two of No. 25.	
27.	GROUND STRIP, for No. 32.	
28.	PIECE OF INSULATED WIRE.	Give length required.
29.	PIECE OF WIRE, in rubber tube.	Give length required.
30.	MAGNET BRACKET.	
31.	BACK STRAP, for No. 32.	
32.	PAIR OF MAGNETS.	
33.	SHAFT, for No. 35.	
34.	INDICATOR NUMBER, fits into No. 35.	
35.	ARMATURE.	

No. PLATE 83.

36. Binding Post and Screw.
37. Brass Washer, $\frac{1}{4}''-\frac{1}{2}''$. } For Nos. 36 and 39.
38. Hexagonal Nut, $\frac{1}{4}''-32$. } For Nos. 36 and 39.
39. Brass Screw, $1\frac{5}{16}''$ x $\frac{1}{4}''-32$, for fastening No. 17 to the lid.
40. Machine Screw, $\frac{13}{16}''$ x 6–32, for joining Nos. 12 and 17.
41. Machine Screw, $\frac{7}{16}''$ x 6–32, for fastening No. 15 to No. 12.
42. Machine Screw, $\frac{5}{16}''$ x 10–32, trunnion for No. 33.
43. Machine Screw, $\frac{3}{8}''$ x 8–32, for fastening Nos. 31 and 32 to No. 30.
44. Machine Screw, $\frac{1}{2}''$ x 12–32, for fastening No. 7 to Nos. 1 and 6.
45. Machine Screw, $\frac{1}{4}''$ x 6–32, for fastening wires to No. 24.
46. Copper Washer, $\frac{3}{16}''-\frac{3}{8}''$, for No. 45.
47. Brass Washer, $\frac{1}{4}''-\frac{3}{8}''$, for No. 48.
48. Brass Rivet, for joining two pieces of No. 7.
49. Wood Screw, #6 flat head, for Nos. 8 and 9.
50. Wood Screw, #6 round head, for No. 25.
51. Wood Screw, #7 round head, for fastening No. 30 to the case.
52. Wood Screw, #8 flat head, for Nos. 6 and 11.

PLATE 84.

Newark Bay Draw Bridge, Central Railroad of New Jersey, protected by the Electro-Pneumatic Automatic Block Signaling System. This system covers the line between Jersey City and Bound Brook, a distance of 30 miles.

PLATE 84.

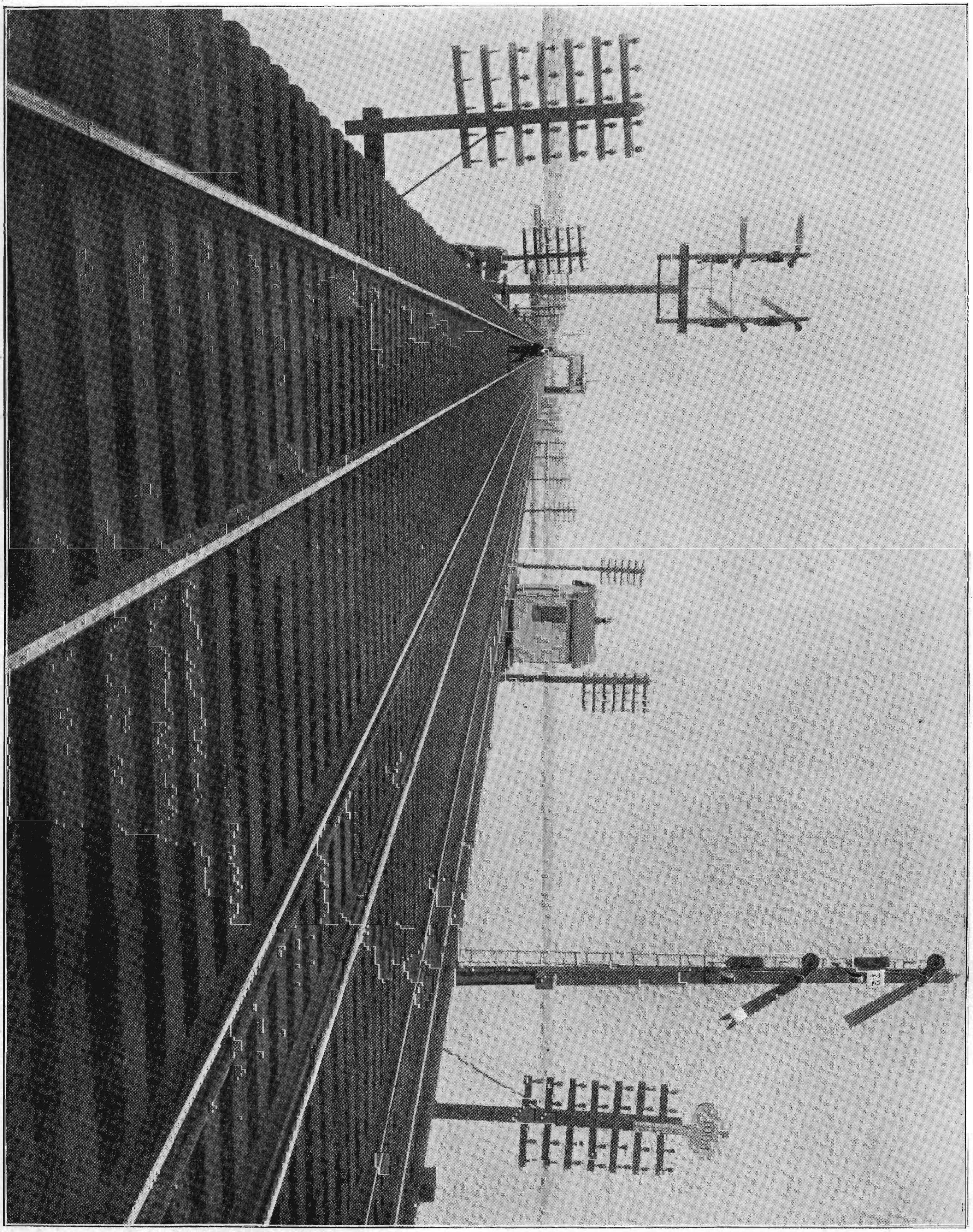
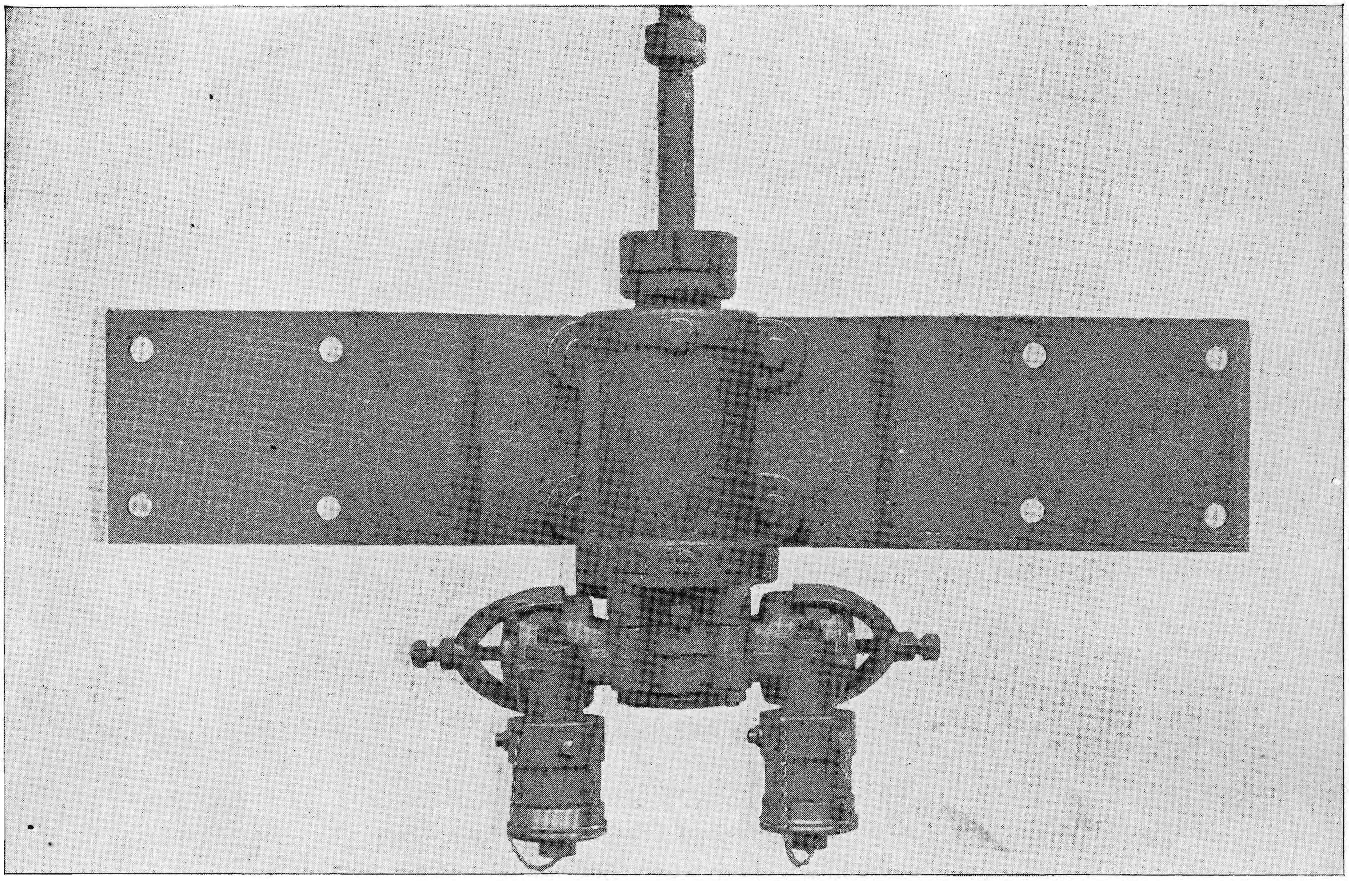
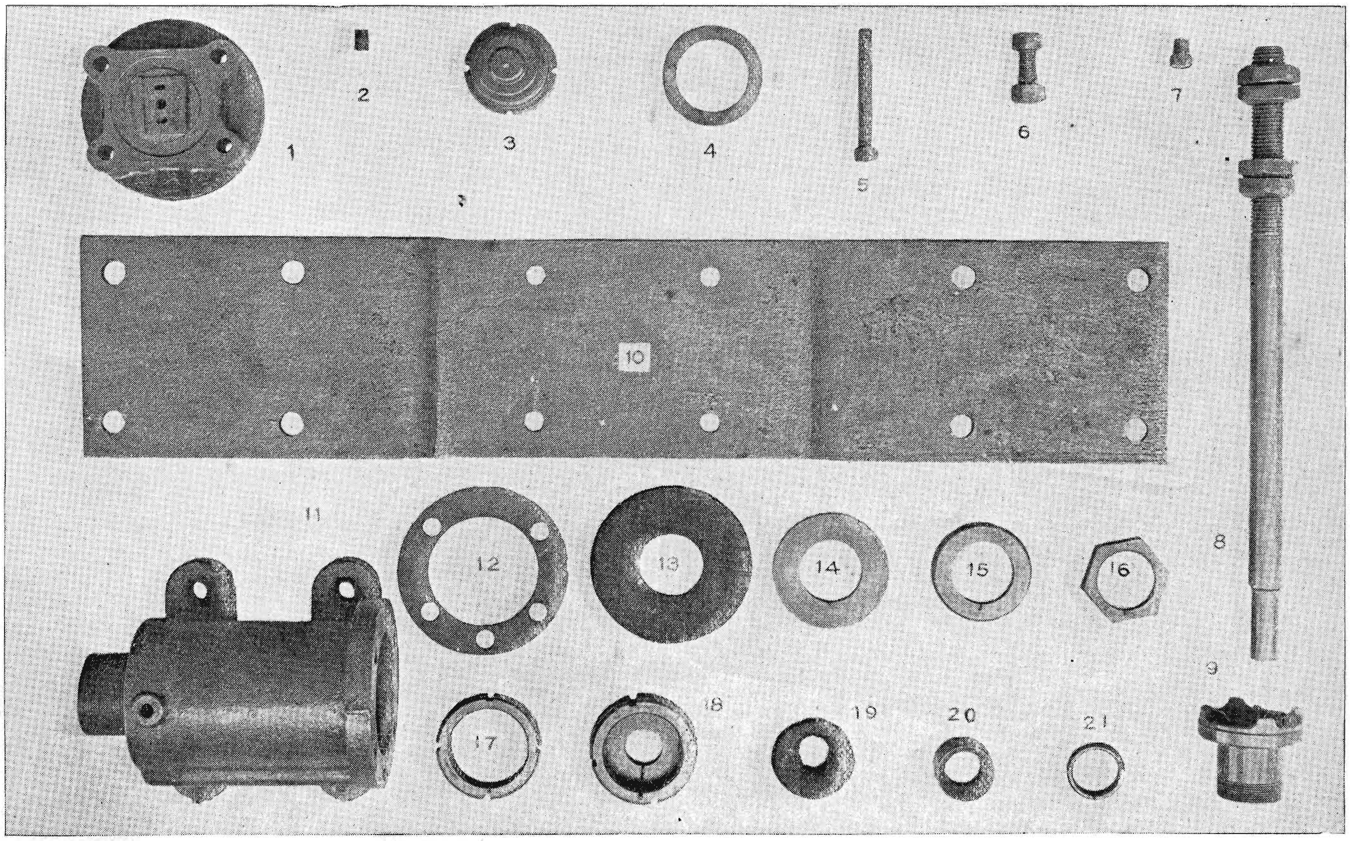


PLATE 85.





Direct Acting Electro-Pneumatic Switch Valve and Cylinder.

PLATE 85.

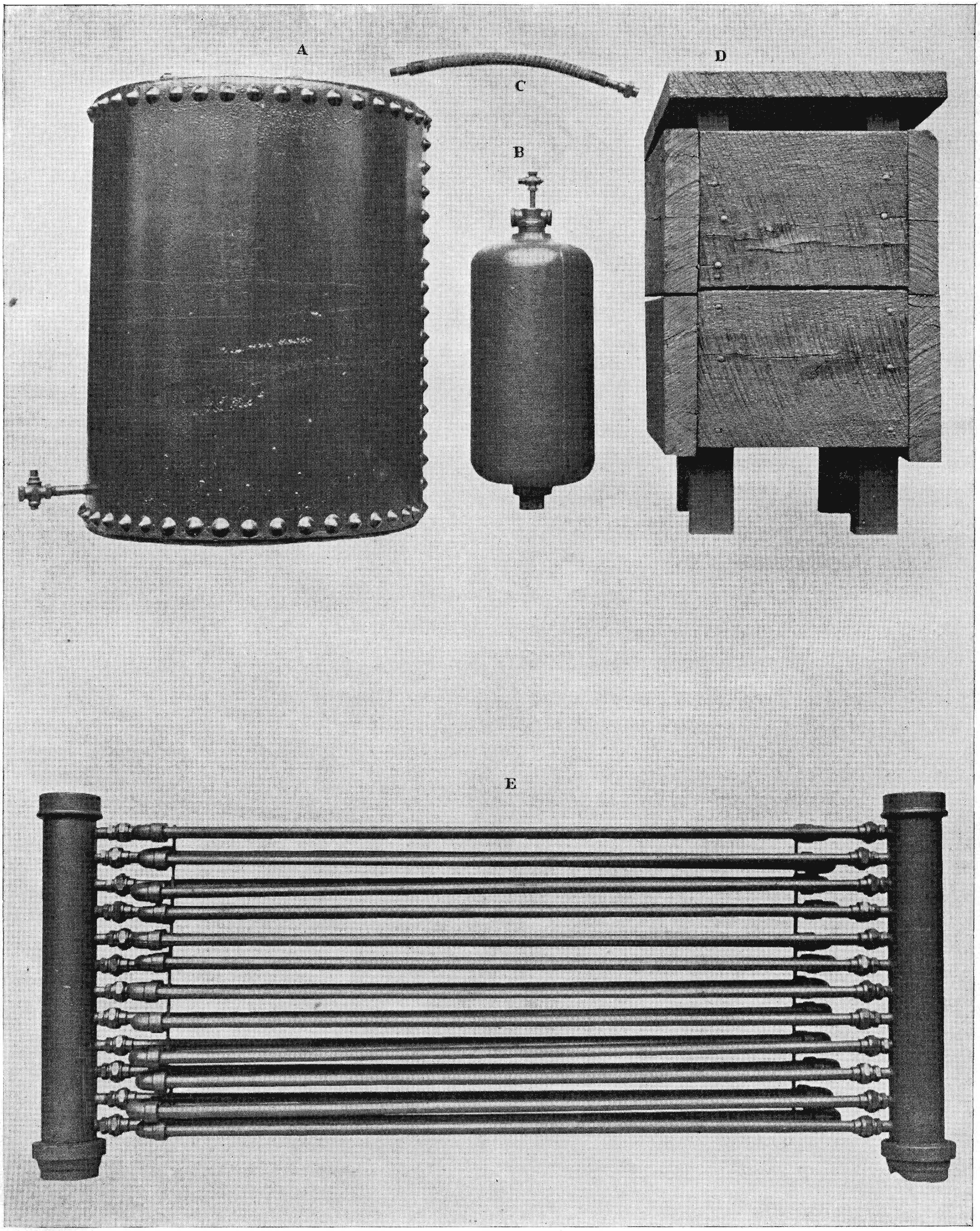
THIS arrangement is used in connection with the Pneumatic Push Button Machine (Plate 82), for the purpose of throwing the switches in distributing yards. The Plate (No. 10) is placed upon the ties, parallel to the rail, while the piston (No. 9), projects through the bridle rod of the switch, which is bent up for the purpose of receiving it. The arrangement of the valves is the same as on the Electro-Pneumatic Switch Movement (Plate 69), with the exception of the lock cylinder and magnet, which are here dispensed with, and are replaced by the Cap (No. 3). Two wires form the connection with the machine, one being run from each of the buttons on the machine to its corresponding valve magnet on the movement.

ORDER BY PLATE AND NUMBER.

FOR THE PARTS OF THE SWITCH VALVE SEE PLATE 000.

No.

1. Valve Seat.
2. Brass Bushing, for connecting valve seat with valve body.
3. Cap (Screw), for replacing lock cylinder in valve body.
4. Fibre Gasket, for inner ring of No. 1.
5. Screw Stud and Nut, for joining Nos. 1, 11 and valve body.
6. Bolt and Nut, 5/8" x 1 5/8", for joining Nos. 10 and 11.
7. Brass Oil Plug, 1/2" x 5/8", for Nos. 1 and 11.
8. Piston Rod and Four Nuts.
9. Piston Head.
10. Foundation Plate.
11. Cylinder.
12. Fibre Gasket, for joint between Nos. 1 and 11.
13. Leather Packing. } For the Piston Head.
14. Guide Ring. } For the Piston Head.
15. Follower. } For the Piston Head.
16. Follower Nut. } For the Piston Head.
17. Jam Nut. } For the Stuffing Box.
18. Packing Nut. } For the Stuffing Box.
19. Leather Packing. } For the Stuffing Box.
20. Follower. } For the Stuffing Box.
21. Follower Spring. } For the Stuffing Box.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Condensing Appliances.

PLATE 86.

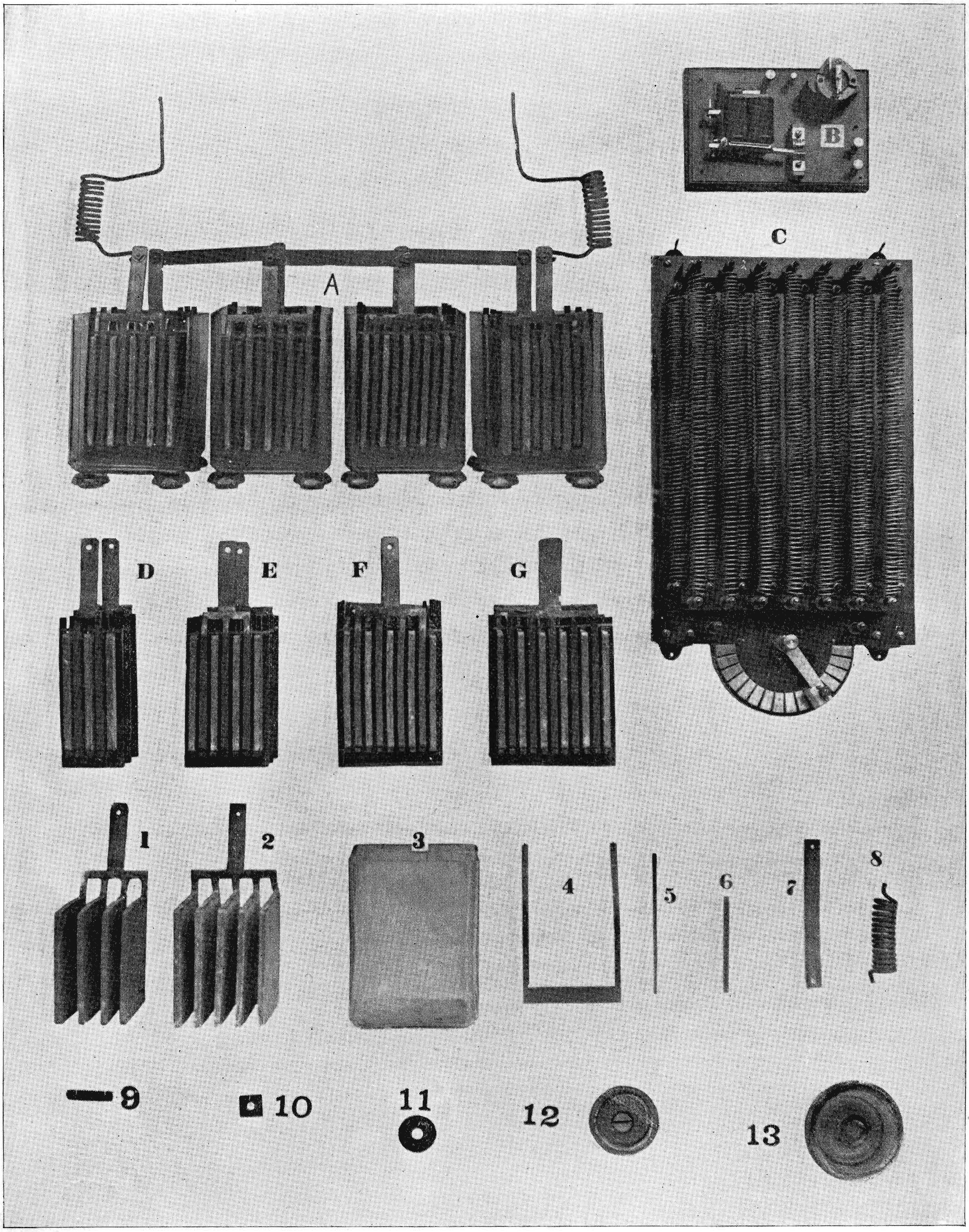
A. Main Reservoir.—This is placed usually between the compressor and the condensing coil (Fig. E), and is intended for collecting and retaining the condensed water which is precipitated from the air that leaves the compressor hot; a draw-off cock is shown at the bottom of the reservoir on the left.

B. Auxiliary Reservoir.—The compressed air is taken from this directly to the signals and switches. It holds the final water of condensation so that nothing but practically dry air shall enter any of the cylinders. In practice, an auxiliary reservoir is located at each switch movement and at the foot of each signal post. As it is placed underground the draw-off cock is on top, and is connected with the bottom of the reservoir by a pipe through which the water is forced into the atmosphere by the air pressure.

C. Flexible Connection with Union.—Used between the auxiliary reservoir and the switch movement.

D. Oak Box and Cover.—For containing the auxiliary reservoir. As this is placed underground it is made very strong but entirely without finish.

E. Condensing Coil.—The coil is located in any convenient spot, not too far from the compressor, but always in an exposed place and in the main pipe line. It is not always made exactly in this form, but is usually designed for the work it is to perform and the situation it is to occupy.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Storage Batteries and Governing Devices.

PLATE 87.

A. Four Cell Storage Battery, of the size and number of elements usually employed in the Electro-Pneumatic Interlocking system.

B. Automatic Switch.

C. Resistance Coil.

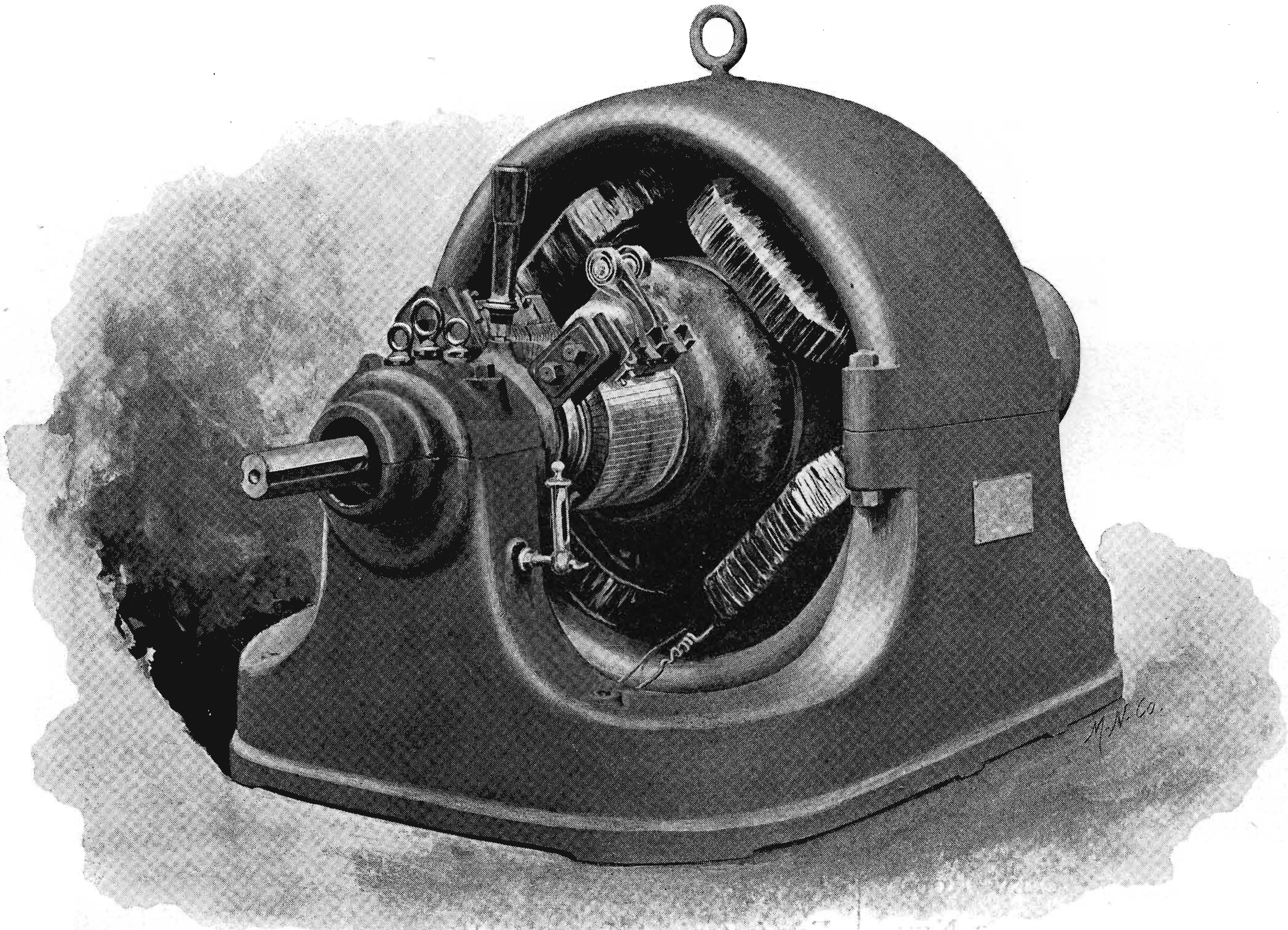
D. Five Plate.
E. Seven Plate.
F. Nine Plate.
G. Eleven Plate.
} Elements of different sizes ready for placing in a jar.

ORDER BY PLATE AND NUMBER.

No.

1. Positive Element.
2. Negative Element.
3. Jar.
4. Outside Strip.
5. Separating Strip.
6. Bottom Strip.
} Hard rubber.
7. Lead Connecting Piece, for joining Nos. 1 and 2.
8. Specially Insulated Copper Wire; give length required.
9. Aluminum Screw Rod.
10. Aluminum Square Nut.
11. Aluminum Washer.
} For fastening Nos. 7 and 8 to Nos. 1 and 2.
12. Lower Cup.
13. Upper Cup.
} Used as insulators for No. 3.

PLATE 88.



Generator for Charging Storage Batteries.

PLATE 88.

THE Electric Generator used by us in connection with the Electro-Pneumatic Interlocking and Block Signal Systems, for the storage of electrical energy is illustrated on Plate 88, and is a Multipolar Direct Current Generator manufactured in Pittsburg by the Westinghouse Electric & Manufacturing Co.

This type of machine is built in sizes varying between 1 horse-power and 5,000 horse-power in the best manner and of the best material.

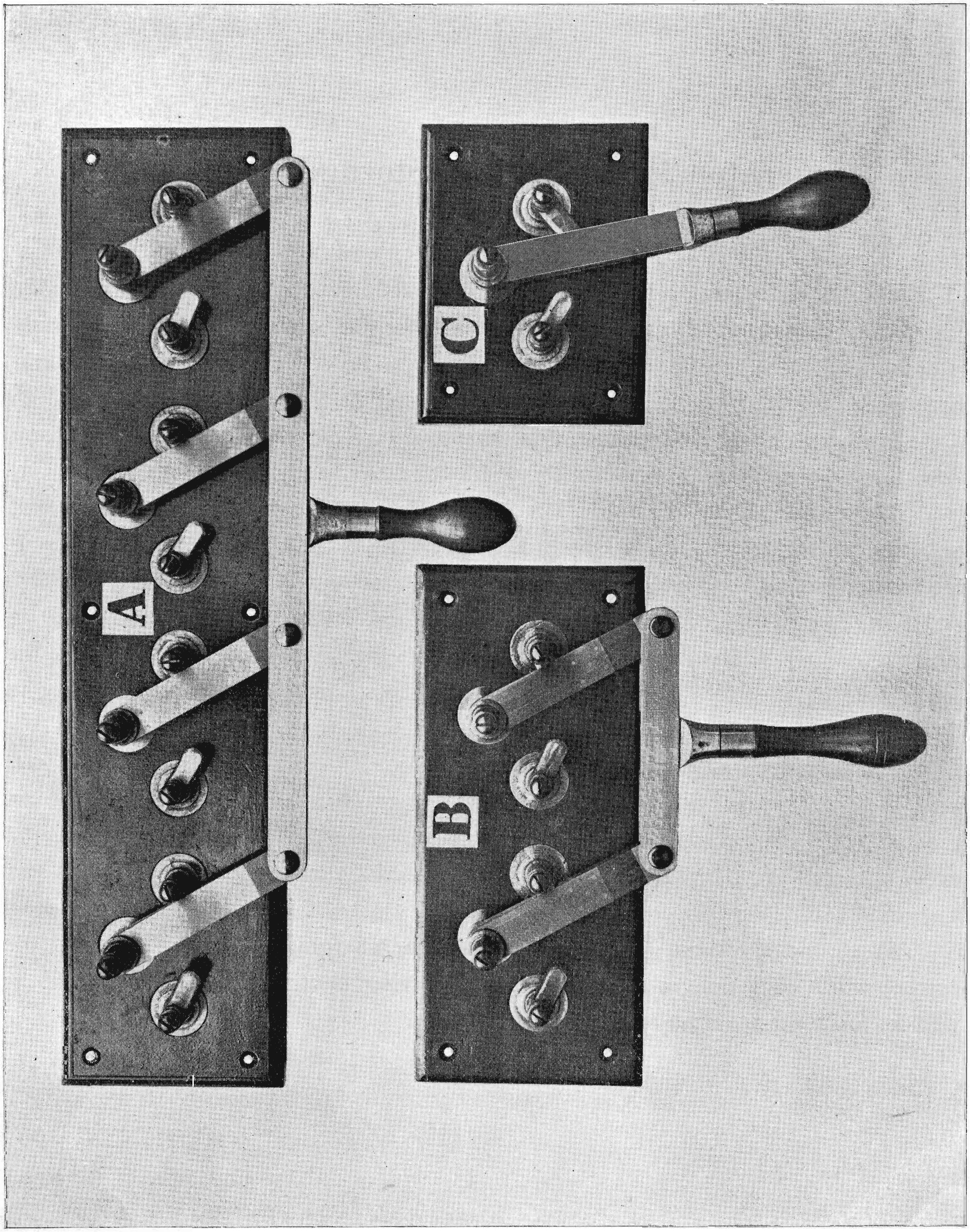
The multipolar principle renders it possible to drive the generator by a belt or connect it directly with the engine shaft. It is self-oiling, self-exciting, self-regulating, and after having been started entirely self-attendant.

The machine is reversible on its bed-plate and can be run equally well in either direction. The supports for the bearings are cast in one piece with the lower half of the field, a construction which gives great strength and rigidity to the bearings and secures the utmost possible freedom from vibration.

The armature is of the drum type; the core is built up of thin discs of soft iron, punched around their circumference with semi-oval holes. These holes form grooves which extend parallel to the shaft the entire length of the armature; in every groove are placed tubes of insulating material, through each of which is run a stranded cable or copper wire.

While we use these generators only for the charging of storage batteries, the current which they deliver may be used for driving electric motors of all kinds as well as for running incandescent and arc lights.

PLATE 89.



Switches for an Electric Current.

PLATE 89.

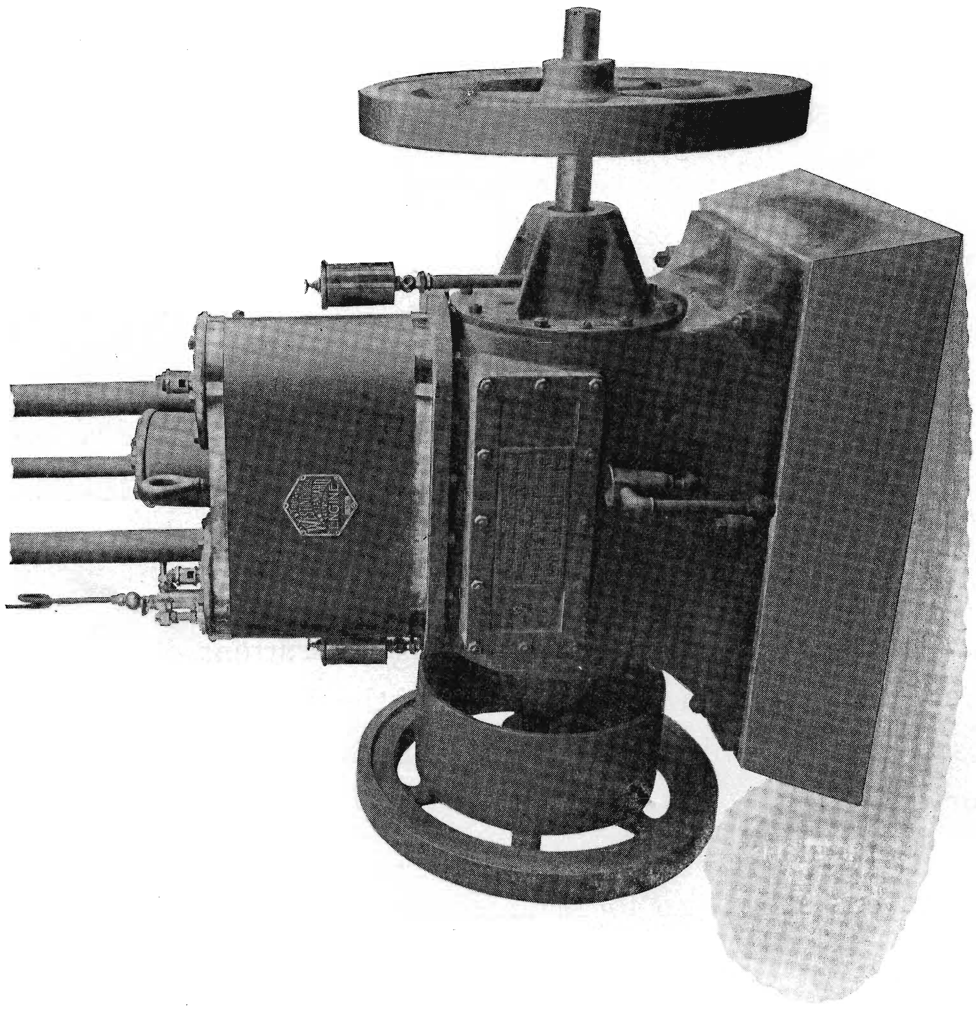
A POSITIVE and reliable switch for directing the current derived from a dynamo or storage battery is an essential part of the Electro-Pneumatic System, and on the opposite page we illustrate three sizes of a kind that we manufacture at our works for this purpose.

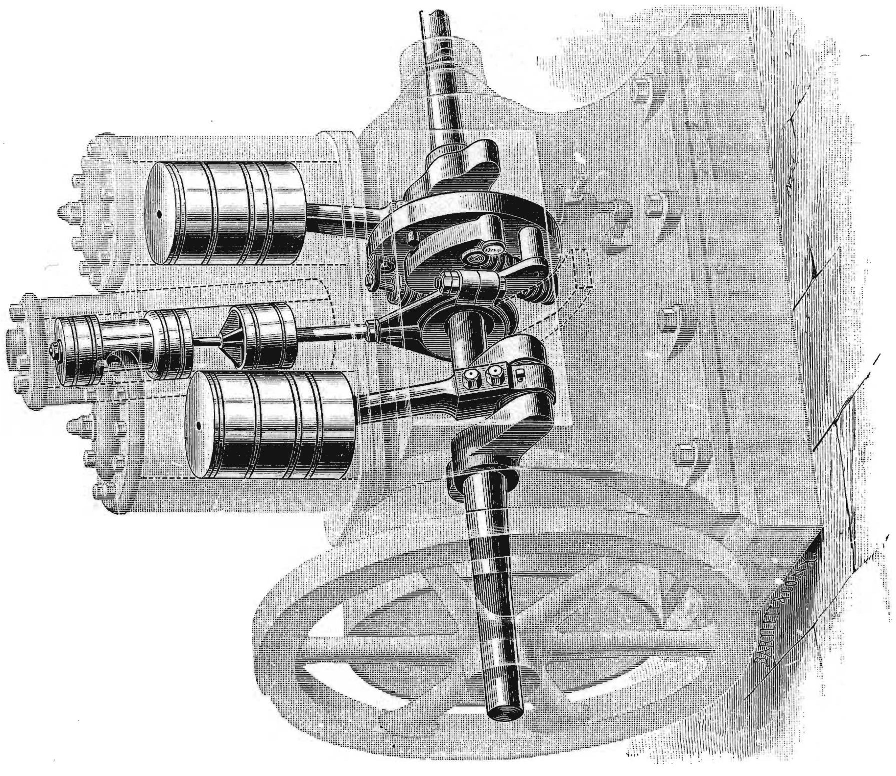
They are particularly substantial in construction, and may be of any desired size from a 1-way as shown up to an indefinite number.

ORDER BY PLATE AND LETTER.

A. 4-Way Switch.
B. 2-Way Switch.
C. 1-Way Switch.

PLATE 90.





Automatic Engine.

PLATE 90.

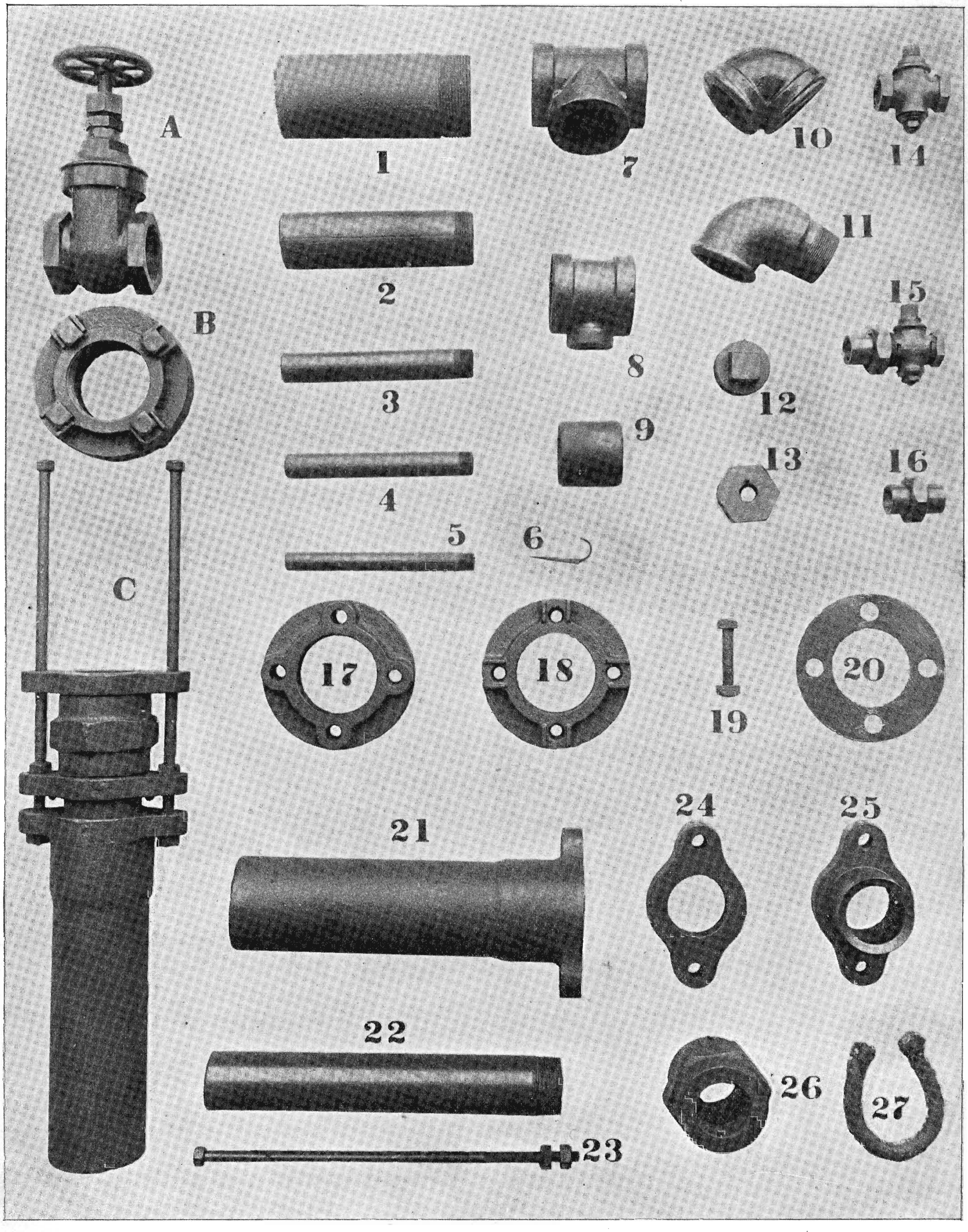
THIS engine is manufactured by the Westinghouse Machine Co., and is one from which we have secured most satisfactory results in connection with driving an electric generator. It is of the simplest construction, entirely automatic in its action, and may be connected to a generator, either by a belt or directly through its shaft, while, owing to its form, the very least amount of floor space is needed.

The external appearance of the engine may be seen on the upper portion of Plate 90, while something of its internal construction may be gathered from the lower portion of the same page. The central cylinder contains the valve, while the two outside cylinders contain the pistons which work in opposite directions and are so constructed as never to stop upon the center.

The lower chamber contains the cranks, the eccentric and the governor; it is in practice partly filled with oil, which is thrown about by the motion of the engine, and thoroughly lubricates all of the internal parts.

So simple and reliable is this engine that it is possible to run it for months at a time with a minimum of attention, other than the shutting off and turning on of the steam.

These engines are built in sizes ranging from 5 to 250 horse-power.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Pipe Fittings for Electro-Pneumatic System.

PLATE 91.

A. Gate Valve.
B. Flange Union, see Nos. 17, 18, 19 and 20, may have either 4 or 5 bolts.
C. Expansion Joint, see Nos. 21 to 27.

Used with 2″ and 3″ pipe.

ORDER BY PLATE AND NUMBER.

No.

1. Piece of 3″ Pipe.
2. Piece of 2″ Pipe.
3. Piece of 1″ Pipe.
4. Piece of ¾″ Pipe.
5. Piece of ½″ Pipe.

State whether the pipe is to be galvanized or not.

6. Hook, for supporting ½″ pipe.

A guide for pipe placed on stakes is shown on Plate 102, No. 10.

7. Plain T.
8. Reducing T.
9. Sleeve.
10. Plain Elbow.
11. Street Elbow.
12. Plug.
13. Reducing Bushing.

Made to fit Nos. 1 to 5. State whether the piece is to be galvanized or not.

14. Plain Cock.
15. Cock, with union.
16. Union.

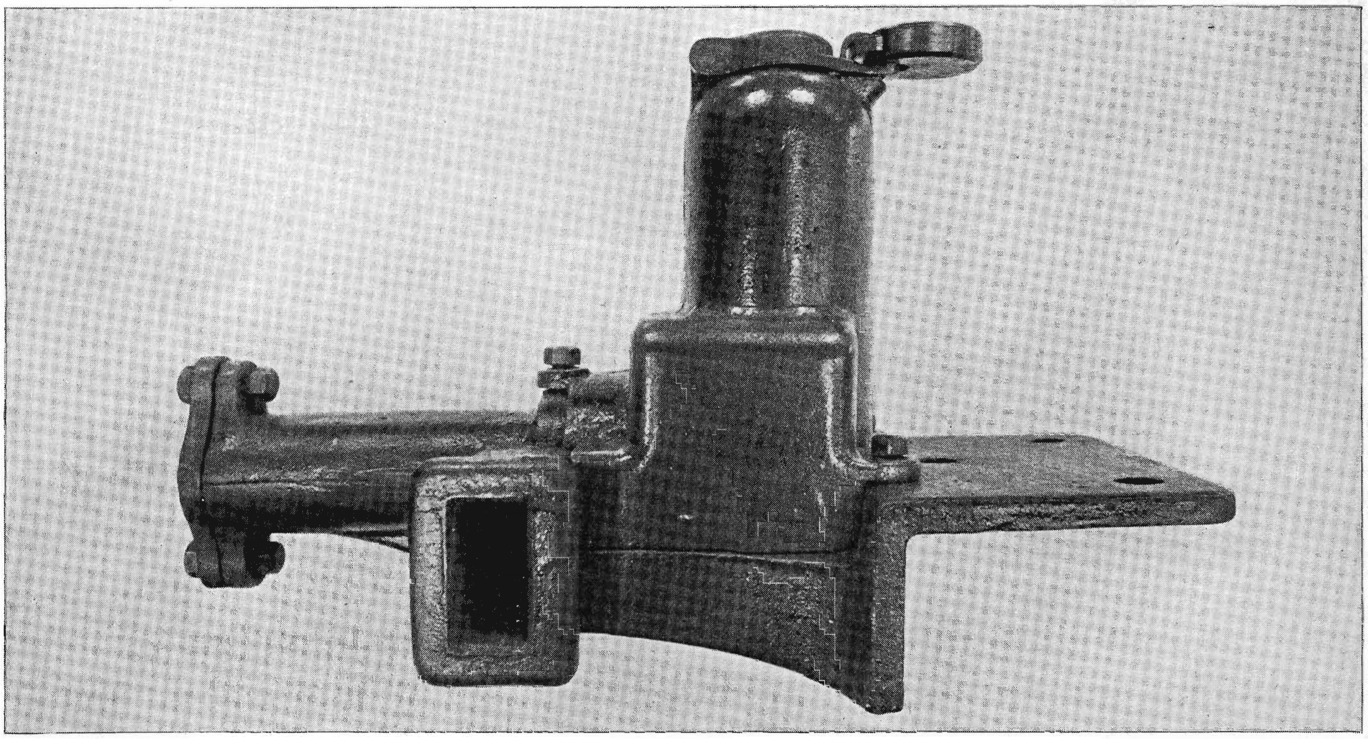
Used with Nos. 3, 4 and 5.

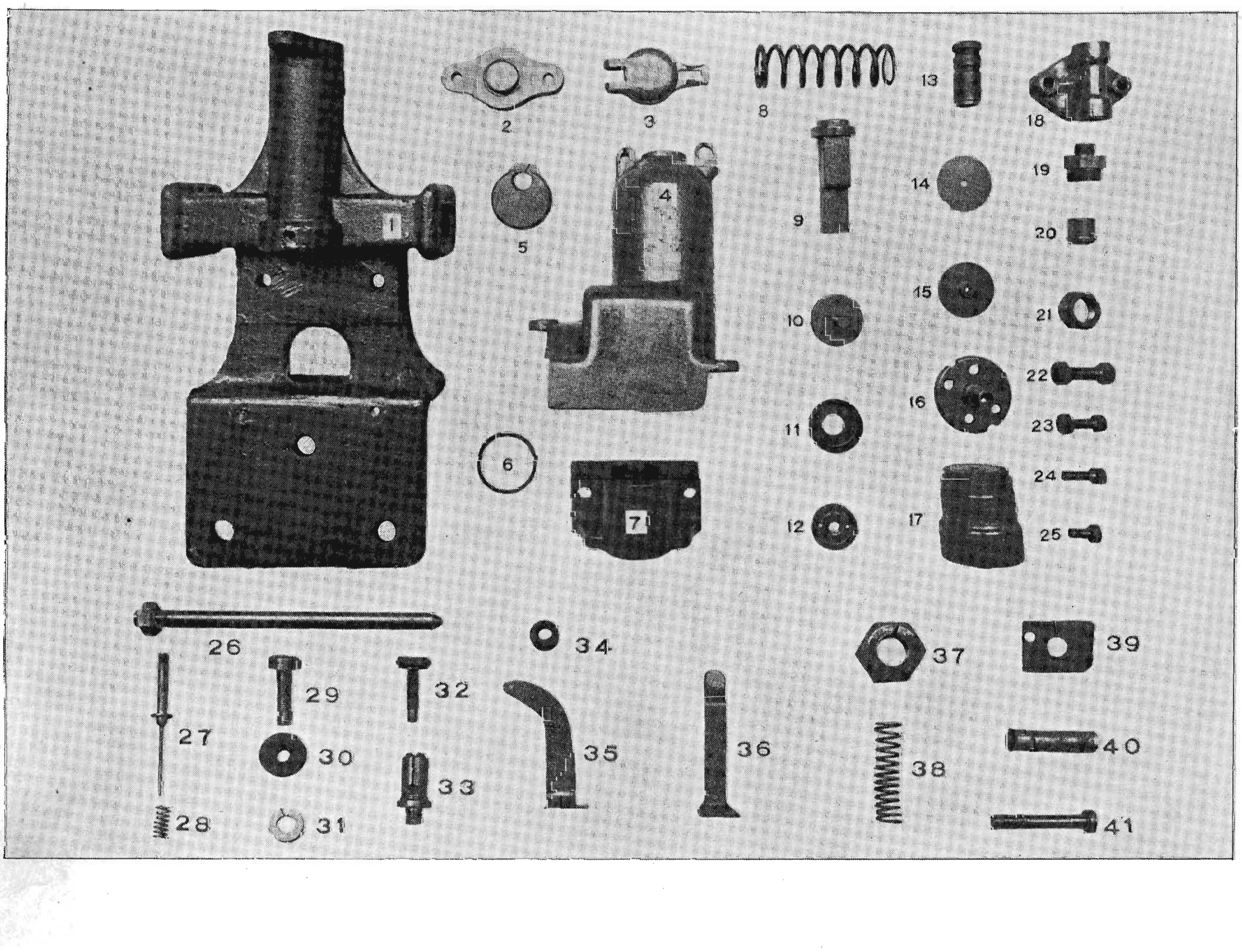
17. Flange, the nut fits against this.
18. Flange, the bolt head fits against this.
19. Bolt and Nut, for joining Nos. 17 and 18.
20. Copper Gasket, for packing Nos. 17 and 18.

Relating to B only. See note with Fig. B, above.

21. Cylinder.
22. Piston.
23. Guide Rod and Nuts.
24. Guide Collar.
25. Stuffing Box Ring.
26. Nut.
27. Asbestos Packing.

Relating to C only.

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Electro-Pneumatic Switch Lock.

PLATE 92.

THIS device is used on outlying switches in connection with the Pneumatic Block Signal System. It is a positive facing point lock, operated by compressed air, and is made to lock the switch by the entrance of a train to the second block section in the rear, and does not release the switch until the train has passed out of the section in which the switch is situated. If a train, occupying the main track, has reached a switch controlled by one of these locks, wishes to enter the siding, a plunger, which is a part of the apparatus, and which mechanically operates the valve, must be depressed in order to unlock the switch. On the contrary, when a train which is on the siding wishes to come onto the main track, an attempt to move the switch stand in the ordinary manner must be made; if it be found fast, the effort must be temporarily abandoned, since the fact that the switch is locked indicates that an approaching train has advanced beyond the distant signal relating to that section, or, in other words, far enough to be endangered by an open switch.

ORDER BY PLATE AND NUMBER.

No.

1. Base.
2. End Cap, for base.
3. Lid of Cover.
4. Cover.
5. Padlock.
6. Fibre Gasket, for face of cylinder.
7. Cylinder.
8. Steel Lock Spring.
9. Lock.
10. Piston Head.
11. Leather Piston Packing.
12. Brass Piston Follower.
13. Plunger.
14. Magnet Shield.
15. Armature.
16. Plunger Base.
17. Magnet.
18. Valve Body.

No. PLATE 92.

19. Union Coupling.
20. Swivel, for union coupling.
21. Nut, for union coupling.
22. Tap Bolt and Nut, ½″ x 1½″, for joining base No. 1 and cylinder No. 7.
23. Tap Bolt and Nut, ⅜″ x 1⅜″, for joining base No. 1 and end cap No. 2.
24. Tap Bolt, ⅜″ x 1¼″, for joining cylinder No. 7 and valve body No. 18.
25. Tap Bolt, ⅜″ x ¾″, for joining base No. 1 to cover No. 4.
26. Armature Stem and Nut.
27. Pin Valve.
28. Spring, for pin valve.
29. Binding Screw, $\frac{13}{16}$″ x 12–32, for electric wires on magnet.
30. Rubber Bushing, for magnet binding screw.
31. Brass Washer, ¼″–½″, for magnet binding screw.
32. Screw, for binding post.
33. Binding Post.
34. Rubber Bushing, ¼″ x ⅜″, for binding post.
35. Contact Spring with Platinum Point.
36. Contact Spring with Platinum Disc.
37. Hex Nut, for joining piston No. 10 and follower No. 12.
38. Brass Spring, for plunger No. 13.
39. Mica Insulation, for contact springs Nos. 35 and 36.
40. Steel Rivet, for joining lid No. 3 to cover No. 4.
41. Brass Machine Screw, 1¼″ x 12–32, for holding spring No. 38 in plunger No. 13.

Note.—A lock bar is used with the device which is illustrated on Plate 73, No. 69.

PLATE 93.

A view of the large train shed of the Philadelphia & Reading R. R. at Philadelphia. Particular attention is called to the starting signals that are suspended from the bottom chord of the portal, for they show how easy it is, in the Electro-Pneumatic System, to place a signal wherever it is wanted. On Plate 31 is given a plan of the tracks at this place.

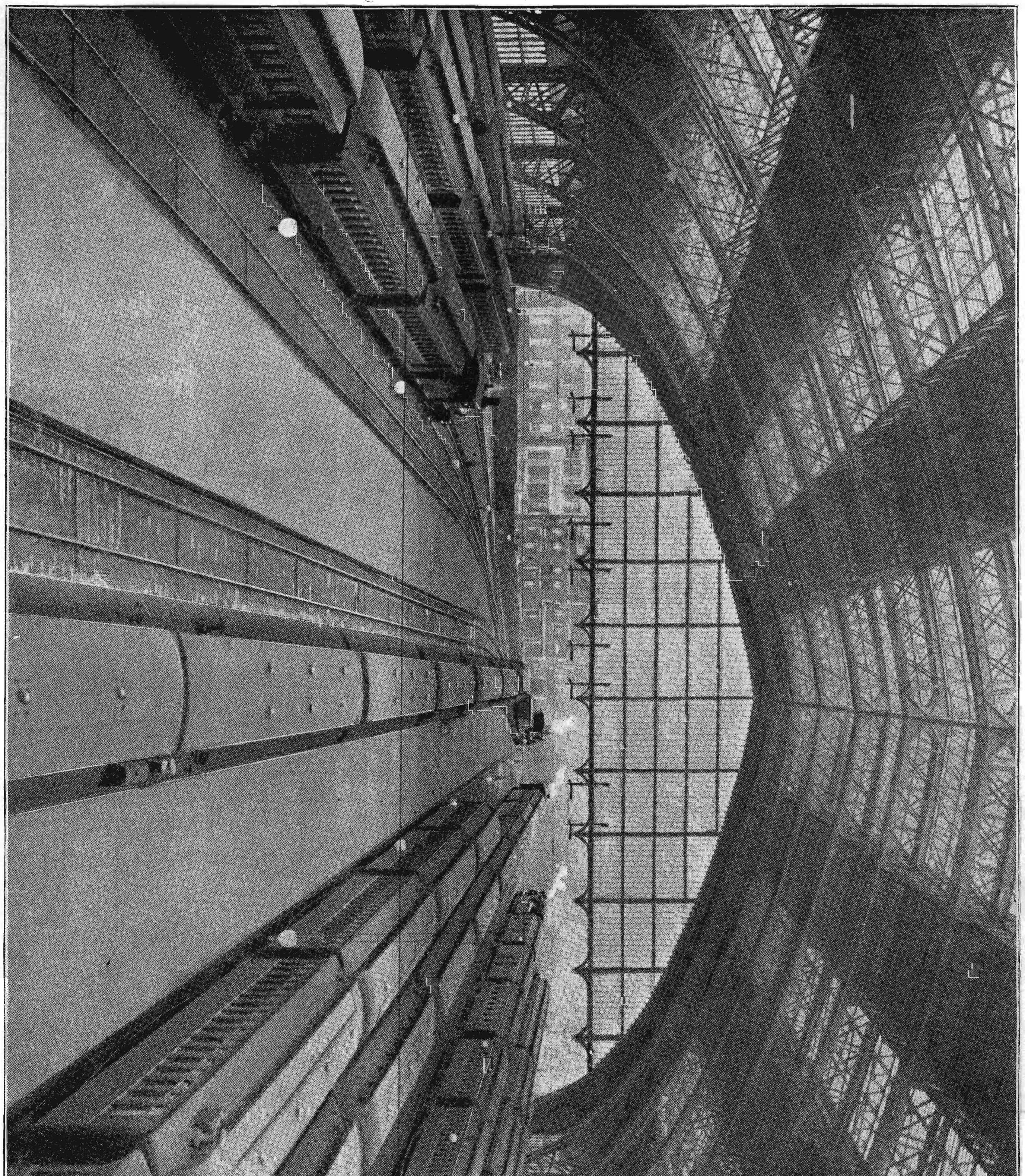
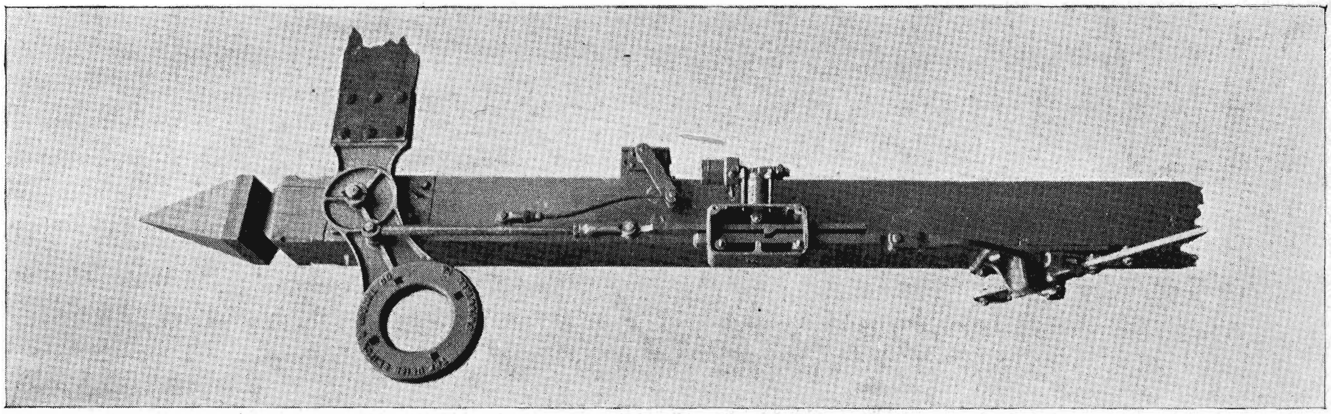
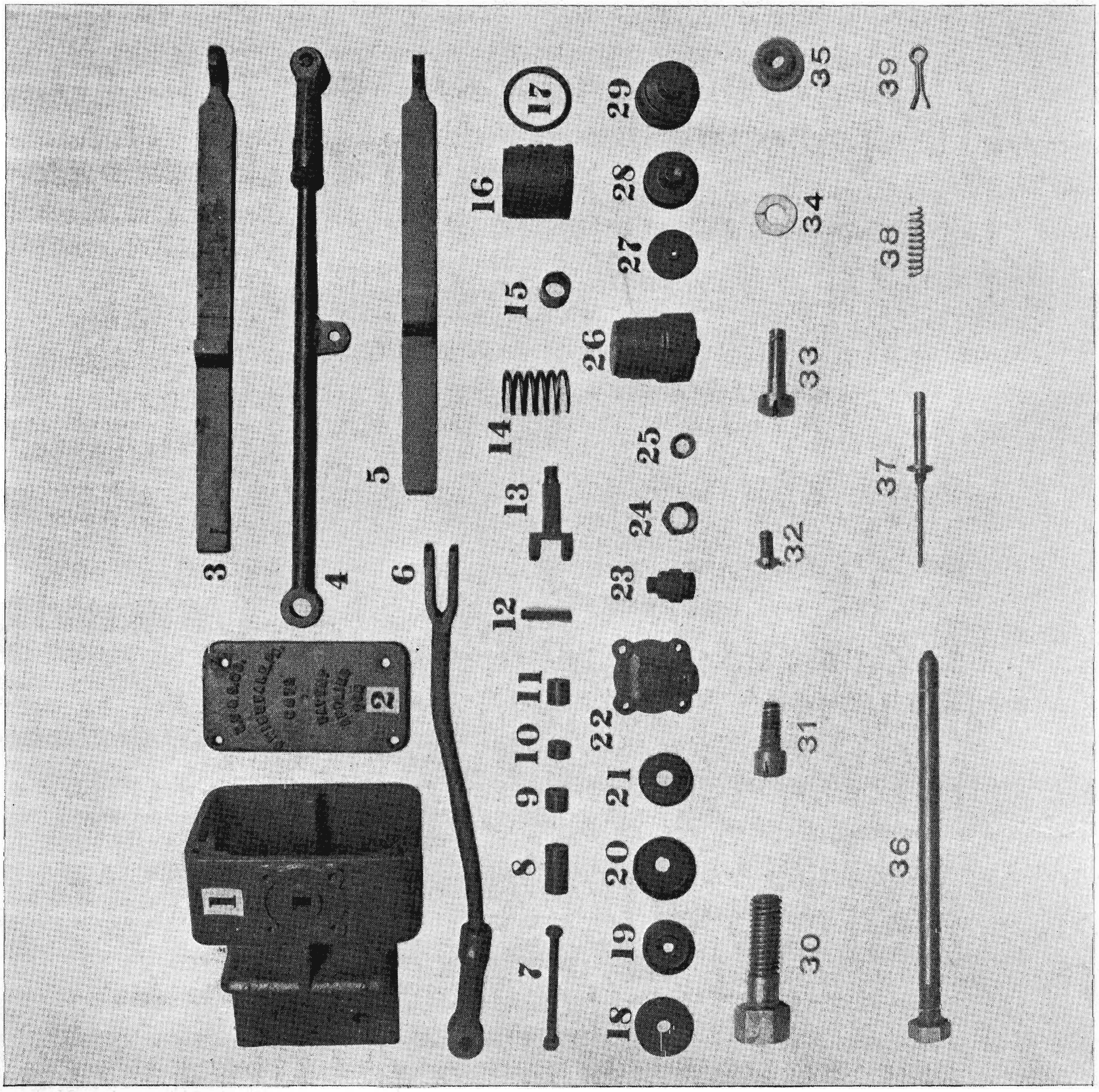


PLATE 94.

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The Electro-Pneumatic Slot.

PLATE 94.

THIS device, like the Electric Slot, Page 215, is for the purpose of making the clearing of a semaphore contingent upon the condition of the track which it controls. It is used in connection with an advance home signal that is operated from a Saxby & Farmer Machine, which is embraced within the limits of an Electro-Pneumatic Block Signal System, and must therefore be semi-automatic in its character.

This is accomplished by making the vertical signal rod in two parts, which shall be joined when the track in advance is unoccupied by any train, but which, when the track circuit is interrupted, will separate the semaphore from the counterweight lever; if the signal should be cleared at the time, it will go to the danger position automatically, while if it should be in the danger position when the change takes place, no reversing of the lever in the machine will affect the signal at all, for the bars Nos. 3 and 5 will only slip by each other.

The signal wires from the machine are connected with the counterweight lever in the ordinary way, while the latter is joined to the lower slot bar (No. 5) by the link (No. 6). The upper slot bar (No. 3) is connected with the semaphore casting by the vertical signal rod (No. 4) to which also is joined the distant signal circuit breaker by its link (Fig. C and No. 43, Plate 100). The slot bars lie within the case (No. 1) to which is attached the cylinder (No. 16), carrying upon its outer end the valve body (No. 22); this, in turn, supports the magnet (No. 26), which when charged closes the exhaust by means of the armature stem (No. 36) and pin valve (No. 37), and opens the passage between the cylinder and the pressure pipe. If the signal is at danger, the lever in the cabin normal, and the track in advance unoccupied, the magnet will be charged, the piston (No. 13) will be forced out against the upper slide bar, the dog on which will be pressed into a corresponding recess on the lower slide bar. Reversing the lever in the cabin will now result in a clear signal, which will continue so until the lever has been restored to its normal position, or, until a train occupies the track in advance, which by cutting out the slot magnet, will open the exhaust port of the cylinder and by removing the pressure, cause the strong spring (No. 14) to retract the piston; this will allow the two slide bars to separate and permit the semaphore casting to fall; the last condition described is shown on the upper part of Plate 94, except that the balance lever is also in the position which it occupies when the lever in the machine is normal. The parts are illustrated on the next page.

ORDER BY PLATE AND NUMBER.

PLATE 94.

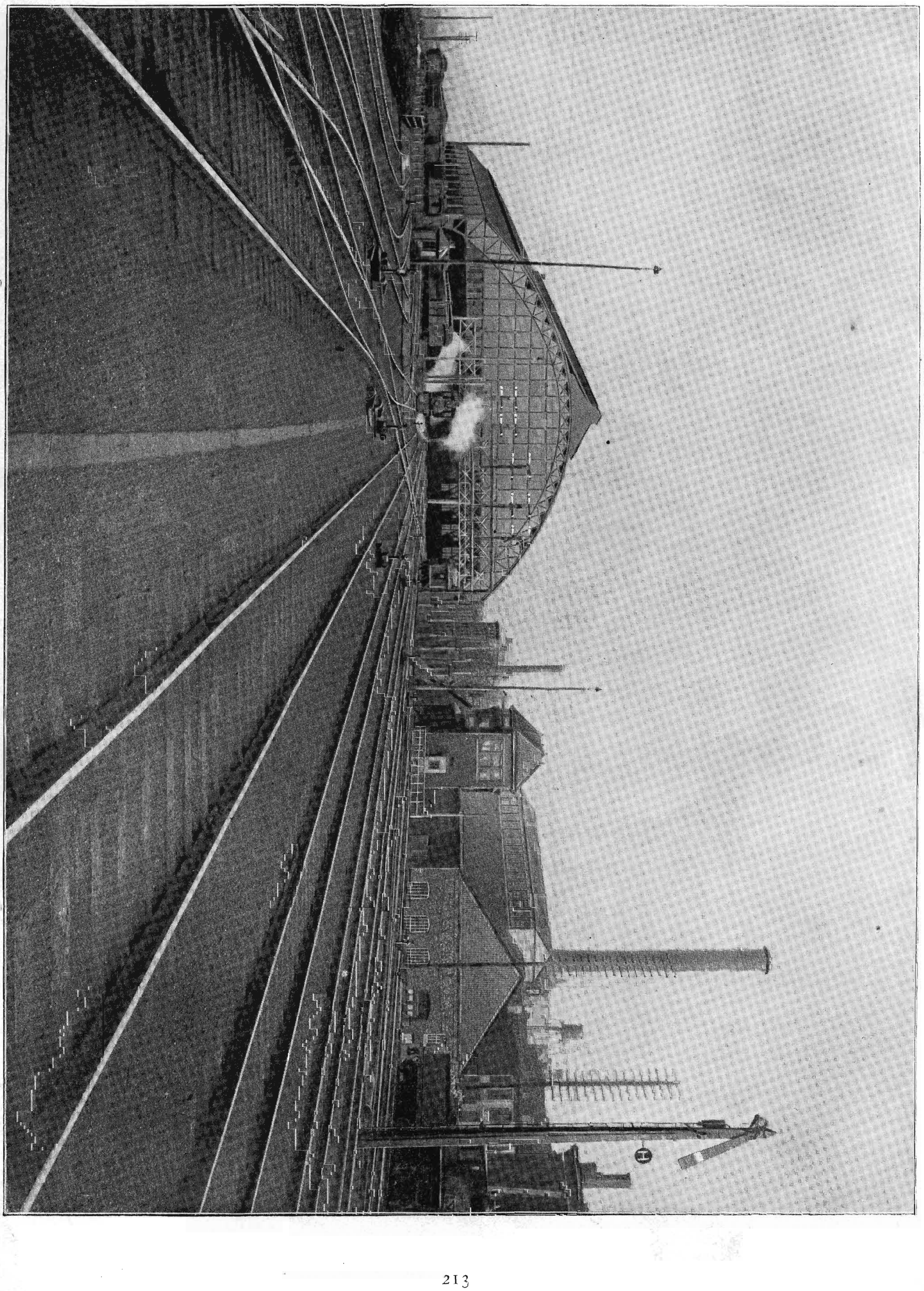
No.

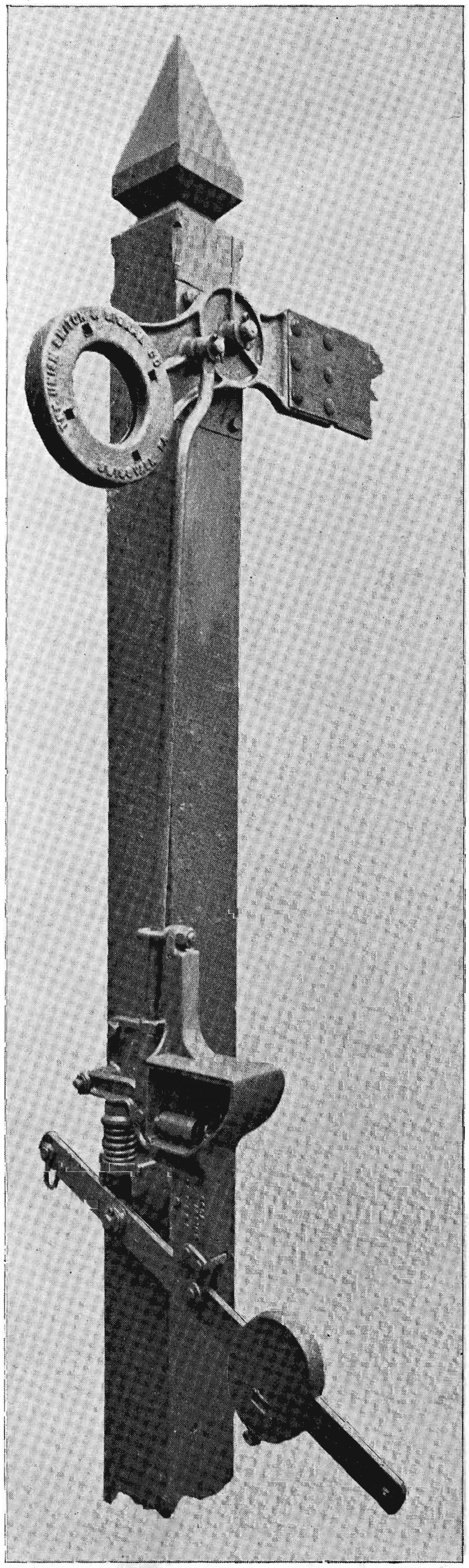
1. CASE.
2. COVER.
3. UPPER SLIDE BAR.
4. VERTICAL SIGNAL ROD.
5. LOWER SLIDE BAR.
6. LINK.
7. BOLT AND NUT. } 3/8″ x 3¾″, for fastening No. 22; 3/8″ x 4⅞″, for Nos. 8, 9 and 10. In ordering, state which is required.
8. LONG. } Anti-friction slide bar rollers.
9. MEDIUM. } Anti-friction slide bar rollers.
10. SHORT. } Anti-friction slide bar rollers.
11. ROLLER, for jaw on No. 13.
12. PIN, 3/8″ x 2¼″, for joining Nos. 11 and 13.
13. PISTON ROD.
14. SPRING. } For Piston Rod.
15. STOP BUSHING. } For Piston Rod.
16. CYLINDER.
17. FIBRE GASKET, for packing between Nos. 1, 16 and 22.
18. PISTON.
19. FOLLOWER NUT.
20. LEATHER PACKING.
21. SPRING FOLLOWER.
22. VALVE BODY.
23. UNION.
24. UNION NUT.
25. UNION SWIVEL.
26. MAGNET. Give resistance required in ohms.
27. ARMATURE.
28. INSIDE. } Magnet Caps.
29. OUTSIDE. } Magnet Caps.
30. CAP SCREW, 3/8″ x 1″, for fastening No. 2 to No. 1.
31. BRASS TAPER OIL PLUG.
32. IRON MACHINE SCREW, 3/8″ x 8–32, set screw for No. 26.
33. BRASS MACHINE SCREW. } For connecting electric wires to magnet.
34. BRASS WASHER. } For connecting electric wires to magnet.
35. HARD RUBBER BUSHING. } For connecting electric wires to magnet.
36. ARMATURE STEM.
37. PIN VALVE.
38. SPRING, for No. 37.
39. SPLIT COTTER, 3/32″ x 5/8″, for No. 12.

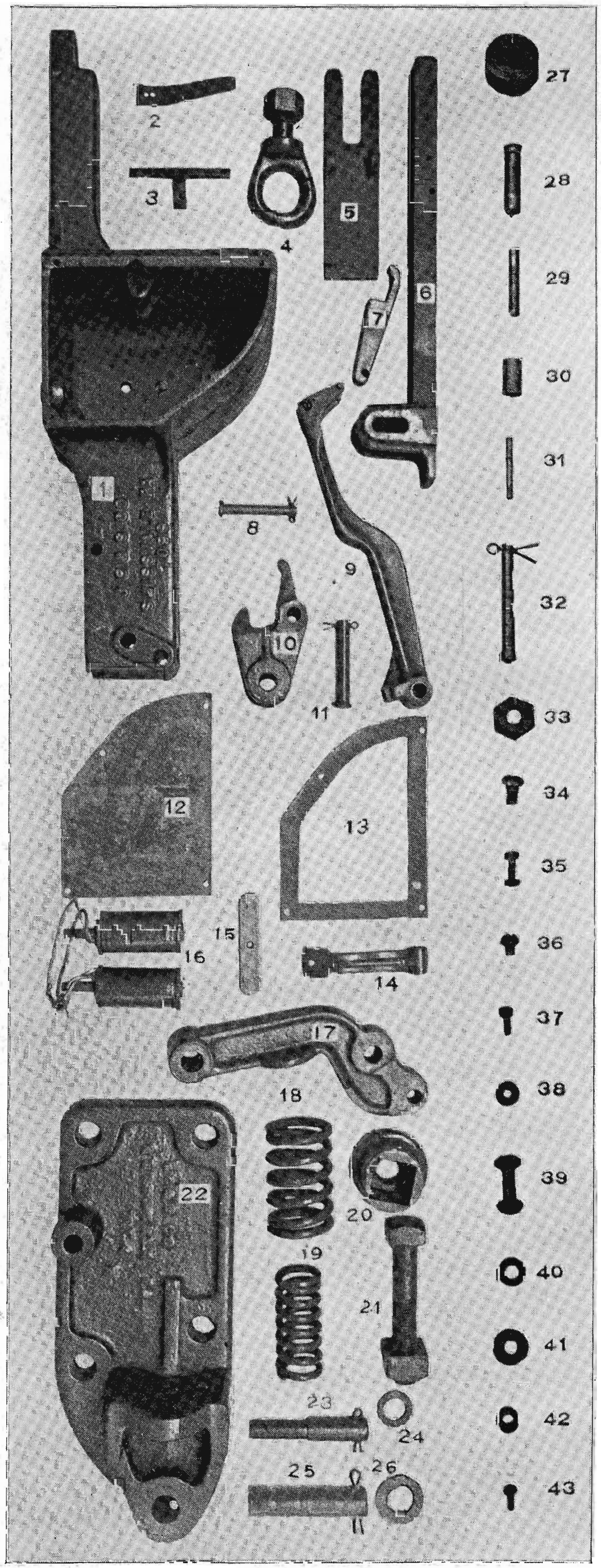
PLATE 95.

A view of the tracks and signals at the Pennsylvania Railroad Terminal, Jersey City. See also Plates 52, 67 and 70.

PLATE 95.



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The Electric Slot.

PLATE 96.

THIS instrument is for the purpose of automatically parting the connection between a mechanical signal and its lever in an interlocking machine. It is usually done by means of a short piece of track circuit, in which case the magnet (No. 16) of the slot, corresponds to the signal magnet of Fig. D, Plate 103. At other times the rupture is caused by the breaking of a different circuit, but the action which causes the rupture in this device is always an electrical one.

When the magnet (No. 16) is charged, it attracts and holds the armature bar, No. 14, which in turn forces the lever (No. 9) under the dog (No. 7) and against the slot rod (No. 6) that slides in, but is not fastened to the case (No. 1). The drop arm (No. 17) is pivoted to the counterweight lever base (No. 22) and its other end is fastened to the rod (No. 6), while to the middle hole of the drop arm is joined the vertical signal rod. If now the counterweight be raised by means of the interlocking lever, the case, the slot rod, the drop arm, and consequently the vertical signal rod will be forced up, resulting in a clear signal. By discharging the slot magnet, the dog (No. 7) which is fastened to the slot rod, is enabled to force its way past the lever, and in that way permits the drop arm to fall, carrying with it the signal itself and the vertical signal rod, which on its return slides through the loop (No. 4) but leaving the counterweight and the case with all its parts still raised. The signal cannot again be cleared without first restoring the counterweight by means of the interlocking lever to its normal position.

This device makes it impossible for an operator to fasten down his signal and through carelessness permit two trains to enter the same block.

The vertical signal rod, the counterweight lever, and its weight are of the ordinary character, and will be found illustrated on Plate 79.

ORDER BY PLATE AND NUMBER.

No.

1. Case.
2. Spring, for No. 14.
3. Anti-magnetic Plate.
4. Loop and Nut.
5. Guide Plate.
6. Slot Rod.

No.

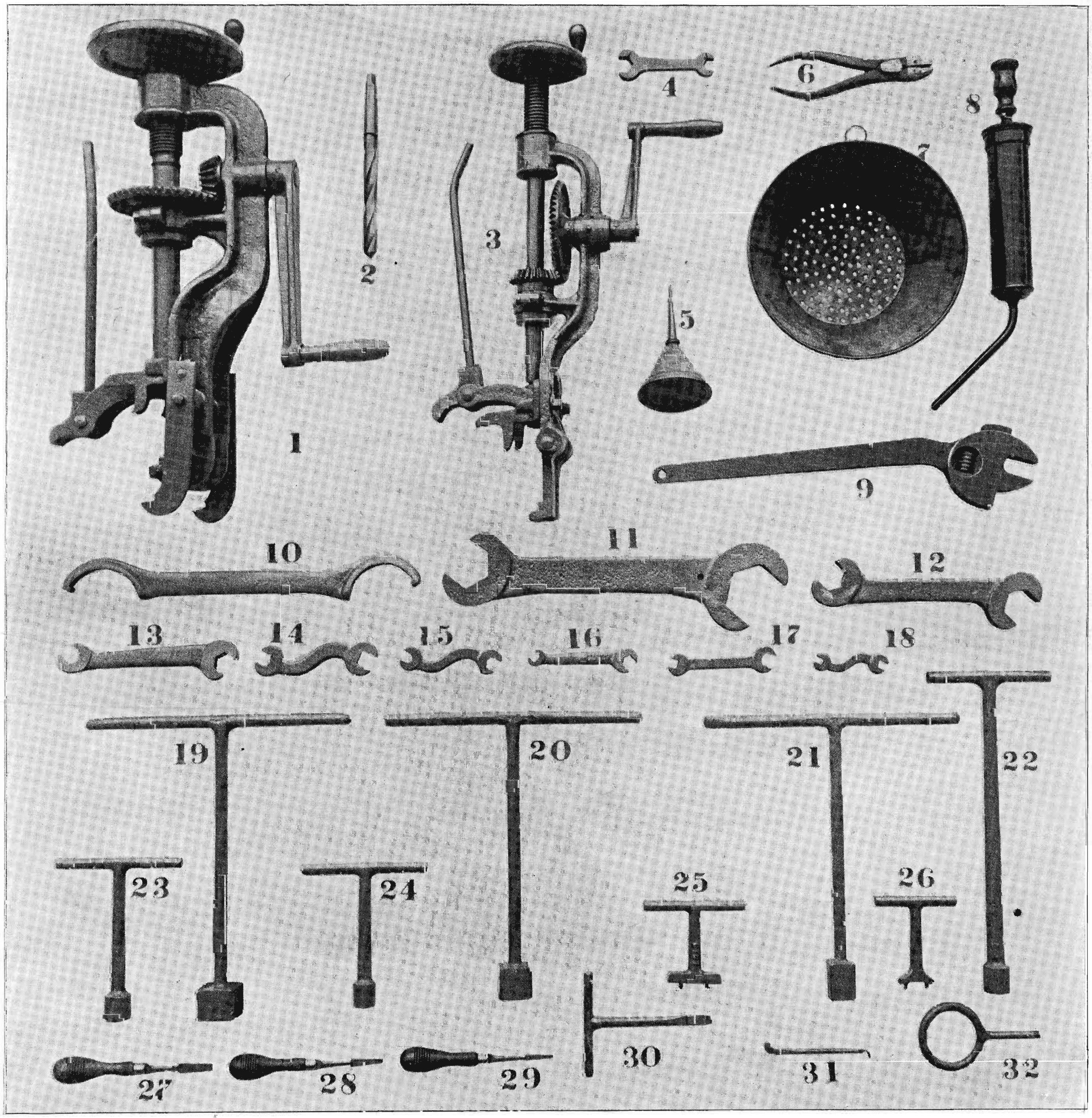
7. Dog.
8. Turned Pin, 3/8" x 2 5/8", and Cotter, for fastening No. 5 to No. 1.
9. Lever.
10. Jaw.
11. Turned Pin, 1/2" x 3", and Cotter, for fastening Nos. 9 and 10 to No. 1.
12. Cover Plate.
13. Rubber Gasket, for No. 12.
14. Armature Bar.
15. Armature.
16. Pair of Magnets. Give resistance required in ohms.
17. Drop Arm.
18. Large Spring.
19. Small Spring
20. Spring Bearing.
21. Bolt and Nut, 7/8" x 5", for fastening Nos. 18, 19 and 20 to No. 22.
22. Counterweight Lever Base.
23. Stud, 3/4" x 4 1/2", for fastening No. 17 to No. 22.
24. Washer, 3/4", for No. 23.
25. Stud, 1" x 4 1/2", and Cotter, for fastening counterweight lever to No. 22.
26. Washer, 1", for No. 25.
27. Large Roller, for No. 9.
28. Rivet, 5/16" x 1 1/8", for No. 27.
29. Rivet, 3/16" x 1 1/4", for No. 7.
30. Small Roller, for No. 9.
31. Rivet, 1/8" x 1 1/8", for No. 30.
32. Turned Pin, 1/4" x 2 1/4", and Cotter, for No. 14.
33. Hexagon Nut, 3/8"–16, for No. 16.
34. Machine Screw, 3/8" x 10–24, for fastening Nos. 12 and 13 to No. 1.
35. Screw and Nut, 1/2" x 8–32, for fastening No. 3 to No. 1.
36. Machine Screw, 1/4" x 10–24, for joining Nos. 14 and 15.
37. Machine Screw, 3/8" x 8–32, for inside wires (screws into No. 39).
38. Washer, 5/32" x 7/16", for No. 37.
39. Bolt and Nut, 3/4" x 1/4"–32, for outside wires.
40. Brass Washer. } For No. 39.
41. Mica Washer. } For No. 39.
42. Rubber Bushing. } For No. 39.
43. Rivet, for fastening No. 2 to No. 1.

Patents Relating to Electric Signaling.

NAME.	DATE.	NUMBER.
S. C. HENDRICKSON,	FEBRUARY 5, 1878,	199,977
H. W. SPANG,	OCTOBER 15, 1878,	208,995
O. GASSETT AND I. FISHER,	MAY 4, 1880,	227,102
O. GASSETT,	JUNE 1, 1880,	228,187
O. GASSETT,	JUNE 8, 1880,	228,455
O. GASSETT AND I. FISHER,	SEPTEMBER 21, 1880,	232,344
O. GASSETT AND I. FISHER,	OCTOBER 26, 1880,	233,612
O. GASSETT,	OCTOBER 26, 1880,	233,746
C. J. MEANS,	NOVEMBER 9, 1880,	234,315
O. GASSETT,	NOVEMBER 23, 1880,	234,707
I. FISHER,	DECEMBER 7, 1880,	235,145
C. J. MEANS,	MARCH 22, 1881,	239,107
W. R. SYKES,	APRIL 26, 1881,	240,622
W. R. SYKES,	MAY 10, 1881,	241,246
O. GASSETT AND I. FISHER,	JUNE 28, 1881,	243,544
I. FISHER,	AUGUST 30, 1881,	246,304
I. FISHER,	AUGUST 30, 1881,	246,486
O. GASSETT,	AUGUST 30, 1881,	246,492
O. GASSETT,	JANUARY 3, 1882,	251,867
F. L. POPE,	FEBRUARY 14, 1882,	253,762
C. H. JACKSON,	APRIL 4, 1882,	255,998
O. GASSETT,	APRIL 18, 1882,	256,797
C. J. MEANS,	MAY 2, 1882,	257,233
C. A. SCOTT,	OCTOBER 31, 1882,	266,904
W. ROBINSON,	NOVEMBER 7, 1882,	267,259
O. GASSETT,	NOVEMBER 21, 1882,	267,978
O. GASSETT,	NOVEMBER 21, 1882,	267,979
GEO. WESTINGHOUSE, JR.,	JANUARY 16, 1883,	270,867
O. GASSETT,	APRIL 17, 1883,	276,021
S. C. HENDRICKSON,	APRIL 17, 1883,	276,038
O. GASSETT AND I. FISHER,	APRIL 17, 1883,	276,138
C. A. SCOTT,	JULY 31, 1883,	282,229

(*Continued on Page* 261.)

PLATE 97.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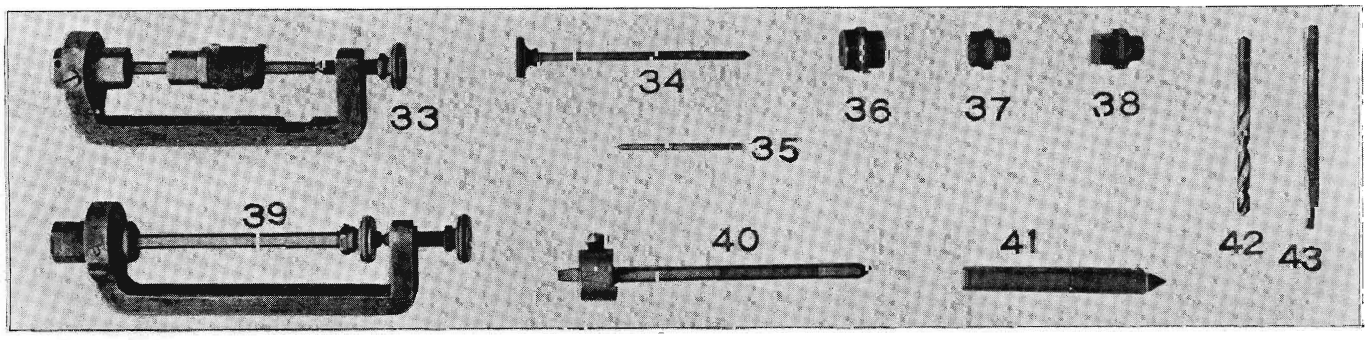
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Special Tools for Electric and Electro-Pneumatic Work.

PLATE 97.

ORDER BY PLATE AND NUMBER.

No.

1. TRACK DRILLING MACHINE, principally used for making holes to receive detector bar rail clip bolts.
2. DRILL, for No. 1.
3. TRACK DRILLING MACHINE, used for making track wire holes; for drill, see No. 42.
4. WRENCH, specify whether it is wanted for No. 1 or No. 3.
5. OIL CAN, for Nos. 1 and 3.
6. PLYERS, for handling line wire.
7. COPPER BATTERY COLLENDER.
8. HARD RUBBER BATTERY SYRINGE.
9. ADJUSTABLE WRENCH, a very convenient tool, made in various sizes, therefore state size of nuts for which it is wanted.
10. WRENCH, for stuffing box and for lock cylinder. } On switch valve and cylinder.
11. WRENCH, for piston jam nut and piston head nut. } On switch valve and cylinder.
12. WRENCH, for foundation bolts on switch cylinder, and for magnet cap and air inlet on signal cylinder.
13. WRENCH, for yoke and cylinder head bolts on switch valve, and for magnet base bolt on signal cylinder.
14. WRENCH, for oil plugs on switch cylinder.
15. WRENCH, for bolts on signal cylinder circuit breaker.
16. WRENCH, for oil plug and pin valve guide on signal cylinder.
17. WRENCH, for armature stem nut and for pin valve guides on switch valves.
18. WRENCH, for armature stem nut, and binding post nuts on signal cylinder.
19. WRENCH, for $\frac{3}{4}''$ lag screw.
20. WRENCH, for $\frac{3}{4}''$ bolt.
21. WRENCH, for $\frac{1}{2}''$ lag screw.
22. WRENCH, for $\frac{1}{2}''$ bolt, long shank.
23. WRENCH, for $\frac{1}{2}''$ bolt, short shank.
24. WRENCH, for $\frac{3}{8}''$ bolt.
25. PIN WRENCH, for signal cylinder follower nut.
26. PIN WRENCH, for switch valve piston packing nut.
27. $\frac{3}{8}''$. } Screw-drivers, black walnut handles.
28. $\frac{1}{4}''$. } Screw-drivers, black walnut handles.
29. $\frac{3}{16}''$. } Screw-drivers, black walnut handles.
30. T HEAD SCREW-DRIVER, $\frac{3}{8}''$.
31. SPECIAL DOUBLE SCREW-DRIVER, $\frac{1}{4}''$.
32. EYE BOLT, for removing switch valve piston.

No. PLATE 97.

33. Re-tapering Tool, for signal armature stem.
34. Re-seating Tool, for armature stem seat in switch valve.
35. Re-seating Tool, for pin valve seat in switch valve.
36. Guide, for No. 35.
37. Guide, for grinding pin valve into seat of switch movement lock cylinder, and into valve seat of signal cylinder.
38. Guide, for grinding pin valve into seat of switch valve.
39. Re-tapering Tool, for switch valve armature stems.
40. Re-seating Tool, for armature stem seat in signal valve.
41. Re-seating Tool and Guide, for pin valve seat in signal cylinder.
42. Drill, for No. 3; give size in ordering.
43. Drift, $\frac{1}{8}''-\frac{1}{4}''$ x 3″, for general use.

Various Electrical Testing Instruments.

PLATE 98.

ORDER BY PLATE AND LETTER.

A. Voltmeter.

B. Ammeter.

C. Mil-ammeter.

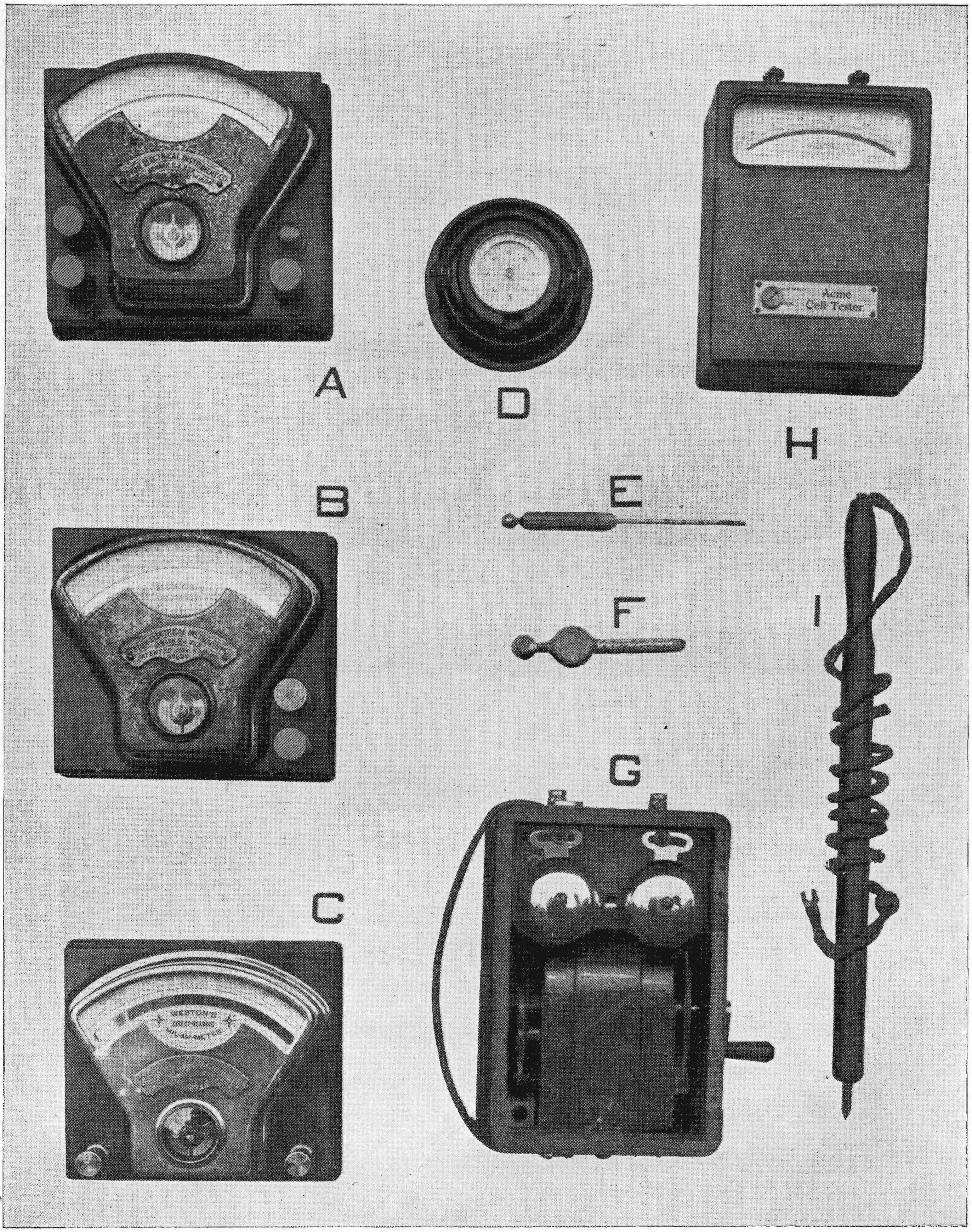
D. Galvanometer.

E.
F. } Hydrometers. { Two forms suitable for testing the specific gravity of storage and gravity batteries.

G. Magneto.

H. Voltmeter, for storage batteries.

I. Connecting Piece, for Fig. H.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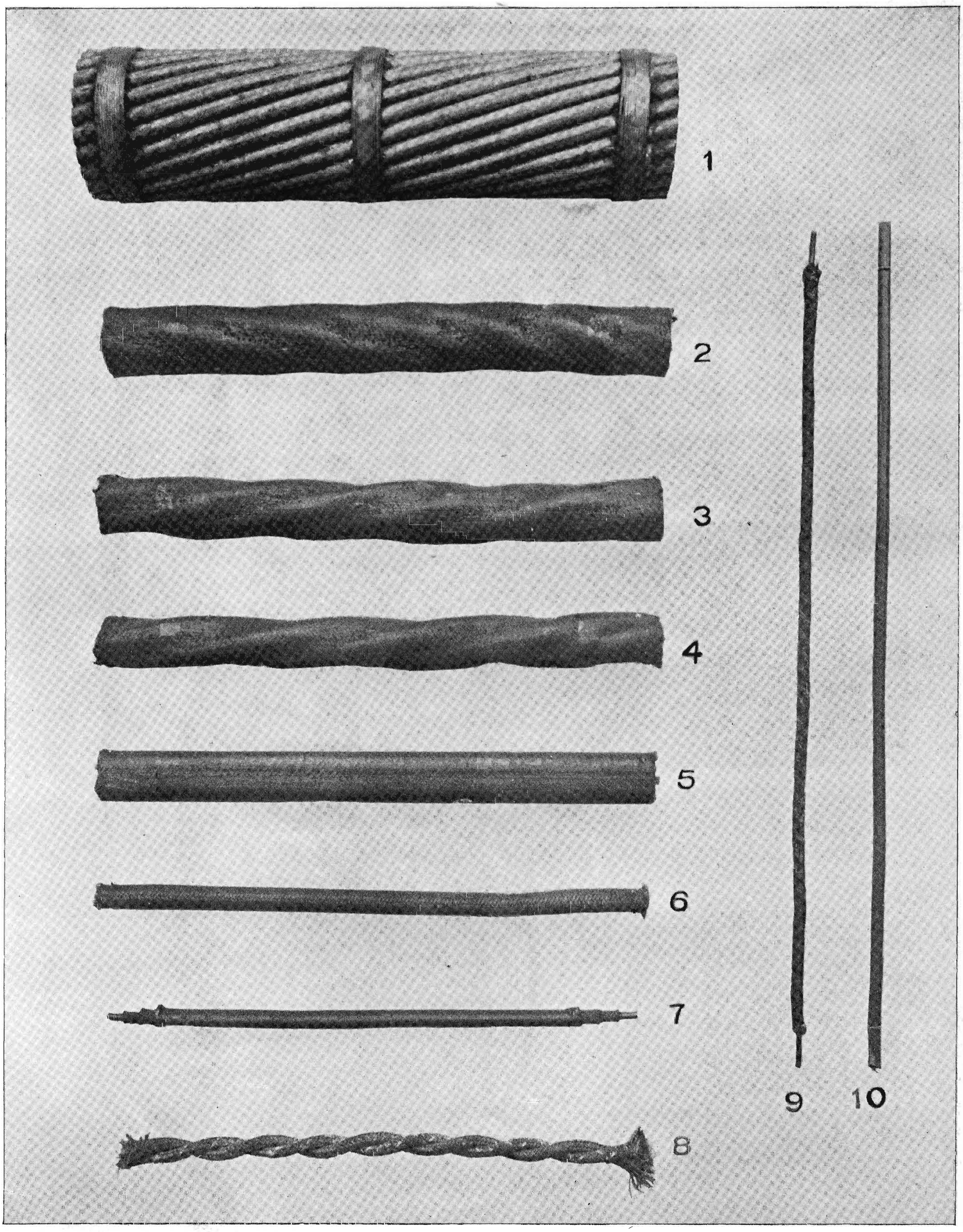
Cell Tester
WESTON'S
DIRECT-READING
MIL-AM-METER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Different Kinds of Conducting Wires.

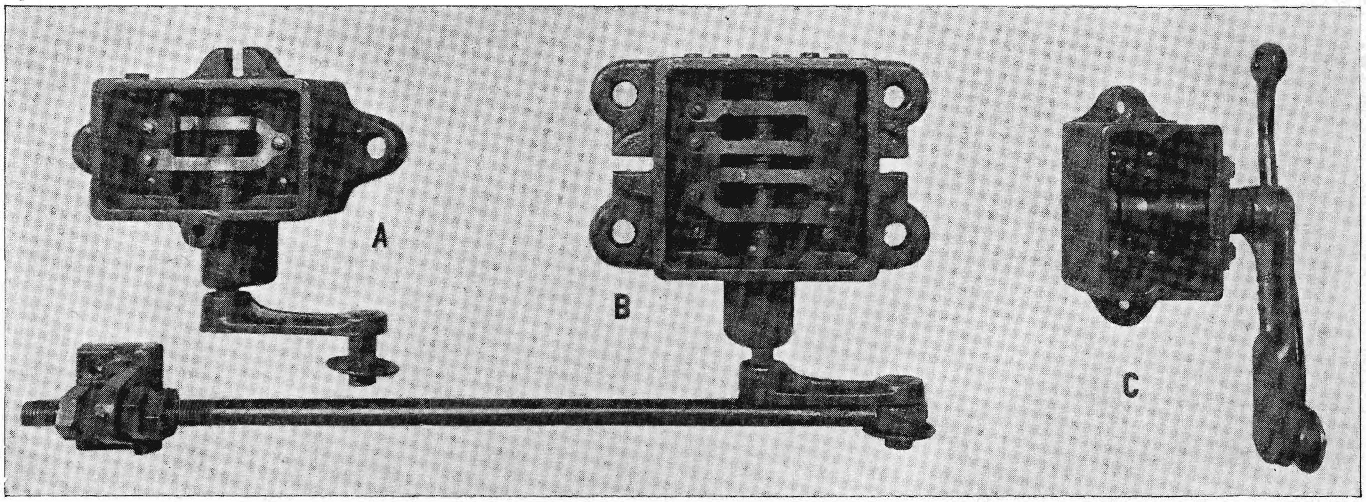
PLATE 99.

ORDER BY PLATE AND NUMBER.

No.

1. Armored Cable, specify in ordering the number and size of wires that it is to contain.
2. Insulated Cable, 5 conductors.
3. Insulated Cable, 4 conductors.
4. Insulated Cable, 3 conductors.
5. Insulated Cable, 2 conductors.
6. Insulated Cable, 1 conductor.
7. Compound Insulated Wire.
8. Flexible Electric Light Wire.
9. Braided Office Wire.
10. Galvanized Iron Line Wire.

Give size of wire required.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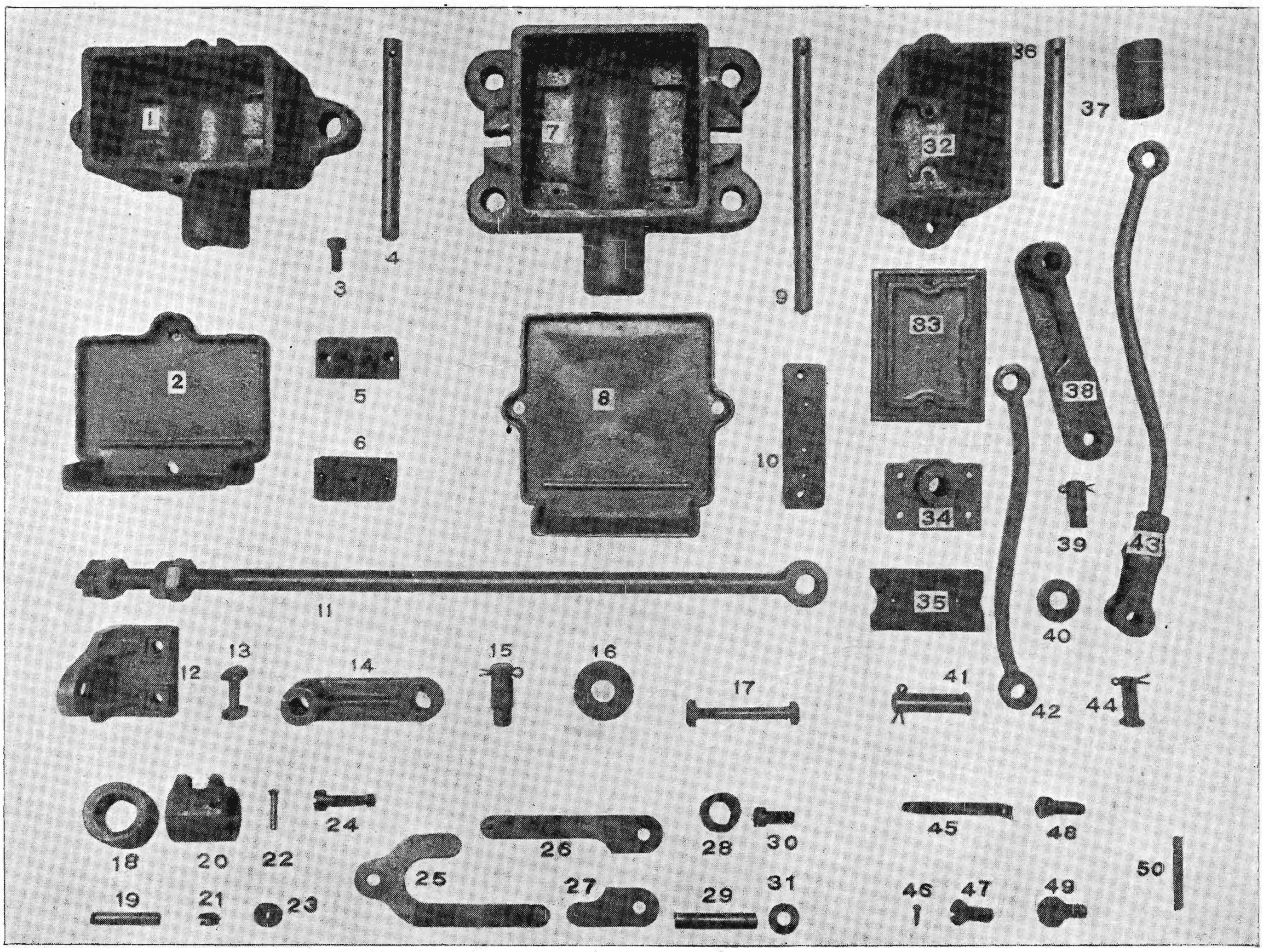
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Switch and Signal Circuit Breakers.

PLATE **100.**

A. SINGLE SWITCH CIRCUIT BREAKER.

B. DOUBLE SWITCH CIRCUIT BREAKER.

Both A and B are placed upon the cross-tie near the point of a switch to which they are joined by the rod (No. 11) and the clip (No. 12). They are usually connected with the track circuit in such a way as to break the circuit whenever the switch is not set for the main route. Fig. C may also be used for this purpose if desired.

C. SIGNAL CIRCUIT BREAKER.—This form is sometimes placed upon an electro pneumatic signal pole and is connected with the counterweight lever of the home signal through the link (No. 42) shown below. The circuit controlling the distant signal magnet is then led through Fig. C, and is broken whenever the home signal, immediately in advance of, or the home signal on the same post with the distant signal, stands in the danger position. Fig. C is also placed upon a mechanical signal pole for controlling the circuit leading to an electric slot upon another signal pole, and it may, in addition, be used for breaking any circuit that depends upon the position of a semaphore signal. If desired, it may be used in place of Figs. A and B.

ORDER BY PLATE AND NUMBER.

	No.	
PARTS RELATING TO A, ONLY.	1.	BOX.
	2.	COVER.
	3.	TAP BOLT, 3/8″ x 3/4″, for oil hole in Nos. 1 and 2.
	4.	SHAFT, for cams, No. 20, and crank, No. 14.
	5.	RUBBER BASE, for two contact strips.
	6.	RUBBER BASE, for one contact strip.
PARTS RELATING TO B, ONLY.	7.	BOX.
	8.	COVER.
	9.	SHAFT, for cams No. 20 and crank No. 14.
	10.	RUBBER BASE, for contact strips.
PARTS RELATING TO BOTH A AND B.	11.	ROD AND JAM NUTS, for connecting A and B with track.
	12.	RAIL CLIP.
	13.	BOLT AND NUT, 3/8″ x 1 1/2″, for fastening No. 12 to track.
	14.	CRANK.
	15.	STUD, 3/4″, AND COTTER, for No. 14.
	16.	WASHER, 3/4″, for No. 15.

PLATE 100.

No.

Parts Relating to Both A and B.

17. Bolt and Nut, 3/8″ x 3 1/4″, for fastening No. 2 to No. 1, and No. 8 to No. 7.
18. Ring, for holding Nos. 4 and 9 in place.
19. Rivet, for No. 18.
20. Cam.
21. Set Screw, 1/4″ x 10–32, for No. 20.
22. Rivet, for No. 23.
23. Rubber Roller, for No. 20.
24. Machine Screw, 3/4″ x 12–32, for fastening Nos. 5, 6 and 10.
25. } Phosphor Bronze Contact Springs. Double.
26. } Phosphor Bronze Contact Springs. Long.
27. } Phosphor Bronze Contact Springs. Short.
28. Rubber Bushing, 7/16″–5/8″, for wire holes in Nos. 1 and 7.
29. Rivet, for fastening No. 14 to Nos. 4 and 9.

Parts Common to A, B and C.

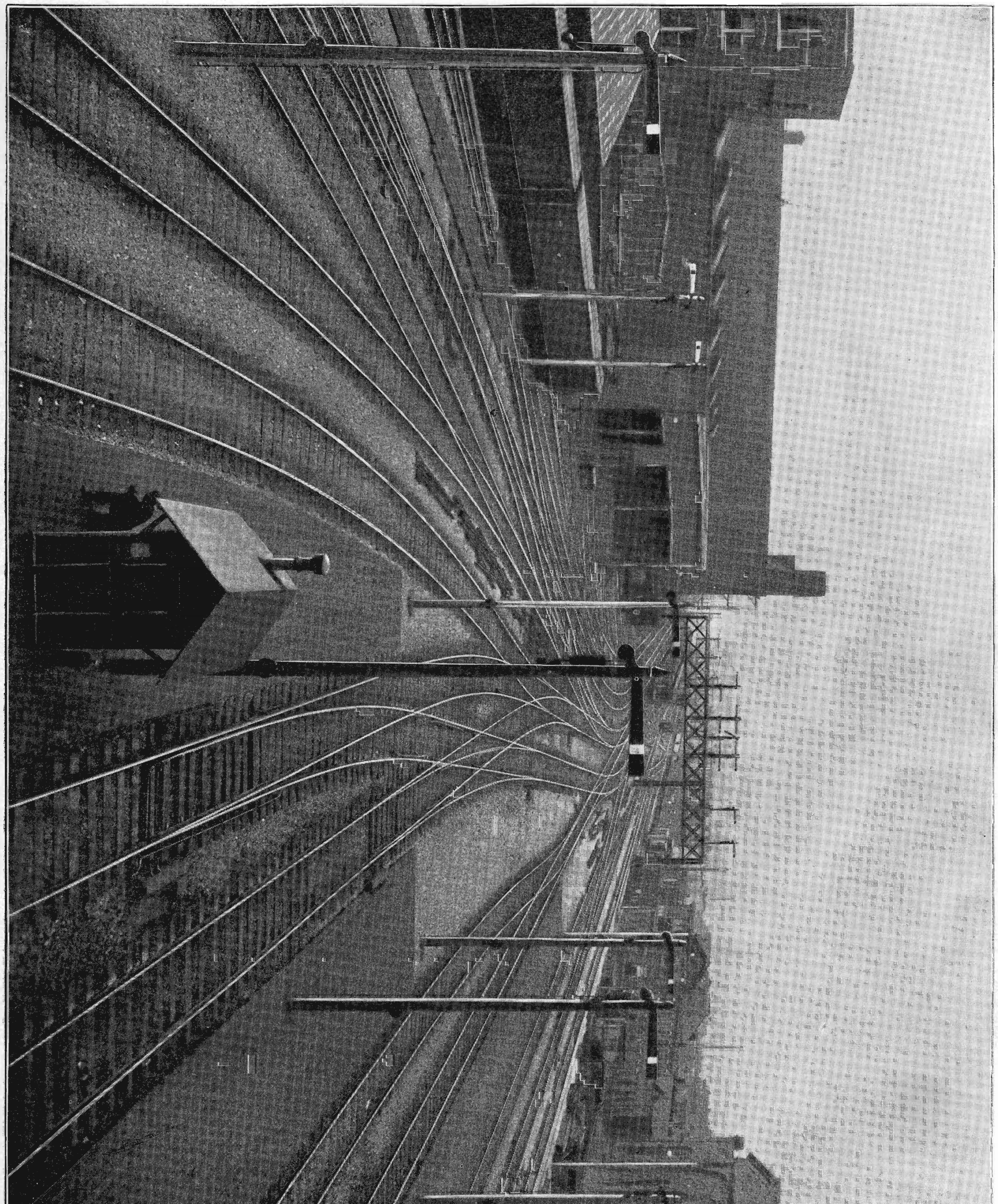
30. Machine Screw, 1/2″ x 12–24, for wires on Nos. 25, 26, 27 and 45.
31. Washer, 7/32″–7/16″, for No. 30.

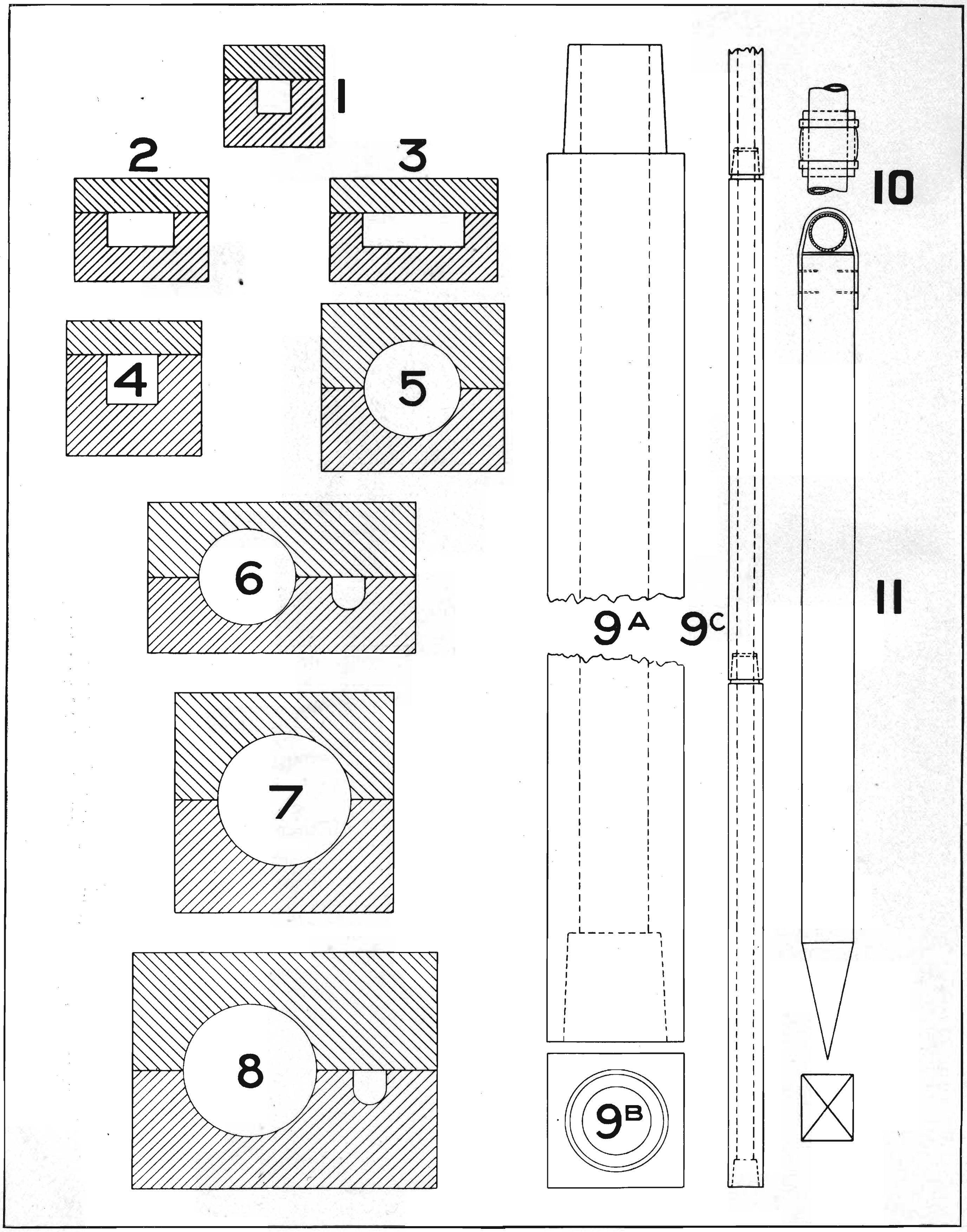
Parts Relating to C, Only.

32. Box.
33. Cover.
34. Journal.
35. Rubber Base, for contact strips.
36. Shaft.
37. Rubber Roller.
38. Crank.
39. Stud, 5/8″, and Cotter, for No. 38.
40. Washer, 5/8″, for No. 39.
41. Turned Pin, 5/8″ x 2 5/16″, and Cotter, for connecting No. 42 with the counterweight lever on a semaphore post.
42. Link, with two eyes.
43. Link, with eye and screw jaw.
44. Turned Pin and Cotter, for jaw on No. 43.
45. Phosphor Bronze Strip. State whether contact strip or roller strip is required.
46. Wood Screw, 3/8″–#2, for fastening No. 45 to No. 35.
47. Machine Screw, 5/8″ x 14–20, for fastening No. 33 to No. 32.
48. Machine Screw, 5/8″ x 12–32, for fastening No. 35 to No. 32.
49. Tap Bolt, 1/2″ x 1/4″–20, for fastening No. 34 to No. 32.
50. Rivet, for fastening No. 37 to No. 36.

PLATE 101.

A view of the tracks and signals at the Philadelphia Terminal of the Pennsylvania Railroad, looking from the end of the train shed. See also Plates 22, 31, 120 and 122.




1
2
3
4
5
6
7
8
9A
9C
9B
10
11

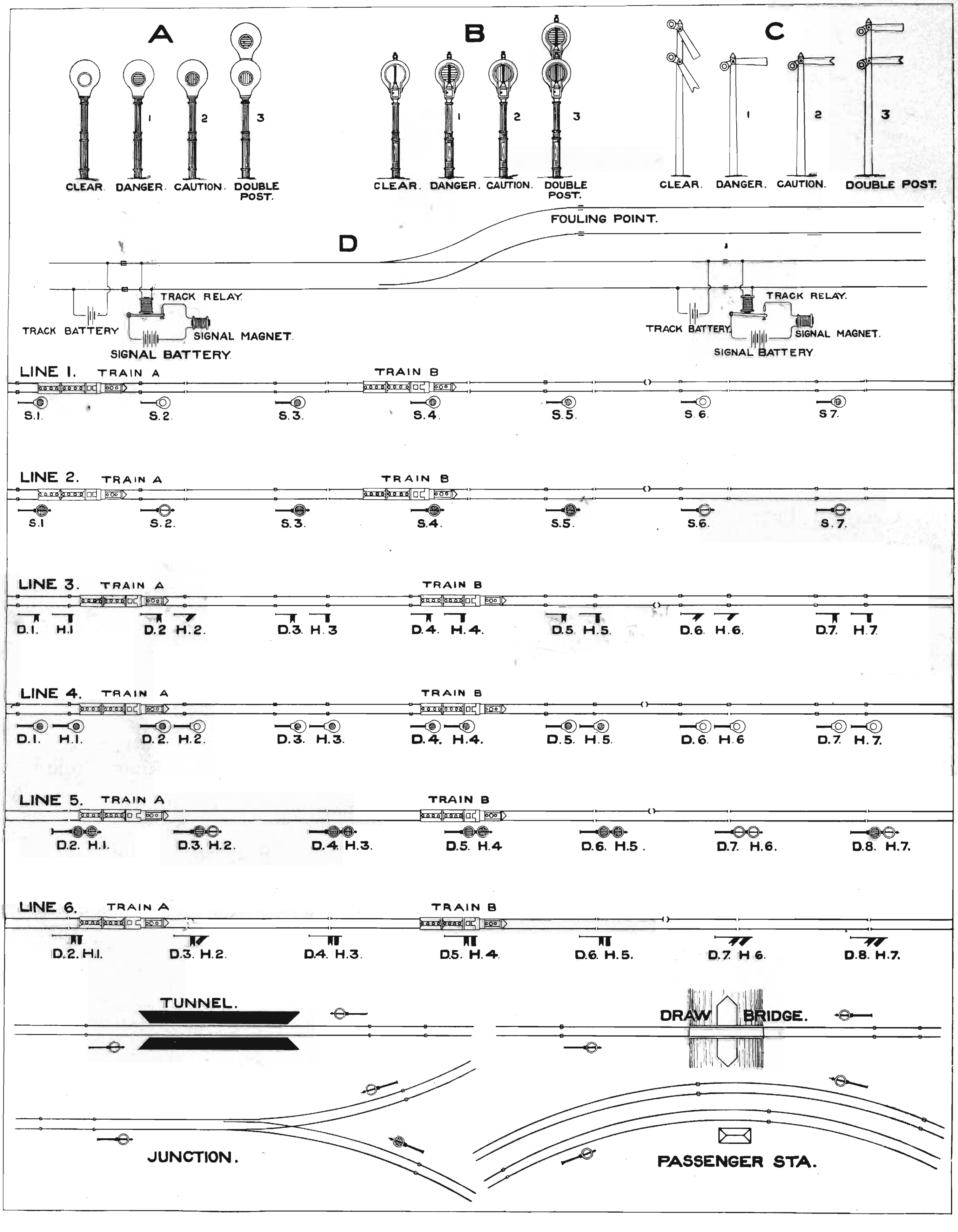
Trunking for Wire and Pipe. Oak Stake and Guide for Pipe.

PLATE 102.

ORDER BY PLATE AND NUMBER.

No.

1. Grooved Trunking, hole 1″ x 1″. } For conducting wires.
2. Grooved Trunking, hole 1″ x 2″. } For conducting wires.
3. Grooved Trunking, hole 1″ x 3″. } For conducting wires.
4. Grooved Trunking, hole 1½″ x 1½″, for ¾″ pipe.
5. Grooved Trunking, hole 2⅞″ diam., for 2″ pipe.
6. Grooved Trunking, same as No. 5, except additional hole for cable.
7. Grooved Trunking, hole 4″ diam., for 3″ pipe.
8. Grooved Trunking, same as No. 7, except additional hole for cable.
9. Tube Trunking, hole 4″ diam.
   - A. Plan of Single Piece.
   - B. End View.
   - C. Small Scale Plan, showing method of connecting.
10. Pipe Guide, consisting of strap, plate and 4 nails; shown in position on top of No. 11, and used for 2″ or 3″ pipe.
11. Oak Stake, 3″ x 4″ x 5′, for supporting pipe run above ground. The guide shown here must be ordered separately, if desired.


A
1
2
3
CLEAR. DANGER. CAUTION. DOUBLE POST.
B
1
2
3
CLEAR. DANGER. CAUTION. DOUBLE POST.
C
1
2
3
CLEAR. DANGER. CAUTION. DOUBLE POST.
D
FOULING POINT.
TRACK RELAY.
TRACK BATTERY
SIGNAL MAGNET.
SIGNAL BATTERY
TRACK RELAY.
TRACK BATTERY.
SIGNAL MAGNET.
SIGNAL BATTERY
LINE 1. TRAIN A
TRAIN B
S.1. S.2. S.3. S.4. S.5. S.6. S.7.
LINE 2. TRAIN A
TRAIN B
S.1 S.2. S.3. S.4. S.5. S.6. S.7.
LINE 3. TRAIN A
TRAIN B
D.1. H.1 D.2 H.2. D.3. H.3 D.4. H.4. D.5. H.5. D.6. H.6. D.7. H.7.
LINE 4. TRAIN A
TRAIN B
D.1. H.1. D.2. H.2. D.3. H.3. D.4. H.4. D.5. H.5. D.6. H.6 D.7. H.7.
LINE 5. TRAIN A
TRAIN B
D.2. H.1. D.3. H.2. D.4. H.3. D.5. H.4 D.6. H.5. D.7. H.6. D.8. H.7.
LINE 6. TRAIN A
TRAIN B
D.2. H.1. D.3. H.2. D.4. H.3. D.5. H.4. D.6. H.5. D.7. H 6. D.8. H.7.
TUNNEL.
DRAW BRIDGE.
JUNCTION.
PASSENGER STA.

Automatic Block Signaling.

PLATE 103.

IT IS proposed to give in this description a general idea of the track circuit principle, together with a few of its most important applications. In order to do this most simply, we have shown under the letters A, B and C at the top of the plate the three signals which are appropriate for the purpose. These signals differ in form and in the force which causes them to change their positions, but the Signal Magnet, Fig. D, is common to all of them, and depending on whether this magnet is excited or discharged rests the question as to what indication will will be given by the signal; the reasons for this are more particularly stated in the description attending Plates 107, 106 and 78, which respectively illustrate Figs. A, B and C. Suffice it to say here, that all of the home signals 1 A, 1 B, 1 C, are referred to in the description relating to S 1, S 2, etc., H 1, H 2, etc., on LINES 1, 2, 3 and 4; that all of the distant signals 2 A, 2 B, 2 C are referred to in the description attending D 1, D 2, etc., on LINES 3 and 4; and that any of the double posts 3 A, 3 B, 3 C are to be understood as being referred to in the description of LINES 5 and 6.

The simplest form of track circuit is illustrated in Fig. D, and consists of a section of railroad, commonly called a "Block," the adjacent rails of which are electrically connected by what are known as track wires, while the ends of each block are insulated from the ends of the adjacent blocks by wooden splices or other non-conducting material. At the farther end of each block is located a track battery, consisting of one or two (seldom more) gravity cells which supplies the current for the rails and the track relay. When the track is in its normal condition, that is, no broken rails, all switches set for the main route, and no train within the limits of the block, the current will flow from one pole of the battery through one line of rails, thence through the track relay and the other line of rails to the other pole of the track battery; should, however, a rail be broken, a switch misplaced, or a pair of wheels be standing beyond the fouling point on a side track or on the main track itself, the current from the track battery, which is very light, is either diverted from, or prevented from reaching, the track relay, which, having a comparatively high internal resistance, remains unexcited. The armature bar of the track relay is pivoted at one end, and at the other end presses against a spring and closes a contact when the track relay magnet is excited. The closing of this contact completes a circuit through the signal magnet and the signal battery which has, as a final effect, the clearing of the signal. It therefore follows that any interruption or diversion of the current from the course above described will result in a danger signal; since each signal is so constructed as to go to and remain at danger in case the power which operates the signal fails, the reliance that is placed upon properly constructed and maintained, automatic track circuit signals by all of those who are concerned with them is easy to be understood.

LINE 1.—In this arrangement a signal occupies the danger position until a train enters the block in its rear, and then, if everything is safe on the block and overlap in advance, assumes the clear position, which it retains until the first pair of wheels passes the block insulation shown like this —□—, near the foot of the post, when it resumes the danger position and holds it under all circumstances until the last pair of wheels has passed the overlap insulation, shown like this —| |—, beyond the next signal in advance; the signal may then be cleared by an approaching train as in the first instance, but will otherwise remain at danger. Train A having passed S 1 holds it at danger, but as it has entered the clearing section of S 2, and nothing interferes in advance, S 2 is found in the clear position. Train B having passed into the block of S 4 holds it, as well as S 3, whose block it has not entirely left, at danger; under ordinary circumstances, S 5 should be in the clear position since there is no train in advance of it, but in this case there is a broken rail, shown like this —( )—, which serves the same purpose and holds S 5 at danger, while for the same reason S 6 is in the clear position, for in this arrangement of circuits it is the interruption of the current in the block immediately in the rear of a signal which first tends to clear that signal. This last feature, although at first glance it seems to be singular, is entirely correct, since it is the danger in advance of a signal which it is supposed to indicate. In consequence of this condition, train B will follow a well known rule; it will pause upon reaching S 5 and after waiting a certain number of minutes will proceed with great care through the blocked section until it reaches S 6, when its course will be clear; S 7 in this line is in the danger position, because, although the track may be uninterrupted in advance, there is nothing on the block immediately in its rear to cause it to assume the clear position.

LINE 2.—Here the arrangement of circuits differs from that just described only in the fact that the signals remain in the clear position at all times when there is no interruption on the block and overlap immediately in advance. Train A having passed S 1 holds it at danger, and finds S 2 at clear, because train B has passed out of the section which controls that signal. Train B now occupies both of the sections that control S 3 and S 4, and it therefore holds both of those signals at danger; upon reaching S 5 train B must come to a stop, for the signal is at danger, owing to the presence of a broken rail. After waiting a certain number of minutes train B will proceed with great caution until it has reached S 6, when it will continue with confidence under the assurance of a clear signal; S 7 is seen to be in the clear position, since, as already stated, the presence of a train on the block immediately in its rear is not necessary for clearing it in this arrangement.

LINE 3.—Under this system the overlapping feature has been abandoned, but is replaced by distant signals, which are located between 1,200 and 2,000 feet in the rear of the home signals, upon whose position they partially depend. In this arrangement the signals keep the danger position until a train enters the section immediately in their rear, as was described in Line 1. Train A having passed D 1, H 1 and D 2 holds them at danger, but since the clearing section of H 2 has been entered, that signal stands at safety. Train B has entered the clearing section of D 5 and H 5, but a broken rail in advance of them holds them at danger, for which reason train B will stop upon reaching H 5 and then proceed with care until it reaches D 6 and H 6, which are in the clear position. D 7 and H 7 naturally stand at danger, since no train has entered the clearing section in their rear.

LINE 4.—The signals shown here are located the same with reference to the blocks as are those on Line 3, but their usual position is at safety, as described in Line 2, instead of being caused to assume that position by an approaching train. Train A has passed D 1, H 1 and D 2, and is therefore holding them at danger, while H 2 is at clear, because train B has passed out of its territory, but D 5 and H 5 are at danger, since there is a broken rail on their controlling block. D 6, H 6, D 7 and H 7 are clear, for the track ahead is intact and unoccupied.

LINE 5.—Here the distant signal has been moved back, and now, instead of being placed within 1,200 or 2,000 feet of the home signal, upon which it depends, is placed directly under and on the same post, with the next home signal in the rear. On this line the signals are caused to assume the clear position by an approaching train. Train A has passed D 2, H 1, and is approaching D 3, H 2; it has cleared H 2, but D 3 remains at caution, because train B has not passed out of the block in advance of H 3 in concert with which D 3 works. It is evident to train A, from the position of D 3, that it may find H 3 at danger, and speed is therefore reduced. Train B has found D 5 at caution, for H 5 is confronted by a broken rail; but H 4 was clear, and train B is therefore proceeding, knowing that the block it is in is clear, but that it may find a danger signal upon reaching H 5. This proves to be the case, and train B must stop, wait the stated length of time, and then proceed with great care until another clear signal is reached.

PLATE 103.

LINE 6.—The arrangement of signals is the same on this line as on line 5, but instead of being cleared by an approaching train they stand ordinarily in the clear position, and only go to danger in the presence of danger. Train A holds D 2, H 1 at caution and danger, but finds H 2 clear. The reasons for this are obvious; D 3, however, being controlled by H 3, is at caution, for train B occupies the block in advance of H 3. On reaching D 6, H 5, train B will come to a stop, made necessary by the presence of a broken rail in advance of H 5; after a pause train B will proceed with great care until it reaches D 7, H 6, which both of them stand in the clear position, and consequently show that at least two blocks are clear in advance.

TUNNEL, DRAW-BRIDGE, JUNCTION.—These figures are given merely as suggestions and to show some of the various applications of which the track circuit automatic signals are susceptible.

PASSENGER STATION.—Here the signals are cautionary, and for the purpose of warning an approaching train on a double-track railroad that a train is occupying the other track in front of the station.

We have not attempted to either illustrate or describe more than a very few of the infinite number of arrangements to which the track circuit may be applied. We, however, shall take great pleasure in estimating on or designing special circuits.

Battery Housings and Relay Box.

PLATE 104.

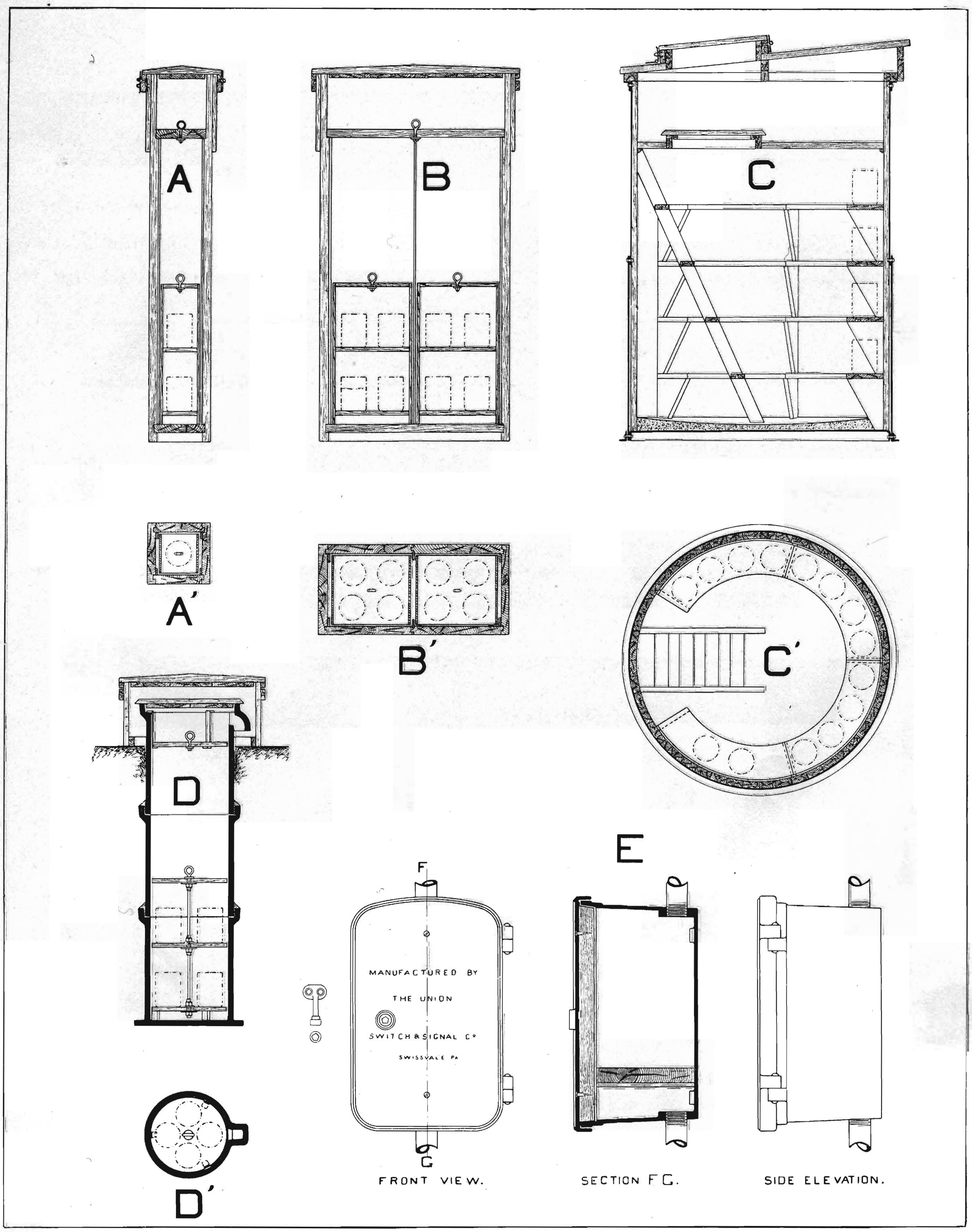
ORDER BY PLATE AND LETTER.

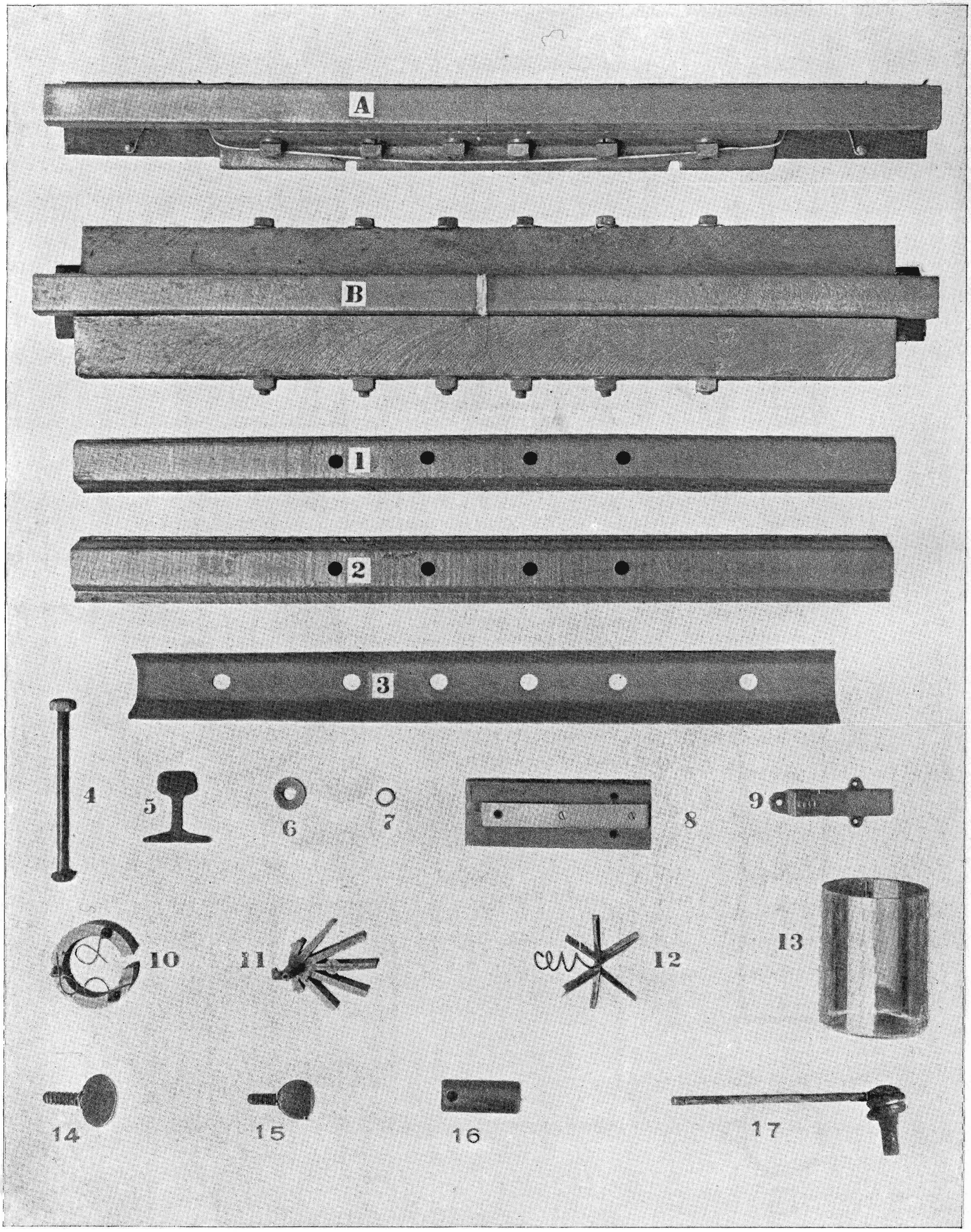
A–A′. WOODEN BATTERY CHUTE, for 2 cells.
B–B′. WOODEN BATTERY CHUTE, for 16 cells.
} This style is also made in sizes to contain 4, 6 and 8 cells.

C–C′. IRON BATTERY WELL, capacity of 64 cells.

D–D′. TERRA COTTA BATTERY CHUTE.

E. IRON RELAY BOX. We also manufacture wooden relay boxes of various styles; in ordering them it is only necessary to state for which relay on Plates 116, 117, 119, 121, 123 and 125 they are required.


A
B
C
A′
B′
C′
D
D′
E
F
G
MANUFACTURED BY
THE UNION
SWITCH & SIGNAL Cº
SWISSVALE PA
FRONT VIEW.
SECTION F G.
SIDE ELEVATION.


A
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15
16
17

Parts Relating to the Track Circuit.

PLATE 105.

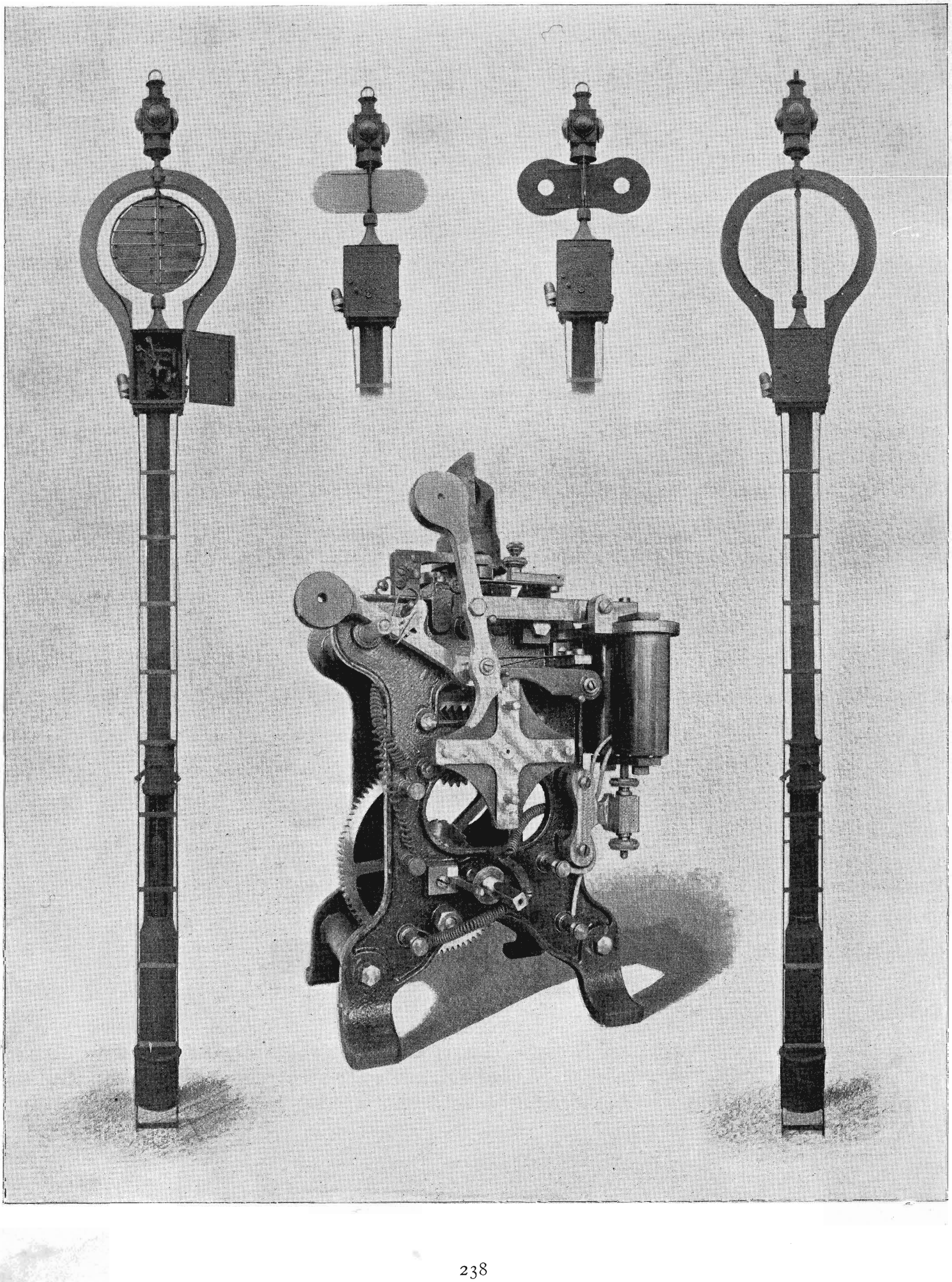
A. JOINT, showing track wire in place. In practice, two track wires are used at each joint, one on each side of the rails.

B. JOINT, showing splice wood insulation. Another method of insulating is by the use of ordinary angle bars, separated from the rails by No. 3. Fig. B is, however, to be preferred wherever it can be used.

ORDER BY PLATE AND NUMBER.

No.

1. INSIDE SPLICE WOOD. } In ordering, give the section and punching of the rail that they must fit.
2. OUTSIDE SPLICE WOOD. }
3. FIBRE ANGLE PLATE.
4. BOLT, ¾″, AND NUT, for fastening Nos. 1 and 2. In ordering, give required length from inside of head to end of bolt.
5. FIBRE END PIECE, for use in connection with Fig. B.
6. WASHER, ¾″. } For No. 4.
7. FIBRE BUSHING }
8. WOODEN SLIDE PLATES. } For raising the switch rail from the cross ties.
9. IRON SLIDE PLATES. }
10. } Two forms of the ZINC ELEMENT. } Parts relating to the battery only.
11. }
12. COPPER ELEMENT.
13. BATTERY JAR.
14. THUMB SCREW, for No. 11.
15. THUMB SCREW, for No. 16.
16. CONNECTING SLEEVE, for the terminals at No. 13.
17. Enlarged view of WIRE AND RIVET. This is used for two purposes: first as a TRACK WIRE, in which case a rivet is used at each end; second, as a CONNECTING WIRE, where only one end has a rivet. In ordering, specify the length of wire and size of rivet.



The Union Electric Banner Signal and the Union Electric Target Signal.

PLATE 106.

THESE signals differ only in the form of the blades by which the condition of the track in advance is indicated to approaching trains; the BANNER SIGNAL is shown on the outside edges of the illustration as it appears in actual service, the figure on the extreme left being in the danger position, while that on the extreme right indicates safety; at times, however, a safety blade No. 10, Plate 108, is added, which is seen while a signal stands in the position occupied by that on the right, furthermore, if circumstances require it, the two shields Nos. 3 and 4, Plate 108, are provided, which cover the back of the signal and lamp, hiding them from the sight of trains approaching from the wrong direction.

The TARGET SIGNAL is illustrated on the upper middle part of Plate 106, but since the post is exactly like that of the Banner Signal, it has been cut off in the picture. Of the Target Signals, the one on the left indicates safety, the one on the right danger, but these are not the only forms used with this signal, for on Plate 108 (Nos. 13, 14, 15 and 16), will be found various arrangements for this purpose.

The weight which operates all of these signals shows through the opening near the bottom of the left-hand post, while the controlling instrument, likewise common to all of them, is shown in its case at the top of the same post, and on a larger scale, in the centre of the page. The doors Nos. 2 and 20, Plate 108, are kept tightly closed when in service, as may be seen by the appearance of the two upper and the extreme right-hand signals.

A chain to which the operating weight is attached, passes over a sprocket wheel that is mounted on the shaft whose square end projects from the face of and near the bottom of the instrument; by means of the crank No. 23, Plate 109, which fits the shaft, the instrument is wound up. The signal magnets (referred to in the description attending Fig. D, Plate 103) are located upon the upper right-hand side of the instrument, and above the magnets, pointing to the left, is the armature bar, which, as its free end is alternately raised and lowered by the charging and discharging of the magnets, releases one of the detent toes Nos. 53 and 54, Plate 109, and holds the other raised. The office of the detent toes is to disengage and then engage the detent pawls Nos. 57 and 58, Plate 109, with the detent crosshead No. 40, Plate 109, first releasing the crosshead, then permitting it to make a quarter turn and finally hold it in its new position. The detent crosshead is mounted upon a shaft which carries one of the train of gears that change the vertical revolution derived from the weight, to the horizontal one necessary for the signal itself.

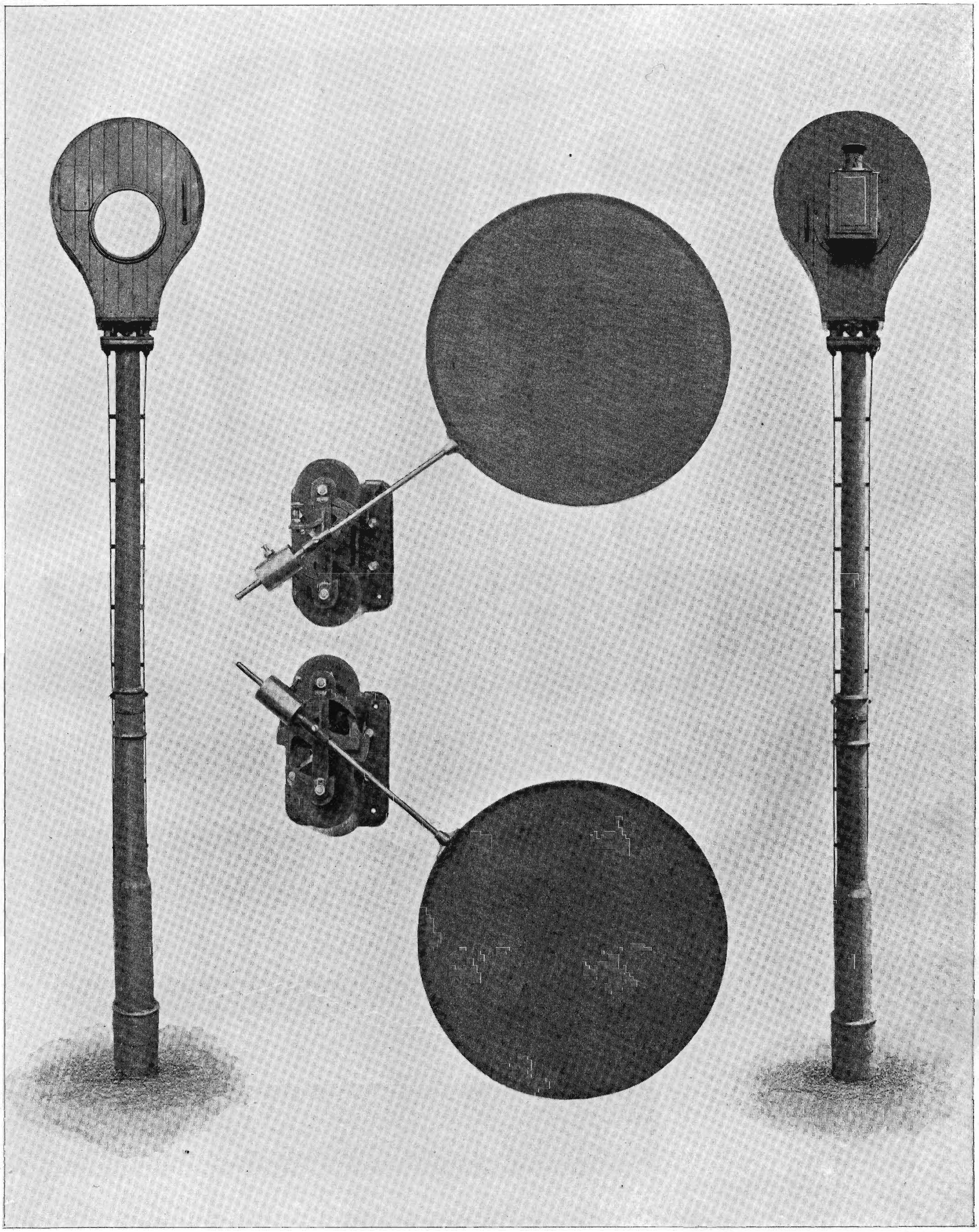
A round nut, whose office is to break the circuit to the signal magnets, when the operating weight is nearly run down, is carried on the shaft that also carries the before-mentioned sprocket wheel; this nut is guided by a brass finger which prevents it from revolving, but forces it to move forward as the shaft is turned by the falling of the weight. To the nut is fastened a hard rubber insulator, which, just before the weight has reached its lowest point, passes between and separates two contact springs through which the current to the signal magnet must go. Since the magnets are necessarily charged before a clear signal can be shown, this arrangement provides that the signal shall go to and remain at danger before the power derived from the weight is exhausted.

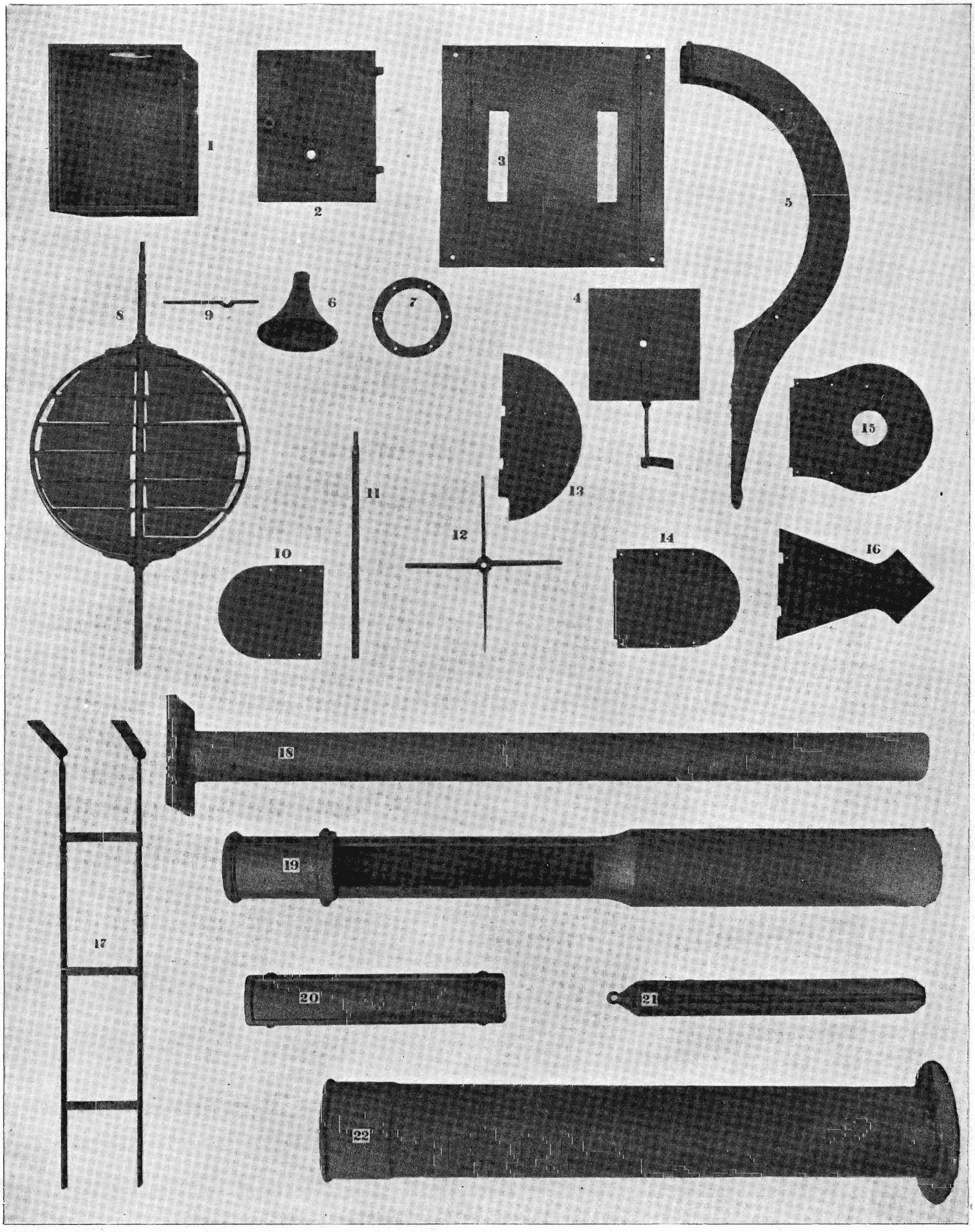
The separate parts of these signals are illustrated on Plates 108 and 109.

The Union Electric Disc Signal. PLATE 107.

THIS is our oldest form of signal, and is one which has been largely copied as to its external appearance. The lamp which illuminates the signal at night is provided with a powerful reflector, by means of which an extremely strong night signal is furnished. One peculiar feature, which will recommend it to all practical men, is the fact that as the background is made of thin white cloth, the lamp need never be removed for any purpose but to clean it.

The figure on the left illustrates the face of the signal as seen by an approaching train; the right-hand figure shows the rear of the case and the position of the lamp. Of the two large scale figures the upper one is the safety position of the disc; the lower one, the danger position. This disc is made usually of thin red silk stretched upon a brass wire frame, that is fastened to, and revolves with, the armature of the signal magnet. When the signal magnet is charged (as illustrated by Fig. D, Plate 103), the disc is drawn up and disappears in the upper part of the case, leaving the white background exposed; upon the breaking of the circuit the disc falls by gravity and comes into view. By this it will be seen that, unlike our other automatic signals, the magnets in this one not only control but also furnish the power to move the signal.

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The Union Electric Banner Signal, and the Union Electric Target Signal.

LARGE PARTS.

PLATE 108.

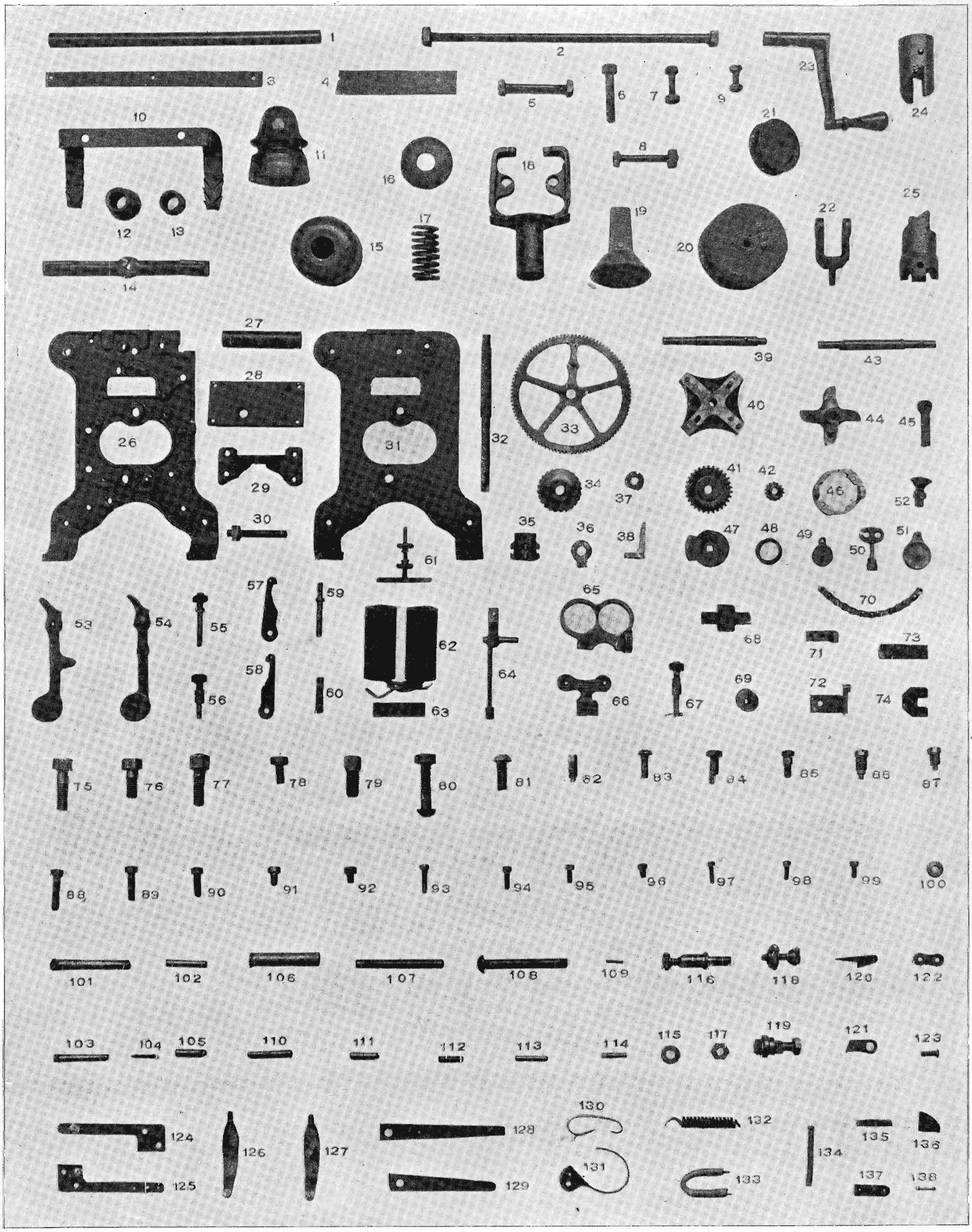
ORDER BY PLATE AND NUMBER.

No.

1. Case.
2. Door of Case.
3. Shield, for back of banner; this is made in different forms.
4. Shield, for back of lamp on banner signals.
5. Yoke.
6. Bell.
7. Rubber Gasket, for bell.
8. Banner and Shaft.
9. Arm, for sheet iron safety piece No. 10. The safety piece is not always used, in which case the arm is omitted.
10. Safety Piece (sheet iron), sometimes used in connection with the banner signal.
11. Shaft, for target signal.
12. Cross Arm, for sheet iron pieces Nos. 13, 14, 15 and 16.

13., 14., 15., 16. } Different forms of sheet iron pieces used in connection with the target signal.

17. Ladder, standard length is 13 ft. 6 in.
18. Upper Section of Post.
19. Middle Section of Post.
20. Door of Post.
21. 100 lb. Weight.
22. Bottom Section of Post. Standard length is 5′, but it can be made 10′ long if desired.


1 2 23 24
3 4 5 6 7 9 21
10 11 16 18 8
12 13 15 17 19 20 22 25
14
27 39 43
28 40 44 45
26 31 32 33
41 42 46 52
29 34 37
30 35 36 38 47 48 49 50 51
61
57 59 65 70
53 54 55 62 68 73
71
58 64 69 72
56 60 63 66 67 74
75 76 77 78 79 80 81 82 83 84 85 86 87
88 89 90 91 92 93 94 95 96 97 98 99 100
101 102 106 107 108 109 116 118 120 122
103 104 105 110 111 112 113 114 115 117 119 121 123
130 132
124 126 127 128 135 136
131 134
125 129 133 137 138

The Union Electric Banner and Target Signals.

SMALL PARTS.

PLATE 109.

ORDER BY PLATE AND NUMBER.

No.

1. Gas Pipe, ½″ x 14″, filling piece for No. 2.
2. Bolt and Nut, ½″ x 15½″, for fastening No. 3, Plate 108, to No. 5, Plate 108.
3. Weather Strip.
4. Rubber Packing, for No. 3.
5. Bolt and Nut, ½″ x 3½″, for joining No. 18, Plate 109, and Nos. 4 and 5, Plate 108, (front). See No. 8.
6. Tap Bolt, ½″ x 2½″, for joining (Plate 108), Nos. 1, 17 and 18.
7. Bolt and Nut, ⅜″ x 1½″, for joining No. 5, Plate 108, to No. 1, Plate 108.
8. Bolt and Nut, ½″ x 3″, for joining No. 18, Plate 109, and No. 5, Plate 108, (back). See No. 5.
9. Bolt and Nut, ⅜″ x 1″, for fastening No. 10, Plate 109, to No. 1, Plate 108.
10. Insulator Bracket.
11. Glass Insulator.
12. Bushing, for No. 6, Plate 108. } Used only with Target Signal.
13. Bushing, for No. 15, Plate 109, } Used only with Target Signal.
14. Strip, for fastening Nos. 26 and 31, Plate 109, to No. 1, Plate 108.
15. Weather Cap.
16. Lead Washer, for No. 15.
17. Compensator Spring.
18. Upper Bearing, for No. 8, Plate 108.
19. Lamp Spindle.
20. Counterweight.
21. Counterweight Pulley.
22. Counterweight Jaw.
23. Winding Crank.
24. Upper Compensator.
25. Lower Compensator.
26. Front Frame Plate.
27. Connecting Piece, for Nos. 26 and 31.
28. Top Plate.
29. Vertical Shaft Bracket.
30. Stud and Nut, for fastening No. 31, Plate 109, to No. 1, Plate 108.
31. Back Frame Plate.
32. Main Shaft.

No.

33. Main Gear.
34. Ratchet Wheel.
35. Sprocket Wheel.
36. Binding Collar, for No. 32.
37. Circuit Breaker Nut, for No. 32.
38. Guide, for No. 37.
39. Vertical Shaft.
40. Detent Crosshead and Stop Pins.
41. Mitre Gear.
42. Pinion, for No. 43.
43. Intermediate Shaft.
44. Coupling Crosshead.
45. Stop Latch.
46. Circuit Breaker Cam.
47. Door Lock.
48. Door Lock Spring.
49. Door Lock Escutcheon.
50. Door Key.
51. Winding Hole Escutcheon.
52. Door Knob of Case.
53. Rear Detent Toe.
54. Front Detent Toe.
55. Stud and Nut, for Nos. 53 and 54.
56. Stud and Nut, for Nos. 57 and 58.
57. Rear Detent Pawl.
58. Front Detent Pawl.
59. Stop Pin, for Nos. 53 and 54.
60. Rubber Tube, for No. 59.
61. Back Strap, Stud and Nut.
62. Magnets. In ordering, give the resistance required in ohms.
63. Armature.
64. Armature Bar.
65. Spectacle.
66. Magnet Bracket.
67. Stud and Nut, for No. 69.
68. Chain Coupling.
69. Chain Roller.
70. Chain, standard length 27′. See Nos. 122 and 123.
71. Bracket, for detent pawl spring.

No. **PLATE 109.**

72. BRACKET, for armature bar spring.

73. HARD RUBBER BASE, for Nos. 124 and 125.

74. HARD RUBBER BASE, for Nos. 126 and 127.

IRON.

75. CAP SCREW, $\frac{5}{16}''$ x $1\frac{1}{4}''$, for joining Nos. 26, 27, 31 and 72.

76. CAP SCREW, $\frac{5}{16}''$ x $\frac{3}{4}''$, for joining Nos. 26, 27 and 31.

77. CAP SCREW, $\frac{5}{16}''$ x $1''$, for clamping (Plate 108) No. 9 to No. 8.

78. CAP SCREW, $\frac{1}{4}''$ x $\frac{1}{2}''$, for fastening No. 61 to No. 62.

79. SET SCREW, $\frac{3}{8}''$ x $\frac{3}{4}''$, for fastening (Plate 108) No. 12 to No. 11.

80. MACHINE SCREW, $1\frac{1}{2}''$ x 18–16, for fastening No. 45 to No. 28.

81. MACHINE SCREW, $\frac{3}{4}''$ x 18–16, for fastening (Plate 108) No. 6 to No. 1.

82. SET SCREW, $\frac{3}{4}''$ x $\frac{1}{4}''$–32, for joining Nos. 25 and 46.

83. MACHINE SCREW, $\frac{5}{8}''$ x 12–24, for fastening (Plate 108) No. 9 to No. 10, and for fastening Nos. 13, 14, 15 and 16 to No. 12.

84. DETENT PIN AND NUT, for No. 54.

85. MACHINE SCREW, $\frac{5}{8}''$ x 12–24, for fastening No. 121 to No. 33.

86. TRUNNION SCREW, for front } of No. 64.

87. TRUNNION SCREW, for rear } of No. 64.

BRASS.

88. MACHINE SCREW, $\frac{7}{8}''$ x 12–32, for fastening Nos. 29 and 66 to No. 26, and No. 74 to No. 26.

89. MACHINE SCREW, $\frac{3}{4}''$ x 12–32, for fastening No. 71 to No. 26, and No. 28 to Nos. 26 and 31.

90. MACHINE SCREW, $\frac{5}{8}''$ x 12–32, for fastening No. 38 to No. 26, and No. 63 to No. 64.

91. MACHINE SCREW, $\frac{5}{16}''$ x 12–32, for fastening No. 128 to No. 72.

92. MACHINE SCREW, $\frac{1}{4}''$ x 12–32, for fastening No. 129 to No. 71.

93. MACHINE SCREW, $\frac{5}{8}''$ x 8–32, for joining Nos. 44 and 46.

94. MACHINE SCREW, $\frac{1}{2}''$ x 8–32, for No. 36.

95. MACHINE SCREW, $\frac{3}{8}''$ x 8–32, for fastening Nos. 3 and 4, Plate 109, to No. 1, Plate 108.

96. MACHINE SCREW, $\frac{1}{4}''$ x 8–32, for fastening Nos. 124 and 125 to No. 73, and No. 130 to No. 53.

97. MACHINE SCREW, $\frac{1}{2}''$ x 6–32, for fastening No. 134 to No. 28.

98. MACHINE SCREW, $\frac{3}{8}''$ x 6–32, for fastening No. 136 to No. 37.

99. MACHINE SCREW, $\frac{5}{16}''$ x 8–32, for ends of Nos. 55 and 56.

100. WASHER, $\frac{3}{16}''$–$\frac{7}{16}''$, for No. 99.

IRON.

101. TAPER PIN, for No. 24.

102. TAPER PIN, for No. 40.

103. TAPER PIN, for No. 44.

104. TAPER PIN, for joining No. 135 to No. 64.

105. TAPER PIN, for No. 19.

106. SHAFT, for No. 21.

THE UNION ELECTRIC BANNER AND TARGET SIGNALS, SMALL PARTS.—(Continued.)

PLATE 109.

	No.		
Iron.	107.	Stop Pin, for armature bar.	
Iron.	108.	Rivet, for joining Nos. 1 and 2, Plate 108.	
	109.	Phosphor Bronze Pin, for Nos. 128 and 131.	
Iron.	110.	Pin, for fastening Nos. 41 and 34 to shafts.	
Iron.	111.	Pin, for No. 42.	
Iron.	112.	Pin, for Nos. 57 and 58.	
Iron.	113.	Pin, for stopping No. 45 (driven into No. 28).	
	114.	German Silver Pin, for No. 120.	
	115.	Binding Post Washer.	
	116.	Binding Post and Screw.	
	117.	Binding Post Nut, ¼″–32.	
	118.	Adjusting Screw and Nut.	
	119.	Lock Spindle and Nut, for No. 47.	
	120.	Pawl, for No. 53.	
	121.	Pawl, for No. 34.	
	122.	Link.	For chain. (See No. 70.)
	123.	Rivet.	For chain. (See No. 70.)
	124.	Phosphor Bronze Contact Spring with Platinum Disc.	For upper circuit controller.
	125.	Phosphor Bronze Contact Spring with Platinum Point.	For upper circuit controller.
	126.	German Silver Contact Spring with Platinum Disc.	For lower circuit controller.
	127.	German Silver Contact Spring with Platinum Point.	For lower circuit controller.
	128.	Armature Bar Spring.	
	129.	Detent Pawl Spring.	
	130.	Spring, for No. 120.	
	131.	Spring, for No. 121.	
	132.	Piece of Insulated Copper Wire.	Any length.
	133.	Piece of Copper Wire in Rubber Tube.	Any length.
	134.	Spring, for No. 45.	
	135.	Detent Pin, for No. 64.	
	136.	Hard Rubber Insulator, for No. 37.	
	137.	Hard Rubber Insulator, for No. 125.	
	138.	Brass Rivet, for No. 137.	

PLATE 110.

This is a very important piece of work; it is one of the most difficult locations in the United States; is used by the passenger and freight trains of five different railroads and is further complicated by the presence of a drawbridge. It is very doubtful if this plant could have been successfully interlocked otherwise than through the Electro-Pneumatic System.

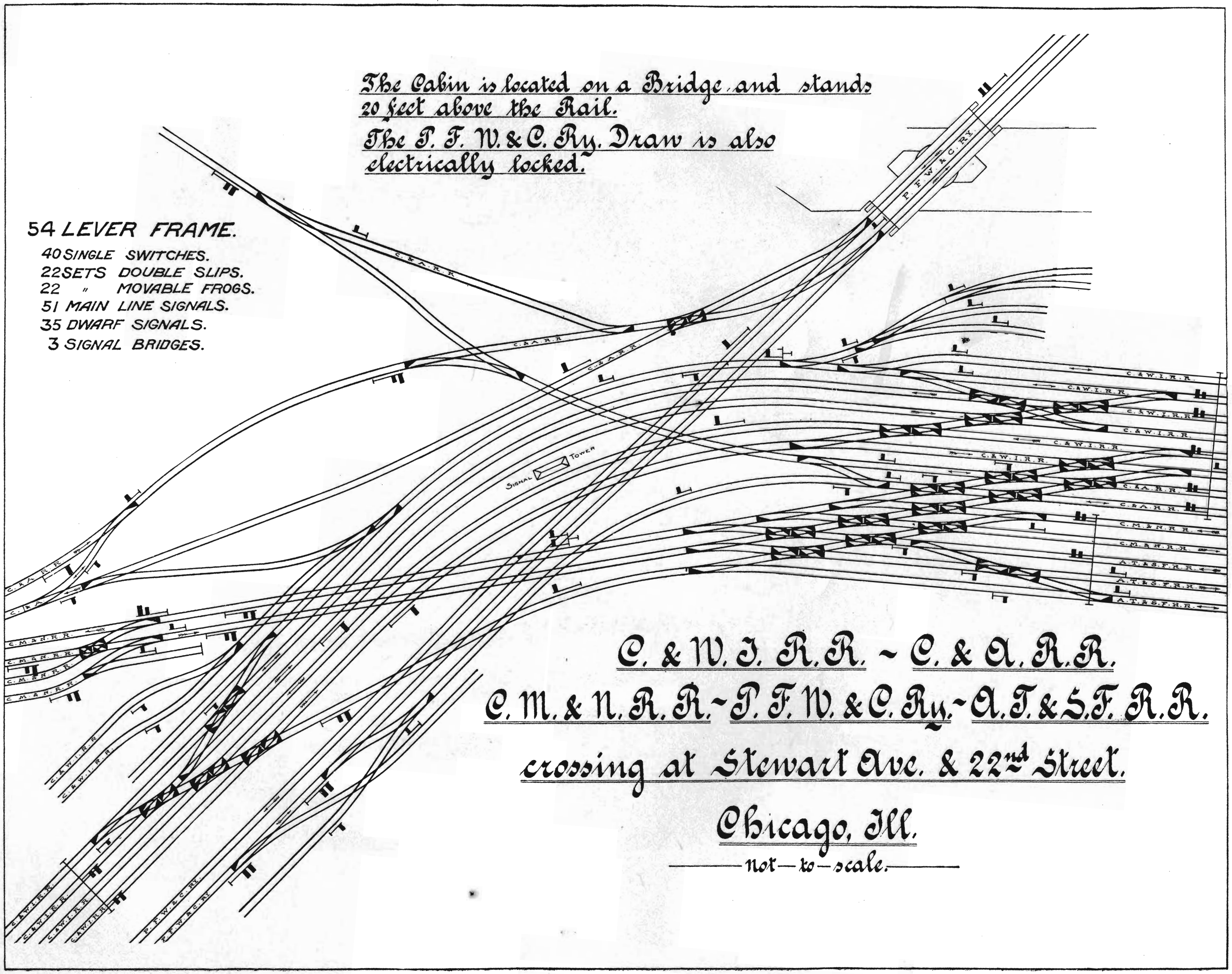
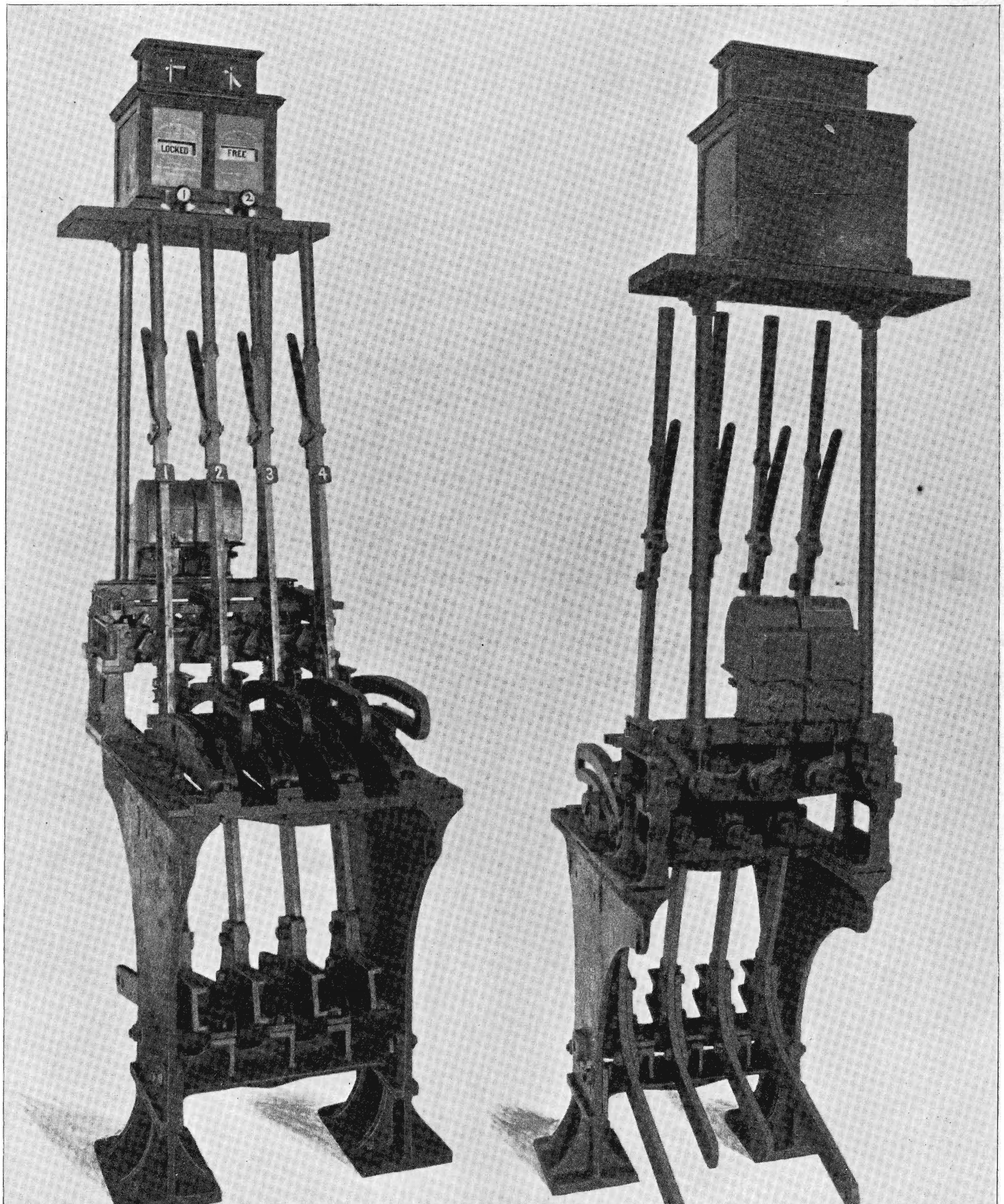

The Cabin is located on a Bridge and stands 20 feet above the Rail.
The P. F. W. & C. Ry. Draw is also electrically locked.
54 LEVER FRAME.
40 SINGLE SWITCHES.
22 SETS DOUBLE SLIPS.
22 " MOVABLE FROGS.
51 MAIN LINE SIGNALS.
35 DWARF SIGNALS.
3 SIGNAL BRIDGES.
SIGNAL TOWER
P. F. W. & C. RY.
C. & A. R. R.
C. & W. I. R. R.
C. M. & N. R. R.
A. T. & S. F. R. R.
P. F. W. & C. RY.
C. & W. I. R. R. ~ C. & A. R. R.
C. M. & N. R. R. ~ P. F. W. & C. Ry. ~ A. T. & S. F. R. R.
crossing at Stewart Ave. & 22nd Street.
Chicago, Ill.
not—to—scale.

PLATE 111.



The Union Lock and Block System.

PLATES 111 AND 112.

THE external appearance of the instruments as mounted on a Saxby & Farmer Improved Interlocking Machine is shown on Plate 111, and the instruments themselves on a larger scale on Plate 112.

From Plate 111 it will be seen that there is no mechanical connection between the block instrument at the top of the machine and the levers, a particular in which this one, which is entirely electric in its operation, differs, from all the old lock and block systems; the electric locks are shown mounted over the interlocking of the machine, and the back view exhibits the connection between them and the interlocking shafts.

The arrangement of four levers and two block instruments is the one commonly employed on double track railroads, whereby two blocks are controlled from a cabin, one block in each direction; the levers numbered 2 and 3 operate the home signals, which are directly governed by the block and lock instruments; the levers 1 and 4 operate the distant signals, which in their turn depend upon the position of the home signals, through the interlocking on the machine.

In describing this system three cabins and trains moving in one direction only will be considered, since the whole plan of operation may be explained through them, and on double track the movement of trains in one direction does not interfere in any way with the movement of trains in the other direction. The cabins, which will be named A, B and C, each contain such a machine as is illustrated on Plate 111, and to simplify the description, the operation of the distant signals will be ignored beyond the statement now, that they are not concerned in the general scheme of the system but are included in the plan solely for the purpose of facilitating traffic, and may be operated or not without in any way affecting the relations which are established between the cabins. In our account, therefore, we shall refer only to a certain lever in each cabin, which will always be lever 2, and will control the entrance of trains to the block immediately to the right of the cabin.

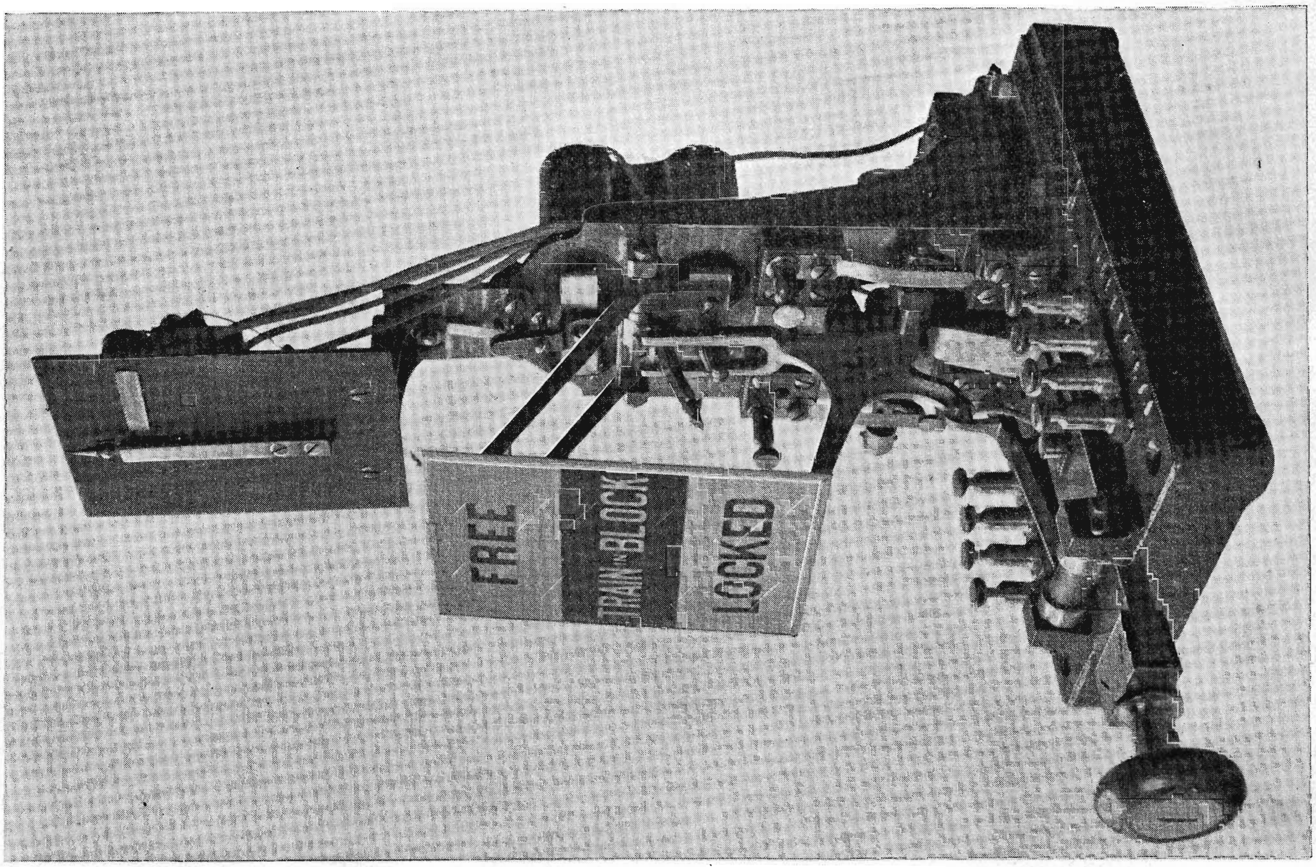
The elements of the system which will be noticed in this description are the

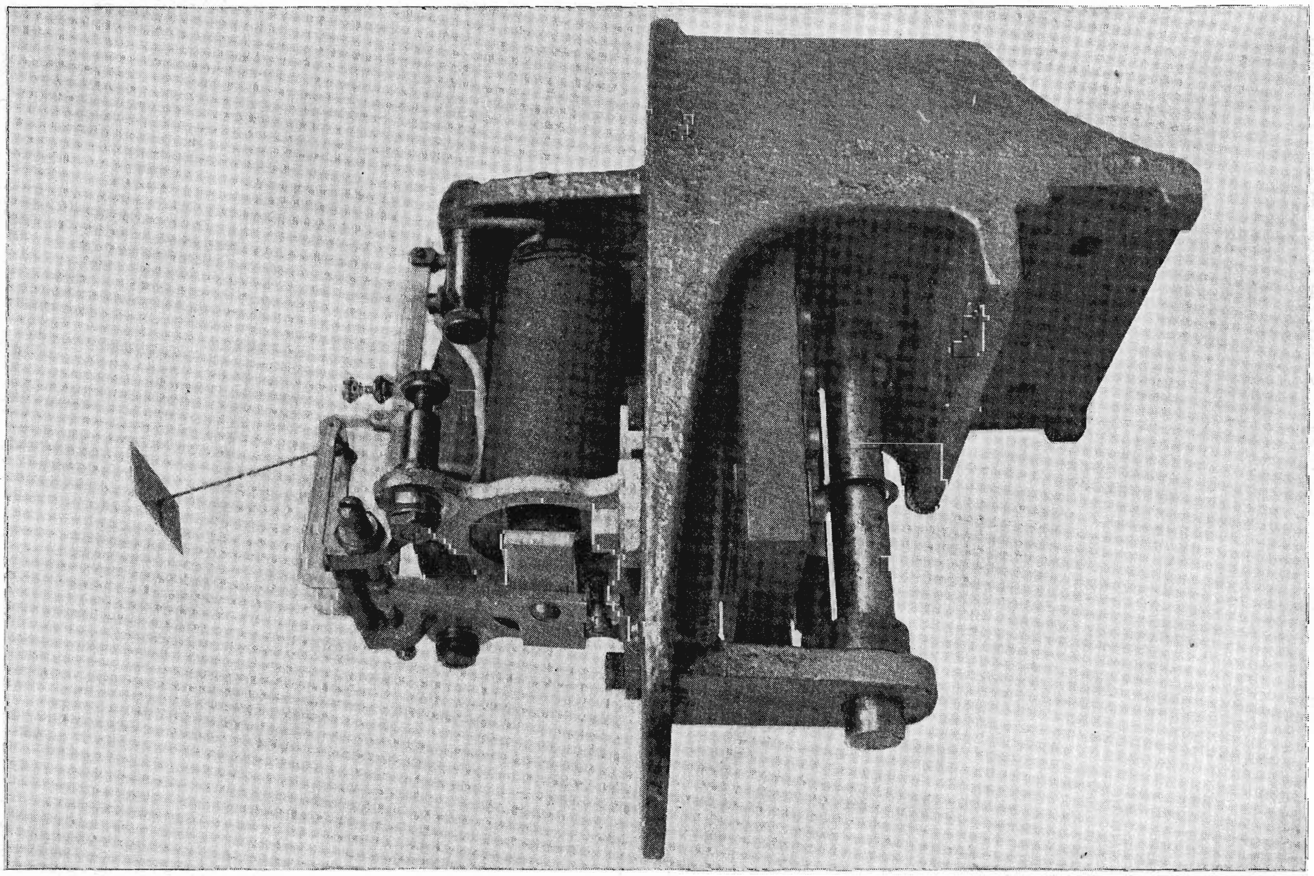
Cabin,	Lever,	Push Button,	Lock Instrument,
Operator,	Block,	Block Instrument,	Signal,

and for convenience these terms will always be followed by the letter A, B or C, which will indicate the particular block that they refer to.

A means of communication must exist between adjoining cabins, which may consist of a bell-tap code, a Morse telegraph or a telephone. Operator B will be able to communicate with both A and C, but for block-signaling purposes no

PLATE 112.





necessity exists for any connection between A and C. Since nothing in this system is left to chance, a fixed course of action is necessary in order that trains may receive permission to proceed; that course we now propose to describe.

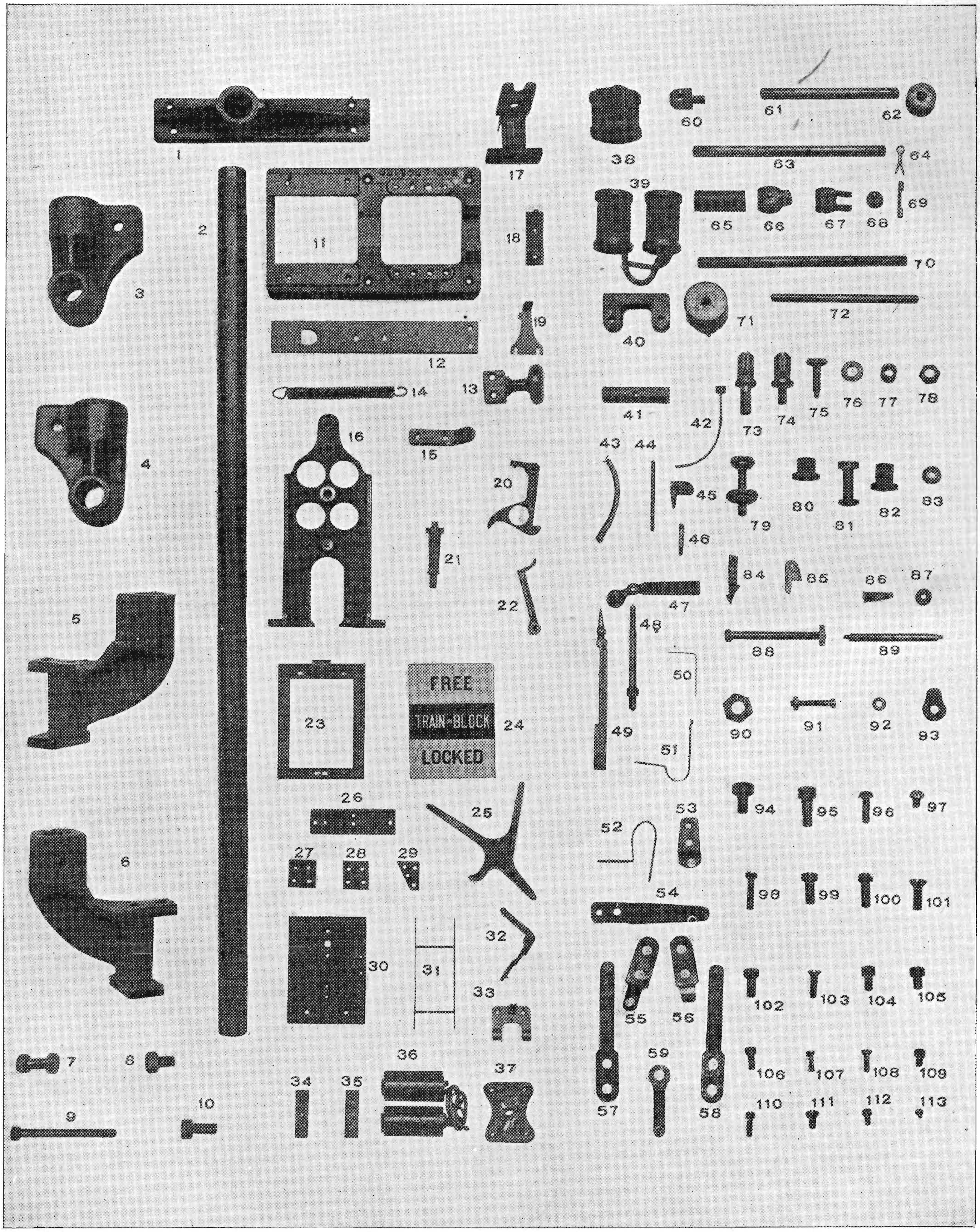
The levers A, B and C are assumed to be normal, all of the blocks are unoccupied, and a train is approaching cabin A that wishes to enter block A. Operator A now asks operator B to release him, which he partially does by grasping the knob and pulling out the slide bar, plainly shown at the base of the block instrument; the result of this action is to clear the small semaphore at the top of block instrument A, and partly establish a circuit through electric lock A, which operator A completes by pushing a button with one hand (this button, by the way, is sometimes located on the floor and is worked by the foot) at the same time that he reverses lever A and clears signal A. The train now enters block A, and upon passing signal A automatically restores signal A to the danger position through the medium of an electric slot, the operation of which is fully explained on page 215; operator A then puts his lever in the normal position, where it is again firmly locked. The same method is followed between cabins B, C, etc., throughout the line.

An important feature of the arrangement is the means employed to prevent operator B from releasing operator A more than once between the passage of each two trains. This is accomplished through the lifting of the plate on the block instrument that is marked FREE. / TRAIN IN BLOCK. / LOCKED. When block A is entirely clear, the instrument B exhibits the word FREE, which indicates that operator B may pull out his slide bar; in doing this the card is raised to the position LOCKED, and so held until a train has entered Block A, upon which it drops to the position TRAIN IN BLOCK, where it continues to hold the slide bar locked until the train has passed cabin B and entirely cleared block A, when the word FREE is again exhibited.

By the above it will be seen that the block instrument in a cabin exercises no control over the machine in that cabin, but is connected with the electric lock which is placed on the machine directly in its rear; that it is impossible to clear a signal twice between the passage of any two trains; and that a failure of the electric current will result in tying up the operations and keeping the signals at danger until its action is restored.

The use of the electric lock here illustrated is not confined to the lock and block system, but is the one which we now use on all of our Saxby & Farmer Improved Machines where electric locking is desired.

The parts of these instruments will be found on the next two following plates.


FREE
TRAIN IN BLOCK
LOCKED

Union Block Instrument.

PLATE 113.

No. **ORDER BY PLATE AND NUMBER.**

1. Shoulder.
2. Leg.
3. Right-Hand Middle Bracket. } These are placed on the locking shaft of an interlocking machine for supporting No. 2.
4. Left-Hand Middle Bracket. }
5. Right-Hand End Bracket. } These are placed on the ends of an interlocking machine for supporting No. 2.
6. Left-Hand End Bracket }
7. Bolt and Nut, ½″ x 1⅜″. } For fastening Nos. 3, 4, 5 and 6, Plate 113, to No. 1, Plate 114.
8. Tap Bolt, ½″ x ¾″. }
9. Cap Screw, ⅜″ x 4⅜″. } For fastening Nos. 5 and 6 to an interlocking machine.
10. Cap Screw, ½″ x 1⅛″. }
11. Base.
12. Slide Bar.
13. Slide Bar Knob.
14. Slide Bar Spring.
15. Brass Strap, for raising No. 25.
16. Main Frame.
17. Bracket, for No. 30.
18. Hasp, for slide bar end of No. 14.
19. Bracket, for No. 48.
20. Back Stop Latch.
21. Pedestal.
22. Front Stop Latch.
23. Indicator Frame.
24. Indicator Plate.
25. Indicator Arm.
26. Rubber Base, for back circuit breaker.
27. Rubber Base (upper), for front circuit breaker.
28. Rubber Base (lower), for front circuit breaker.
29. Rubber Base, for Nos. 50 and 51.
30. Brass Semaphore Plate.
31. Support, for No. 23.
32. Upper Armature Bar.
33. Lower Armature Bar.
34. Upper Armature.
35. Lower Armature.
36. Magnets. In ordering a pair of magnets give the resistance required in ohms.

No.

37. Back Strap, for No. 36.

38. Resistance Coil. In ordering give the resistance required in ohms.

39. Semaphore Magnets. In ordering give the resistance required in ohms.

40. Back Strap, for No. 39.

41. Armature, for No. 39.

42. Semaphore Counterbalance.

43. Copper Wire, in rubber tube. Give length required.

44. Phosphor Bronze Rod, for joining Nos. 23 and 31.

45. Hard Rubber Guide, for Nos. 50 and 51.

46. Dowel Pin, for fastening Nos. 25, 66 and 67 to No. 70 and No. 32 to No. 89.

47. Semaphore.

48. Semaphore Shaft.

49. Semaphore Post.

50. Lower Contact Spring. } For No. 29.

51. Upper Contact Spring. } For No. 29.

52. Goose Neck Contact Spring.

53. Straight Contact Spring, with platinum disc. } For No. 26.

54. Straight Contact Spring, with double platinum point. } For No. 26.

55. Short Contact Spring, with platinum disc. } For Nos. 27 and 28.

56. Short Contact Spring, with platinum point. } For Nos. 27 and 28.

57. Long Contact Spring, with platinum disc. } For Nos. 27 and 28.

58. Long Contact Spring, with platinum point. } For Nos. 27 and 28.

59. German Silver Contact Spring, for No. 79.

60. Hasp, for base end of No. 14.

61. Shaft, for No. 22.

62. Roller, for No. 61.

63. Shaft, for No. 20.

64. Split Cotter, $\frac{3}{32}'' \times \frac{5}{8}''$, for Nos. 61 and 63.

65. Roller, for No. 63,

66. Socket, for No. 72.

67. Jaw, for No. 68.

68. Rubber Roller Circuit Breaker.

69. Latch Pin, for No. 25.

70. Shaft, for Nos. 25, 66 and 67.

71. Counterbalance.

72. Arm, for Nos. 66 and 71.

73. Long Binding Post.

74. Short Binding Post.

75. Binding Post Screw, $\frac{3}{4}'' \times 10\text{–}32$.

No.

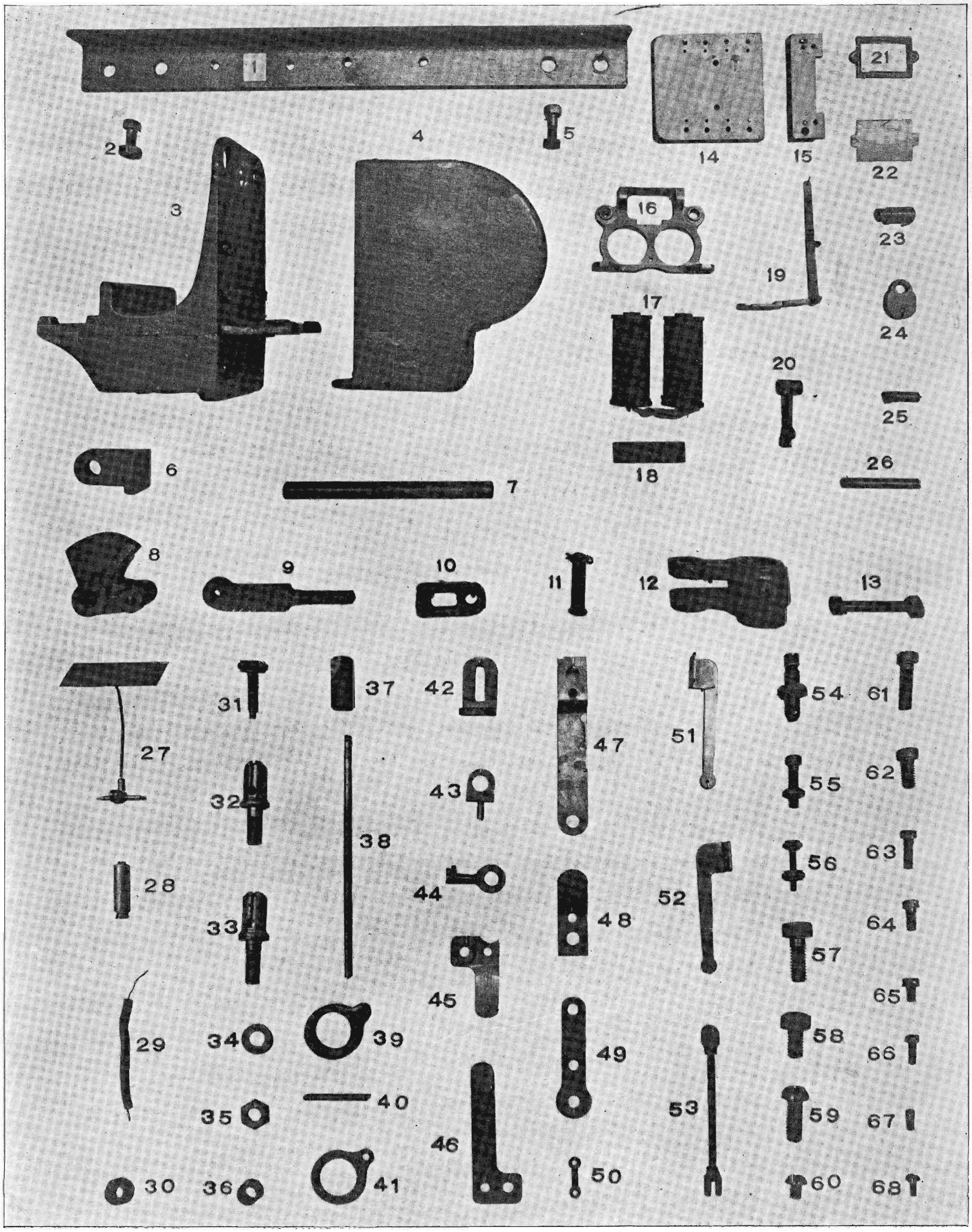
76. Brass Washer, ¼″–½″, for Nos. 73, 74, 81 and 102.
77. Rubber Bushing, ¼″–⅜″. } For No. 73.
78. Hex. Nut, ¼″–32. } For No. 73.
79. Adjusting Screw and Jam Nut, 1⅛″ x 10–32, with platinum point.
80. Rubber Bushing, for No. 79.
81. Brass Bolt and Nut, ⅞″ x ¼″–32, for fastening No. 59 to No. 17.
82. Rubber Bushing, for No. 81.
83. Brass Washer, 5/32″–7/16″, for head of No. 81.
84. Latch, for No. 32.
85. Latch, for No. 33.
86. Latch Spring, for No. 85.
87. Steel Roller, for No. 25.
88. Bolt and Nut, 2¼″ x 10–32, for holding No. 38.
89. Shaft, for Nos. 32 and 33.
90. Hex. Nut, ⅜″–16, for No. 21.
91. Bolt and Nut, ⅞″ x 8–32; stop for No. 32.
92. Brass Washer, ⅛″–5/16″, for contacts on No. 29.
93. Plate Terminal, for wire at No. 79.

Iron.

94. Cap Screw, ½″ x ¼″–20, for fastening No. 16 to No. 11.
95. Machine Screw, ⅝″ x ¼″–20, for fastening Nos. 15 and 18 to No. 12.
96. Machine Screw, ⅝″ x 10–24, for joining Nos. 36 and 37.
97. Machine Screw, ¼″ x 10–24, for fastening No. 34 to No. 32, and No. 35 to No. 33.

Brass.

98. Machine Screw, ¾″ x 8–32, for fastening No. 26 to No. 16.
99. Trunnion Screw, ½″ x 12–32, for No. 89.
100. Machine Screw, ⅝″ x 12–32, for fastening Nos. 27 and 28 to No. 16.
101. Machine Screw, ⅝″ x 12–24, for joining Nos. 12 and 13.
102. Machine Screw, ½″ x 12–24, for fastening Nos. 55, 56, 57 and 58 to Nos. 27 and 28.
103. Machine Screw, ⅝″ x 8–32, for fastening Nos. 39 and 40 to No. 30.
104. Machine Screw, ⅜″ x 10–32, for No. 71.
105. Machine Screw, ⅜″ x 12–32, for fastening No. 17 to No. 16.
106. Machine Screw, ⅜″ x 8–32, for wire connections on Nos. 52, 53 and 54.
107. Machine Screw, ⅜″ x 6–32, for wire connections on No. 29.
108. Machine Screw, ½″ x 6–32, for fastening No. 49 to No. 30.
109. Machine Screw, ¼″ x 8–32, for fastening Nos. 52, 53 and 54 to No. 26, and for wire connections on No. 81.
110. Machine Screw, ½″ x 6–32, for fastening No. 29 to No. 30.
111. Machine Screw, ⅜″ x 8–32, for fastening No. 30 to No. 17.
112. Machine Screw, ¼″ x 6–32, for fastening Nos. 50 and 51 to No. 29.
113. Machine Screw, ⅛″ x 4–40, for fastening No. 86 to No. 33.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Union Electric Lock.

PLATE 114.

ORDER BY PLATE AND NUMBER.

No.

1. Angle Iron, made in different lengths and fastened to interlocking machine, for supporting No. 3, Plate 114, and Nos. 3, 4, 5 and 6, Plate 113.
2. Bolt and Nut, 3/8" x 1", for fastening No. 1 to interlocking machine.
3. Cast-Iron Base.
4. Cover.
5. Bolt and Nut, 3/8" x 1 1/4", for fastening No. 3 to No. 1.
6. Bracket, for No. 7.
7. Shaft, for locking-circuit breaker.
8. Locking Dog.
9. Adjustable Link.
10. Swivel, for No. 9.
11. Turned Pin, 1/2" x 2", and Cotter, 1/8" x 3/4", for joining Nos. 10 and 12.
12. Driver.
13. Cap Screw and Nut, 3/8" x 2 3/4", for fastening No. 12 to shaft of interlocking machine.
14. Rubber Base, for locking-circuit breaker.
15. Rubber Base, for indicator-circuit breaker.
16. Spectacle.
17. Magnets. Give resistance required in ohms.
18. Armature.
19. Armature Bar.
20. Locking Latch.
21. Brass Frame, for No. 22.
22. Celluloid Sheet, for protecting indicator No. 27.
23. Stud, 1/2" x 1 1/4", stop for No. 9.
24. Padlock, for fastening No. 4.
25. Screw Stud, 3/8" x 1 1/4", for joining Nos. 8 and 9.
26. Screw Stud, 3/8" x 2 3/4", for joining Nos. 3, 4 and 20.
27. Indicator.
28. Stud, 1/4" x 7/8", for joining Nos. 7, 8 and 49.
29. Copper Wire in Rubber Tube. Give length required.
30. Rubber Bushing, 1/4"–3/8", insulation for wire passing through No. 3.
31. Binding Screw.
32. Short Binding Post.
33. Long Binding Post.
34. Brass Washer, 1/4"–1/2", for binding posts.

No.

35. Hex. Nut, ¼″–32, for binding posts.
36. Rubber Bushing, ¼″–⅜″, for binding posts.
37. Rubber Roller, ⅜″ x ⅞″, for locking-circuit breaker.
38. Shaft, for No. 37.
39. End Bearing, for No. 38.
40. Dowel Pin, ⅛″ x 1″, for No. 39.
41. Centre Bearing, for No. 38.
42. Hasp. } For No. 24.
43. Staple. } For No. 24.
44. Key. } For No. 24.
45. Short German Silver Contact Spring.
46. Long German Silver Contact Spring.
47. Long Phosphor Bronze Contact Spring.
48. Short Phosphor Bronze Contact Spring.
49. Phosphor Bronze Fastening, for No. 28.
50. Connecting Link, for Nos. 19 and 27.
51. Right-hand Bracket, for No. 27.
52. Left-hand Bracket, for No. 27.

Brass.
53. Rod and Screw Jaws, for joining Nos. 19 and 20.
54. Trunnion Screw and Nut, 1⅛″ x ¼″–32, for supporting No. 19.
55. Machine Screw and Nut, ¾″ x 10–32, stop for No. 19.
56. Adjusting Screw and Nut, for No. 19.

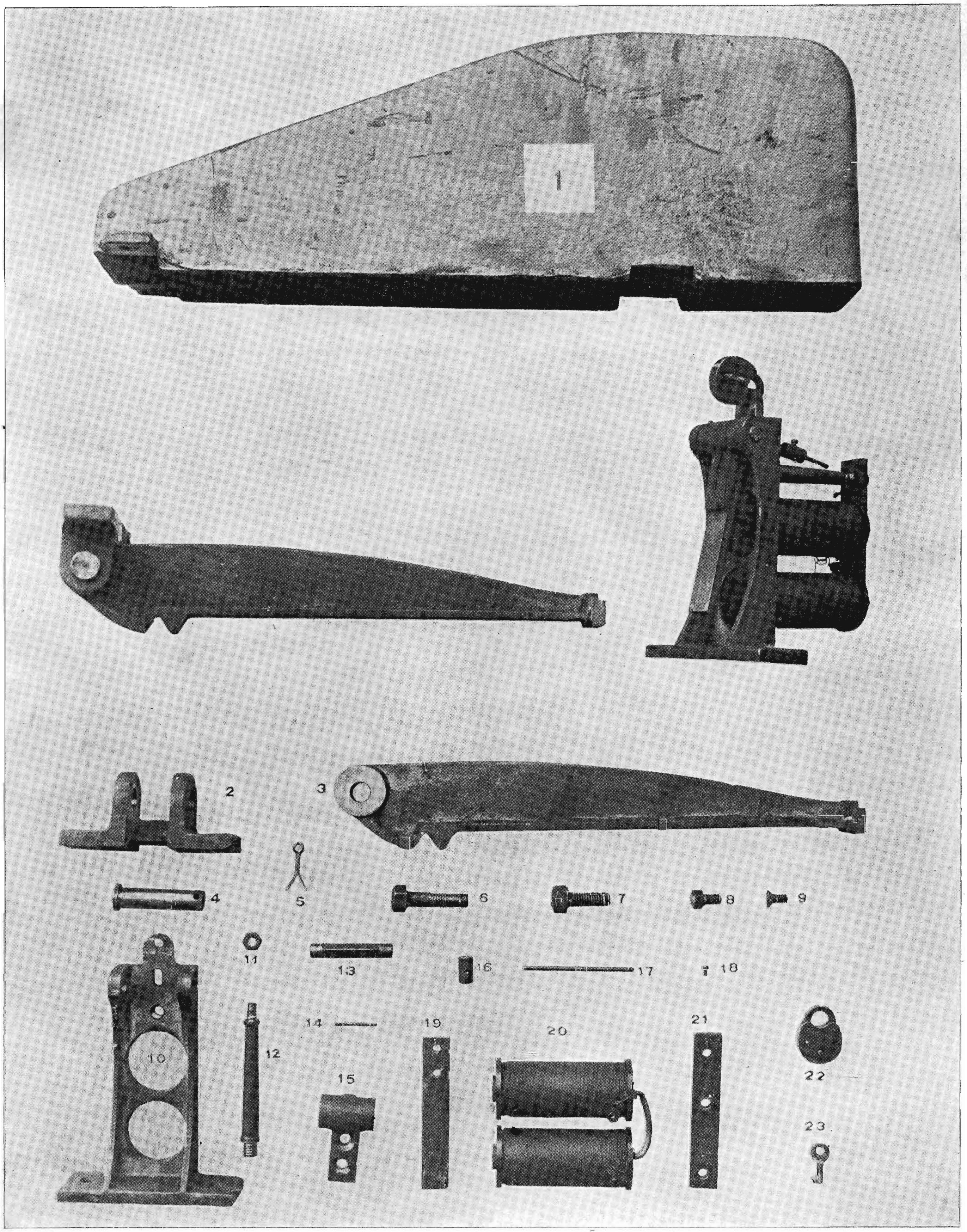
Iron.
57. Cap Screw, ¾″ x ¼″–20, for fastening No. 17 to No. 3.
58. Cap Screw, ½″ x ¼″–20, for fastening No. 16 to No. 3.
59. Machine Screw, ¾″ x ¼″–20, for fastening No. 6 to No. 3.
60. Machine Screw, ¼″ x ¼″–20, for fastening No. 18 to No. 19.

Brass.
61. Machine Screw, ⅞″ x 12–32, for fastening No. 14 to No. 3.
62. Machine Screw, ½″ x 12–24, for fastening wires to Nos. 47 and 48.
63. Machine Screw, ½″ x 8–32, for fastening No. 15 to No. 3.
64. Machine Screw, ⅜″ x 8–32, for fastening No. 15 to No. 16.
65. Machine Screw, ¼″ x 8–32, for fastening Nos. 47 and 48 to No. 14; for fastening wires to Nos. 45 and 46, and for fastening No. 21 to No. 4.
66. Machine Screw, ⅜″ x 6–32, for fastening Nos. 45 and 46 to No. 15.
67. Screw Stud, ⅜″ x 4–40, for fastening No. 53 to Nos. 19 and 20.
68. Rivet, ⅛″ x ⅜″, for fastening No. 42 to No. 4.

PATENTS RELATING TO ELECTRIC SIGNALING.—(Continued from Page 217.)

NAME.	DATE.		NUMBER.
C. A. SCOTT,	JULY	31, 1883,	282,230
GEO. WESTINGHOUSE, JR.,	JULY	31, 1883,	282,249
GEO. WESTINGHOUSE, JR.,	JULY	31, 1883,	282,250
C. A. SCOTT,	AUGUST	14, 1883,	283,152
O. GASSETT,	AUGUST	14, 1883,	283,231
O. GASSETT,	AUGUST	14, 1883,	283,232
O. GASSETT,	DECEMBER	11, 1883,	289,827
C. A. SCOTT,	JANUARY	29, 1884,	292,687
O. GASSETT,	JANUARY	29, 1884,	292,743
O. GASSETT,	JANUARY	29, 1884,	292,744
O. GASSETT,	FEBRUARY	12, 1884,	293,571
O. GASSETT,	FEBRUARY	26, 1884,	294,030
F. L. POPE,	MARCH	18, 1884,	295,427
C. H. JACKSON,	MAY	6, 1884,	298,209
C. H. JACKSON,	JULY	1, 1884,	301,369
C. A. SCOTT,	JULY	8, 1884,	301,837
F. L. POPE,	AUGUST	12, 1884,	303,589
F. L. POPE,	AUGUST	12, 1884,	303,590
C. A. SCOTT,	AUGUST	12, 1884,	303,595
J. T. HAMBAY,	NOVEMBER	25, 1884,	308,492
J. T. HAMBAY,	NOVEMBER	25, 1884,	308,493
J. T. HAMBAY,	NOVEMBER	25, 1884,	308,494
J. P. COLEMAN,	MAY	7, 1889,	402,562
J. P. COLEMAN,	MAY	28, 1889,	404,170
J. G. SCHREUDER,	DECEMBER	9, 1890,	442,338
J. T. HAMBAY,	APRIL	5, 1892,	472,499
J. V. YOUNG,	DECEMBER	13, 1892,	488,138
S. H. STUPAKOFF,	APRIL	11, 1893,	495,125
S. H. STUPAKOFF,	MAY	16, 1893,	497,732
E. H. GOODMAN,	JULY	25, 1893,	502,229

AND OTHERS.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Electric Lock for Stevens Machine.

PLATE 115.

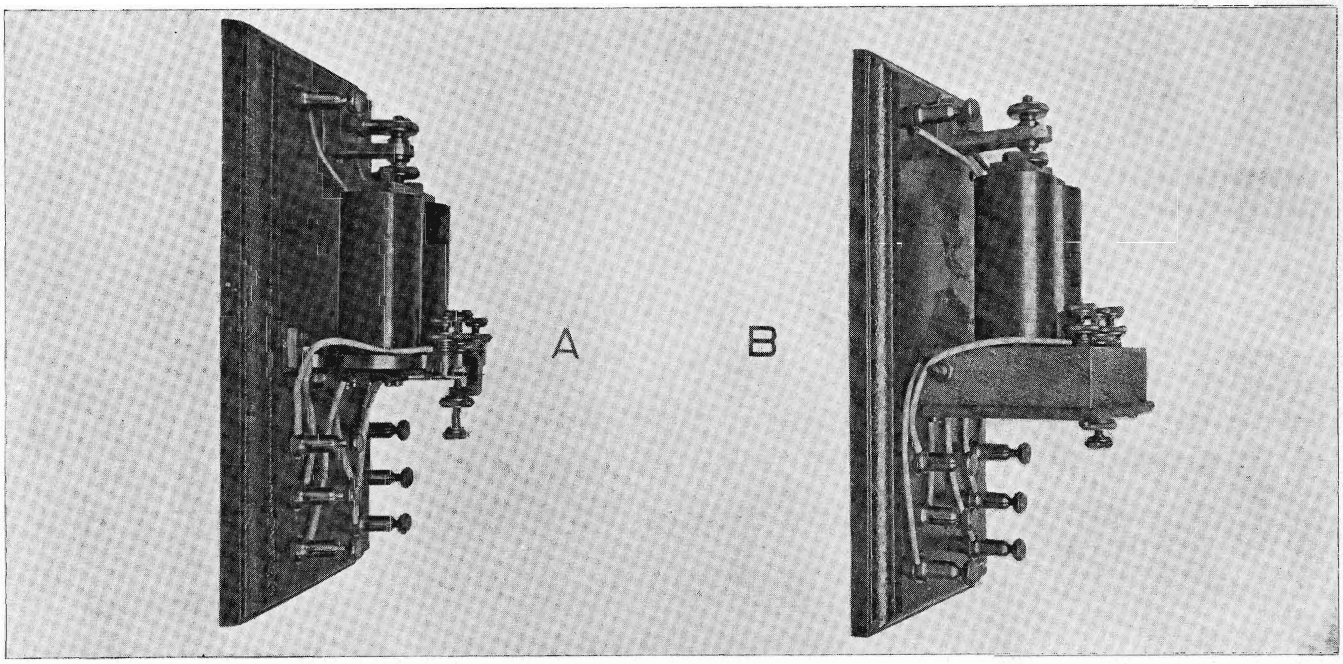
THIS lock is placed above the interlocking of the machine, perpendicular to its longitudinal axis, and in a horizontal position. The notch in the lock lever (No. 3) engages with a dog that is built upon the tappet (No. 14, Plate 7), and holds the tappet fast when the magnets (No. 20) are discharged; the armature (No. 19) is pulled from its position above the lock lever when the magnets are excited, thus permitting the dog upon the tappet to raise the lock lever and force its way out of the notch.

For the purpose of showing how the Cover (No. 1) is fixed with reference to the rest of the device, it is placed at the top and away from the other details.

ORDER BY PLATE AND NUMBER.

No.

1. Cover.
2. Bracket, for lock lever.
3. Lock Lever.
4. Turned Pin, for joining Nos. 2 and 3.
5. Split Cotter, for No. 4.
6. Tap Bolt, 1½″ x ⅜″, for joining Nos. 1 and 2 to Stevens machine.
7. Tap Bolt, 1″ x ⅜″, for joining No. 10 to Stevens machine.
8. Cap Screw, ½″ x ¼″, for joining Nos. 20 and 21.
9. Machine Screw, ½″ x ¼″, for joining Nos. 15 and 19.
10. Spectacle.
11. Brass Nut, for No. 12.
12. Back Strap Support.
13. Shaft, for No. 15.
14. Dowel Pin, for fastening No. 13 into No. 10.
15. Armature Bar.
16. Counterweight.
17. Counterweight Arm.
18. Machine Screw, ¼″ x 4–32, for fastening No. 16 to No. 17.
19. Armature.
20. Pair of Magnets.
21. Back Strap.
22. Pad Lock.
23. Key.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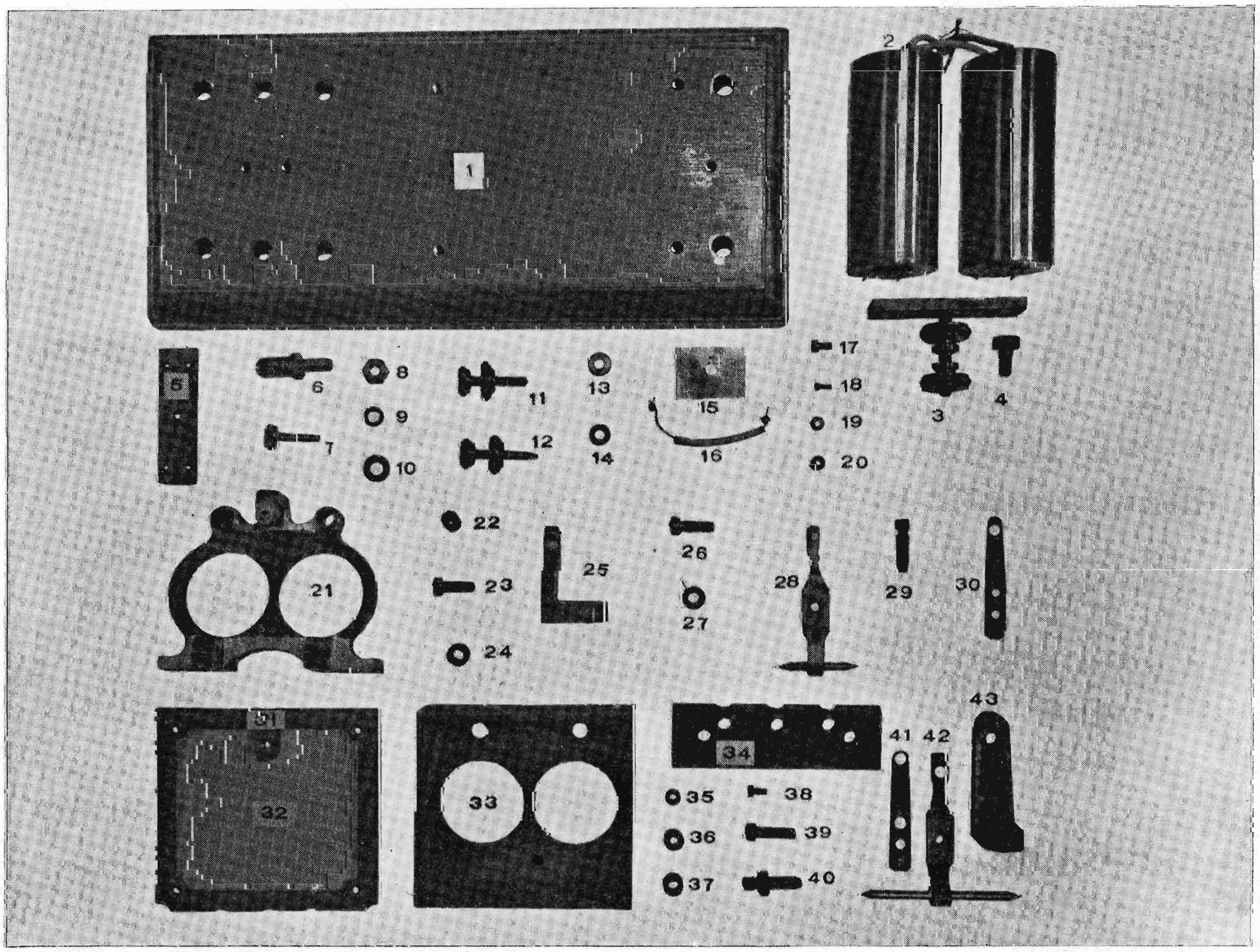
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Relays.

PLATE 116.

OTHER FORMS ARE SHOWN ON PLATES 117, 119, 121, 123 AND 125.

A. 3-Point Uncovered Relay.

B. 3-Point Dust Proof Relay.

IN ORDERING ANY RELAY, GIVE THE RESISTANCE REQUIRED IN OHMS.

ORDER BY PLATE AND NUMBER.

No.

Parts Common to A and B.

1. Base.
2. Pair of Magnets. Give resistance required in ohms.
3. Back Strap, with stud and adjusting nut.
4. Cap Screw, ½″ x ¼″–20, for fastening back strap to magnets.
5. Armature.
6. Binding Post.
7. Screw, ⅞″ x 10–32.
8. Hex. Nut, ¼″–32.
9. Rubber Bushing, ¼″–⅜″.
10. Brass Washer, ¼″–½″.

For binding post No. 6. (Nos. 7–10)

11. Adjusting Screw and Jam Nut, with platinum point, 1″ x 10–32.
12. Adjusting Screw and Jam Nut, with insulated point, 1″ x 10–32.
13. Brass Washer, 7/32″–½″.
14. Rubber Bushing, 7/32″–½″.

For adjusting screws Nos. 11 and 12. (Nos. 13–14)

15. Mica Insulation. Made in different sizes and forms, depending on where it is to be used.
16. Copper Wire, in rubber tube. Give length required.
17. Brass Machine Screw, ¼″ x 8–32, for fastening armature No. 5 to armature bars Nos. 28 and 42.
18. Brass Machine Screw, ¼″ x 4–40, for fastening wires to armature bars and spectacles, and for fastening contact springs Nos. 30 and 41 to armature.
19. Brass Washer, ⅛″–5/16″.
20. Rubber Bushing, ⅛″–5/16″.

For screw No. 18. (Nos. 19–20)

Parts Relating to A, only.

21. Spectacle.
22. Rubber Bushing, ⅜″ x 10–32, for adjusting screw holes in spectacle.
23. Brass Machine Screw, ⅝″ x 12–32, for fastening spectacle to base.
24. Rubber Bushing, 7/32″–⅜″, for screw No. 23.
25. Magnet Bracket.
26. Brass Machine Screw, ¾″ x 12–32, for fastening magnet bracket to base.

PLATE 116.

No.		
Parts Relating to A, only.	27.	Rubber Bushing, $\frac{7}{32}''$ x $\frac{3}{8}''$, for screw No. 26.
	28.	Armature Bars.
	29.	Trunnion Screw, $1''$ x $\frac{1}{4}''$–32, for holding armature bar.
	30.	Phosphor Bronze Contact Spring, with platinum disc.
Parts Relating to B, only.	31.	Cover Frame.
	32.	Celluloid Sheet, for cover frame.
	33.	Dust Proof Spectacle.
	34.	Hard Rubber Base, for insulation of dust proof spectacle.
	35.	Rubber Bushing, $\frac{1}{8}''$–$\frac{1}{4}''$, for wire holes in spectacle No. 33.
	36.	Rubber Bushing, $\frac{1}{4}''$ x 10–32, for adjusting-screw holes in spectacle.
	37.	Rubber Bushing, $\frac{7}{32}''$–$\frac{3}{8}''$, for screw No. 39.
	38.	Brass Machine Screw, $\frac{3}{8}''$ x 6–32, for fastening cover frame to spectacle.
	39.	Brass Machine Screw, $\frac{3}{4}''$ x 12–32, for fastening magnet bracket and spectacle to base.
	40.	Trunnion Screw and Jam Nut, $1\frac{1}{8}''$ x $\frac{1}{4}''$–32, for holding armature bar.
	41.	Phosphor Bronze Contact Spring, with platinum disc.
	42.	Armature Bar.
	43.	Magnet Bracket.

Interlocking Relays.

PLATE 117.

IN ORDERING ANY RELAY GIVE THE RESISTANCE REQUIRED IN OHMS.

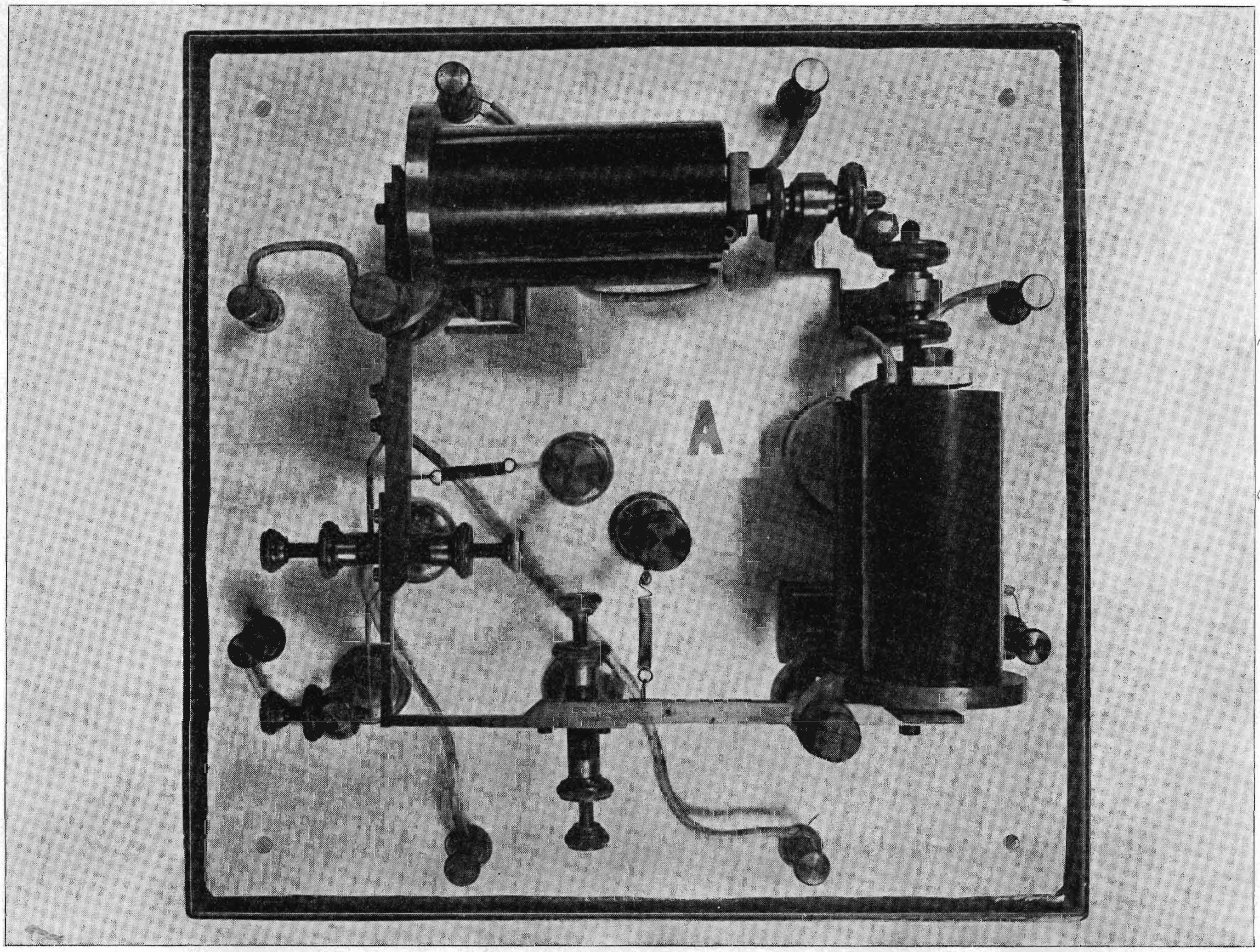
A. Interlocking Relay.—Square ends on the armature bars, two contact springs.

B. Interlocking Relay.—Square ends on the armature bars, one contact spring.

C. Interlocking Relay.—Hooked ends on the armature bars, no contact springs.

Any one of these relays may be built without, or be furnished with, either one, two, three or four contact springs on the armature bars.

A list of the parts is given on the following page.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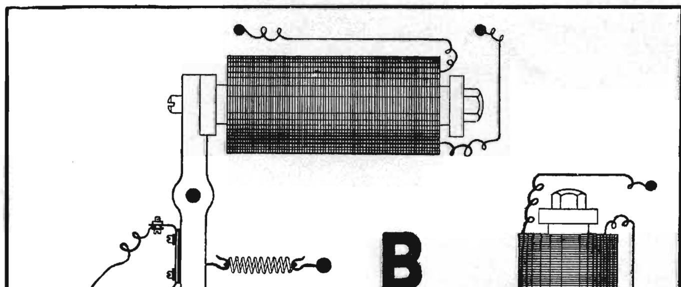
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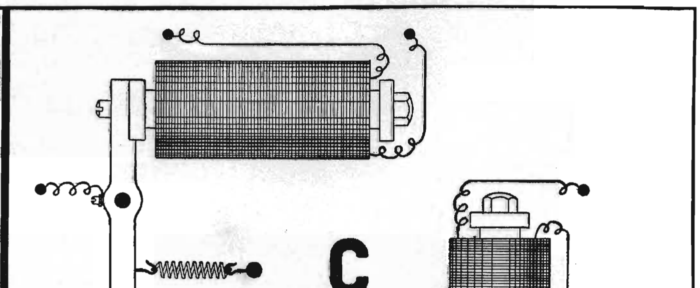
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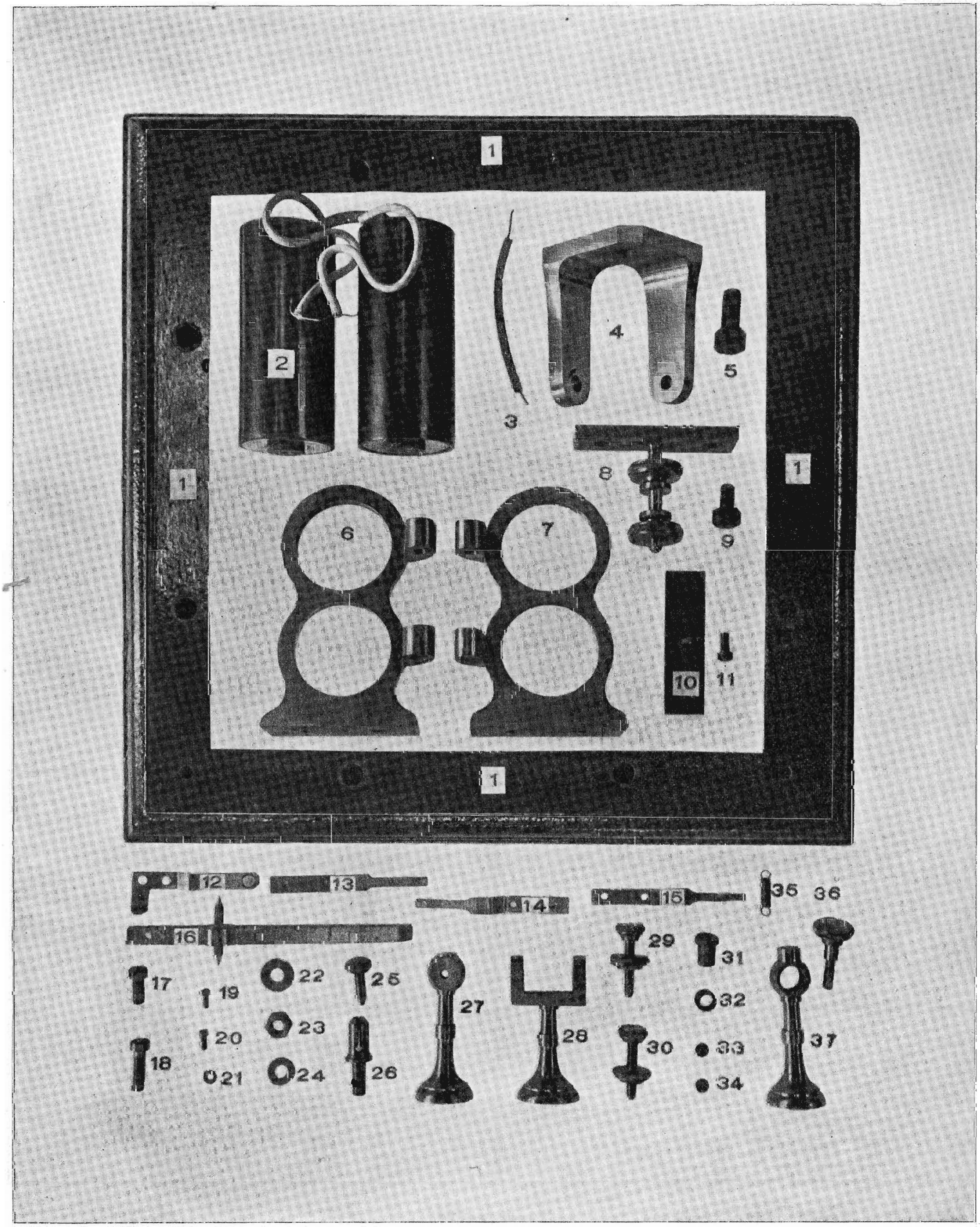
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Interlocking Relays.

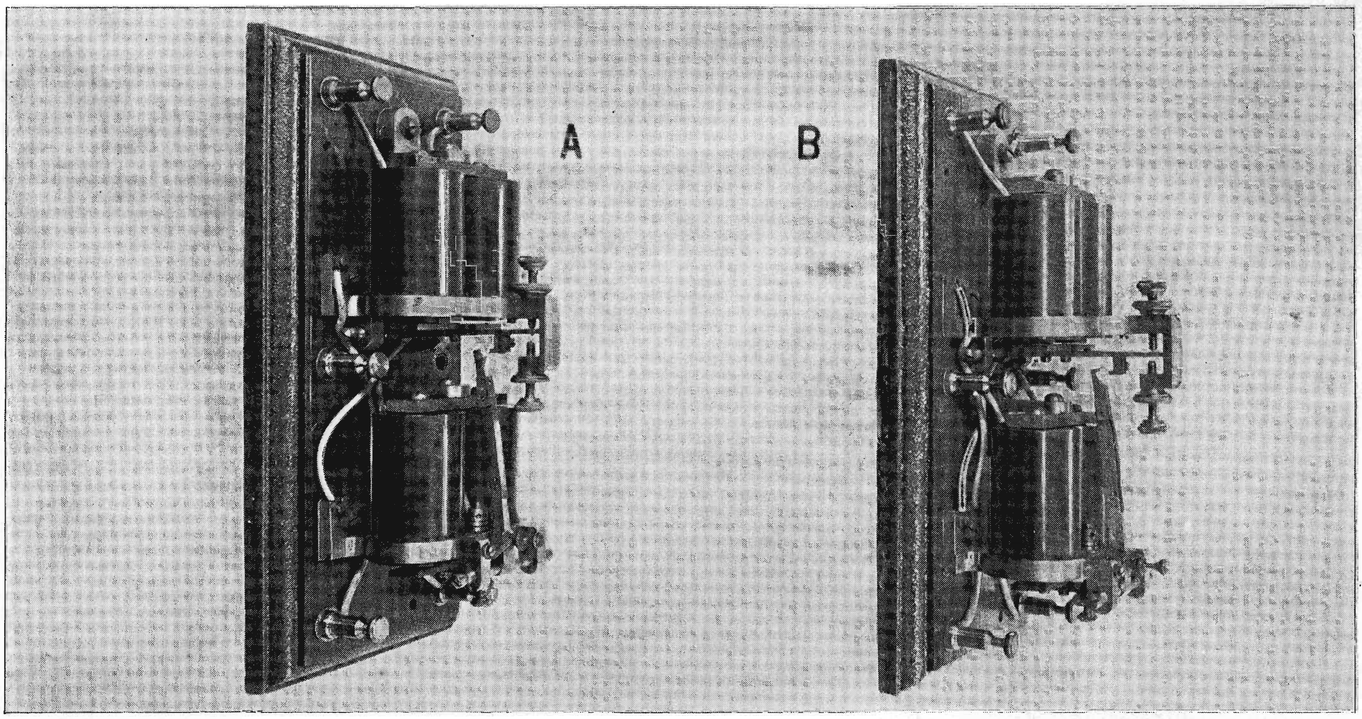
PLATE 118.

PARTS RELATING TO PLATE 117.

ORDER BY PLATE AND NUMBER.

No.

1. Base.
2. Magnets, give resistance required in ohms.
3. Copper Wire in Rubber Tube, give length required.
4. Magnet Bracket.
5. Cap Screw, $\frac{3}{4}''$ x $\frac{5}{16}''$–18, for No. 4.
6. Right-Hand Spectacle.
7. Left-Hand Spectacle.
8. Back Strap, stud and adjusting nuts.
9. Cap Screw, $\frac{1}{2}''$ x $\frac{1}{4}''$–20, for No. 8.
10. Armature.
11. Brass Screw, $\frac{3}{8}''$ x 8–32, for No. 10.
12. Contact Spring (A and B, only).
13. Stop, for armature bar (A and B, only).
14. Contact Spring (B, only).
15. Hook, for armature bar (C, only).
16. Armature Bar.
17. Machine Screw, $\frac{1}{2}''$ x 12–32, for fastening spectacle to base.
18. Machine Screw, $\frac{3}{4}''$ x 12–32, for fastening adjustment post, contact post and tension posts to base.
19. Machine Screw, $\frac{1}{4}''$ x 4–32, for fastening contact springs Nos. 12 and 14 to armature bar.
20. Machine Screw, $\frac{3}{8}''$ x 4–32, for fastening Nos. 13 and 15 to No. 16.
21. Brass Washer, $\frac{1}{8}''$–$\frac{1}{4}''$, for Nos. 19 and 20.
22. Piece of Mica Insulation, made in different sizes and forms, depending on where it is to be used.
23. Brass Hex Nut, $\frac{1}{4}''$–32, for binding post.
24. Brass Washer, $\frac{1}{4}''$–$\frac{1}{2}''$, for binding post.
25. Brass Screw, 10–32 for binding post.
26. Binding Post.
27. Contact Post (for A only).
28. Adjustment Post.
29. Adjusting Screw, insulated point.
30. Adjusting Screw, platinum point.
31. Rubber Bushing, $\frac{1}{2}''$–$\frac{3}{8}''$, for armature bearing in spectacles.
32. Rubber Bushing, $\frac{1}{4}''$–$\frac{3}{8}''$, for base (No. 1).
33. Rubber Bushing, $\frac{1}{8}''$–$\frac{3}{16}''$, for hook (No. 15).
34. Rubber Bushing, $\frac{1}{8}''$–$\frac{3}{16}''$, for contact spring (No. 12).
35. Tension Spring.
36. Tension Shaft.
37. Tension Post.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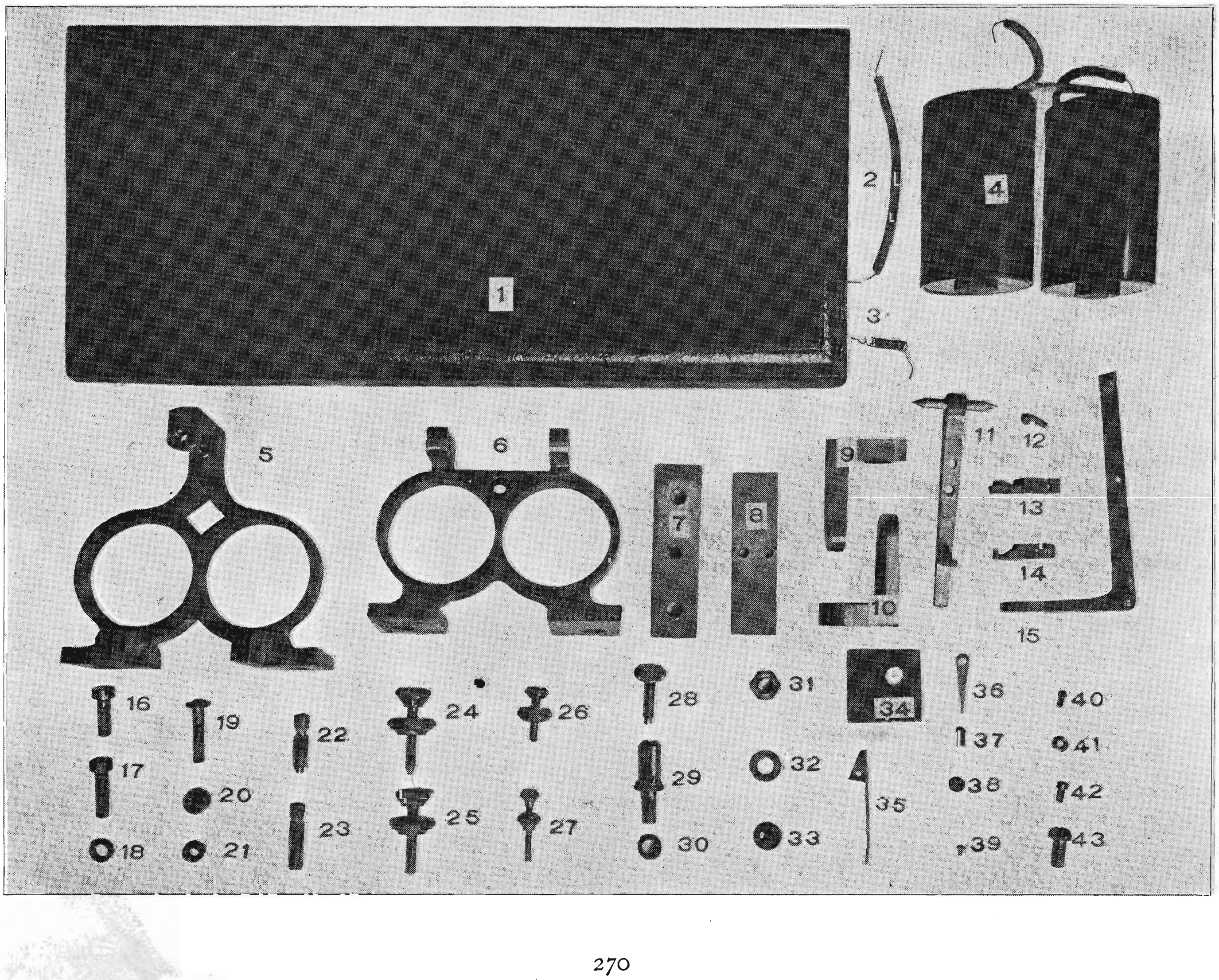
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Relays.

PLATE 119.

OTHER FORMS ARE SHOWN ON PLATES 116, 117, 121, 123 AND 125.

A. INTERLOCKING RELAY.—Upper magnet open circuit; lower magnet closed circuit.

B. INTERLOCKING RELAY.—Both magnets are on a closed circuit.

IN ORDERING ANY RELAY, GIVE THE RESISTANCE REQUIRED IN OHMS.

ORDER BY PLATE AND NUMBER.

No.

1. BASE.
2. COPPER WIRE, in rubber tube. } Give length required.
3. COPPER WIRE, silk insulation. } Give length required.
4. MAGNETS. Give resistance required in ohms.
5. SPECTACLE, for the upper magnet.
6. SPECTACLE, for the lower magnet.
7. BACK STRAP.
8. ARMATURE.
9. BRACKET, for the upper magnet.
10. BRACKET, for the lower magnet.
11. ARMATURE BAR, for the upper magnet.
12. HOOK, for armature bar No. 11.
13. LATCH, for relay "A."
14. LATCH, for relay "B."
15. ARMATURE BAR, for the lower magnet.
16. MACHINE SCREW, $\frac{5}{8}''$ x 12–32, for fastening spectacle to base.
17. MACHINE SCREW, $\frac{3}{4}''$ x 12–32, for fastening magnet brackets to base.
18. BRASS WASHER, $\frac{7}{32}''$ x $\frac{3}{8}''$, for back contact post on lower spectacle.
19. CONTACT POST, $\frac{7}{8}''$ x 10–32, for lower spectacle.
20. CAPSTAN JAM NUT, for contact post No. 19.
21. RUBBER BUSHING, $\frac{7}{32}''$–$\frac{5}{16}''$–$\frac{5}{16}''$, for contact post No. 19.
22. BRASS SCREW, $1''$ x $\frac{1}{4}''$–32, without rubber tip; trunnion for lower armature bar.
23. BRASS SCREW, $1''$ x $\frac{1}{4}''$–32, with rubber tip; trunnion for upper armature bar.
24. ADJUSTING SCREW AND JAM NUT, $1''$ x 10–32, with insulated point, for upper spectacle.
25. ADJUSTING SCREW AND JAM NUT, $1''$ x 10–32, with platinum point, for upper spectacle.
26. ADJUSTING SCREW AND JAM NUT, $\frac{5}{8}''$ x 8–32, with platinum point, for contact of lower spectacle.
27. ADJUSTING SCREW AND JAM NUT, $\frac{7}{8}''$ x 4–52, for lower armature bar.
28. BRASS SCREW, $\frac{3}{4}''$ x 10–32, for binding post.

PLATE 119.

No.

29. Binding Post.
30. Rubber Bushing, $\frac{1}{4}''-\frac{3}{8}''$, for binding post.
31. Brass Hex. Nut, for binding post.
32. Brass Washer, $\frac{1}{4}''-\frac{1}{2}''$, for binding post.
33. Rubber Bushing, $\frac{7}{32}''-\frac{7}{16}''-\frac{1}{4}''$, for spectacle and upper magnet brackets.
34. Mica Insulation, made in different shapes and sizes to suit location.
35. Bronze Latch Spring, for lower armature bar.
36. Silver Balance Spring, for upper armature bar.
37. Machine Screw, $\frac{1}{4}''$ x 4–40, for fastening hook to upper armature bar.
38. Rubber Bushing, $\frac{3}{32}''-\frac{5}{32}''$, for screw No. 37.
39. Machine Screw, $\frac{1}{8}''$ x 2–64, for latch spring to lower armature bar.
40. Machine Screw, $\frac{3}{16}''$ x 4–32, for fastening wire to spectacle.
41. Brass Washer, $\frac{1}{8}''-\frac{1}{4}''$, for No. 40.
42. Machine Screw, $\frac{1}{4}''$ x 6–32, for fastening armature to bars.
43. Machine Screw (Iron), $\frac{1}{2}''$ x 12–24, for fastening back strap to magnets and brackets.

PLATE 120.

This is a recent and most successful installation. It is at the Philadelphia Terminal of the Pennsylvania Railroad, one of the most important stations on one of the most important railroads in the United States. For many years this point was protected by a Saxby & Farmer Machine that was erected in 1881; under the demands of a rapidly increasing business the original locking was replaced by our improved locking (see Plates 1, 2, 3 and 5) in 1890, which continued in service until the station itself was greatly enlarged and the tracks entirely rearranged. Then it was decided to make use of the Electro-Pneumatic System, which resulted in the present plant.

Other views of this place are given on Plates 22, 31, 101 and 122.

PLATE 120.

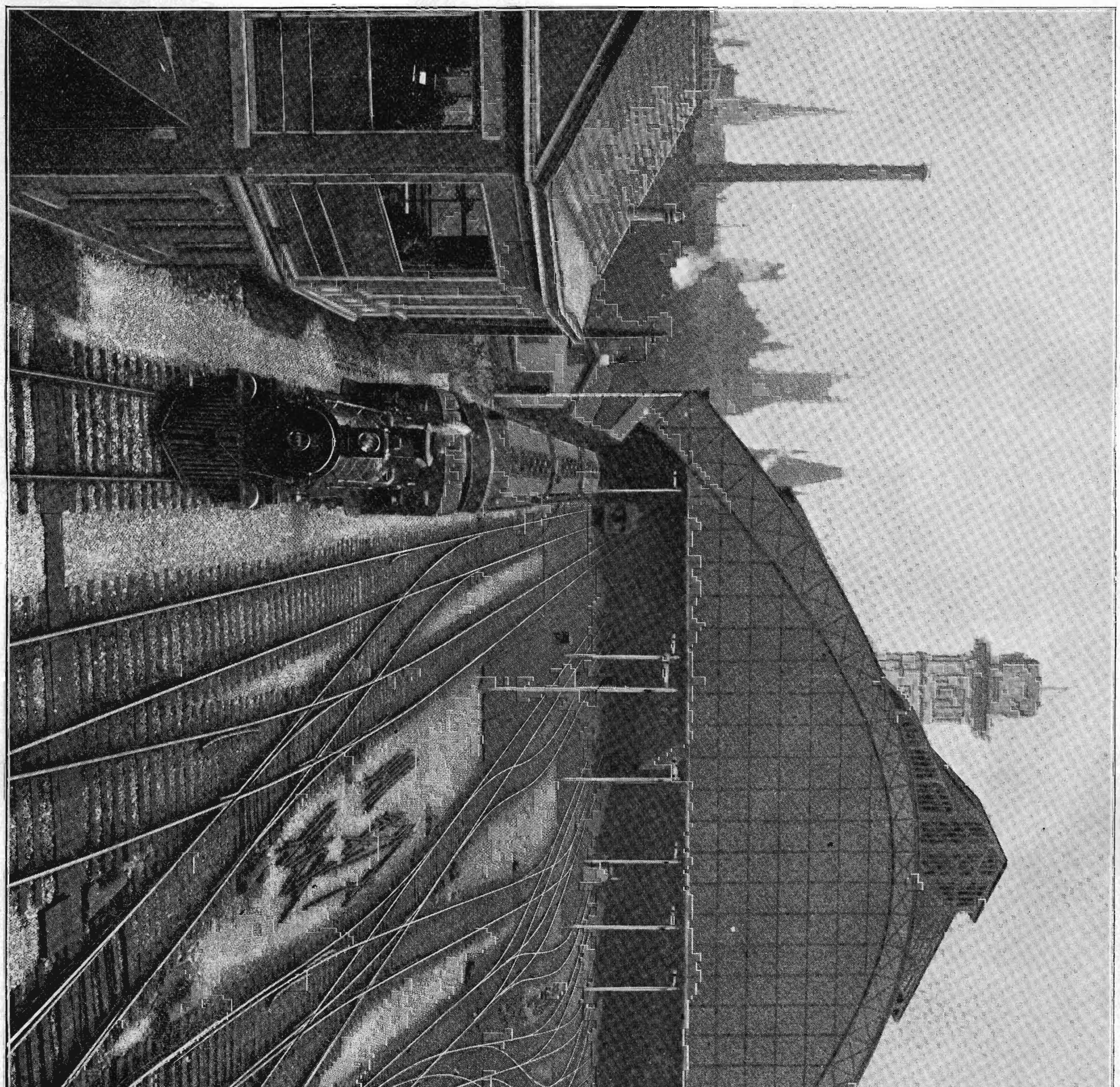
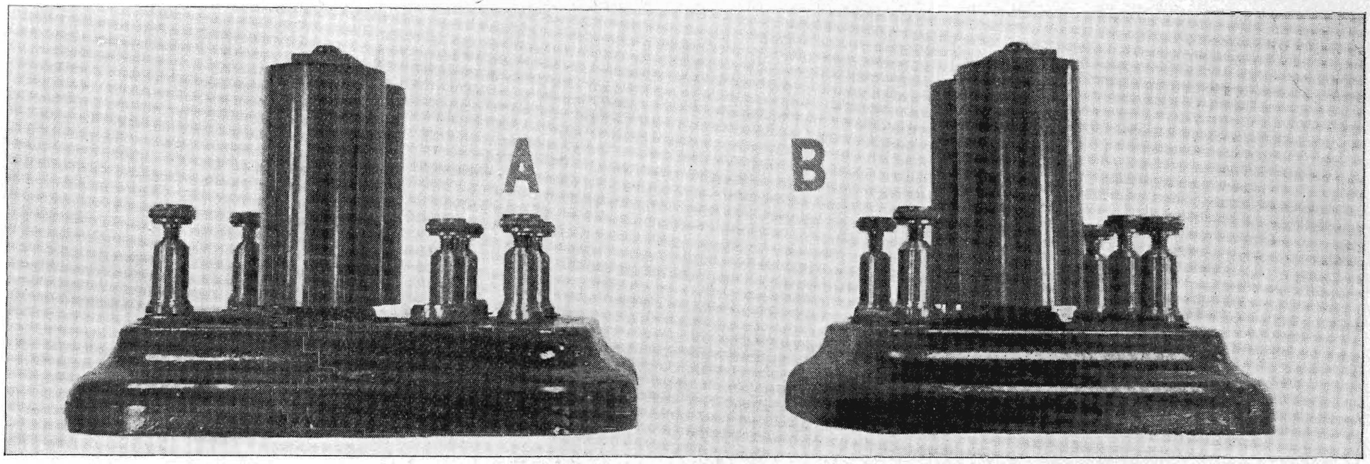


PLATE 121.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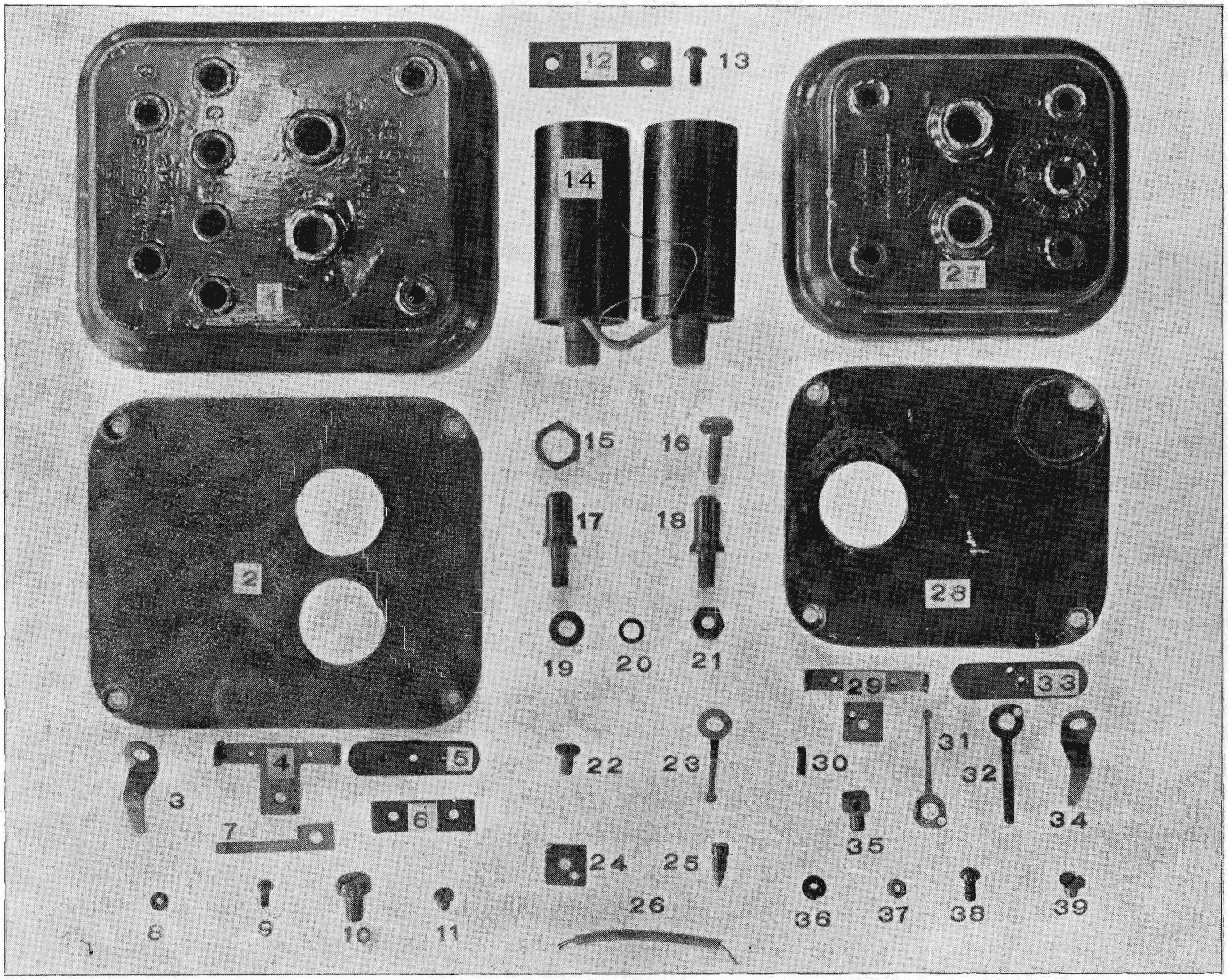
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Relays.

PLATE 121.

OTHER FORMS ARE SHOWN ON PLATES 116, 117, 119, 123 AND 125.

A. 2-Point Relay, sealed base.

B. 1-Point Relay, sealed base.

These relays are tested in the shop and are then permanently sealed against moisture or meddling.

IN ORDERING ANY RELAY, STATE THE RESISTANCE REQUIRED IN OHMS.

ORDER BY PLATE AND NUMBER.

No.

Parts Relating to A, only.

1. Base.
2. Base Plate.
3. Back Stop (no contact).
4. Armature Bracket.
5. Armature.
6. Rubber Insulator, between No. 5 and No. 7
7. Phosphor-Bronze Spring, jeweled point.
8. Rubber Bushing, $\frac{5}{32}''$–$\frac{1}{4}''$, for Nos. 7 and 9.
9. Iron Machine Screw, $\frac{5}{16}$ x 8–32, for fastening Nos. 5, 6 and 7 together.
10. Special Screw, $\frac{1}{2}$ x $\frac{1}{4}$–32, for fastening No. 3 to No. 1.
11. Iron Machine Screw, $\frac{1}{4}''$ x 8–32, for joining Nos. 4 and 5.

Parts Common to A and B.

12. Back Strap.
13. Iron Machine Screw, $\frac{3}{8}$ x 10–24, for back strap No. 12.
14. Magnets.—(In ordering give resistance that is wanted.)
15. Special Brass Nut, $\frac{1}{2}''$–28, for fastening magnets to base.
16. Brass Screw, 10–32, for binding post.
17. Binding Post, with platinum end.
18. Binding Post, plain.
19. Brass Washer, $\frac{1}{4}''$–$\frac{1}{2}''$, for binding post.
20. Rubber Bushing, $\frac{1}{4}''$–$\frac{3}{8}''$, for binding post.
21. Brass Nut, $\frac{1}{4}''$–32, for binding post.
22. Iron Machine Screw, $\frac{3}{8}''$ x 10–24, for joining base to base plate.
23. German Silver Contact Spring, platinum point.
24. Mica Insulation, made in different sizes and forms, depending on where it is to be used.
25. Screw Trunnion, for armature bracket.
26. Piece of Copper Wire in Rubber Tube.

PLATE 121.

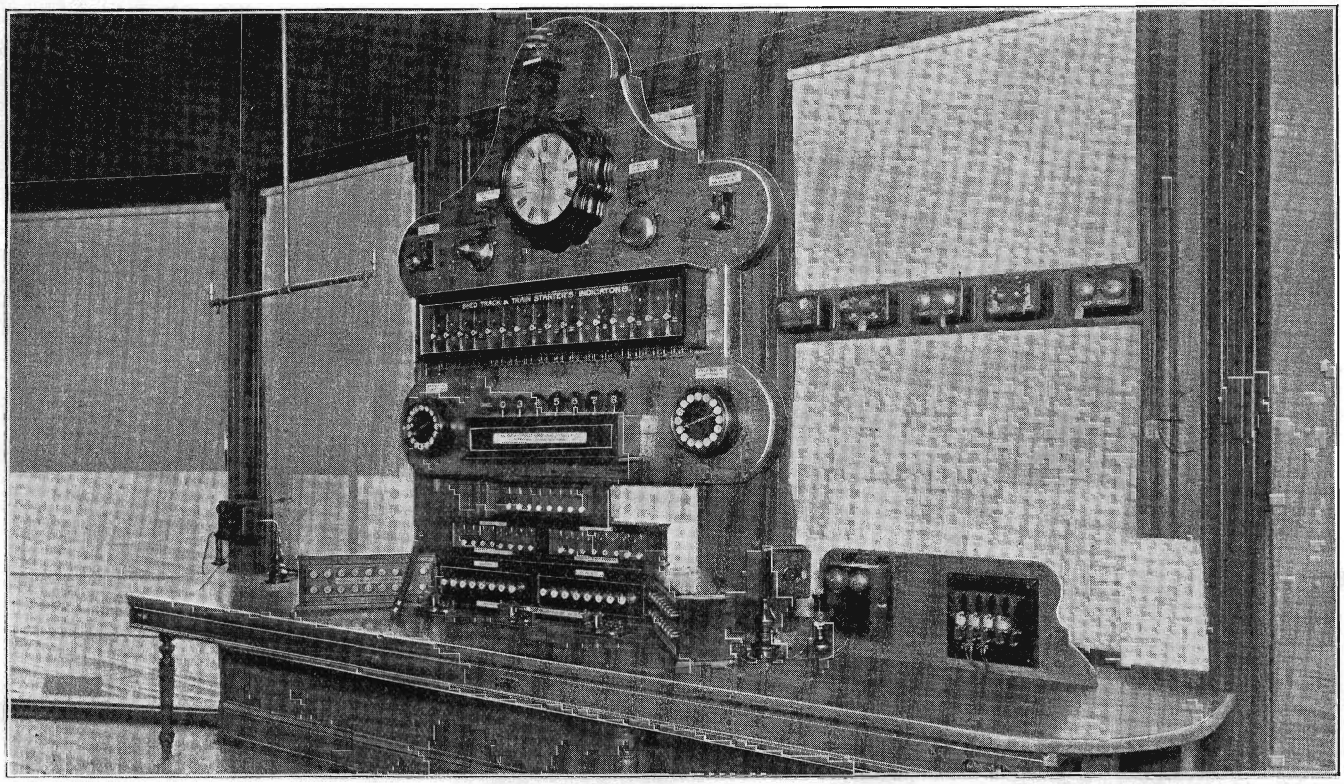
Parts Relating to B, only.

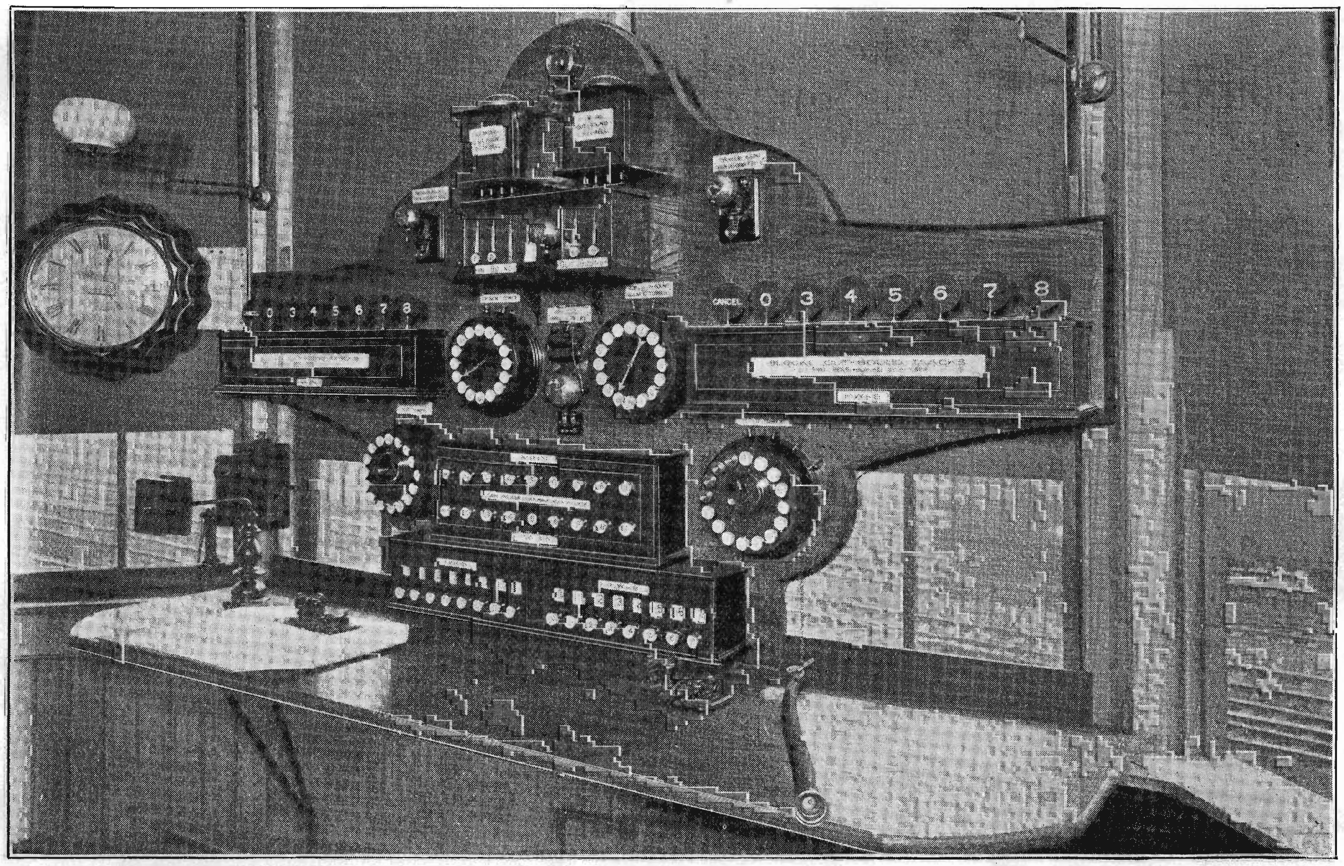
No.	
27.	Base.
28.	Base Plate.
29.	Armature Bracket.
30.	Rubber Screw Pin, 3/8″ x 4–32.
31.	German Silver Contact Spring, platinum point.
32.	Phosphor-Bronze Spring, jeweled point.
33.	Armature.
34.	Back Stop, with contact point.
35.	Fibre Plug.
36.	Rubber Bushing, for No. 38.
37.	Brass Nut, 8–32 for No. 38.
38.	Iron Machine Screw, 7/16″ x 8–32, for joining Nos. 29, 31, 32 and 33.
39.	Iron Machine Screw, 1/4″ x 10–24, for joining base plate to base at the sealed corner.

PLATE 122.

These illustrations show the method of arranging the instruments in a cabin at a large terminal, by means of which the train director is able to keep himself informed of the movement of trains, the condition of the tracks, etc.

These views were taken in cabins of the Pennsylvania Railroad, at Philadelphia, where the Electro-Pneumatic System is in use.

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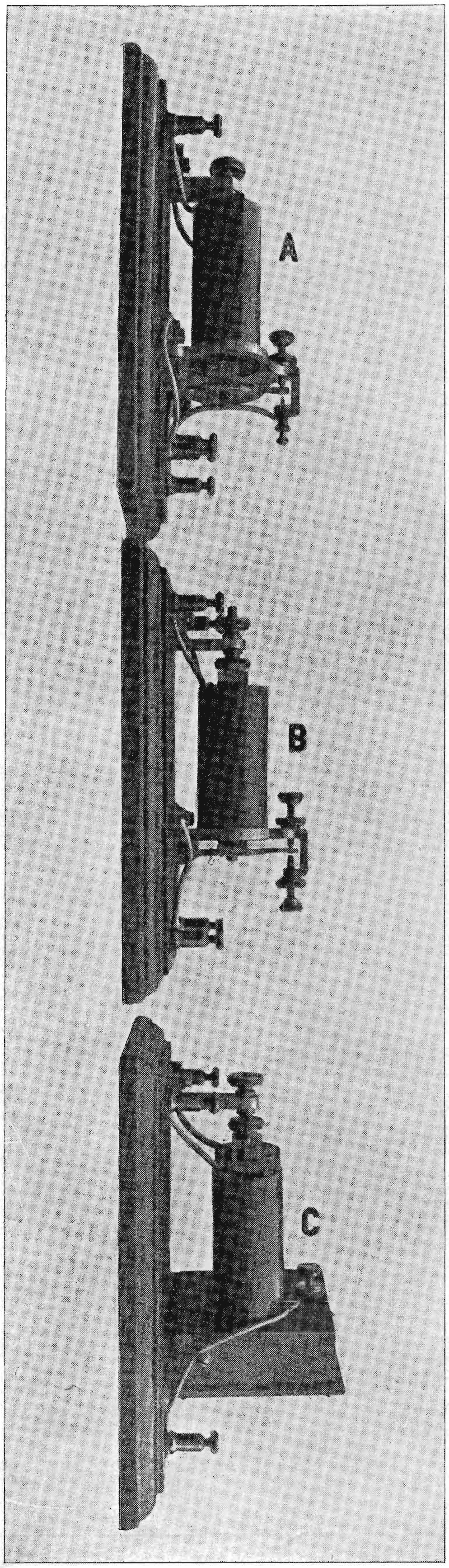
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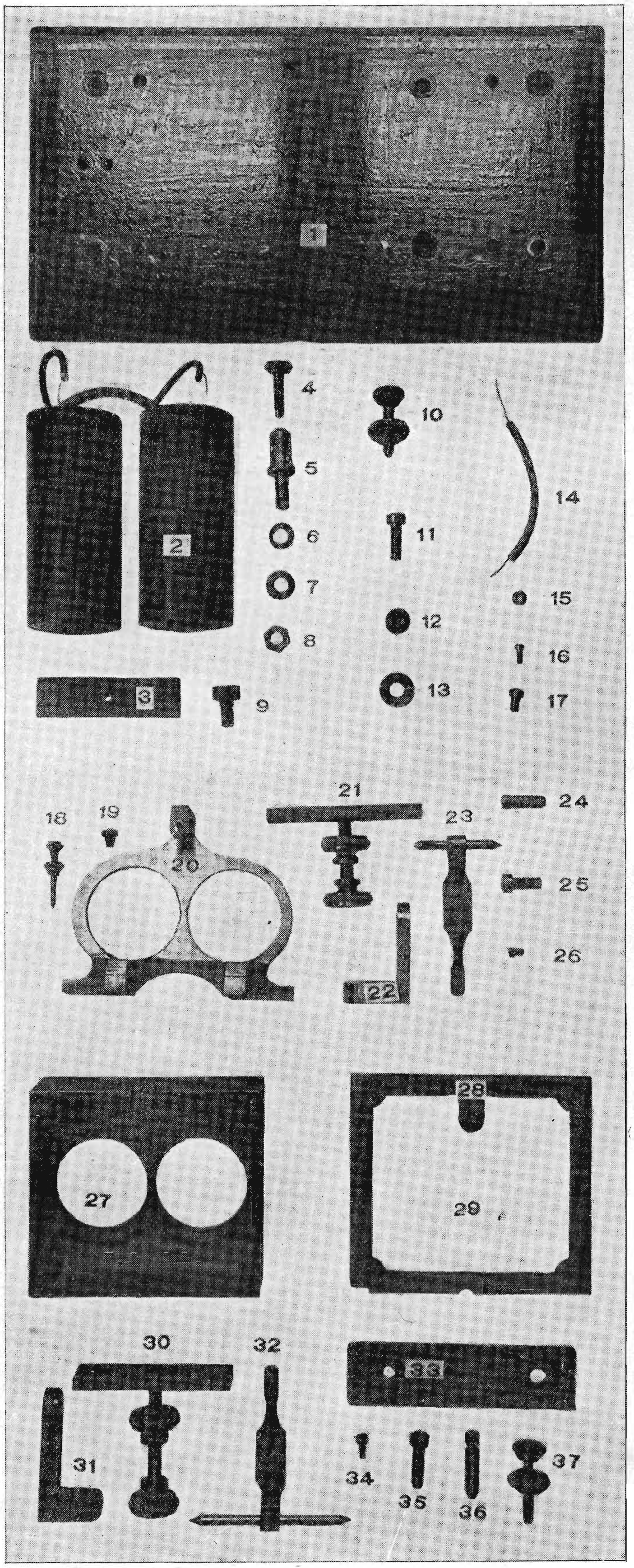
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Relays.

PLATE 123.

OTHER FORMS ARE SHOWN ON PLATES 116, 117, 119, 121 AND 125.

A. 1-Point Relay, front and back contact.

B. 1-Point Relay, back contact, only. Uncovered.

C. 1-Point Relay, back contact, only. Dust proof spectacle.

IN ORDERING ANY RELAY, GIVE THE RESISTANCE REQUIRED IN OHMS.

ORDER BY PLATE AND NUMBER.

No.

Parts Common to A, B and C.

1. Base.
2. Magnets; give resistance in ohms required.
3. Armature.
4. Binding Post Screw.
5. Binding Post.
6. Rubber Bushing, 1/4″—3/8″, for binding post.
7. Brass Washer, 1/4″—1/2″, for binding post.
8. Brass Hex Nut, 1/4″—32, for binding post.
9. Cap Screw, 1/2″ x 1/4″–20, for fastening magnets to back strap.
10. Adjusting Screw and Jam Nut, 1″ x 10–32, with platinum point.
11. Brass Machine Screw, 5/8″ x 12–32, for fastening spectacles A and B and bracket C to base.
12. Rubber Bushing, 7/32″–3/8″, for spectacles A and B and bracket C.
13. Mica Insulation, made in different shapes to suit its position.
14. Copper Wire, in rubber tube.
15. Brass Washer, 1/8″–1/4″, for holding wire to armature bar.
16. Machine Screw, 1/4″ x 4–40, for fastening washer No. 15 to armature bar.
17. Machine Screw, 1/4″ x 8–32, for fastening armature to armature bar.

For Front Contact on A.

18. Adjusting Screw, 7/8″ x 4–52, with plantinum point.
19. Rubber Bushing, 1/4″ x 10–32, for No. 18.

Parts Common to A and B.

20. Spectacle.
21. Back Strap, with stud and adjusting nuts.
22. Magnet Bracket.
23. Armature Bar.
24. Brass Screw, 7/8″ x 1/4″–32, trunnion for armature bar.
25. Machine Screw, 1/2″ x 12–32, for fastening spectacle to base.
26. Machine Screw, 1/4″ x 4–40, for connecting wire to armature bar.

See number 37, part common to B and C.

1-POINT UNCOVERED AND DUST-PROOF RELAYS.—(Continued.)

PLATE 123.

No.

PARTS RELATING TO B, ONLY.

27. DUST PROOF SPECTACLE.
28. COVER-RIM, for spectacle.
29. CELLULOID SHEET.
30. BACK STRAP, with stud and adjusting nuts.
31. MAGNET BRACKET.
32. ARMATURE BAR.
33. RUBBER INSULATION, for dust proof spectacle.
34. MACHINE SCREW, 3/8" x 6–32, for fastening cover to spectacle.
35. MACHINE SCREW, 3/4" x 12–32, for fastening spectacle to base.
36. BRASS SCREW, 1" x 1/4"–32, trunnion for armature bar.
37. ADJUSTING SCREW AND JAM NUT, 1" x 10–32, with insulated point. This is common to B and C.

PLATE 124.

There is here shown a plan of the tracks and signals that are operated by the machine illustrated on Plate 63.

This and that of the Boston & Maine R. R. at Boston (Plate 126), are the largest Electro-Pneumatic Machines yet built.

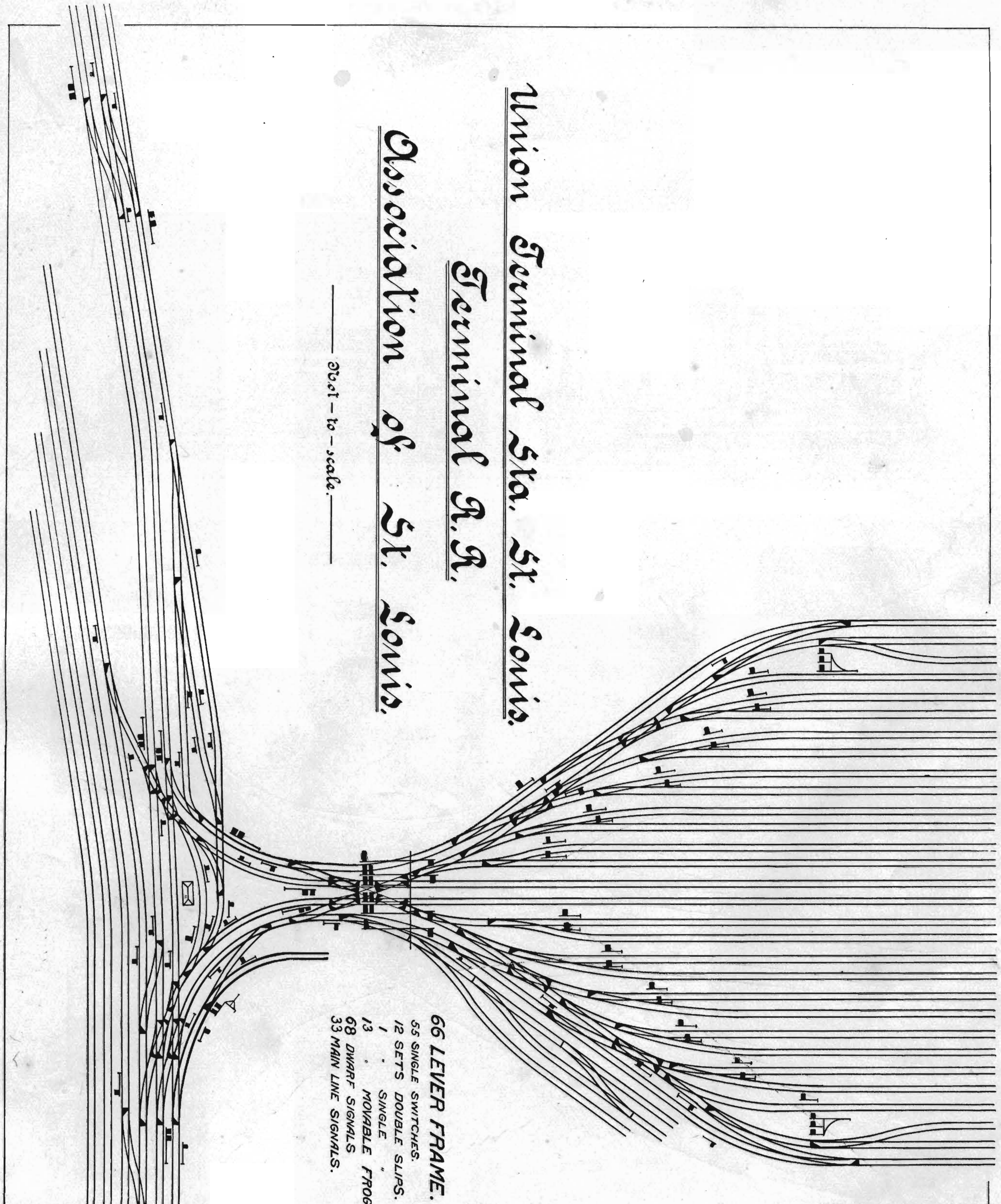
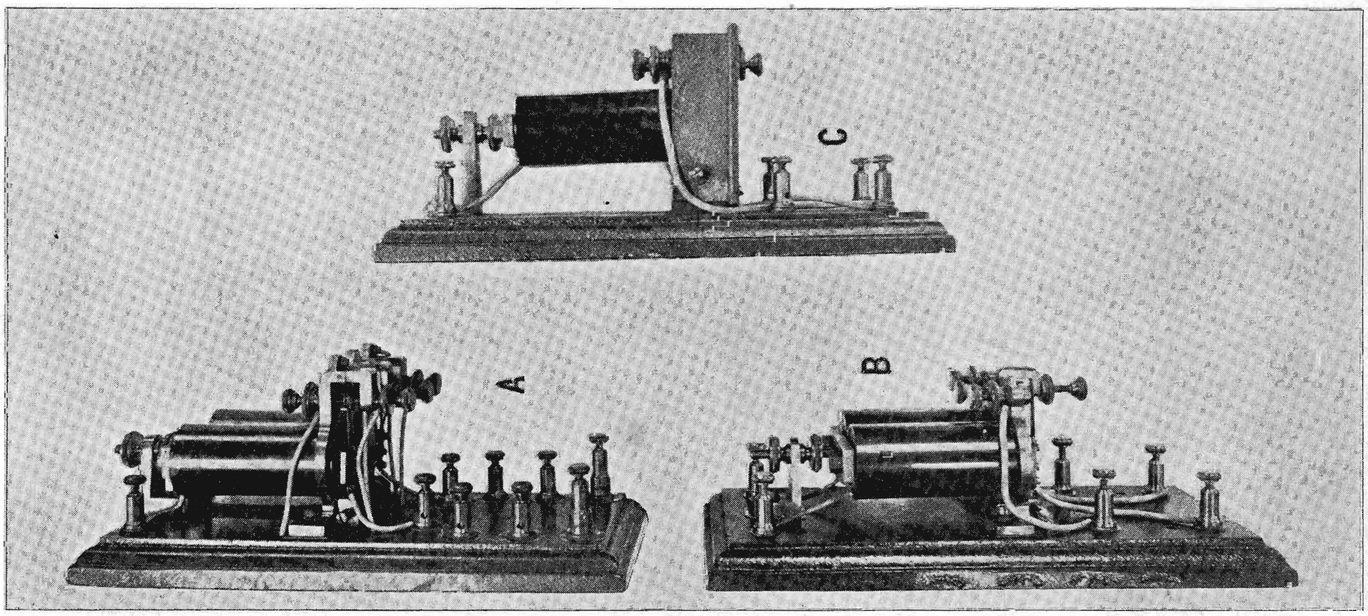

Union Terminal Sta. St. Louis.
Terminal R.R.
Association of St. Louis.
—Not-to-scale.—
66 LEVER FRAME.
55 SINGLE SWITCHES.
12 SETS DOUBLE SLIPS.
1 " SINGLE "
13 " MOVABLE FROGS
68 DWARF SIGNALS.
33 MAIN LINE SIGNALS.

PLATE 125.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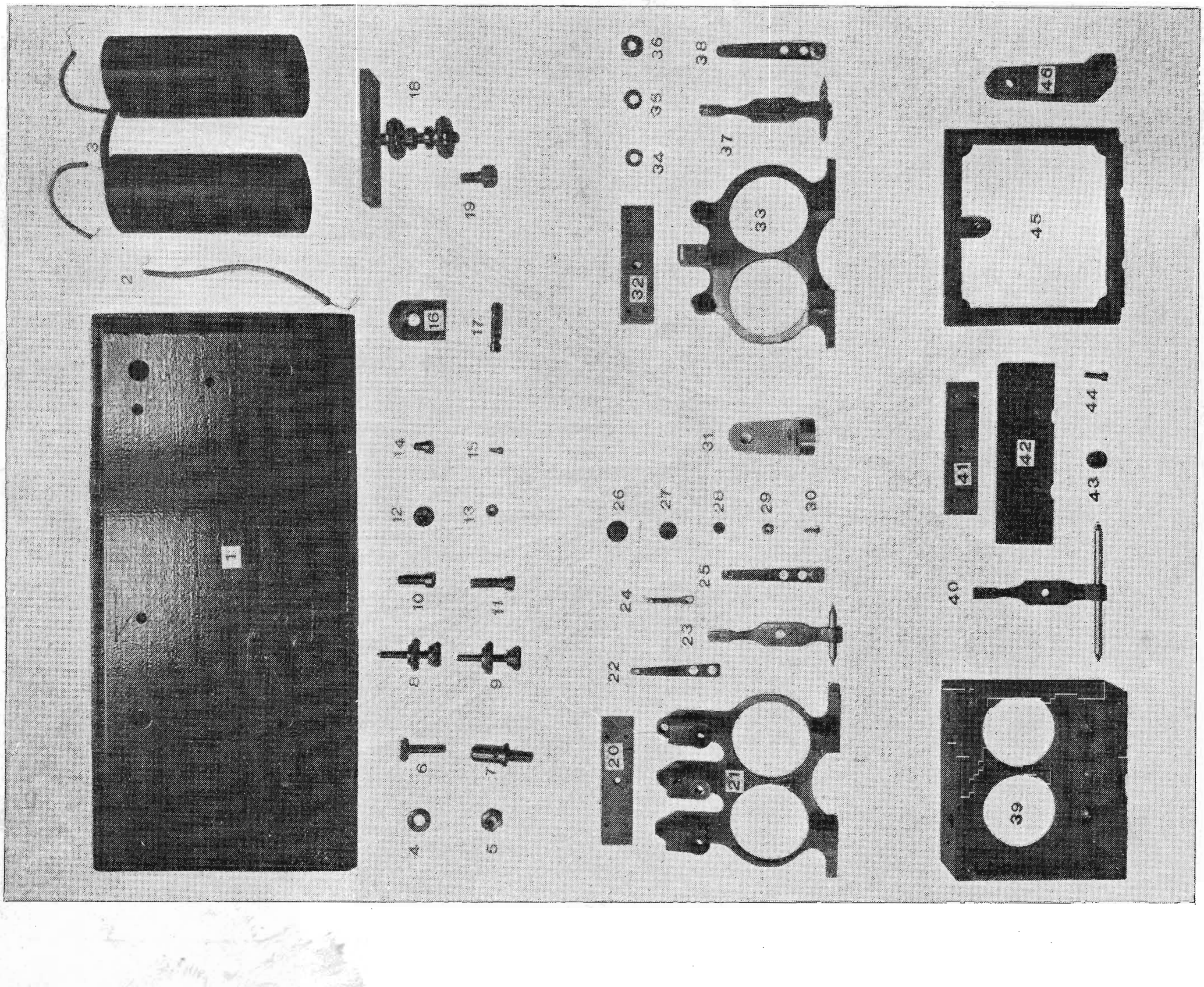
B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Relays.

OTHER FORMS ARE SHOWN ON PLATES 116, 117, 119, 121 AND 123.

PLATE 125.

A. 3-Point Fuse Shunt Relay.
B. 2-Point Relay, Uncovered.
C. 2-Point Relay, dust-proof spectacles.

IN ORDERING ANY RELAY GIVE THE RESISTANCE REQUIRED IN OHMS.

ORDER BY PLATE AND NUMBER.

No.

Parts Common to A, B, and C.

1. Base.
2. Wire Encased in Rubber Tube.
3. Pair of Magnets.—In ordering give required resistance.
4. Brass Washer, $\frac{1}{4}''-\frac{1}{2}''$, for binding posts.
5. Brass Hex Nut, $\frac{1}{4}''$-32, for binding posts.
6. Binding Post Screw.
7. Binding Post.
8. Adjusting Screw and Jam Nut, with contact point.
9. Adjusting Screw and Jam Nut, with insulated point.
10. Brass Machine Screw, $\frac{5}{8}''$ x 12–32, for fastening spectacles.
11. Brass Machine Screw, $\frac{3}{4}''$ x 12–32, for fastening magnet brackets.
12. Rubber Bushing, $\frac{1}{4}''-\frac{3}{8}''$ x $\frac{1}{4}''$, for binding post holes.
13. Rubber Bushing, $\frac{1}{8}''-\frac{1}{4}''$, insulations for side contact springs.
14. Brass Machine Screw, $\frac{1}{4}''$ x 12–32, for fastening armature.
15. Brass Machine Screw, $\frac{1}{4}''$ x 6–32, for fastening side contact springs.
16. Mica Insulation.—This is made in different sizes. Specify what it is wanted for.
17. Brass Trunnion Screw, $1''$ x $\frac{1}{4}''$- 32 for supporting armature bar.
18. Back Strap, with stud and adjusting nuts.
19. Cap Screw, $\frac{1}{2}''$ x $\frac{1}{4}''$-20, for fastening magnets to back strap.

Parts Relating to "A," only.

20. Armature.
21. Spectacle.
22. Front Contact Spring.
23. Armature Bar.
24. Back Contact Spring.
25. Phosphor-Bronze Strip, with jeweled point.
26. Rubber Bushing, $\frac{3}{8}''$ x $\frac{5}{16}''$-18, for back contact screw.
27. Rubber Bushing, $\frac{7}{32}''$ x $\frac{5}{16}''$, for spectacle insulation.
28. Rubber Bushing, $\frac{1}{4}''$ x 12–32, for back contact spring.
29. Brass Washer, $\frac{1}{8}''$ x $\frac{1}{4}''$, for back contact spring.
30. Brass Machine Screw, $\frac{1}{4}''$ x 4–40, for back contact spring.

3-POINT FUSE SHUNT, 2-POINT UNCOVERED AND 2-POINT DUST-PROOF RELAYS.—(Continued.)

No. **PLATE 125.**

31. Magnet Brackets, for A and B.

Parts Relating to "B," only.

32. Armature.
33. Spectacle.
34. Brass Washer, $\frac{3}{16}''$—$\frac{3}{8}''$, for contact screws.
35. Rubber Bushing, $\frac{7}{32}''$—$\frac{3}{8}''$, for spectacles and magnet brackets.
36. Rubber Washer, $\frac{7}{32}''$—$\frac{1}{2}''$, for contact screws.
37. Armature Bar.

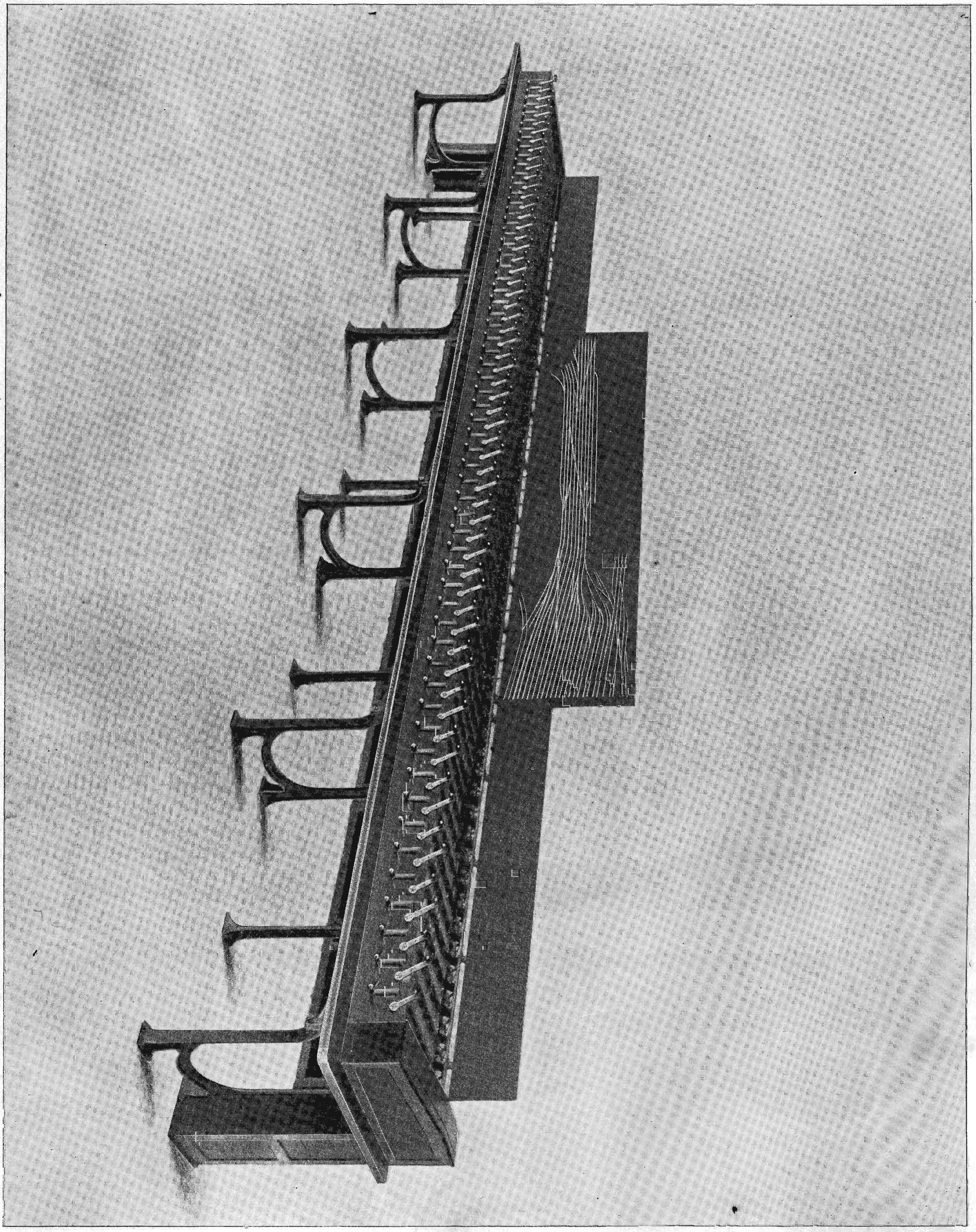
38. Contact Spring, for B and C.

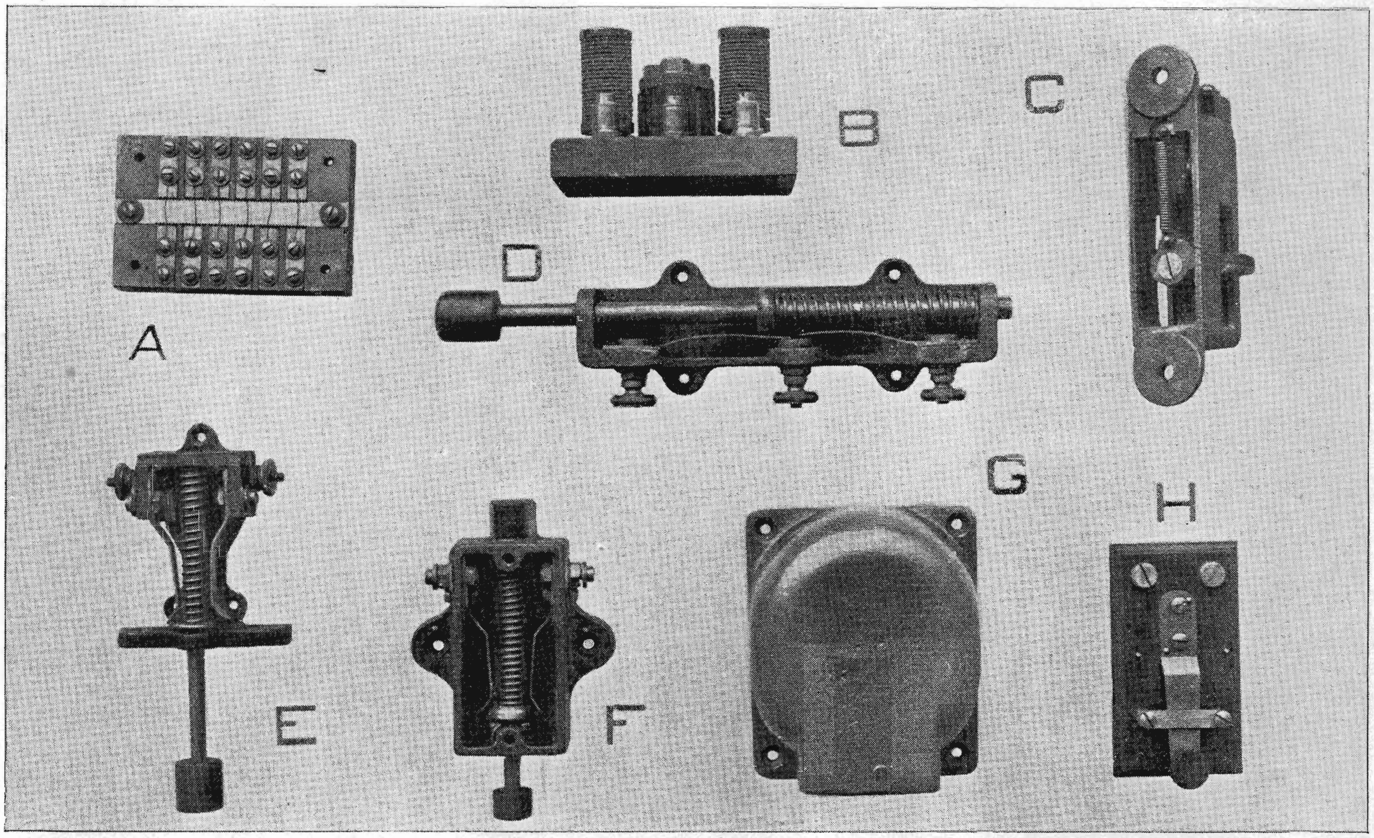
Parts Relating to "C," only.

39. Dust-Proof Spectacle.
40. Armature Bar.
41. Armature.
42. Rubber Insulator, for dust-proof spectacle.
43. Rubber Bushing, $\frac{1}{4}''$—$\frac{3}{8}''$ x 10–32, for contact screws.
44. Brass Machine Screw, $\frac{3}{8}''$ x 6–32, for fastening cover to spectacle.
45. Cover, for spectacle; this includes a celluloid sheet, which if wanted without the brass rim must be so specified.
46. Magnet Bracket.

PLATE 126.

This machine has been recently placed in service at Boston on the Boston & Maine Railroad, and operates the switches and signals at Causeway Street which are shown on Plate 18.




A
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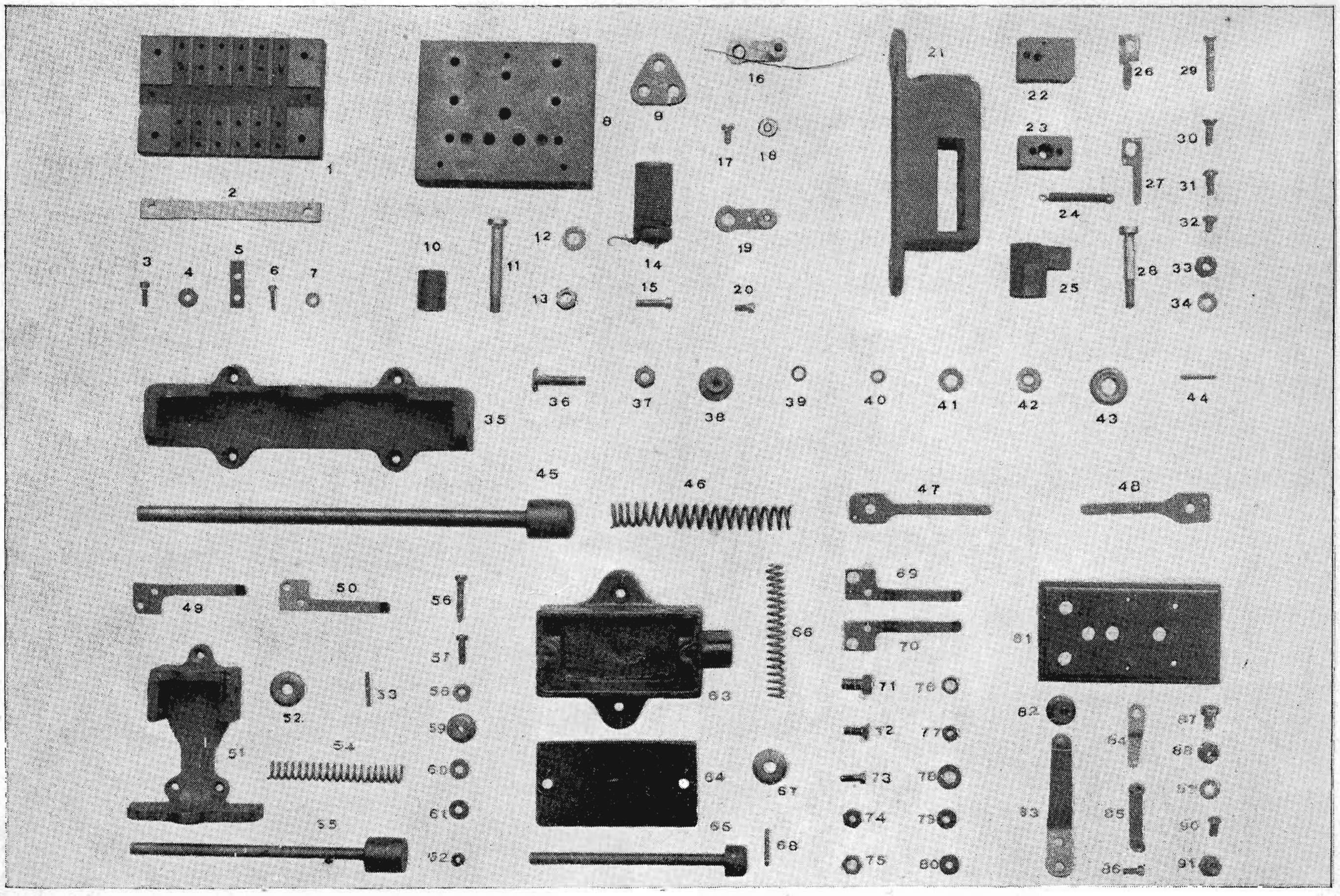
D
E
F
G
H



Lightning Arresters and Circuit Controllers.

PLATE 127.

A. Multiple Lightning Arrester. Made in any size from a 1-way up to a 25-way.

B. Lightning Arrester, for one wire only. This is our most recent form, and has proved extremely reliable.

In ordering any one of figures C, D, E, F or H, state whether it is to be on an open or closed circuit.

C. Circuit Controller. To be placed underneath and fastened to the top plate of an interlocking machine. The lever of the machine strikes the small dog visible on the right-hand side of the figure and thus closes or opens the circuit. The contact springs are struck by the cam that projects from the pivoted end of the dog, which is restored to its normal position by a vertical spring. It may be on either an open or closed circuit.

D. Double Circuit Controller. Especially designed for use in connection with a mechanical interlocking machine. It is placed upon the wooden frame which supports the machine, and is operated by the lever, which strikes it and compresses the spring.

E. Single Circuit Controller. This is the one used in connection with the Union Lock and Block System, and is placed either on the block instrument table, where it can be operated by hand, or under the floor, where it can be reached by the foot of the signal man. In the latter case the rod is made longer than the one shown in the illustration. The controller is usually placed upon an open circuit.

F. Single Circuit Controller. This form is generally placed at the edge of a station platform, where it can be pressed by the foot of a conductor, or in some other convenient place for the purpose of notifying a train starter's office or a signal cabin that a train is ready to start. This instrument is usually placed upon an open circuit.

G. Cover, for Fig. F. Used only when the instrument is exposed to wet or dirt.

H. Press Key Circuit Controller. It has a multitude of applications, and is made either for an open or a closed circuit.

A list of the separate parts will be found upon the following pages.

PLATE 127.

ORDER BY PLATE AND NUMBER.

	No.		
Parts Relating to A.	1.	Hard Rubber Base.	
	2.	Ground Strip.	
	3.	Machine Screw, 1/2" x 8–32, for No. 2.	
	4.	Copper Washer, 3/16"–1/2", for No. 3.	
	5.	Cross Strip.	
	6.	Machine Screw, 1/2" x 6–32, for No. 5.	
	7.	Copper Washer, 5/32"–3/8", for No. 6.	
Parts Relating to B.	8.	Slate Base.	
	9.	Slate Cap.	
	10.	Pole Piece.	
	11.	Brass Screw, 2 1/4" x 5/16"–32, for No. 10.	
	12.	Washer, 5/16"–5/8".	For No. 11.
	13.	Nut, 5/16"–32.	
	14.	Resistance Coil.	
	15.	Machine Screw, 3/4" x 12–32, for No. 14.	
	16.	Binding Post, for No. 10.	
	17.	Machine Screw, 3/8" x 12–32.	For No. 16.
	18.	Washer, 7/32"–7/16".	
	19.	Binding Post, for No. 14.	
	20.	Machine Screw, 3/8" x 8–32, for No. 19.	
Parts Relating to C.	21.	Brass Box.	
	22.	Hard Rubber Base, for Nos. 26 and 27.	
	23.	Hard Rubber Base, for outside wires.	
	24.	Spring, for No. 25.	
	25.	Cam.	
	26.	Bent Contact Spring.	
	27.	Straight Contact Spring.	
	28.	Iron Screw, 1 7/8" x 1/4"–32, for No. 25.	
	29.	Machine Screw, 1 3/8" x 12–24, for joining Nos. 21, 22 and 23.	
	30.	Machine Screw, 5/8" x 12–24, for No. 22.	
	31.	Machine Screw, 1/2" x 12–24, for wires in No. 23.	
	32.	Machine Screw, 3/8" x 12–24, for wires in No. 22.	
	33.	Hex. Nut, 1/4"–32, for No. 28.	
	34.	Brass Washer, 1/4"–1/2", for Nos. 31 and 32.	
Parts Relating to D.	35.	Base.	
	36.	Brass Screw, 1 1/4" x 1/4"–32, for Nos. 47 and 48.	
	37.	Hex. Nut, 1/4"–32, for No. 36.	

LIGHTNING ARRESTERS AND CIRCUIT CONTROLLERS.—(Continued.)

PLATE 127.

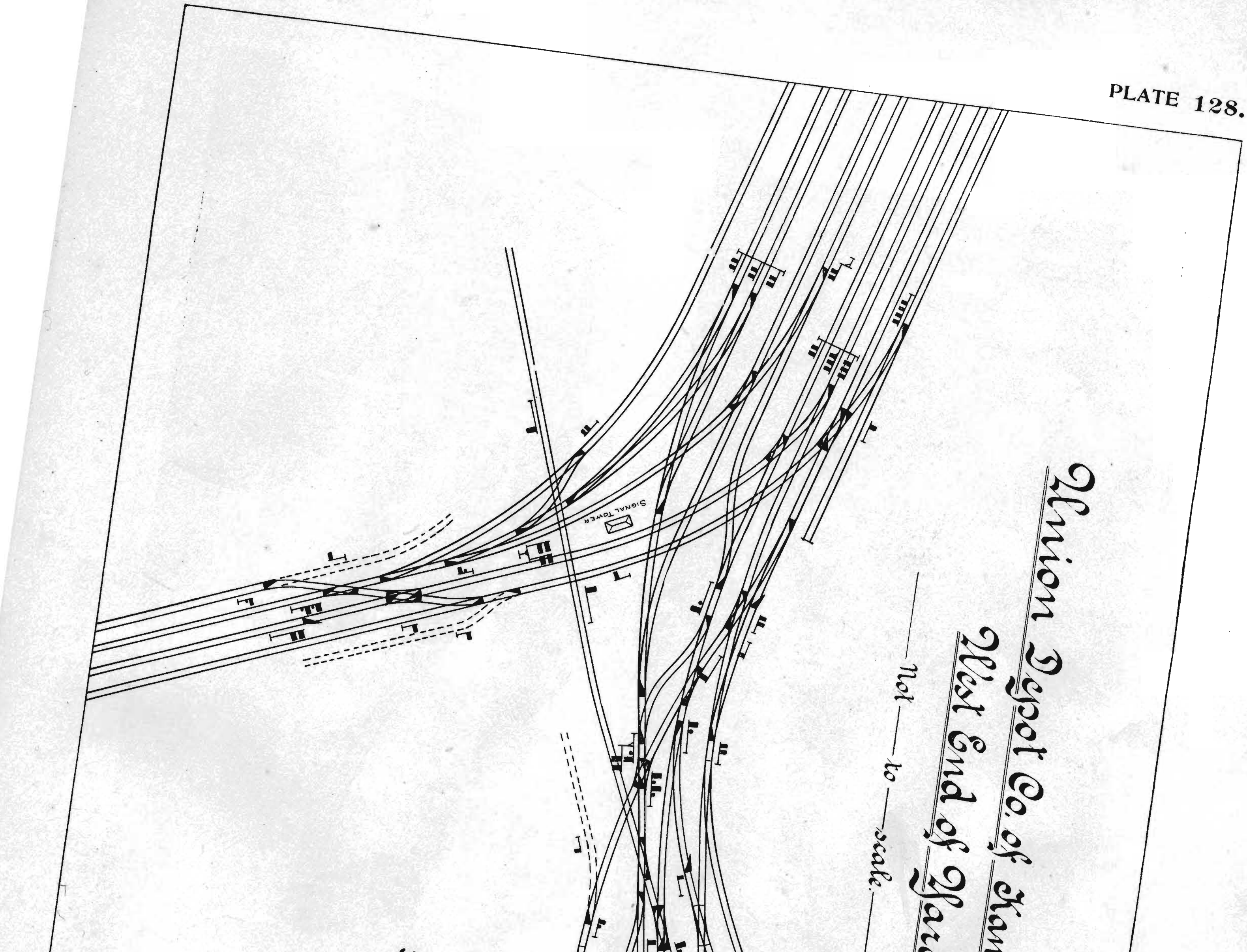
	No.		
Parts Relating to D.	38.	Thumb Nut, 1/4″–32.	For No. 36.
	39.	Rubber Bushing, 1/4″–3/8″.	
	40.	Brass Bushing, 1/4″–3/8″.	
	41.	Brass Washer, 5/16″–5/8″.	
	42.	Fibre Washer, 1/4″–5/8″.	
	43.	Contact Ring, for No. 45.	
	44.	Dowel Pin, for No. 43.	
	45.	Operating Rod and Knob.	
	46.	Spring, for No. 45.	
	47.	Long Contact Spring.	
	48.	Short Contact Spring.	
Parts Relating to E.	49.	Right-Hand Contact Spring.	
	50.	Left-Hand Contact Spring.	
	51.	Base.	
	52.	Contact Ring, for No. 55.	
	53.	Dowel Pin, for No. 52.	
	54.	Spring, for No. 55.	
	55.	Operating Rod and Knob.	
	56.	Machine Screw, 1″ x 10–32, for outside wires and for Nos. 49 and 50.	
	57.	Machine Screw, 5/8″ x 10–32, for Nos. 49 and 50.	
	58.	Hex. Nut, 10–32, for Nos. 56 and 57.	
	59.	Thumb Nut, 10–32, for No. 56.	
	60.	Brass Washer, 7/32″–7/16″.	For Nos. 56 and 57.
	61.	Fibre Washer, 7/32″–7/16″.	
	62.	Rubber Bushing, 3/16″–5/16″.	
Parts Relating to F.		See Fig. G.	
	63.	Base.	
	64.	Cover.	
	65.	Operating Rod and Knob.	
	66.	Spring.	For No. 65.
	67.	Contact Ring.	
	68.	Dowel Pin, for No. 67.	
	69.	Right-Hand Contact Spring.	
	70.	Left-Hand Contact Spring.	
	71.	Cap Screw, 1/2″ x 5/16″–32, for fastening wires.	
	72.	Machine Screw, 5/8″ x 14–20, for fastening No. 64 to No. 63.	
	73.	Machine Screw, 1/2″ x 10–32, for head of No. 71, and for fastening Nos. 69 and 70.	
	74.	Hex. Nut, 10–32, for No. 73.	

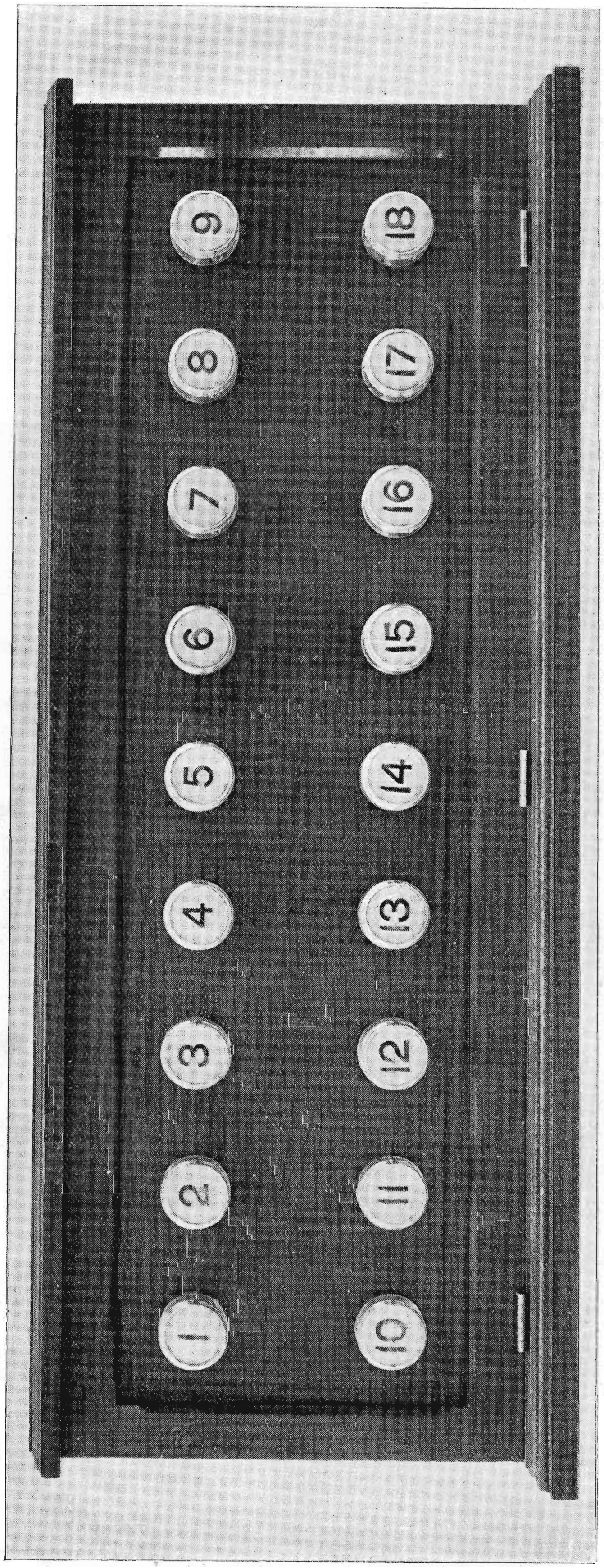
PLATE 127.

	No.		
Parts Relating to F.	75.	Hex. Nut, $\frac{5}{16}$"–32, for No. 71.	
	76.	Rubber Bushing, $\frac{5}{16}$"–$\frac{7}{16}$", for No. 71.	
	77.	Rubber Bushing, $\frac{3}{16}$"–3/8", for No. 73.	
	78.	Fibre Washer, $\frac{5}{16}$"–5/8", for No. 71.	
	79.	Fibre Washer, $\frac{3}{16}$"–1/2".	For No. 73.
	80.	Brass Washer, $\frac{3}{16}$"–1/2".	
Parts Relating to H.	81.	Rubber Base.	
	82.	Knob, for No. 83.	
	83.	Large Contact Spring.	
	84.	Small Contact Spring.	
	85.	Bridge.	
	86.	Machine Screw, 3/8" x 10–32, for No. 85.	
	87.	Machine Screw, 1/2" x 1/4"–32, for fastening wires.	
	88.	Hex. Nut, 1/4"–32.	For No. 87.
	89.	Brass Washer, 1/4"–1/2".	
	90.	Machine Screw, 3/8" x 12–32, for joining Nos. 83 and 84.	
	91.	Hex. Nut, 12–32, for No. 90.	

PLATE 128.

This was a comparatively early installation of the Electro-Pneumatic System, for it has been in constant service since 1889. The system of tracks is an extremely complicated one, consisting as it does of Railroad crossings and switches directly in front of a large union passenger station.


Union Depot Co. of Kansas City, Mo.
West End of Yard.
Not to scale.
SIGNAL TOWER
36 LEVER FRAME
23 SINGLE SWITCHES
3 DERAILS
5 SETS DOUBLE SLIPS.
6 " SINGLE "
21 DWARF SIGNALS.
41 MAIN LINE SIGNALS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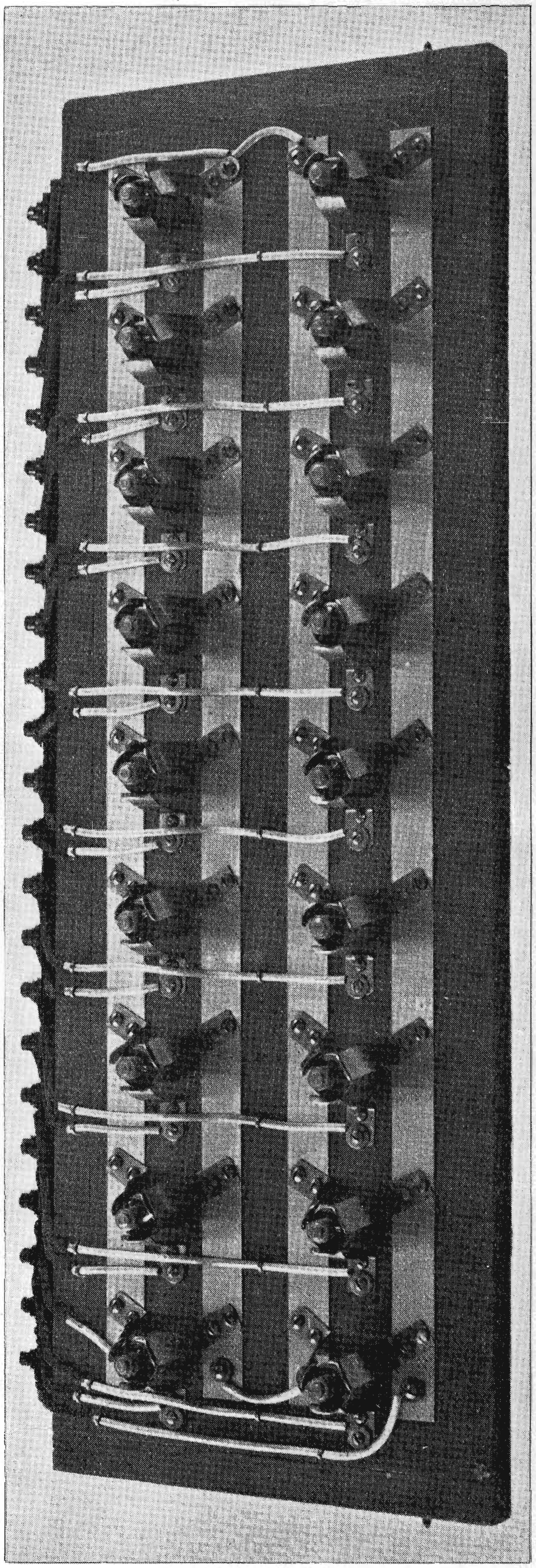
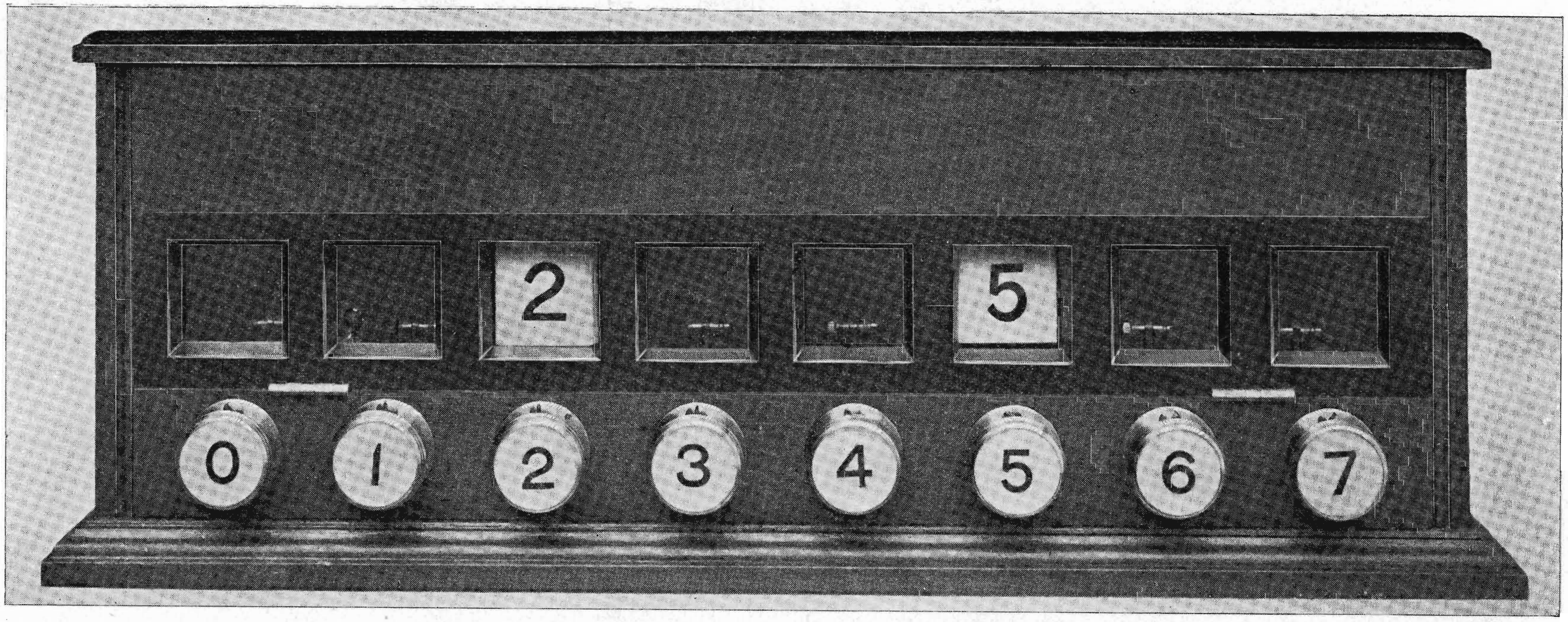


Multiple Push Button Instrument.

PLATE 129.

THIS is one form of the many push button instruments that we manufacture; it may be worked on a closed or open circuit, and is intended for either operating or restoring a drop annunciator. One of its applications is in the train starter's office at the Philadelphia terminal of the Pennsylvania Railroad. In this case it is used for operating the semaphore annunciator in the interlocking cabin which tells the director that a train upon a certain track is ready to start. It may also be used between cabins for various purposes, and is an extremely useful and substantial instrument.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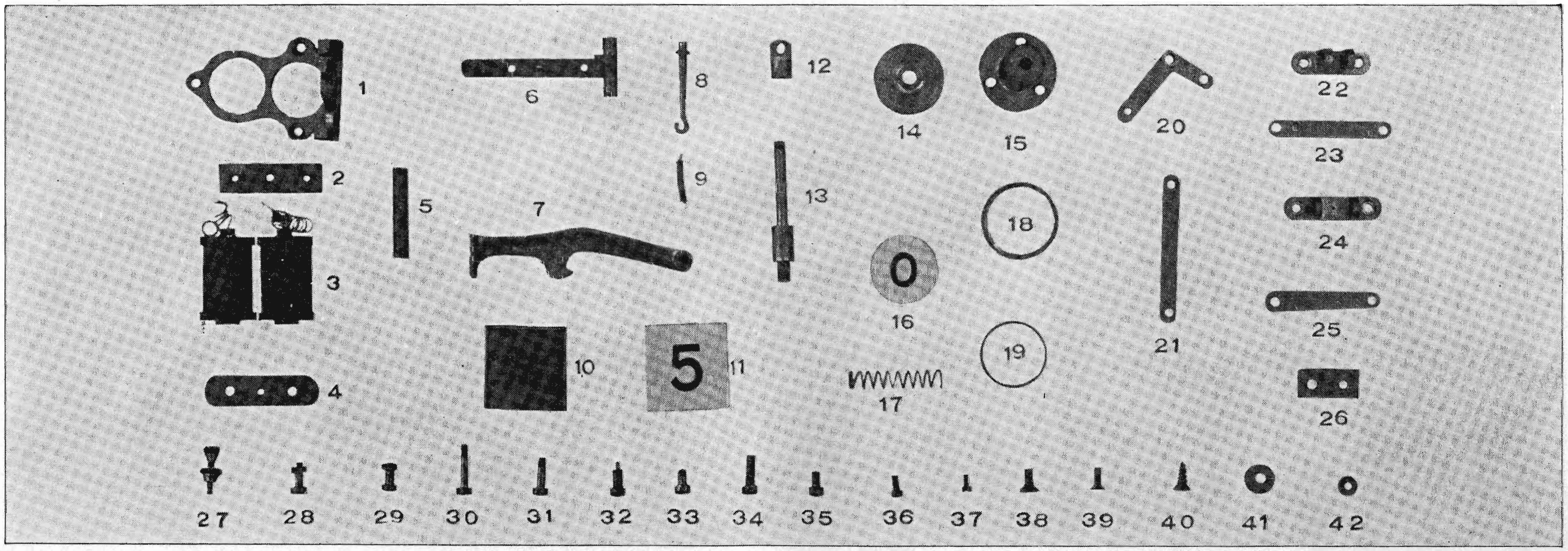
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PLATE 130.

Drop Indicator Without Bell.

PLATE 130.

WE ILLUSTRATE this instrument for two reasons: first, it is unusually substantial in construction; second, any one of the indicators may be caused to disappear without disturbing any of the others. It is made in many different sizes, and like almost all of our electrical instruments may be connected either with a track circuit or a push button.

ORDER BY PLATE AND NUMBER.

No.

1. Spectacle.
2. Back Strap.
3. Magnets.
4. Armature.
5. Spectacle Support.
6. Armature Bar.
7. Indicator Arm.
8. Tension Post.
9. Tension Spring.
10. Indicator Plate.
11. Indicator Number.
12. Push Button Jaw.
13. Push Button Shaft.
14. Push Button.
15. Push Button Guide.
16. Push Button Number.
17. Push Button Spring.
18. Push Button Ring.
19. Push Button Glass.
20. Crank.
21. Horizontal Link.
22. Crank Stand.
23. Vertical Link.
24. Upper Link Stand.
25. Upper Link.
26. Phosphor-Bronze Contact Plate.
27. Adjusting Screw and Jam Nut, ¾″ x 4–52, for No. 1.

No. PLATE 130.

28. Special Screw and Nut, $\frac{7}{16}''$ x 6–32, for joining Nos. 7 and 22.
29. Special Screw and Nut, $\frac{3}{8}''$ x 6–32, for joining Nos. 12 and 23.
30. Special Screw, $\frac{3}{4}''$ x 6–32, for joining Nos. 7, 24 and 25.
31. Special Screw, $\frac{1}{2}''$ x 6–32, for joining Nos. 20 and 22.
32. Special Screw, $\frac{7}{16}''$ x $\frac{1}{4}''$–32, for joining Nos. 1 and 6.
33. Special Screw, $\frac{1}{4}''$ x 6–32, for joining Nos. 20 and 21.
34. Brass Machine Screw, $\frac{1}{2}''$ x 8–32, for coarse wire in No. 26.
35. Brass Machine Screw, $\frac{1}{4}''$ x 8–32, for joining Nos. 4 and 6.
36. Brass Machine Screw, $\frac{1}{4}''$ x 6–32, for fastening Nos. 22 and 24 to the case.
37. Brass Machine Screw, $\frac{1}{4}''$ x 4–40, for fine wire in No. 26.
38. Iron Machine Screw, $\frac{3}{8}''$ x 8-32, for joining Nos. 2 and 3.
39. Brass Machine Screw, $\frac{3}{8}''$ x 6–32, for joining Nos. 1 and 5.
40. Brass Wood Screw, $\frac{1}{2}''$–#6, for No. 15.
41. Copper Washer, $\frac{3}{16}''$–$\frac{1}{2}''$, for No. 34.
42. Brass Washer, $\frac{1}{8}''$–$\frac{5}{16}''$, for No. 37

Multiple Disc Indicator.

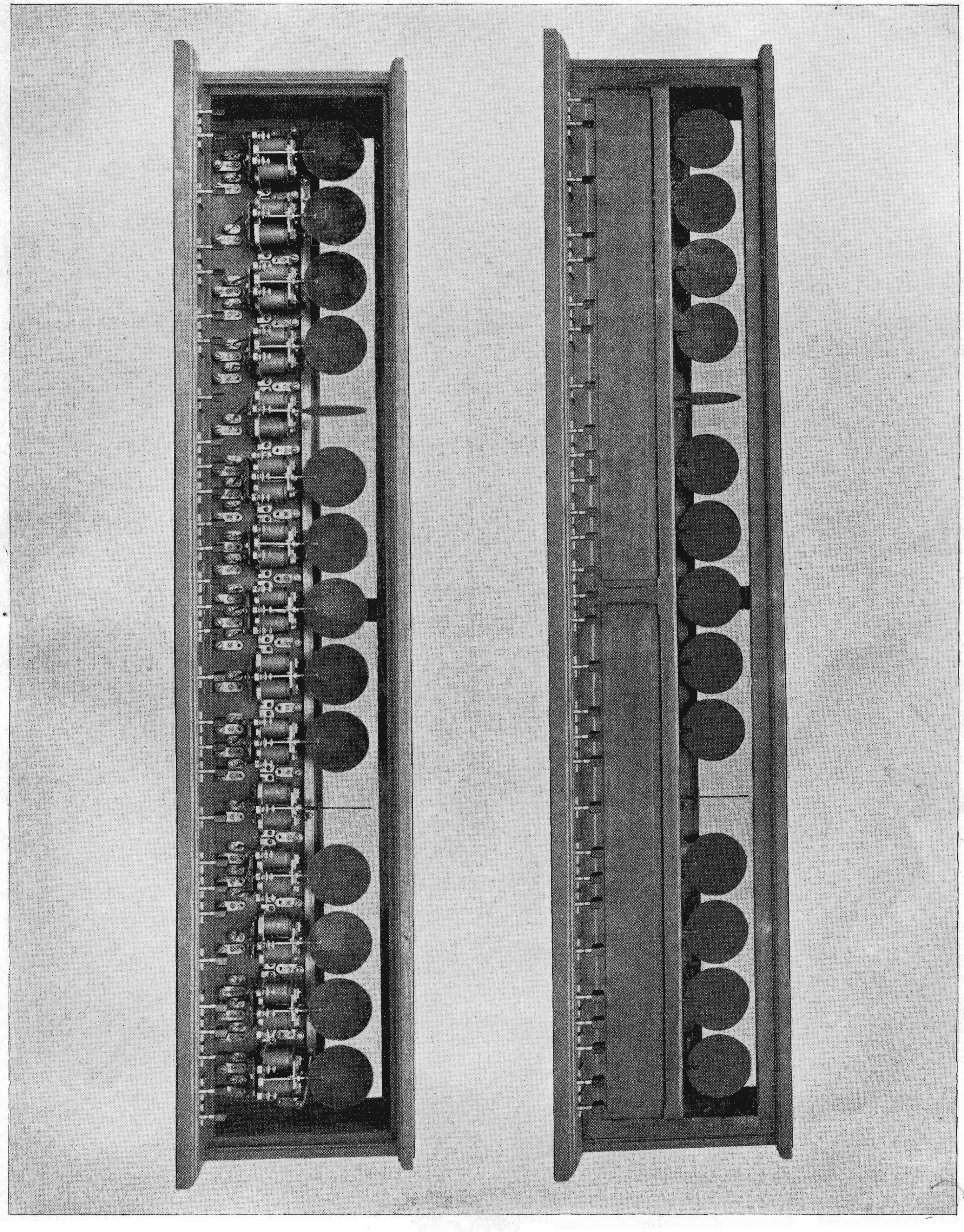
PLATE 131.

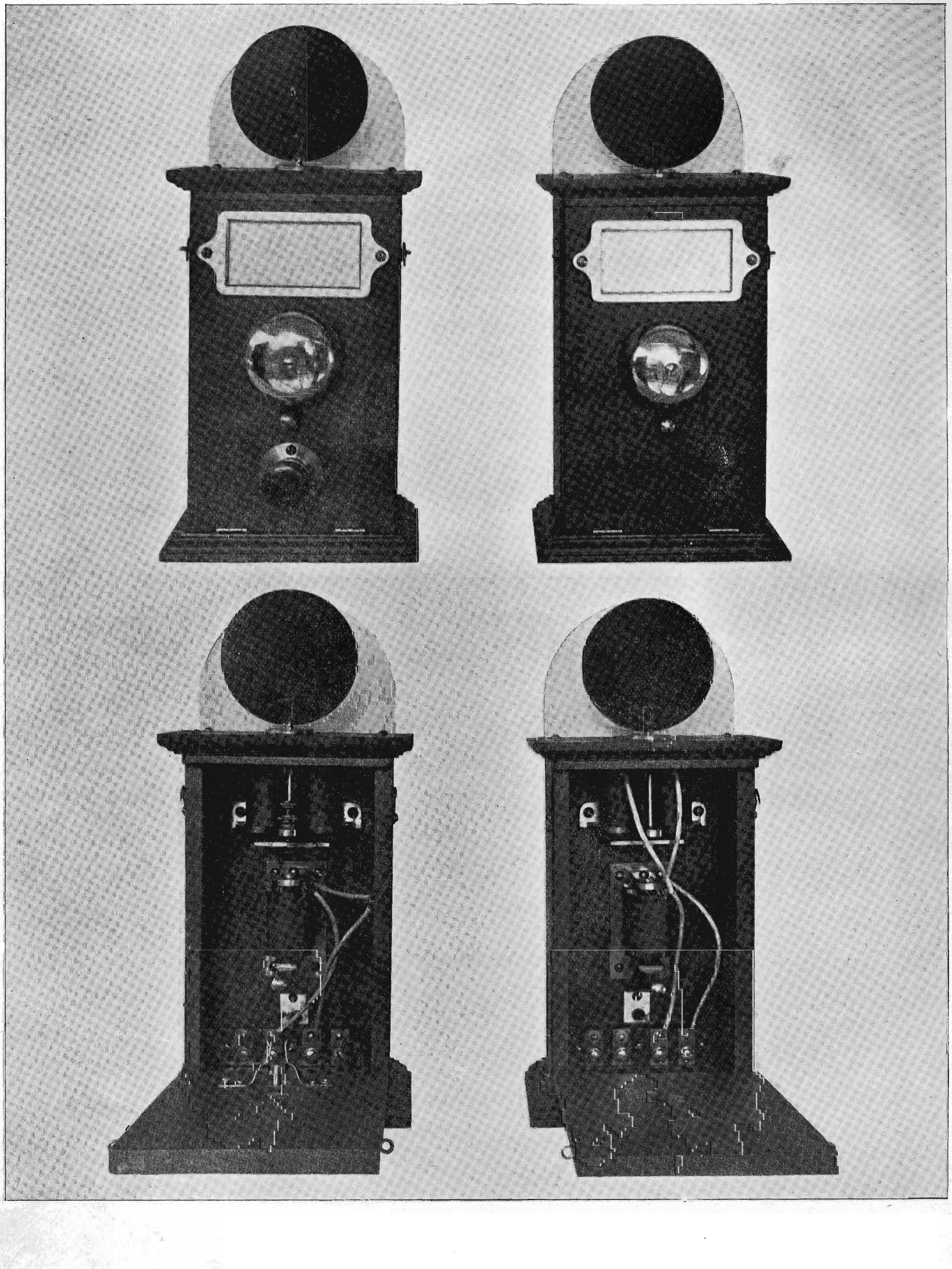
THERE are so many different forms of indicators that it is impossible to illustrate or describe them in all of their variations. This instrument is sometimes operated by a push button, sometimes by a track circuit and may be worked over long distances.

The faces of the discs are marked with figures or letters which indicate their functions. When the full front of the disc is exposed it indicates that the track with which it is in communication is blocked; on the contrary by turning its edge to the front, the disc shows that the track connected with it is clear.

The upper figure presents the appearance of the indicator as it is seen when ready for service, while the lower one has the front of the case removed, and exposes to view the magnets and relative parts.

A single indicator much after this pattern is shown on the lower part of Plate 133.





Two Forms of Single Disc Indicators with Bells.

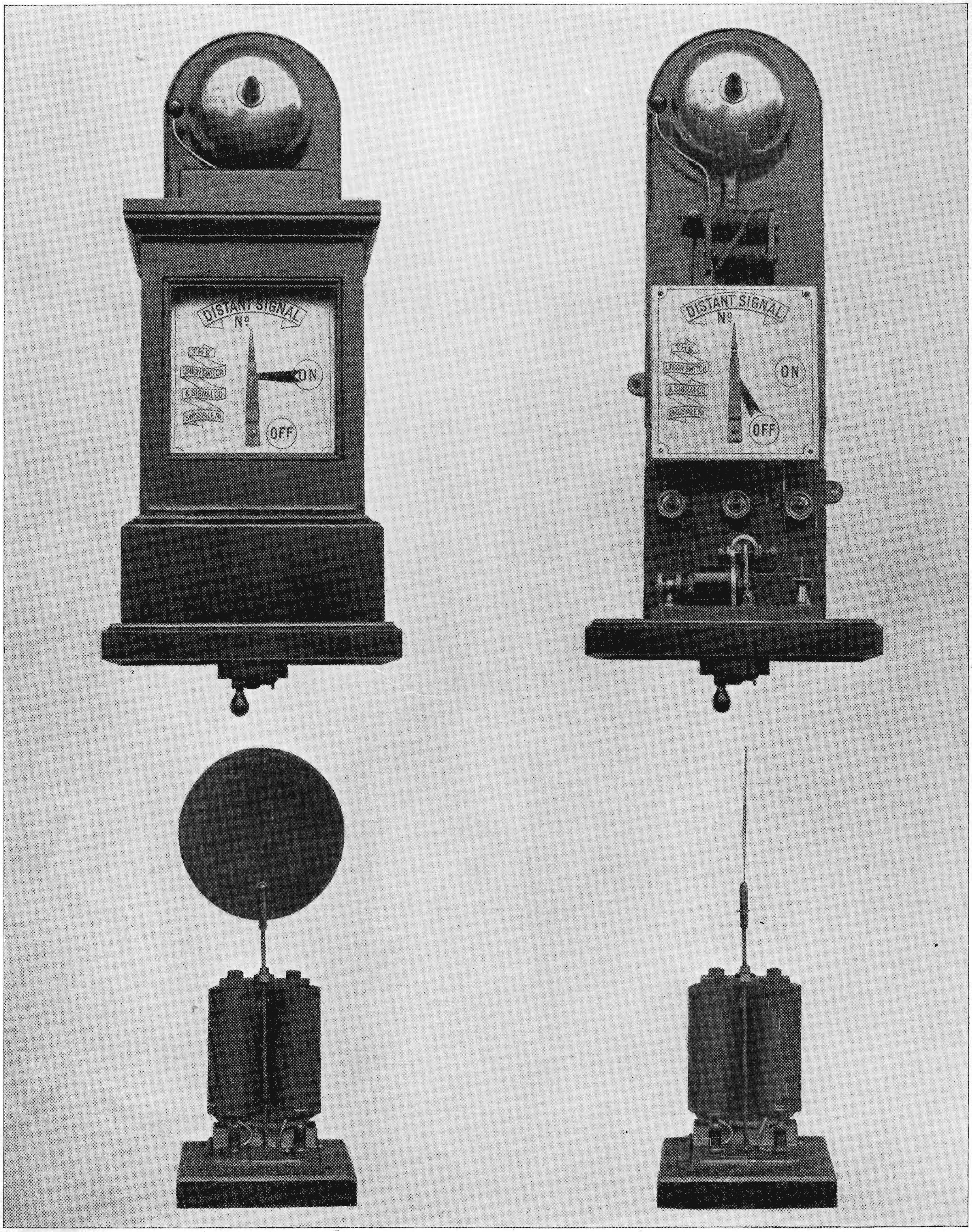
PLATE 132.

THE upper figure on the left is usually placed in a signal cabin for the purpose of indicating the approach of a train. The disc, which is now in its normal position, revolves through an arc of 90°, and in making its passage closes the bell circuit and calls the attention of the operator to its movement; the knob which appears below the bell is for the purpose of acknowledging the signal and of restoring the disc to its normal position.

The right-hand figure resembles the one on the left, except in the fact that it is frequently made automatic in its action. The bell may be arranged to ring continuously when the disc is in one or other of its positions, or it may be arranged to ring only while the disc is in motion.

This instrument is often used to inform an operator as to whether or not a track is occupied, in which event it is connected with a track circuit.

The lower figures correspond with the ones above them, but show the cases open and illustrate the arrangement of the magnets.


DISTANT SIGNAL
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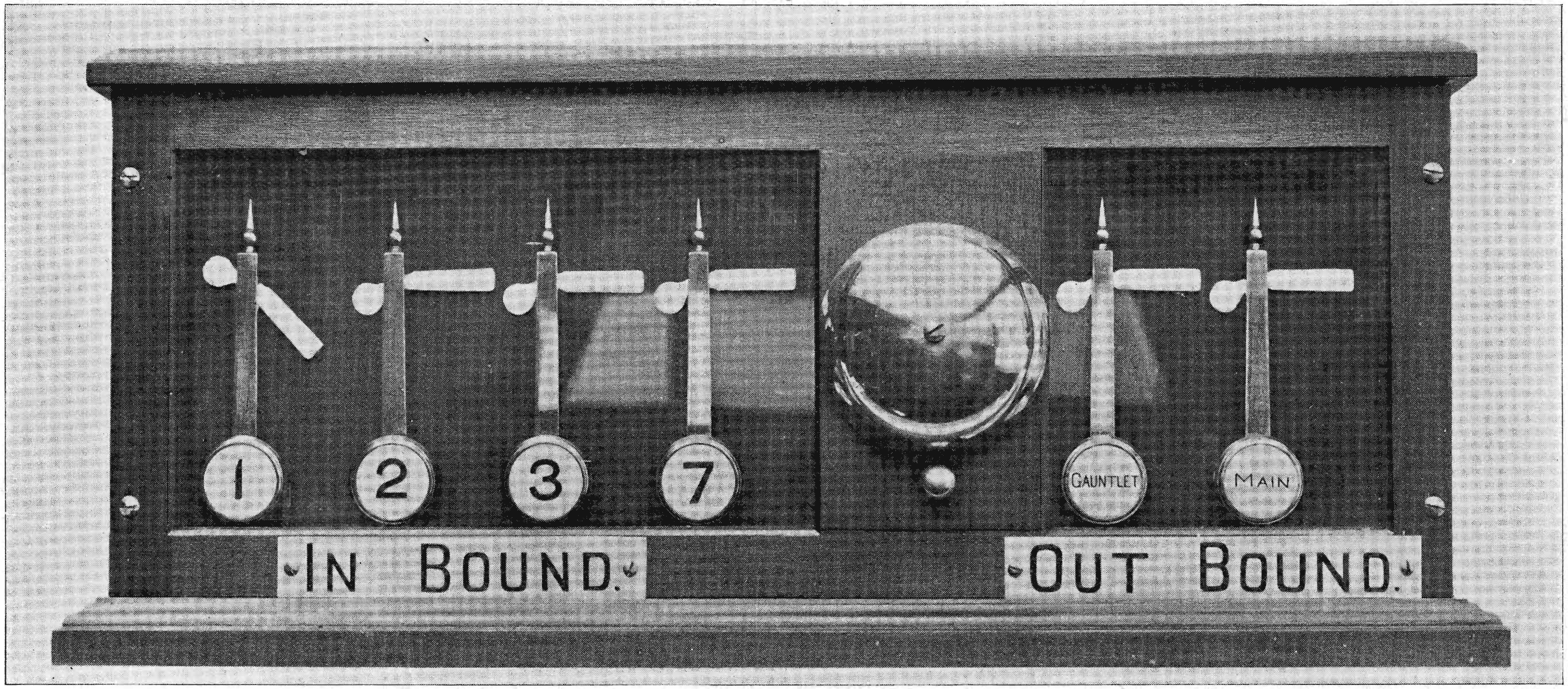
THE
UNION SWITCH
& SIGNAL CO.
SWISSVALE PA.
ON
OFF
DISTANT SIGNAL
No
THE
UNION SWITCH
& SIGNAL CO.
SWISSVALE PA.
ON
OFF

Single Semaphore Indicator and Single Disc Indicator.

PLATE 133.

THERE are here shown single forms of the Multiple Semaphore Indicator and Multiple Disc Indicator illustrated on Plates 135 and 131. The SEMAPHORE INDICATOR which occupies the upper part of the plate is arranged as a distant signal repeater, and through a circuit breaker (Fig. C, Plate 100), located on a distant signal post, will inform an operator that a certain signal has followed the movement of its lever in the cabin. This may be arranged to work with a home signal quite as well, while other uses will suggest themselves.

The DISC INDICATOR is illustrated on the lower half of the plate, and is so simple in form and construction that no particular description is necessary.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GAUNTLET
MAIN
IN BOUND.
OUT BOUND.

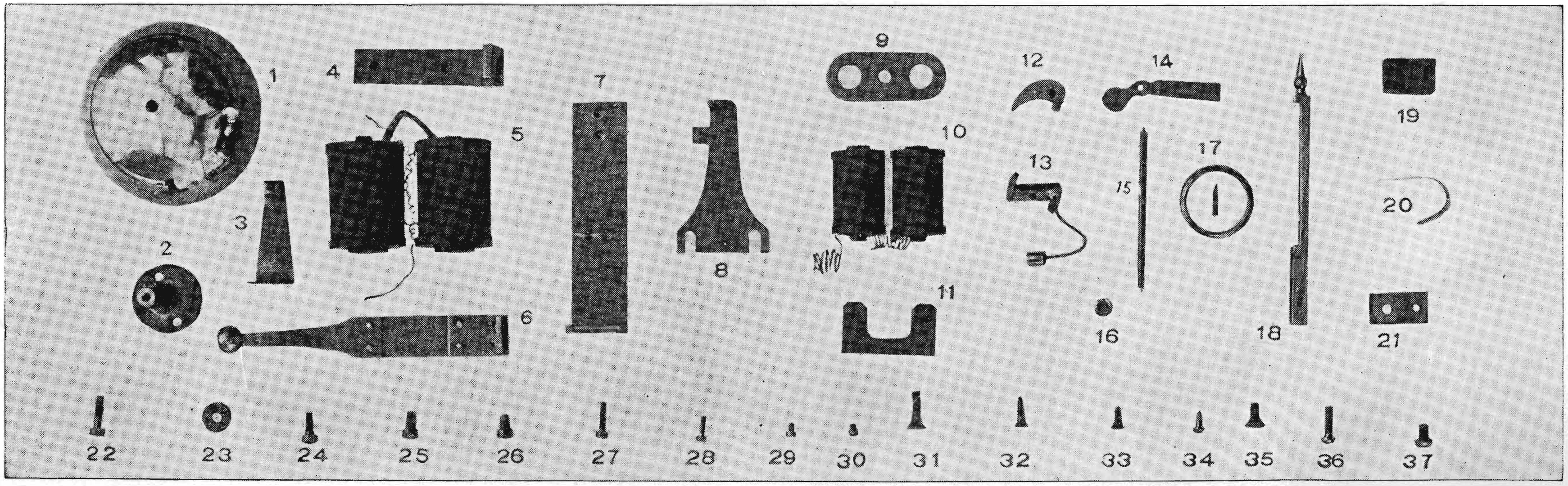
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PLATE 134.

Semaphore Indicator with Bell Attachment.

PLATE 134.

THIS instrument was designed for the purpose of informing the leverman in a cabin as to the condition of the tracks which he controls. When a track is unoccupied by any train the arm will be lowered as on post 1; on the contrary, for those tracks which are occupied the arms will retain the horizontal position as shown on posts 2, 3, 7, "Gauntlet" and "Main." The arms in passing from one position to another make a temporary contact and ring the bell.

The device may be operated either by the track circuit or a push button, and is susceptible of many applications, only one of which is described above. It may also be made of any size.

ORDER BY PLATE AND NUMBER.

No.		
1.	Bell.	
2.	Post.	For Bell.
3.	Hammer Stop.	
4.	Back Strap.	
5.	Magnet.	
6.	Hammer (armature).	
7.	Back Strap Support.	
8.	Bracket.	For Semaphore.
9.	Magnet Spectacle.	
10.	Magnets.	
11.	Back Strap.	
12.	Magnet Pole.	
13.	Magnet Armature.	
14.	Semaphore.	
15.	Semaphore Shaft.	
16.	Commutator.	
17.	Number Plate and Brass Ring.	
18.	Semaphore Post.	
19.	Rubber Circuit Breaker Base.	
20.	German Silver Circuit Breaker Spring.	
21.	Connecting Wire Terminal.	
22.	Brass Machine Screw, ½″ x 8–32, for fastening No. 21.	
23.	Copper Washer, ⅛″—½″, for No. 22.	

No. PLATE 134.

24. Brass Machine Screw, 3/8" x 8–32, for joining Nos. 4 and 7.
25. Brass Machine Screw, 5/16" x 8–32, for joining Nos. 6 and 7.
26. Brass Machine Screw, 1/4" x 8–32, for joining Nos. 8 and 11.
27. Brass Machine Screw, 1/2" x 6–32, for fastening No. 19.
28. Brass Machine Screw, 3/8" x 4–40, for connecting magnet wire to No. 21.
29. Brass Machine Screw, 1/8" x 4–40, for connecting ground wire to No. 21.
30. Brass Machine Screw, 1/8" x 6–32, for fastening No. 20 to 19.
31. Brass Machine Screw, 5/8" x 8–32, for joining Nos. 10 and 11.
32. Brass Wood Screw, 1/2"—#6, for fastening No. 7 to case.
33. Brass Wood Screw, 3/8"—#6, for fastening No. 2 to case.
34. Brass Wood Screw, 1/4"—#5, for fastening No. 3 to case.
35. Iron Machine Screw, 3/8" x 8–32, for joining Nos. 4 and 5.
36. Iron Machine Screw, 1/2" x 6–32, for joining Nos. 10 and 12.
37. Iron Machine Screw, 3/8" x 10–32, for joining Nos. 1 and 2.

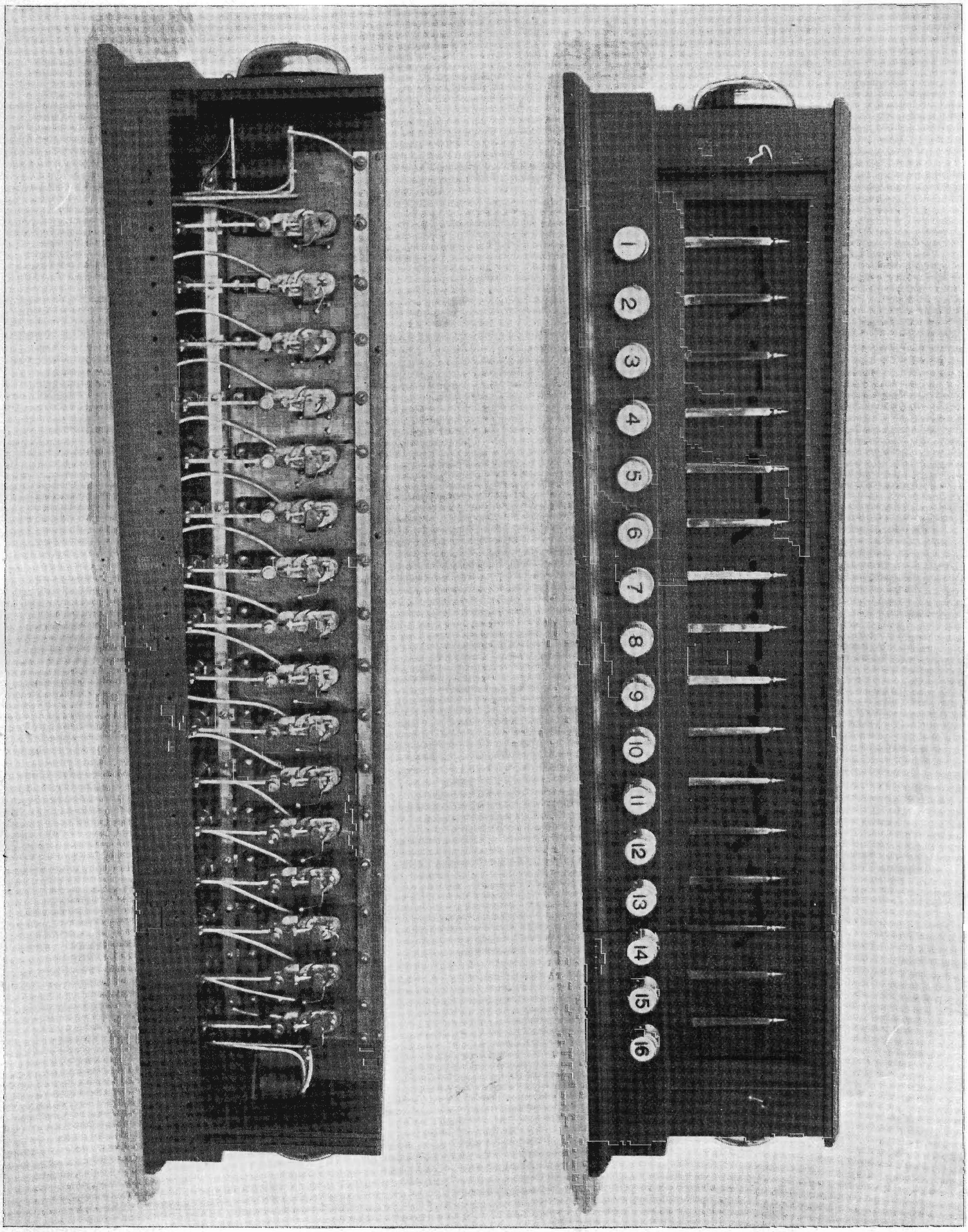
Multiple Semaphore Indicator with Bells.

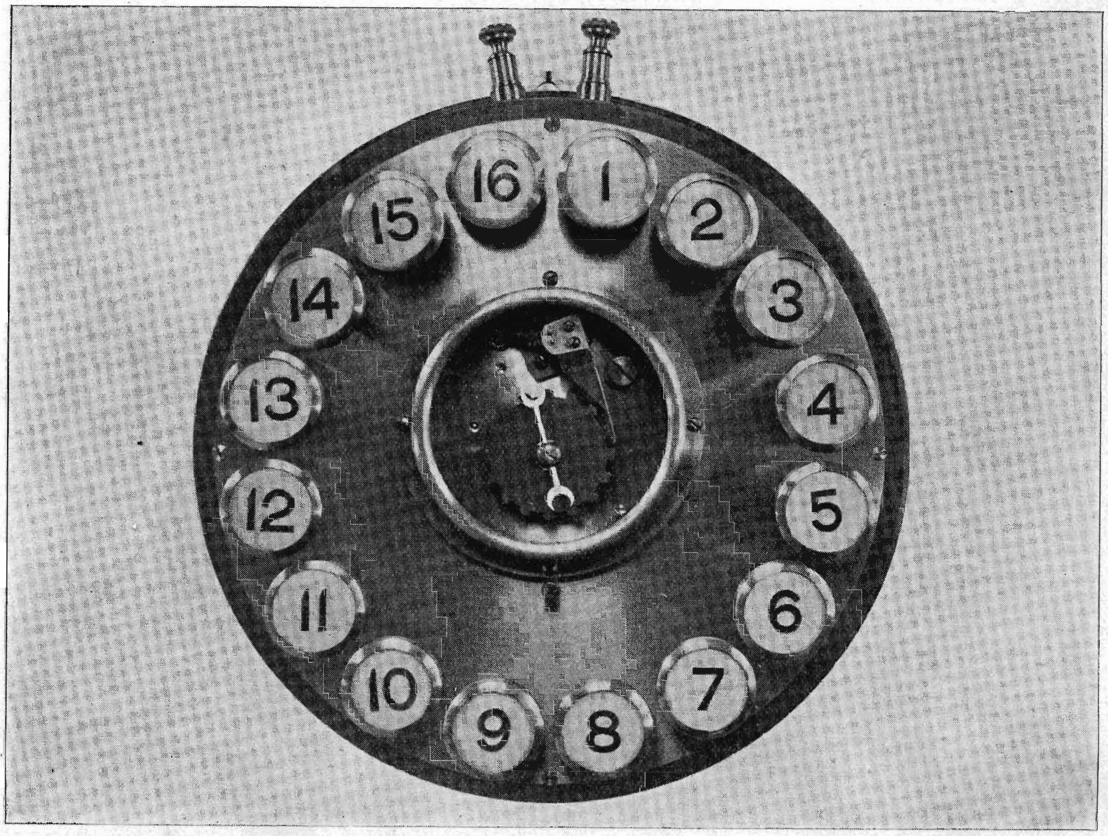
PLATE 135.

THIS arrangement is placed in the train starter's office at a large passenger terminal, and serves two purposes. The semaphores are connected with push buttons located near the various tracks, and when one of them is inclined, informs the train starter that a train is ready to go from a certain track; at the same time one of the bells rings to attract his attention. Having received this information, the train starter pushes the button on his instrument, which corresponds with the semaphore that has been lowered, and thus notifies the signal cabin that such a train is ready to go; the signal cabin then acknowledges the receipt of the message by ringing the other bell on the instrument that we are describing, at the same time restoring the semaphore to its normal position.

A single instrument of this character will be found illustrated on Plate 133.

PLATE 135.

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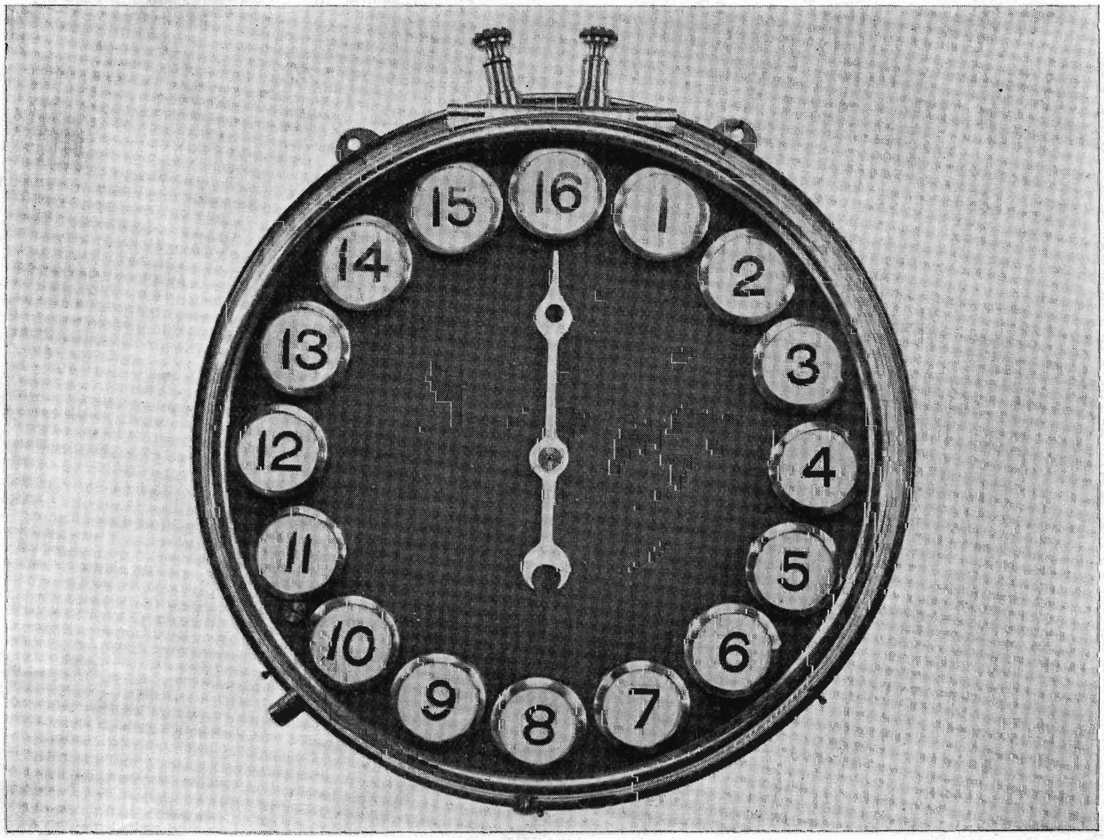
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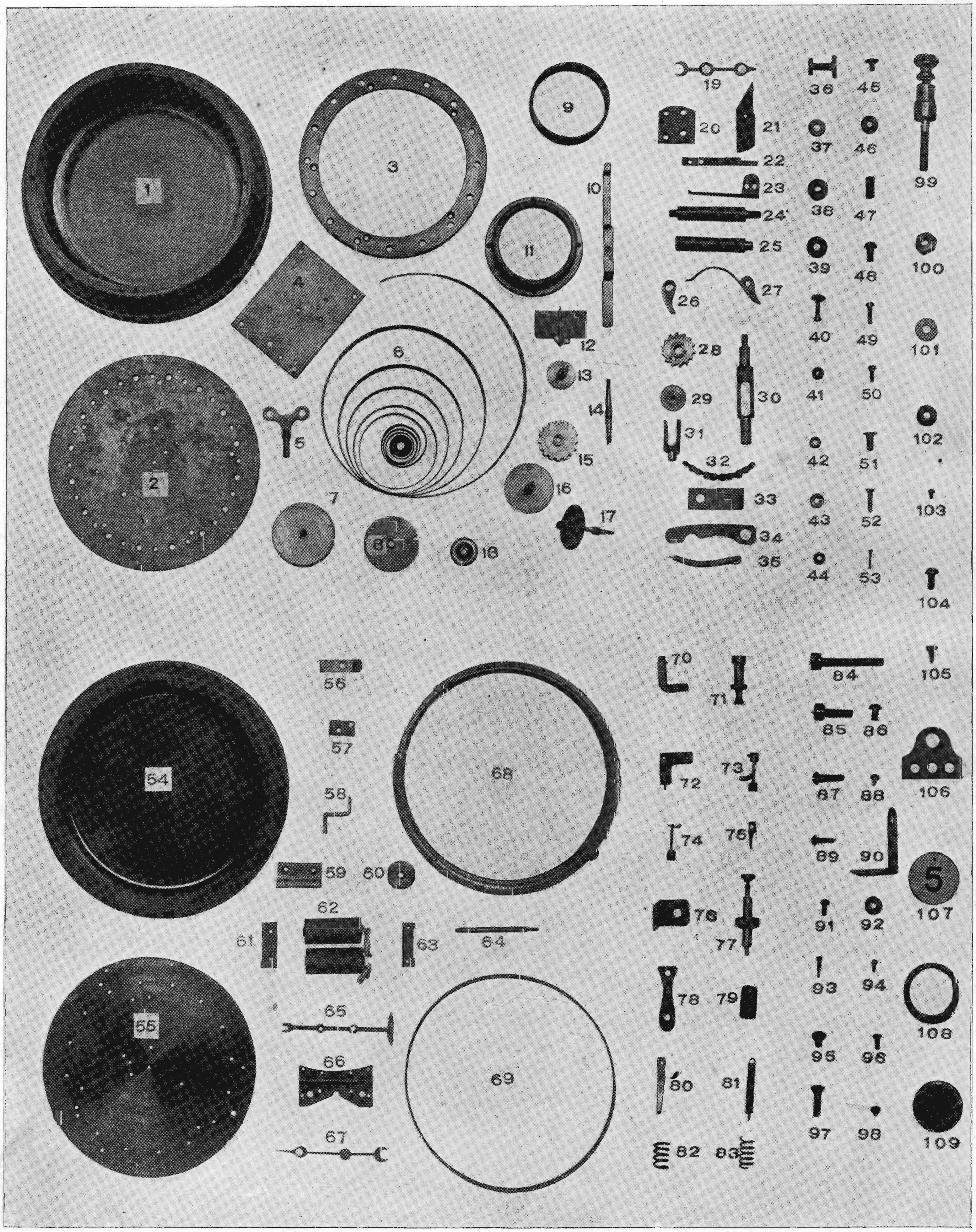
Train Describing Instruments.

PLATE 136.

THE instruments illustrated on Plate 136 are for the purpose of sending over long distances the information as to what track a train is approaching on. The upper one, which is called the transmitter, and the lower one, which is called the recorder, are located in separate cabins, and are connected by an electric wire. The operation is as follows: the approach of a train going from cabin A towards cabin B on, let us say, track No. 8 is announced by operator A, who presses button 8 on the transmitting instrument; this releases the needle which is now pointing to button 16, and interposes a stop, which holds the needle, upon reaching button 8. This needle is mounted on a ratchet wheel that is driven by clock work, and has the same number of teeth as there are buttons on the instrument; it alternately makes and breaks a circuit eight times in the passage of the needle from No. 16 to No. 8. The making and breaking of the circuit through the transmitter alternately excites and discharges a magnet on the recorder, which in its turn drives the needle belonging to it.

Should any error of operation occur, which, however, is not likely, a means of again bringing the needles to the same point, is provided on the recording instrument, by which the recording needle may be mechanically propelled. This is accomplished through a small push button, which projects through the lower left-hand part of the recording instrument's case.

The parts illustrated in detail will be found on Plate 137.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Train Describing Instruments.

PLATE 137.

ORDER BY PLATE AND NUMBER.

No.

1. Case.
2. Dial Plate.
3. Guide Ring.
4. Clock Work Plate.
5. Winding Key.
6. Spiral Spring.
7. Drum, for spiral spring.
8. Cover, for drum.
9. Ring, for holding glass in No. 11.
10. Stop Bar.
11. Crystal Rim.
12. Escapement.
13. Escapement Wheel and Pinion Shaft.
14. Main Shaft.
15. Commutator.
16. Large Gear, with pinion and shaft.
17. Small Gear, with pinion, shaft and nut.
18. Push Button.
19. Pointer.
20. Bracket, for commutator springs.
21. Hard Rubber Insulation, for commutator springs.
22. Straight Commutator Spring.
23. Offset Commutator Spring.
24. Screw Stud, for joining Nos. 2 and 4.
25. Stud, for joining Nos. 2 and 3.
26. Ratchet Pawl.
27. Spring, for ratchet pawl.
28. Ratchet Wheel.
29. Chain Wheel, for Nos. 30 and 31.
30. Push Button Stem.
31. Stationary Bracket, for chain wheel No. 29.
32. Chain. Give length required.
33. Wire Terminal.
34. Terminal Contact Spring.
35. Copper Wire in Rubber Tube. Give length required.

Parts Relating to Transmitting Instrument, Only.

No. **PLATE 137.**

Parts Relating to Transmitting Instrument, Only.—(Concluded).

36. Brass Screw and Nut, $\frac{1}{2}''$ x 8–32, for connection between commutator springs and terminal.
37. Brass Washer, $\frac{1}{8}''$–$\frac{3}{8}''$.
38. Rubber Bushing, $\frac{5}{32}''$–$\frac{3}{8}''$. For No. 36.
39. Rubber Washer, $\frac{5}{32}''$–$\frac{3}{8}''$.
40. Brass Screw and Nut, $\frac{1}{2}''$ x 4–40, for connection between commutator springs and terminal.
41. Rubber Bushing, $\frac{1}{8}''$–$\frac{1}{4}''$.
42. Brass Washer, $\frac{1}{8}''$–$\frac{1}{4}''$.
43. Brass Washer, $\frac{1}{8}''$–$\frac{5}{16}''$. For No. 40.
44. Rubber Washer, $\frac{1}{8}''$–$\frac{1}{4}''$.
45. Brass Screw, $\frac{3}{16}''$ x 4–32, for fastening No. 19 to No. 17.
46. Rubber Bushing, $\frac{1}{8}''$–$\frac{3}{8}''$, for No. 45.
47. Rubber Bushing, $\frac{1}{2}''$ x $\frac{1}{8}''$–$\frac{3}{16}''$, for insulating wire passing through stud No. 25.
48. Machine Screw, $\frac{3}{8}''$ x 10–32, for fastening No. 26 to No. 4.
49. Machine Screw, $\frac{3}{8}''$ x 4–32, for fastening No. 11 to No. 2.
50. Machine Screw, $\frac{1}{4}''$ x 4–32, for fastening No. 20 to No. 2, and No. 27 to No. 4.
51. Machine Screw, $\frac{3}{8}''$ x 8–32, for fastening No. 3 to No. 25.
52. Wood Screw, $\frac{1}{2}''$–#5, for fastening No. 2 to No. 1.
53. Brass Shaft, for No. 29.

Parts Relating to Recording Instrument, Only.

54. Case.
55. Dial Plate.
56. Wire Terminal.
57. Bracket, for fastening No. 55 to No. 54.
58. Bracket, for No. 65 and No. 77.
59. Magnet Bracket.
60. Number Base.
61. Armature.
62. Magnets.
63. Back Strap.
64. Rod, for manual operation of the device.
65. Armature Bar.
66. Hinge, for No. 68.
67. Pointer.
68. Rim, for glass cover.
69. Ring, for holding glass in No. 68.
70. Bracket, for Nos. 84 and 85.
71. Tension Post and Ring.
72. Bracket, for holding No. 74.

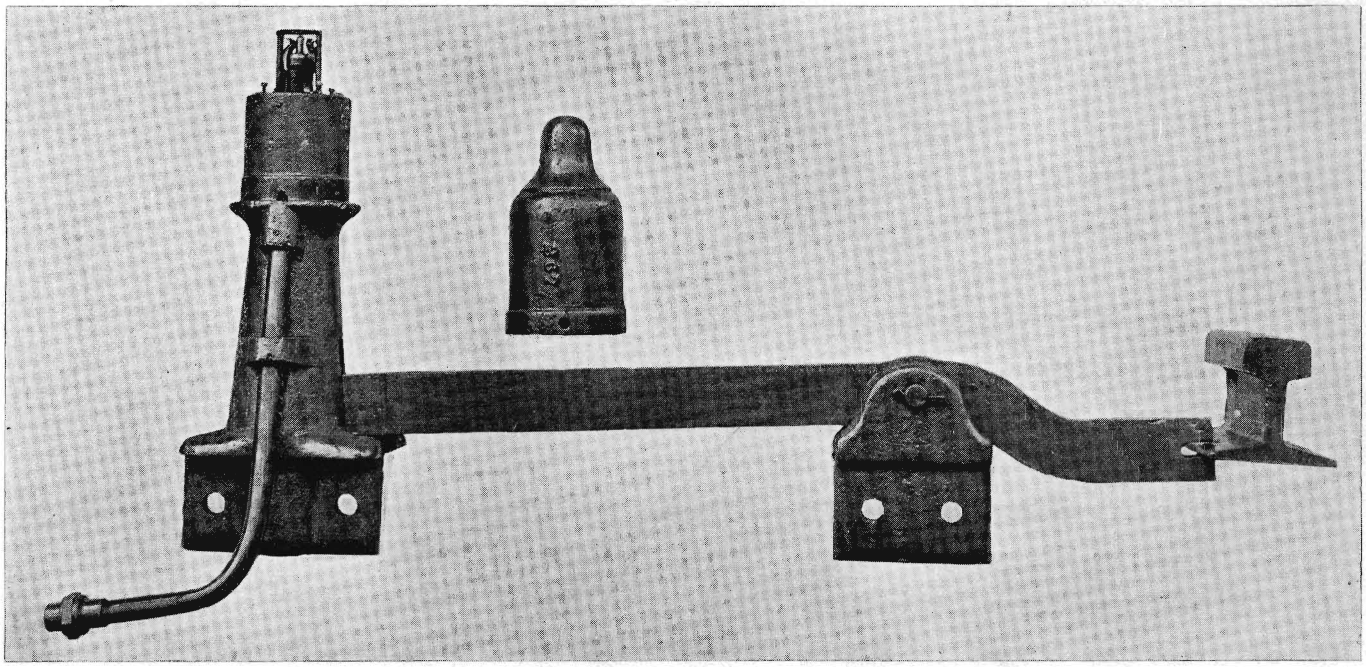
PLATE 137.

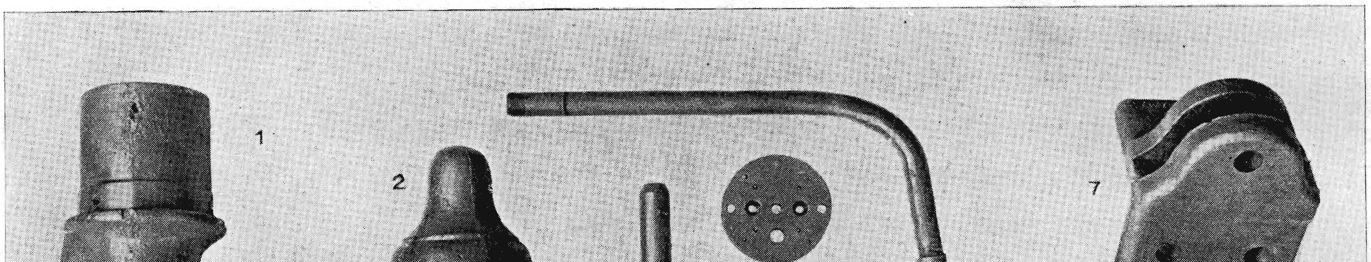
Parts Relating to Recording Instrument, Only.—(Concluded.)

No.	
73.	Propelling Latch and Spring.
74.	Holding Latch.
75.	Stop, for ratchet wheel, No. 77.
76.	Binding Post Terminal.
77.	Ratchet Wheel, Shaft and Nut.
78.	Catch, for No. 68.
79.	Knob, for No. 64.
80.	German Silver Spring, for No. 74.
81.	Armature Spring.
82.	Spring, for No. 64.
83.	Tension Post Spring, for No. 71.
84.	Capstan Screw, $1\frac{3}{8}''$ x 10–32. } These are placed in No. 70 for adjusting the play of No. 63.
85.	Capstan Screw, $\frac{5}{8}''$ x 10–32. }
86.	Machine Screw, $\frac{1}{4}''$ x 8–32, for fastening No. 58 to No. 55.
87.	Machine Screw, $\frac{3}{8}''$ x 8–32, for fastening No. 56 to No. 55.
88.	Wood Screw, $\frac{3}{16}''$–#5, for fastening No. 78.
89.	Wood Screw, $\frac{3}{8}''$–#5, for fastening Nos. 90 and 57.
90.	Bracket, for No. 64.
91.	Machine Screw, $\frac{1}{4}''$ x 4-32, for fastening magnet wires to No. 56.
92.	Copper Washer, $\frac{1}{8}''$–$\frac{3}{8}''$, for No. 91.
93.	Machine Screw, $\frac{1}{2}''$ x 2–64, for No. 73.
94.	Machine Screw, $\frac{3}{16}''$ x 2–64, for No. 74.
95.	Machine Screw, $\frac{1}{4}''$ x 8–32, for Nos. 60 and 63.
96.	Machine Screw, $\frac{5}{16}''$ x 4–32, for fastening No. 57 to No. 55.
97.	Machine Screw, $\frac{5}{8}''$ x 8–32, for joining Nos. 59, 61 and 62.
98.	Machine Screw, $\frac{1}{8}''$ x 4–32, for No. 66.

Parts Common to Both Instruments.

No.	
99.	Binding Post and Nut.
100.	Brass Nut, 10–32, for Nos. 24 and 99.
101.	Brass Washer, $\frac{3}{16}''$–$\frac{1}{2}''$, for No. 99.
102.	Rubber Washer, $\frac{3}{16}''$–$\frac{3}{8}''$, for No. 104.
103.	Machine Screw, $\frac{1}{8}''$ x 3–50, for Nos. 22, 23, 75 and 80.
104.	Machine Screw, $\frac{3}{8}''$ x 8–32, for Nos. 34, 58, 59 and 70.
105.	Wood Screw, $\frac{3}{8}''$–#6, for No. 106.
106.	Hanger, for Nos. 1 and 54.
107.	Number Plate.
108.	Number Plate Rim.
109.	Number Plate Crystal.

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Track Instrument.

PLATE 138.

THIS is one of our oldest devices, and when it is not advisable to use the track circuit, may be substituted for it in many places, wherever necessary to make or break a circuit automatically through the presence of a train at any particular point.

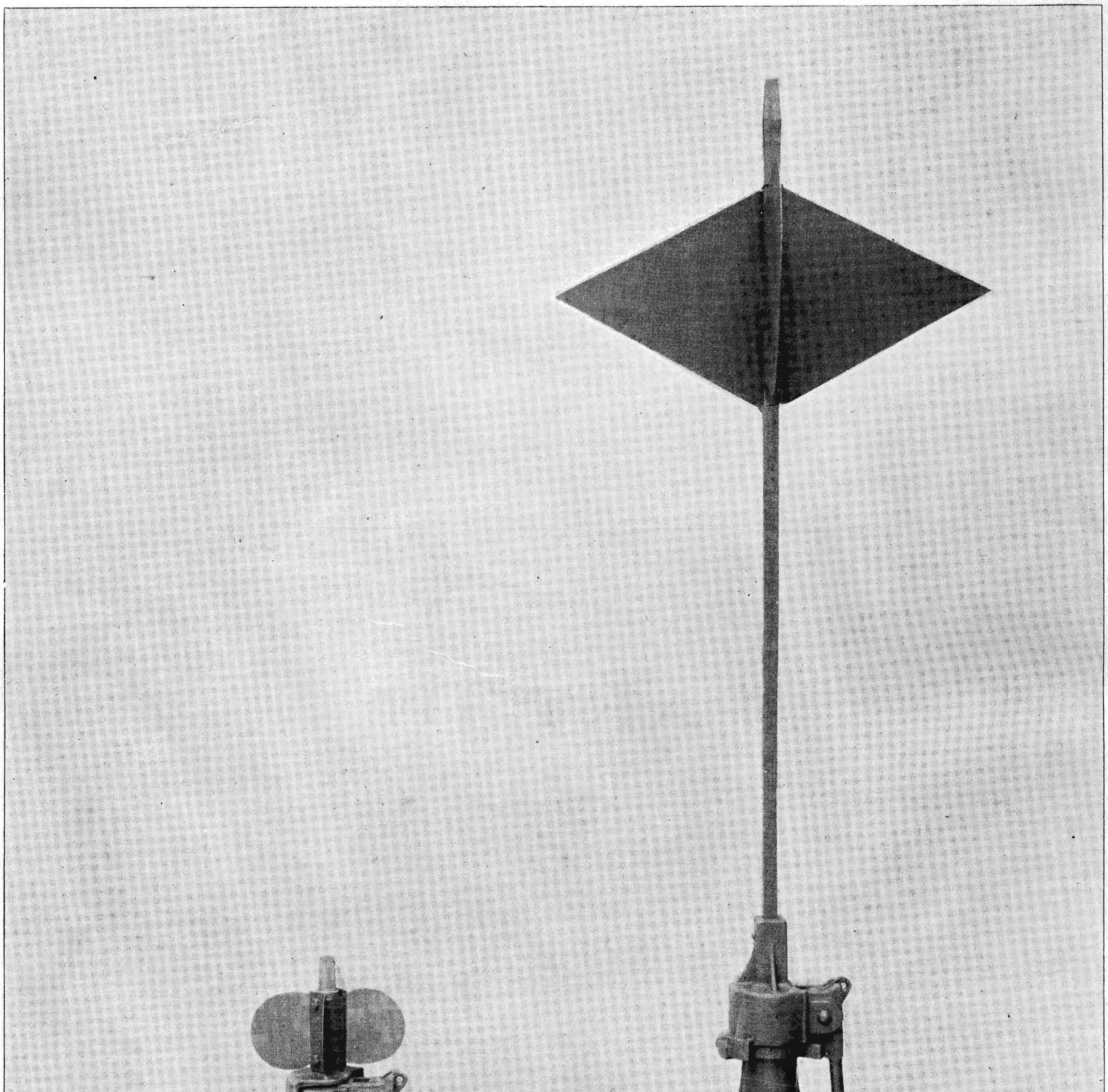
The Stand (No. 1) and the fulcrum casting (No. 7) are usually placed beside the track upon a long tie; the operating lever (No. 9) projects from the stand where it is engaged with the jaw (No. 3), to the rail; its relation with the latter is shown in the upper figure.

The jaw passes up through the stand and carries in its upper end the contact rod (No. 5), which, in its turn, is encircled by the rings Nos. 13 and 14 which lie above the top of the stand. Any vertical movement of the rail is therefore transmitted to the contact ring, which is, in that way, either thrown out of or into touch with the contact springs (Nos. 11 and 12), depending on whether the device is placed upon a closed or open circuit. The cap (No. 2) which ordinarily rests upon the top of the stand is here shown detached from the other parts, in order that the construction of the instrument may be more clearly shown.

ORDER BY PLATE AND NUMBER.

No.
1. Stand.
2. Cap.
3. Jaw.
4. Hard Rubber Base, for contact springs.
5. Contact Rod.
6. Pipe and Union, $\frac{3}{4}''$, for containing wires.
7. Fulcrum Casting.
8. Fulcrum Pin.
9. Operating Lever.
10. Split Cotter, $\frac{3}{16}'' \times 1\frac{1}{2}''$, for No. 8.
11. Contact Spring, for closed circuit.
12. Contact Spring, for open circuit.
13. Contact Ring, with rubber bushing.
14. Hard Rubber Ring, stop for No. 13.
15. Iron Machine Screw, $\frac{3}{4}'' \times \frac{5}{16}''$–18, for fastening No. 4 to No. 1.
16. Iron Machine Screw, $\frac{7}{8}'' \times \frac{3}{8}''$–16, for fastening No. 2 to No. 1.
17. Brass Machine Screw, $\frac{1}{2}'' \times 8$–32, for fastening Nos. 11 and 12 to No. 4.
18. Brass Washer, $\frac{7}{32}'' \times \frac{7}{16}''$, for No. 17.
19. Guide and Nuts, for No. 5.

PART III.



The High and Low Union Stands.

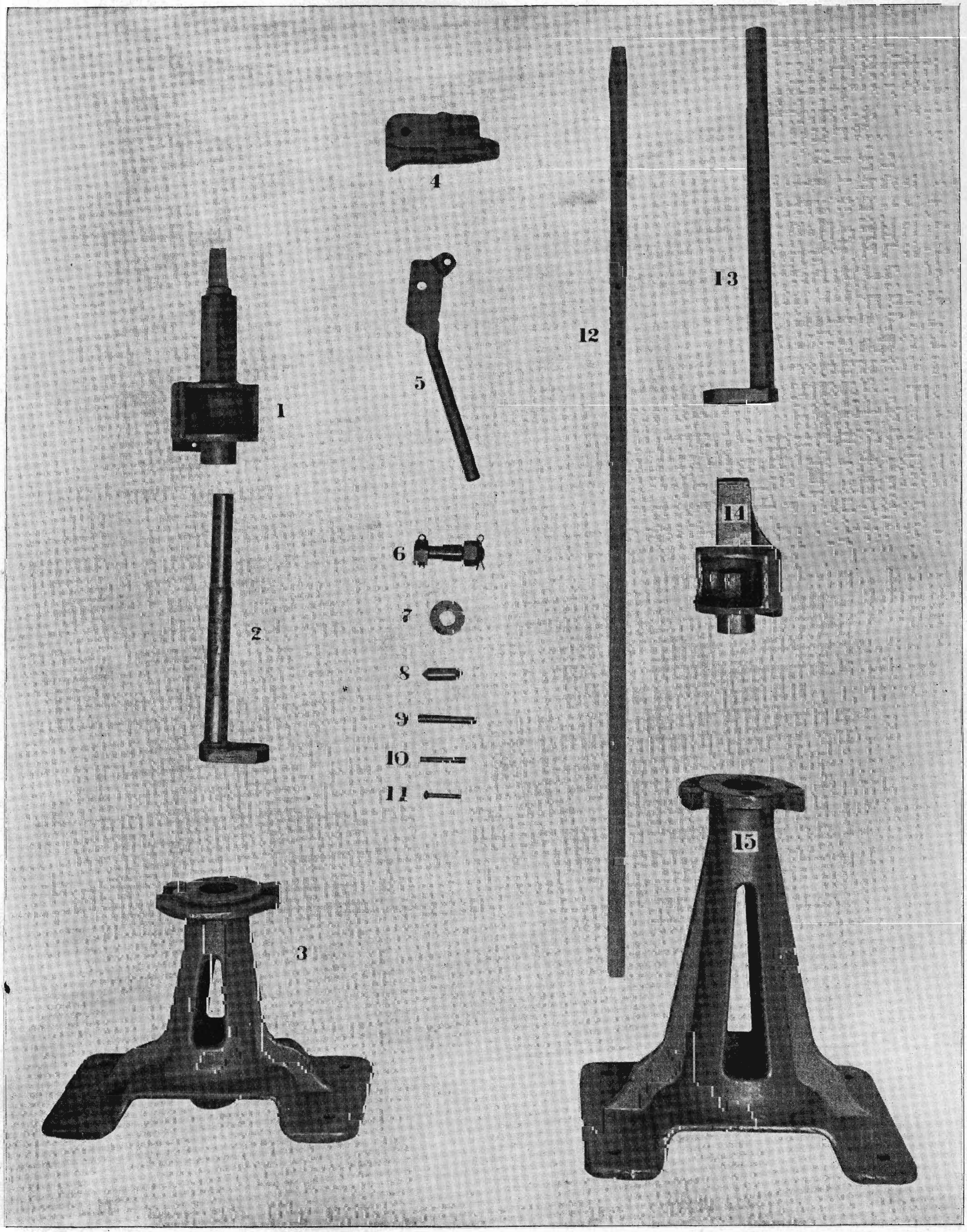
PLATE 139.

IN ORDERING ANY SWITCH STAND, GIVE THE THROW OF THE SWITCH.

BESIDES throwing a switch, these stands accomplish a very desirable thing. When the switch is in the correct position for the main track any movement of the handle will move the target, but when the switch is set for the siding the target will remain in that position until the switch has made one half of its throw towards the main track position.

Any style of lamp or target may be used with these stands.

A list of the parts will be found on the next page.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Parts of High and Low Union Stands.

PLATE 140.

ORDER BY PLATE AND NUMBER.

	No.	
Parts Relating to the Low Stand, only.	1.	Head.
	2.	Shaft.
	3.	Base.
Parts Common to Both Stands.	4.	Lever Casting.
	5.	Lever.
	6.	Crank Pin (1¼" x 5"), nuts and cotters (¼" x 1½"), for switch rod connection.
	7.	Washer, 1¼" diameter for No. 6.
	8.	Lock Pin.
	9.	Dowel Pin, ½" x 4", for joining Nos. 4 and 5.
	10.	Dowel Pin, ½" x 3¾", for joining heads Nos. 1 and 14 to shafts 2 and 13.
Parts Relating to the High Stand, only.	11.	Rivet, ⅜" x 1¾", for joining vanes to target rod No. 12.
	12.	Target Rod.
	13.	Shaft.
	14.	Head.
	15.	Base.

High and Low Automatic Stands.

PLATE 141.

IN ORDERING ANY SWITCH STAND GIVE THE THROW OF THE SWITCH.

THE principal merits of this stand are that it is automatic in both positions, locks itself and the switch firmly in both positions and, owing to the peculiar construction of its parts, is not subject to the wear and subsequent lost motion which are the unfortunate features of most automatic stands.

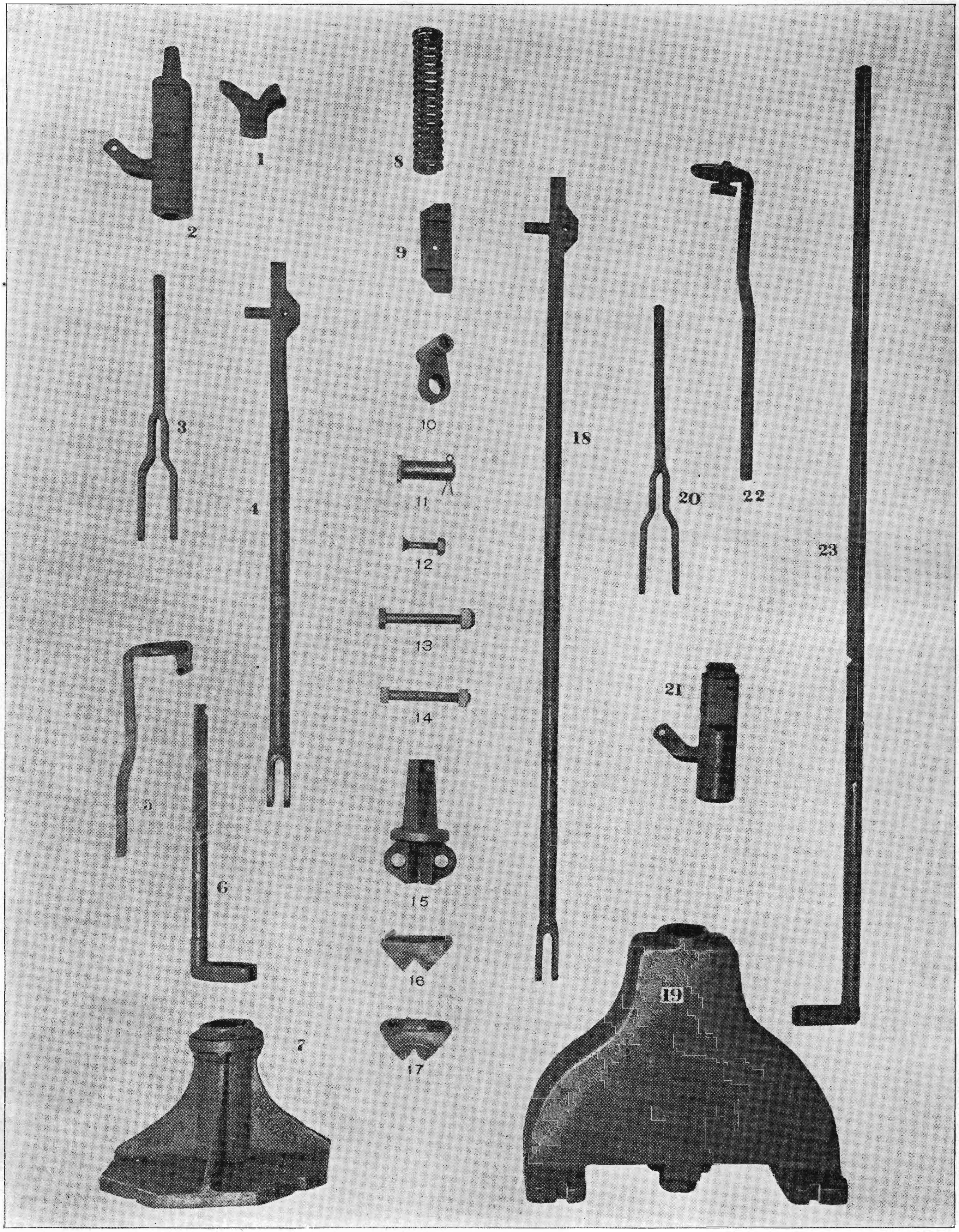
In the illustration the handle of the LOW STAND is raised preparatory to throwing the switch, and the switch rod is shown connected with the stand; in this position the switch is unlocked. The target in the low stand is movable to make place for the lamp, which much reduces its height.

On the HIGH STAND the handle is lowered and the locking rod projects below the stand, in which position it engages with the casting (Plate 142, No. 9), which in practice is fastened to the end of the switch rod.

Any style of target or lamp can be furnished that is desired.

The details of the parts will be found on the following page.

PLATE 142.



Parts of Automatic Stands.

PLATE 142.

ORDER BY PLATE AND NUMBER.

Parts Relating to the Low Stand, only.

No.

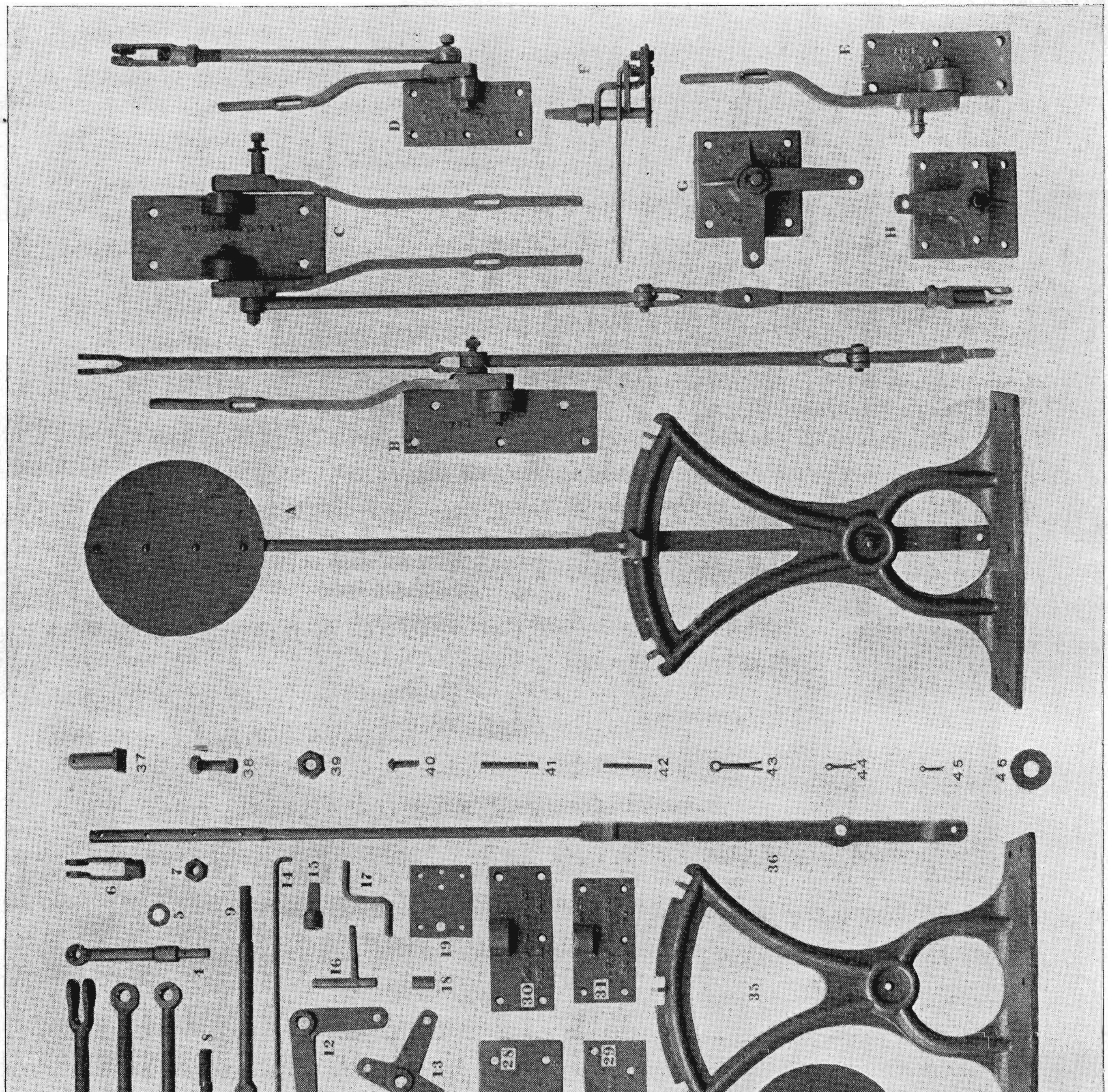
1. Vane Socket.—In ordering give the shape that is needed to suit the lamps.
2. Head.
3. Handle.
4. Switch Rod.
5. Locking Rod
6. Shaft.
7. Main Casting.

Parts Common to Both.

8. Spring.
9. Lock Casting.
10. Link.
11. Turned Pin, 7/8" x 2 3/8", for the jaw on the switch rods.
12. Bolt and Nut, 3/8" x 1 3/8", for joining switch rod and lock casting.
13. Bolt and Nut, 1/2" x 4 1/4", for handle.

Parts Relating to the High Stand, only.

14. Bolt and Nut, 1/2" x 4 1/2", for lamp-spindle and clamps.
15. Lamp Spindle.—In ordering give the shape that is wanted.
16. Plain Clamp.—To be used with both lamp-spindle and bottom clamp.
17. Bottom Clamp.
18. Switch Rod.
19. Main Casting.
20. Handle.
21. Head.
22. Locking Rod.
23. Shaft.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Various Rigid Switch Stands.

PLATE 143.

IN ORDERING SWITCH STANDS GIVE THE THROW OF THE SWITCH.

In Ordering State Whether Connecting Rods and Links are Required or Not.

- A. Three Throw "Harp" Switch Stand.
- B. Single Ground Switch Stand, arranged to operate a single or double slip with rigid frogs.
- C Double Ground Switch Stand, arranged for operating a single or double slip with movable frogs.
- D. Single Ground Switch, Stand, with adjustable connecting rod. For ordinary track work.
- E. Single Ground Switch Stand, for narrow gauge or very light track work.
- F. Lamp Stand, for use in connection with Figs. A, B, C, D and E.
- G. Bell Crank.
- H. T Crank.

(G and H:) For use in connection with movable frog and slip work.

ORDER BY PLATE AND NUMBER.

No.

1., 2., 3. Various Links, see Figs. B and C.

4. Eye Rod, see Fig. B.
5. Washer, 1¼", for No. 10.

6. Screw Jaw., 7. Jam Nut. — For Nos. 8 and 9.

8., 9. Various Links, see Figs. C and D.

10. Stud, for No. 11., 11. Base., 12., 13. Cranks. — Relating to Figs. G and H.

14. Driving Rod., 15. Lamp Spindle., 16. Rocker., 17. Brace., 18. Bushing., 19. Base. — Relating to Fig. F.

20. Bridle Rod., 21. Switch Rod. — For stub switch; in ordering give gauge of track and section of rail.

22. Staple, for Nos. 23, 24 and 25.

No. PLATE 143.

23. SWITCH LEVER, for Figs. B and C. } In ordering give the throw of the switch.
24. SWITCH LEVER, for Fig. D. }
25. SWITCH LEVER, for Fig. E. }
26. STUD, for single links on Figs. C, D and E.
27. STUD, for double links on Figs. B and C, and for Nos. 28, 29, 30 and 31.
28. BASE, for Fig. C.
29. BASE, for Fig. B.
30. BASE, for Fig. D.
31. BASE, for Fig. E.
32. TARGET, this may be made of any desired shape. } Relating to Fig. A.
33. BOLT AND NUT, for supporting No. 36. }
34. HASP. }
35. FRAME. }
36. SWITCH LEVER. }
37. TURNED PIN, $\frac{7}{8}'' \times 2\frac{3}{8}''$, for jaws on Nos. 1, 2, 6 and 9.
38. BOLT AND NUT, for joining Nos. 17 and 19.
39. HEX. NUT, for Nos. 26 and 27.
40. RIVET, for fastening No. 32 to No. 36.
41. RIVET, for No. 34.
42. RIVET, for No. 15.
43. SPLIT COTTER, for No. 37.
44. SPLIT COTTER, for Nos. 26, 27 and 33.
45. SPLIT COTTER, for No. 14.
46. WASHER, for Nos. 26, 27 and 33.

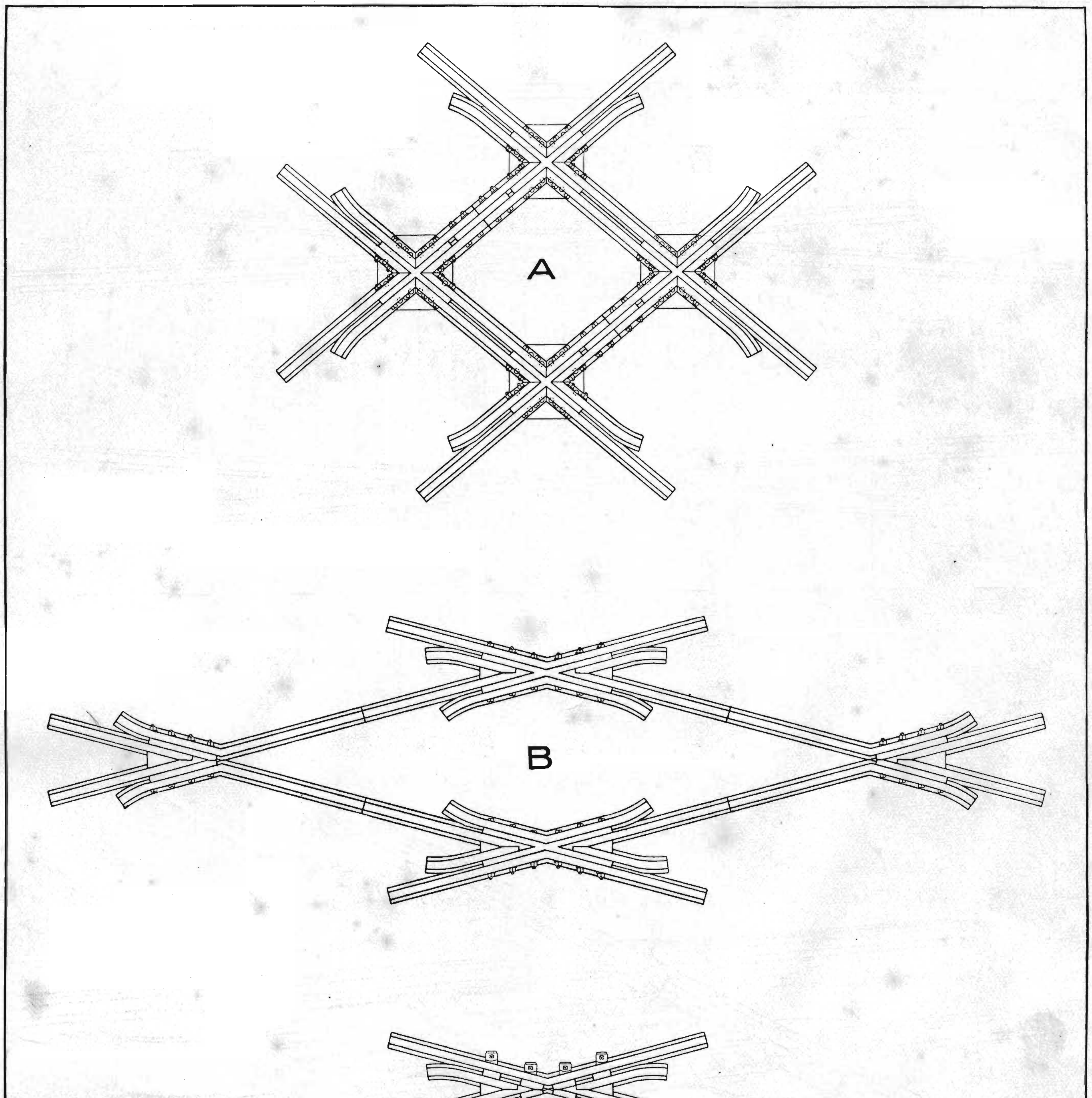
Railroad Crossing Frogs.

PLATE 144.

IN ORDERING FROGS GIVE THE ANGLE, THE GAUGE OF TRACK, THE WEIGHT, SECTION AND PUNCHING OF THE RAIL.

FIGURES A, B and C show frogs of different angles and give some idea as to how the joints and connections are made.

A. RIVETED AND BOLTED FROG.
B. BOLTED FROG.
C. CLAMPED FROG.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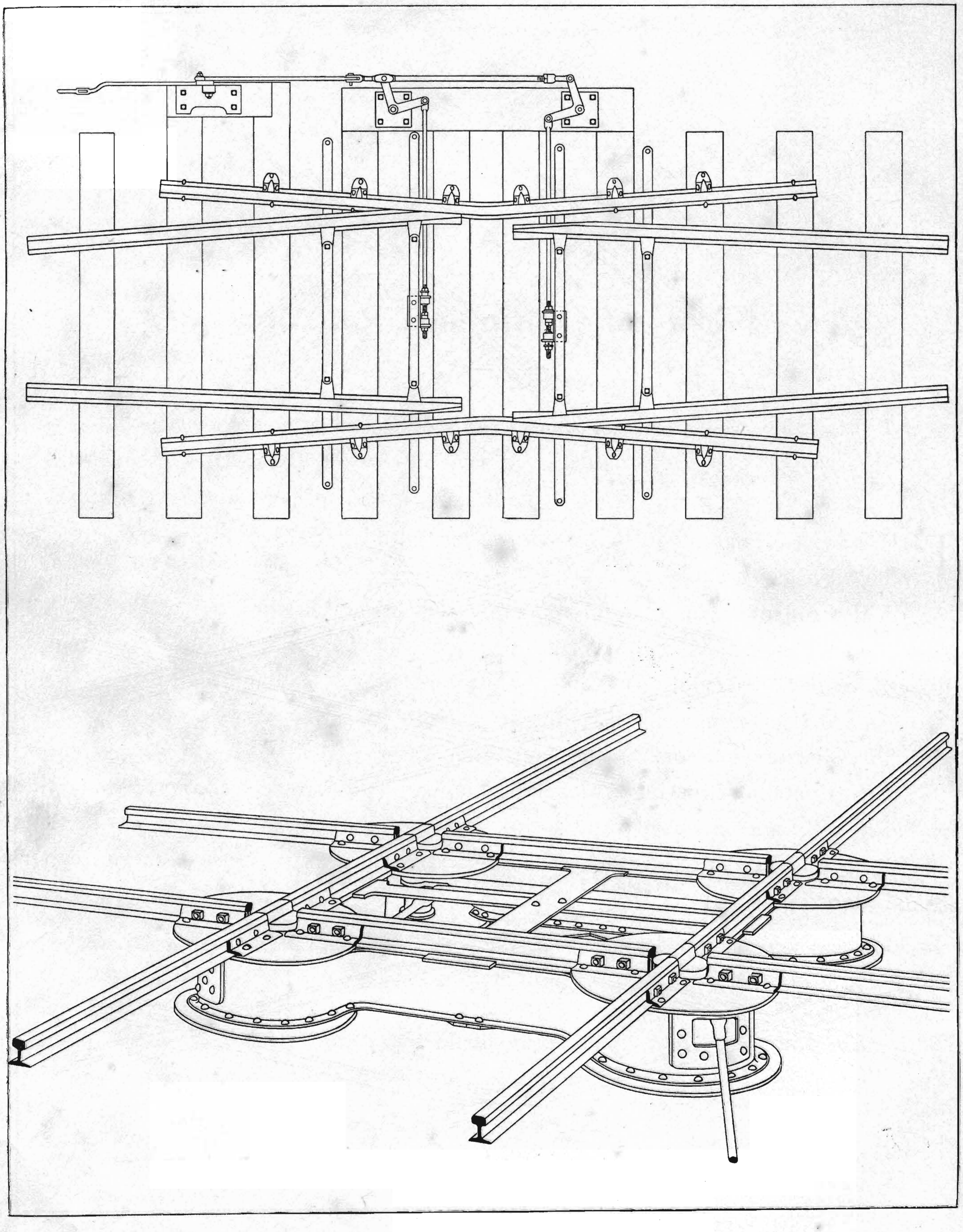


Two Forms of Continuous Rail Crossings.

PLATE 145.

IN ORDERING FROGS GIVE THE ANGLE, THE SECTION OF RAIL AND ITS PUNCHING.

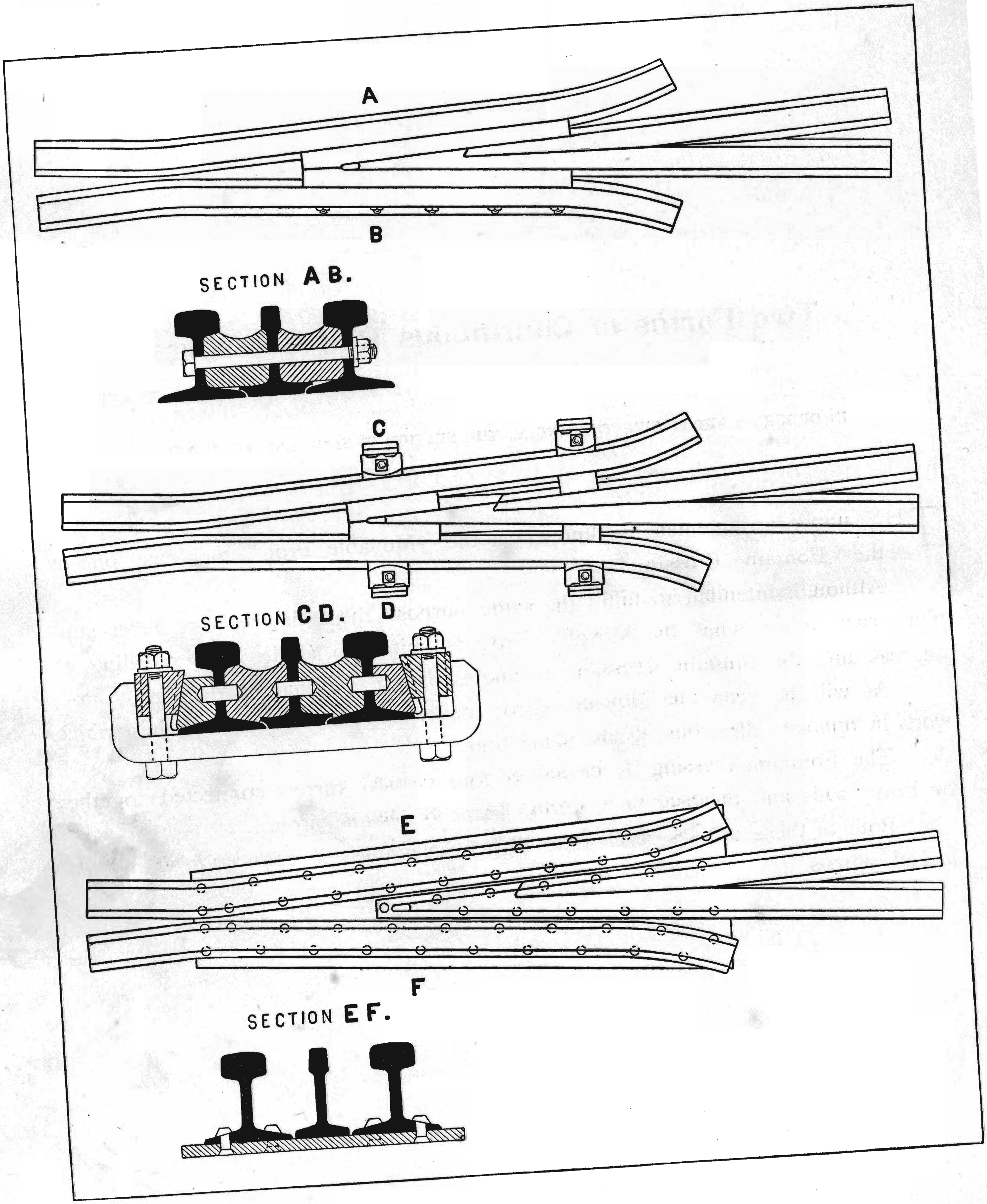
THE upper arrangement is known as the "Movable Frog," the lower one as the "Fontaine Crossing."

Although intended to fulfill the same purpose these devices can never supplant each other, since the Movable Frog is suited to angles not exceeding 45 degrees, and the Fontaine Crossing to angles of not less than 45 degrees.

As will be seen, the Movable Frog really consists of two switches which work in opposite directions at the same time.

The Fontaine Crossing is formed of four vertical turrets connected together by heavy rods and enclosed in a strong frame of channel iron.

Both of these articles reach their highest usefulness in connection with interlocked signals.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SECTION AB.
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SECTION CD.
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SECTION EF.

Rigid Frogs.

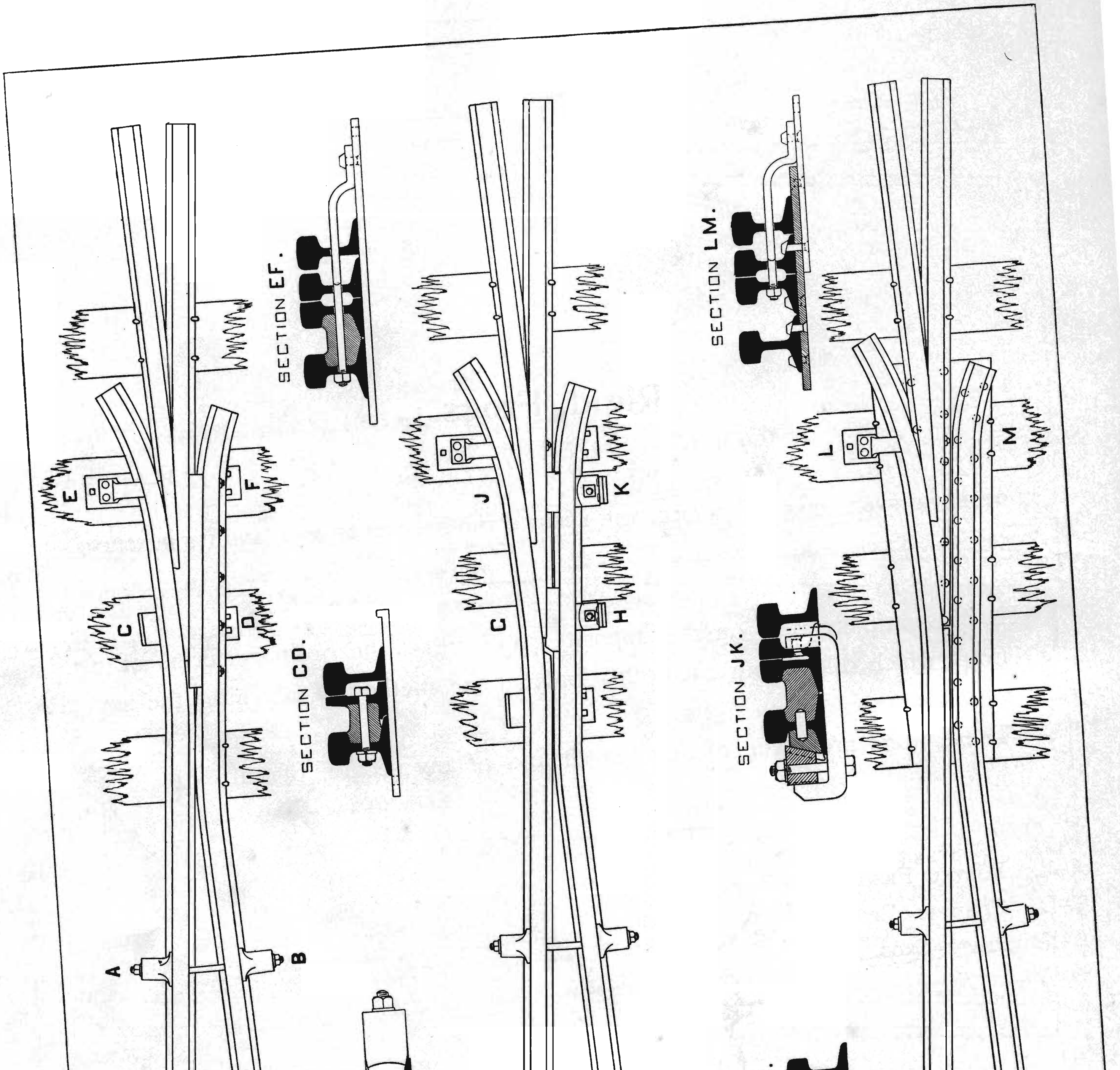
PLATE 146.

IN ORDERING FROGS GIVE THE ANGLE, THE LENGTH, THE SECTION OF RAIL AND ITS PUNCHING.

THE illustrations given on the opposite page are of the ordinary forms of rigid frogs, which differ from each other only in the method of fastening the several rails together.

These frogs are made of any length and of any section of rail.

A–B. Bolted Frog.
C–D. Clamped Frog.
E–F. Plate Frog.


SECTION EF.
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Ordinary Spring Rail Frogs.

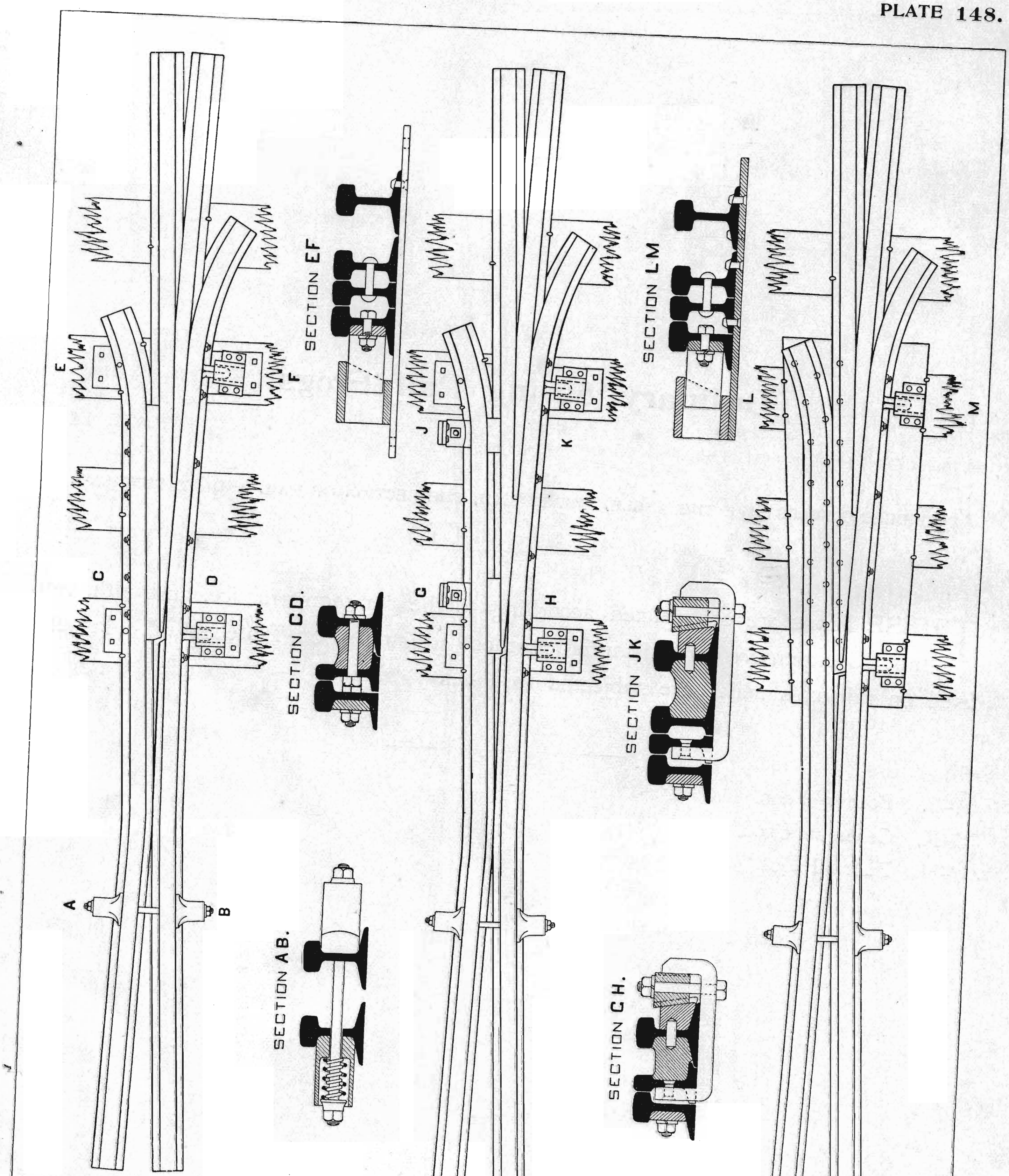
PLATE 147.

IN ORDERING FROGS GIVE THE ANGLE, THE LENGTH, THE SECTION OF RAIL AND ITS PUNCHING.

THESE Frogs are constructed according to the common practice, and, although not so expensive or substantial as those illustrated on Plate 148, are largely used on railroads which are subjected to a heavy traffic.

A–F. Bolted Frog.
G–K. Clamped Frog.
L–M. Plate Frog.

PLATE 148.


SECTION AB.
SECTION CD.
SECTION EF
SECTION GH.
SECTION JK
SECTION LM

Spring Rail Frogs.

MODEL OF 1893.

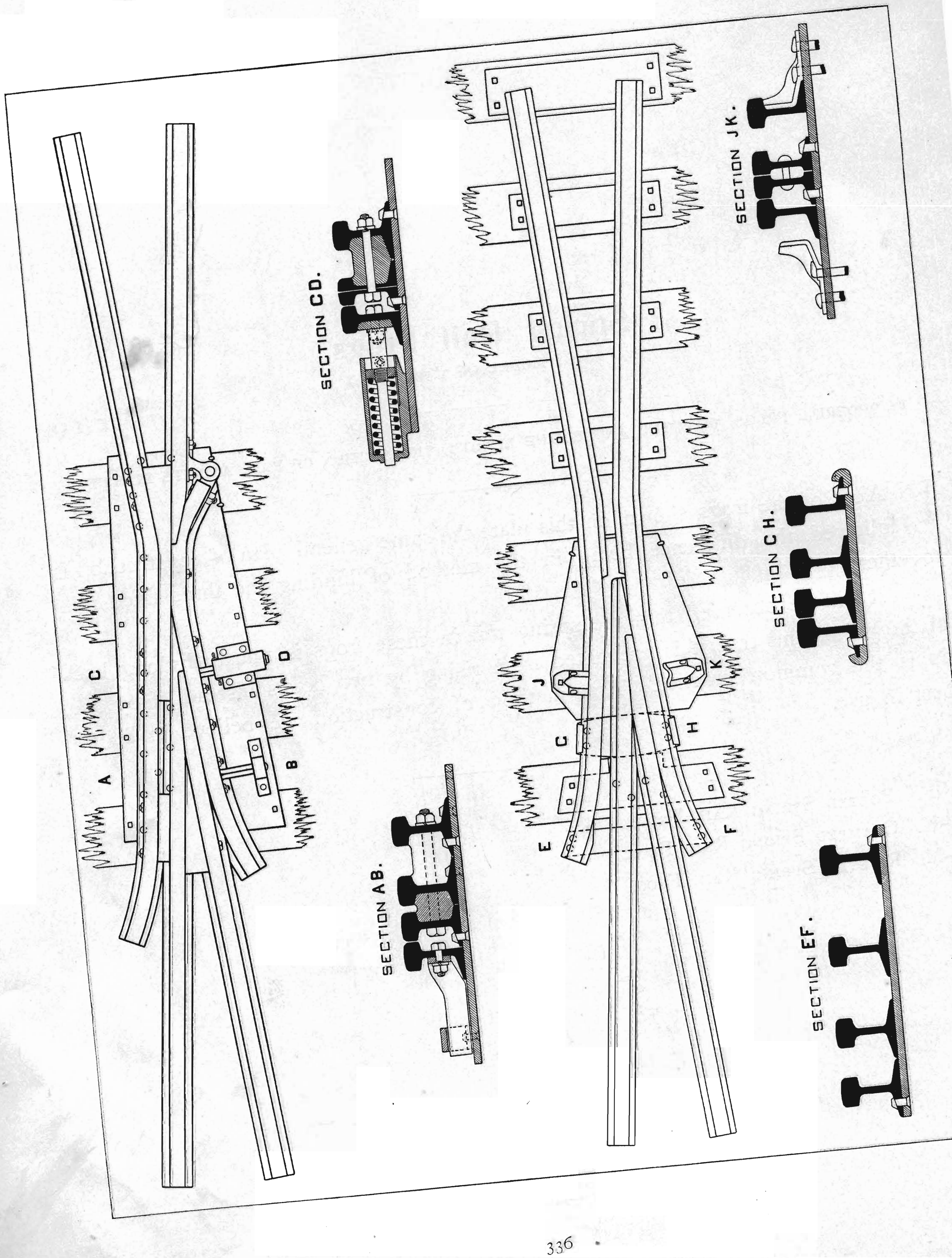
PLATE 148.

IN ORDERING FROGS, GIVE THE ANGLE, THE LENGTH, THE SECTION OF RAIL AND ITS PUNCHING.

IN ALL of the frogs shown on this plate the same general plan of construction is followed, the difference being in the method of binding the three fixed rails together.

It will be observed that the spring rail in these frogs is unusually long, back of the point, and that it is prevented from rising by two boxes instead of by one, as is the common practice. This method of construction we believe to be the best in use.

A–F. Bolted Spring Rail Frog.
G–K. Clamped Spring Rail Frog.
L–M. Riveted Spring Rail Frog.


SECTION CD.
SECTION JK.
SECTION CH.
SECTION AB.
SECTION EF.
A
C
B
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F

Special Forms of Automatic Frogs.

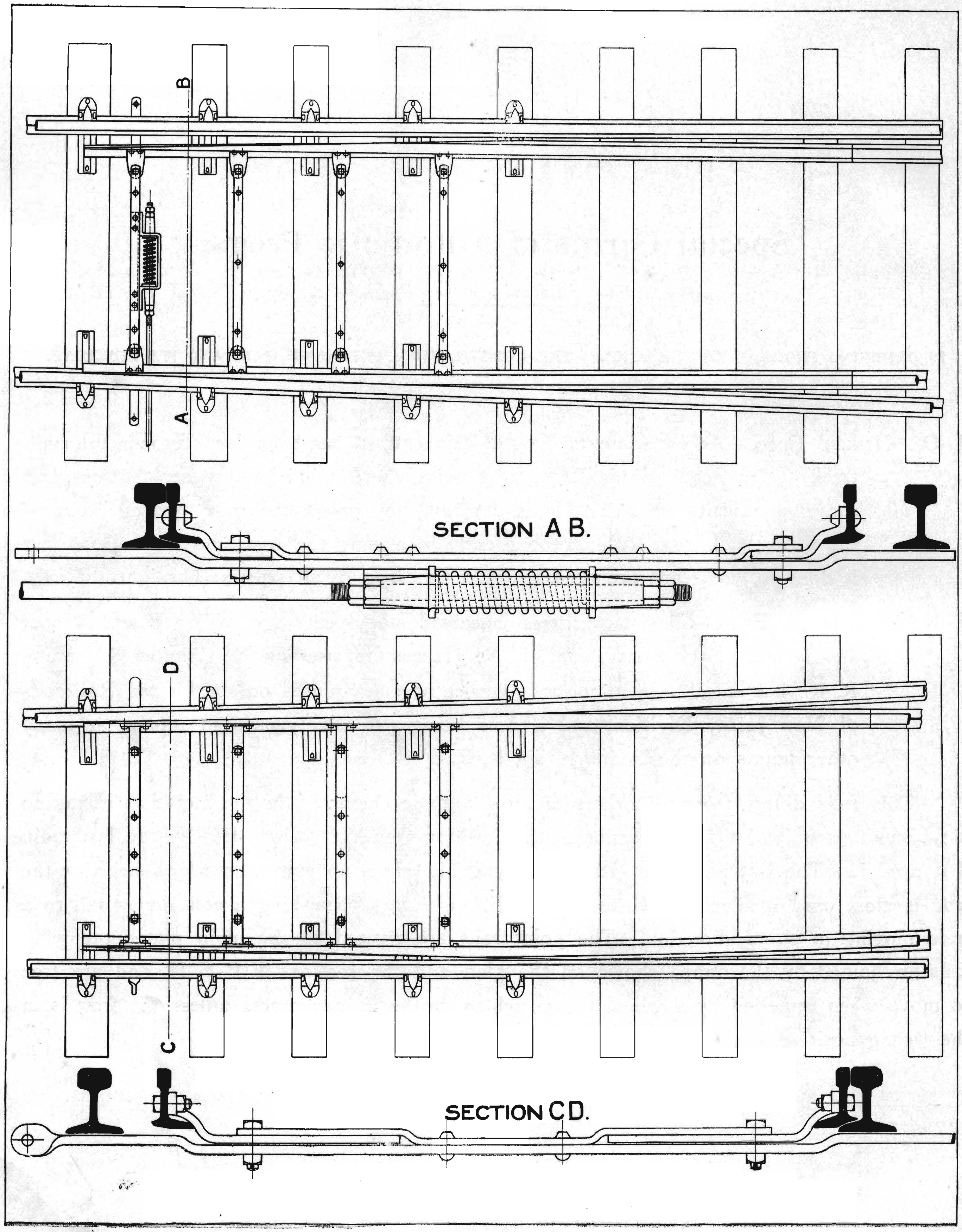
PLATE 149.

IN ORDERING FROGS, GIVE THE ANGLE, THE LENGTH, THE SECTION OF RAIL AND ITS PUNCHING.

A–D. Hinged Frog.—An experimental frog of this pattern has been for a year in the main track of the Pennsylvania R. R., at a point where it is in almost constant use, and shows practically no wear. It is designed to correct the most glaring faults of the spring rail frog, without too greatly increasing the cost, and we believe that it does so. We are prepared to build this frog of all sizes and weights of rail.

E–K. The Wood Frog.—This pattern was conceived many years ago by Mr. Joseph Wood, an engineer of the Pennsylvania R. R. It was first used on the Camden & Amboy R. R., has since been in constant service at many places on the United Railroads of New Jersey Division, and is now being extensively used in repairs at many other points on the Pennsylvania R. R.

This frog differs from all others of an automatic character, in the fact that it has no loose small parts, and that it remains in the position in which it was left by the last train that used it. The last particular ensures its long life, since no matter in which direction the frog is most used it adapts itself to the condition, always furnishing a continuous rail to a train moving in either direction. The point rails are riveted to the main plate; the wing rails are joined by the straps shown on the plan and the sections E F–G H, and are free to move when impelled by a wheel flange, which, however, never acts unless the frog is in the wrong position.


B
A
SECTION A B.
D
C
SECTION C D.

Simple Split Switches.—Derail.

PLATE 150.

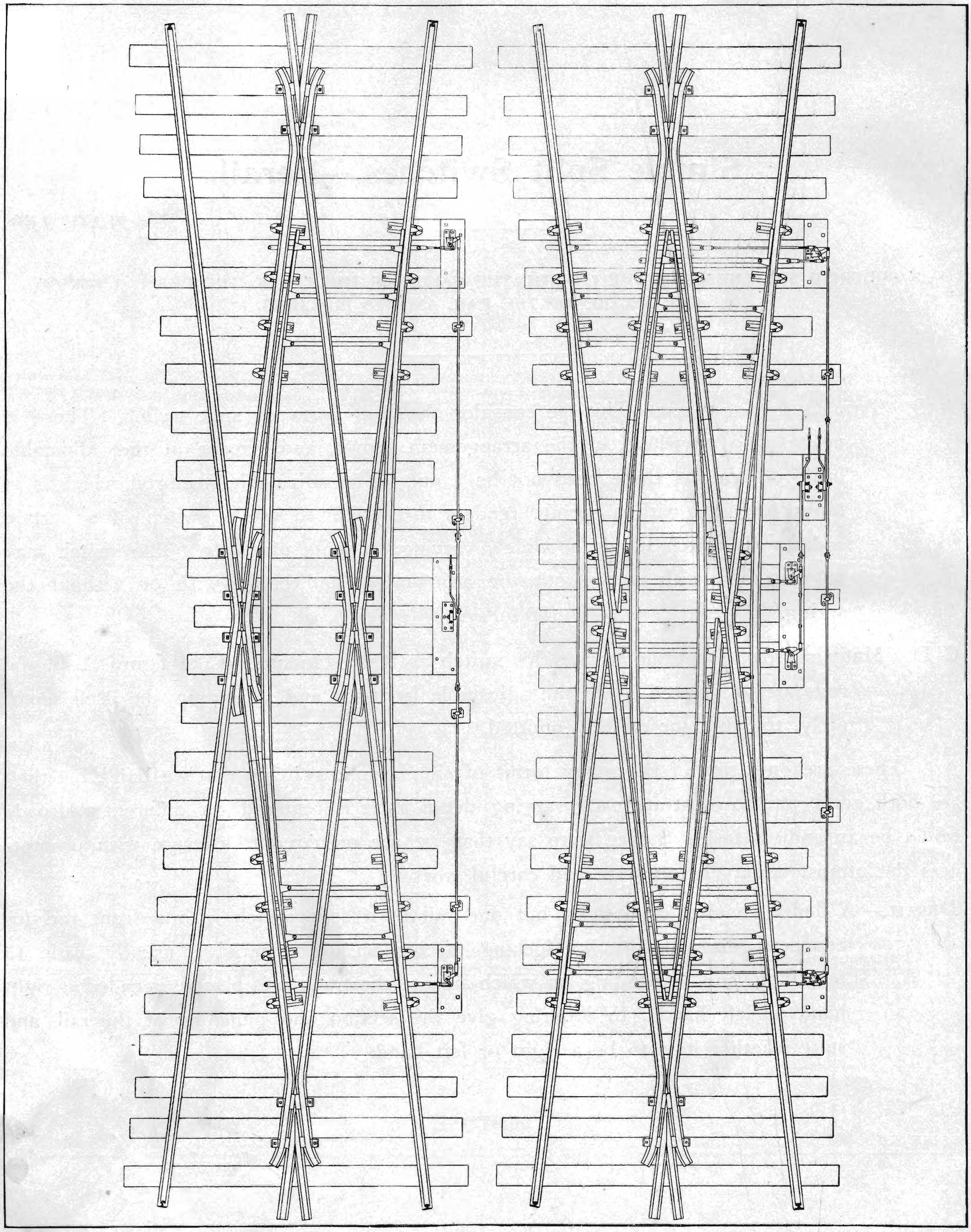
IN ORDERING SWITCHES GIVE THE LENGTH, THE GAUGE OF THE TRACK, THE DESIRED THROW, THE SECTION OF THE RAIL AND ITS PUNCHING.

A–B. THE RIVETED SWITCH.—This we consider the best form of split switch. There is not a weld anywhere in the arrangement shown, and, except in the adjustable front-rod feature, there need not be a nut. The adjustable front-rod, which is at times provided with a spring, renders it possible to use a switch of a certain width with switch stands of widely varying amounts of throw. The switch may be furnished with or without the adjustment, and either with or without the spring.

C–D. Many railroads continue to use this switch as their standard. Like figure A–B, the rods are all jointed, while the adjustable front-rod and spring may be used separately, together, or entirely omitted.

These are only two of the many forms of simple split switches that we build, but they are both good, and to illustrate each varying detail as it is required on different railroads would be an endless task. Suffice it to say that we are prepared to execute with promptness the utmost variety of accurate and careful work.

DERAIL.—A derail consists of nothing but one rail of a split switch with a front rod for connecting it with the interlocking mechanism. The derail is usually made 15 feet long, and, depending on which side of the track it is placed, is called a right hand or left hand. In ordering give the section and punching of the rail, and state whether it is to be a right or left hand.



Double and Single Slips.

PLATE 151.

IN ORDERING SLIPS, GIVE THE DESIRED THROW, THE ANGLE OF THE FROG, THE GAUGE OF THE TRACK, THE WEIGHT, SECTION AND PUNCHING OF THE RAIL.

WE ILLUSTRATE here two forms of SLIPS, which are extremely convenient for crossover work in main tracks, or at other points where economy in space is of great importance.

Slips may be arranged to work in connection with frogs varying between and including Nos. 6 and 15; these limits may even be exceeded, but experience has proved that it is not advisable; for passenger traffic, slips in connection with a No. 8 Movable Frog (Plate 145) are found to be entirely reliable.

On Plate 151 the double slip is shown in connection with a movable frog and the single slip with a rigid frog, but it is to be understood that either slip may be joined with either frog.

The switch stands and connecting rods for operating slips are shown on Plate 143.