

The
Union Switch & Signal Co.
Swissvale, Pa.



1907

Electric
Train Staff
Catalogue

A CATALOGUE AND PRICE LIST

OF

**Interlocking and
Signaling Devices**

MADE BY

**THE
UNION SWITCH & SIGNAL Co.
OF PITTSBURGH, PA.**

**Owners of the Westinghouse System of Electro-
Pneumatic Block Signaling and Interlocking.**

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The Union Switch & Signal Company's Publishing Department,
Swissvale, Pa.
Murdoch-Kerr Press, Pittsburgh, Pa.

PREFACE

As our edition of Bulletin 23 describing the Electric Train Staff System has been nearly exhausted we place before the railroads this new catalogue of the devices used in this system.

In the first part of the book we have outlined the development of this system and given a detailed description of the manner in which the devices are operated.

Particular attention is called to the description of the Staff System installed on the Southern Pacific Railway on pages 12 and 13. This, the largest installation of its kind in this country, has been in successful operation for over a year and a half and has given entire satisfaction.

In the latter part of the book will be found a detailed price list of the devices which will facilitate the ordering of new instruments and repair parts.

We firmly believe that as railroad officials become more familiar with its efficiency, cheapness and simplicity of operation, the staff system will in the next few years become the standard method of operating trains on single track in this country.

The Union Switch & Signal Company

Swissvale, Pa., September, 1907.

ORDERS

In ordering material from this catalogue, the Plate and Figure number should be given in all cases, also **such other information as may be called for in the notes or lists.**

**DESCRIPTION OF
THE ELECTRIC TRAIN STAFF SYSTEM**

THE ELECTRIC TRAIN STAFF SYSTEM

DEVELOPMENT

The Electric Train Staff System of today is a gradual development from a simple principle for the operation of railroads which was recognized in England as early as 1840; namely, that to safely pass over a given section of single track, every train should have in its possession a tangible right to do so in the form of some specific article of which there is only one obtainable. The first train staff was a metal bar about two feet long, which had cast or engraved on it the name of the two stations between which it alone gave authority for any train to proceed. Unless trains moved alternately in opposite directions the staff had to be returned over the section by a special engine or in some cases by road.

To partially overcome this difficulty the staff and ticket system was devised, in which device the original staff became a key that would unlock a box at either end of the section and permit tickets to be taken therefrom. If it was desired to forward say three trains from one station to another before one should proceed in the opposite direction, the ticket box was unlocked with the staff and a ticket given to the first and second trains, the third train receiving the staff.

Since an engineer or guard of any train when receiving a ticket was required to see the staff as well, this system while making head-on collisions impossible did not permit trains to enter a section from the end at which the staff did not happen to be. To accomplish this result Mr. Edward Tyer in 1878 introduced his electric tablet apparatus which consisted of two instruments, one at either end of a section, each instrument containing a certain number of tablets, any one of which constituted the right of a train to pass over that section. The two instruments were electrically connected and synchronized so that the removal of a tablet from either instrument absolutely prevented any other being taken out.

In 1889 Mr. Webb, Chief Mechanical Engineer, and Mr. Thompson, Signal Superintendent of the London & North Western Railway, invented the Webb & Thompson Electric Train Staff, in which staffs were substituted for the tablets in the Tyer system and a permissive feature added whereby several trains could follow each other into a block section if desired, in a manner similar to that employed in the non-electric staff and ticket system.

The American rights for the Webb & Thompson system are owned by this Company, which installed the first instruments in May, 1894, on the Chicago, Milwaukee & St. Paul Railway, between Savanna, Ill., and Sabula, Iowa, with eminently satisfactory results.

Since that time this staff system has been introduced on the Chesapeake & Ohio; the Cincinnati, New Orleans & Texas Pacific; the Atchison, Topeka & Santa Fe; the Chicago, Rock Island & Pacific; and the Canadian Pacific Railways.

The main objection to the extended adoption of the Webb & Thompson apparatus was the size of the staff, which made it difficult to catch at high speed. To overcome this objection, the Union Switch & Signal Company in 1900 introduced what was known as its High Speed Train Staff System, which, although based on the same general principles and method of operation as the Webb & Thompson, possessed the essential advantage of employing staffs only six inches in length, weighing 6½ ounces; as against staffs 22 inches long, weighing 4 pounds, of the Webb & Thompson system, thus greatly simplifying the problem of taking the staff at high speeds.

This latter system was installed on the Chesapeake & Ohio; Cincinnati, New Orleans & Texas Pacific; Gulf, Colorado & Santa Fe; Philadelphia & Reading; Chicago, Milwaukee & St. Paul; Chicago & Great Western; Chicago & Alton; Southern; and the Atchison, Topeka & Santa Fe Railways.

On the last named railroad among other places this system was applied to a section extending from Trinidad, Colorado, to Raton, New Mexico, a distance of 25 miles, which was divided into seven block sections. This portion of the Atchison comprises mountain grades averaging 3½ per cent. for a greater part of the distance, over which a traffic of approximately 60 trains a day is operated. On account of the number of trains, and also the fact that each train required two and sometimes three engines on the up grade, an average of one hundred and fifty train orders was issued in each twenty-four hours, most of which were sent to not less than two stations, so that the total delay to trains awaiting these orders can easily be imagined. With the introduction of the staff system as many trains, or more, have since been handled over this section with no collisions and a minimum of delays.

At the intermediate stations on this section, staff cranes are provided from which the enginemen can take the staffs at a speed up to 25 miles an hour without the use of any special attachments on the engines.

At another point where this apparatus is in use the practice is followed of handing the staff to an engineer by means of a rattan hoop about two feet in diameter, similar to the method followed by many railroads for delivering "19 orders" and clearance cards. The staff being small and light is as easily delivered on such a hoop as a train order. This method may be safely followed for all trains which can afford to reduce speed to 25 miles or even 30 miles an hour when passing the staff station, thus avoiding the special catching apparatus on the majority of the locomotives.

On the Cincinnati, New Orleans & Texas Pacific Ry., which operates a number of staff stations, the practice is to deliver the staff to any train which can afford to slow down to 30 miles an hour without any special attachments on the locomotives, such a device being only applied to their fast expresses on which the staff has to be caught at speeds frequently exceeding 60 miles an hour, as shown by the accompanying views.

Our latest type of staff instrument, known as the Electric High Speed Train Staff, Model No. 2, has been developed during the past four years, and employs a staff of practically the same size and weight as the Model No. 1 instrument, over which it possesses the following advantages:

By having separate drums for putting in and taking out the staffs, equal wear on all staffs is secured; whereas, in the earlier instrument some of the staffs would be practically worn out from constant use while others would hardly ever be used.

The second advantage lies in the special type of indicator employed in this instrument, which plainly shows the operator by the display of a white or red disc whether or not his instrument is in condition for him to remove a staff, and thus leaves him no excuse to strain the mechanism.

PRINCIPAL ADVANTAGES OF THE ELECTRIC TRAIN STAFF SYSTEM

While in the foregoing we have described generally the principles on which the Electric Train Staff is operated, yet we call particular attention to the following points:

First—The Electric Train Staff System may be considered as a mechanical assistant which issues metal train orders under the general direction of the train dispatcher, giving trains the right to proceed over certain sections of track, and will only issue one such order at a time for any section, except in the case of following trains where the permissive system is used, thus obviating all danger of "lap orders."

Second—In place of eliminating the train dispatcher, as has at times been erroneously supposed, the train staff by removing all dangers of collision and doing away with all train orders, relieves his mind from the constant strain imposed upon it under the present system and gives ample time to issue orders to operators on his division for the proper movements of the trains under his control.

Third—It avoids all the delay now experienced in waiting for train orders. If conditions are right for a train to proceed the staff can be obtained immediately and when the permissive system is employed trains can follow each other as closely as the rules of the road may permit.

Fourth—It alone, of all block systems, provides a tangible piece of evidence in the shape of the staff to the engineer or conductor of his right to the particular block section he may occupy.

Fifth—It can be surrounded with all such additional safeguards as conditions and locations may warrant, including semaphore signals and continuous track circuit, electric locks, etc.

Sixth—It can be safely operated by any railroad employee of average intelligence. As a knowledge of telegraphy is not necessary for its operation, a number of staff stations can, if desired, be operated by partially disabled employees.

Seventh—At stations where telegraph operators are employed who have other duties, it will be found that the operation of the staff will take up considerable less of their time than is now expended on telegraphic train orders.

Where the blocks are of necessity long, and traffic is heavy through certain portions of the day only, the permissive feature may be introduced, which, while it makes it impossible for two trains proceeding in opposite directions to be in any given block at one time, permits as high as twelve trains to follow each other in the same block at close intervals. This feature is treated upon hereafter.

THE ELECTRIC TRAIN STAFF SYSTEM

DETAILED DESCRIPTION AND METHOD OF OPERATION

ABSOLUTE STAFFS AND STAFF INSTRUMENTS

In the operation of the electric train staff the track to be protected is divided into blocks or sections of such length as best accommodate local and traffic conditions. These blocks usually terminate at existing stations or telegraph offices, though occasionally, as in the telegraph block system, additional block stations have to be installed when the distance between any two existing stations is too great for the expeditious handling of traffic.

Each section is controlled by two instruments (Fig. 1) one at each end, which for convenience in this description are referred to as "X" and "Y." Each instrument is equipped with a sufficient number of staffs (varying from 10 to 35 per section) to take care of the traffic conditions. No train is permitted to proceed between "X" and "Y" in either direction unless the conductor or engineer has in his possession one of these staffs which is in effect a metal train order. The instruments at "X" and "Y" are electrically connected and synchronized so that the withdrawal of a staff from either can only be effected by the joint action of the operators at "X" and "Y," and but one staff can be out of both instruments at any one time.

To move a train from "X" to "Y" the manipulation of the instruments is as follows:

The operator at "X" presses bell key (A, Fig. 1) the number of times prescribed in the bell code, which rings bell (L, Fig. 2) at "Y." The operator at "Y" first acknowledges receipt on his bell key, ringing bell (L, Fig. 2) at "X" through circuit shown on Plate No. 1, and then holds it closed, thereby deflecting the "current indicating needle" (F, Fig. 3) at "X" to the right. This informs "X" that "Y" has furnished current and he proceeds to remove the staff by turning the preliminary spindle handle (B, Fig. 1) to the right as far as it will go, which raises the armature (J, Fig. 4) up to the magnets (K, Fig. 4) transferring the current from the bell "L" to the magnet K-88 Plate No. 2, closing the circuit as shown in red on Plate No. 2, and at the same time closing the circuit on K-360 shown in green on Plate No. 2, after which the preliminary spindle handle (B, Fig. 1) is permitted to automatically return to its normal position. This unlocks the revolving drum (C, Fig. 4) and indicates the fact by displaying a white instead of a red disc in the indicator at H, Fig. 3. The operator now moves the end staff (E, Fig. 1) up the vertical slot into engagement with the drum (C, Fig. 4), the outer guard (N, Fig. 3) having first been turned to the right position, revolves the latter through a half turn using the staff as a handle, and finally withdraws the staff through the opening at (M, Figs. 1 and 5). In making the half turn the drum (C, Fig. 4) has reversed the polarity of the operating current, thereby throwing the instruments at "X" and "Y" out of synchrony with each other

and moving the "staff indicating needle" at "X" (G, Fig. 5) from "Staff In" to "Staff Out." Immediately on withdrawing the staff, the operator at "X" once more presses his bell key "A" which indicates to the operator at "Y" by moving his needle from "Staff In" to "Staff Out" that the operation is completed.

The staff withdrawn is now delivered to the train by hand if the train is at rest, or passing at a speed of less than 25 miles per hour. For higher speeds the staff is placed in a special holder and delivered by methods similar to those followed in the Railway Mail Service, the engine being fitted with a catching and delivering device. A glance at the accompanying cuts will make this clear.

As mentioned before, in taking out a staff the polarity of the operating current is reversed. This prevents a second staff from being taken out of either instrument, as will be noted from the following:

The polarity of the current flowing through magnet K-360 Plate No. 2 is never changed, the current for same being local. The polarity of the current flowing through K-88 Plate No. 2 is changed each time a staff is put in or taken out of either instrument. This puts the instruments either in or out of synchrony. The magnet (K, Fig. 4) is formed of two separate coils, one energized by the local and one by the line battery. The construction of this magnet is such that when the currents in both coils flow in the same direction, the lines of force flow round the cores and connecting straps, thus forming no point of attraction for the armature. When the current is reversed in one coil, the lines of force oppose each other and the armature being brought to the point of attraction is held there. With the staff out, if an attempt be made to release another staff, the circuit closed will be as shown on Plate No. 3 with the polarity of the current flowing through magnet K-88 reversed. By comparing this circuit with the one shown on Plate No. 2 for releasing a staff, it will be seen that in the former the currents flowing through magnets K-360 and K-88 oppose each other, and in the latter they do not, thus preventing the release of a second staff. On arrival of the train at "Y" the staff is delivered either by hand or deliverer to the operator who, having seen that the train is complete by observing the rear end markers, places the staff in the opening (M, Figs. 1 and 5) of his instrument, having first turned the outer guard (N, Fig. 3) to place, moves the staff into engagement with and revolves drum (D, Fig. 4) through one-half turn, using the staff as a handle (see Fig. 8) and allows it to roll down the spiral. He then presses his bell key the prescribed number of times, thus notifying "X" that the train is out of the section, which operation also moves the "staff indicating needle" at "X" from "Staff Out" to "Staff In." The operator at "X" presses his bell key in acknowledgment and by so doing moves the "staff indicating needle" at "Y" from "Staff Out" to "Staff In" (see Fig. 8). The machines are now synchronized and another staff can be obtained from either in the manner above described.

The staff being put in the instrument at "Y," the circuits for releasing a staff at "X" or "Y" would be as shown on Plates Nos. 4 and 5 respectively.

While it takes some little time to describe the method of operating the staff instruments, yet, as a matter of fact, the removal of the staff actually takes less than 5 seconds, and the operation of putting one in an instrument less than 2 seconds, under ordinary conditions.

The same methods are followed at each succeeding staff station, but no two adjacent sections use the same design of staff; that is to say, the staffs used between "X" and "Y" will not fit the instruments controlling the section between "Y" and "Z."

Usually four different designs of staffs are employed in actual practice, to avoid any possibility of their being improperly used.

PERMISSIVE FEATURE

While the absolute system, where but one train is allowed in any section, is the ideal arrangement, yet cases occur where it is desirable to allow several trains to follow each other into the block at short intervals. This is known as the permissive system, and consists of an attachment to the absolute machine at each end of the section with *one* permissive staff. This instrument is shown on Plate 2317.

To operate this feature an absolute staff is withdrawn from the instrument at "X" in the usual manner and used as a key to unlock the attachment or base containing the permissive staff which is then taken out. The opening of the base and the removal of the permissive staff locks the absolute staff in the permissive attachment, there to remain until the permissive staff is replaced. The permissive staff consists of a steel rod and 11 removable rings, any one of which authorize a train to pass through the section to "Y." If less than 12 trains are to follow each other, the last one takes *all the remaining rings and steel rod*. When all the rings and rods are received at "Y," the operator reassembles them into the complete permissive staff which he then places in the permissive attachment or base and locks it therein by the absolute staff already in the lock of this attachment. By so doing he releases the absolute staff which he restores to the absolute instrument in the regular manner. The machines are now synchronized and a movement can be made with an absolute staff in either direction and from "Y" to "X" with the permissive staff.

If it is again found necessary to move several trains from "X" to "Y" under the permissive system, the permissive staff must be obtained by "Y" as before described and forwarded to "X" as a whole by the first train moving in that direction. The entire permissive staff confers the same rights as does an absolute staff.

CONTROL OF SIGNALS

In its capacity as a key the absolute staff has a number of uses in addition to that already described. Where signals are used to indicate to an approaching train whether or not it will receive a staff, an instrument known as the staff and lever lock is attached to each lever operating such signals. This instrument is shown on Plate 2323. To clear a signal the staff after being withdrawn is first used to unlock the lever lock. The signal is then cleared and the staff removed from the lock and delivered to the train.

To insure the signal being placed at danger behind a train the act of unlocking the signal lever opens the staff circuit, and no communication can be made between the two staff stations until the signal is at danger and the lever locked in that position. This does not indicate, however, that the operator will have the staff ready for delivery by hand, or in the mechanical deliverer. To cover this point an electric slot is attached to the signal governing train movements into the staff section, which slot is controlled by the staff and lever lock and the mechanical deliverer, so that before the signal can be cleared the staff must be released, used to unlock the signal lever and put in the staff deliverer which closes the circuit on the electric slot. The signal can then be cleared. With this arrangement, therefore, a clear signal cannot be given until the staff is actually in the deliverer.

When the train picks up the staff, the circuit on the slot is opened, automatically setting the signal to danger and it cannot again be cleared until the operation described above is repeated.

SWITCH LOCKING

The staff is also used as a key to unlock siding switches which may occur between staff stations, the switch locks being so designed that the staff cannot be removed from the lock until the switch is set and locked for the main line, thus providing absolute protection against misplaced switches.

INTERMEDIATE SIDING AND JUNCTION INSTRUMENTS

In some sections there is a siding of sufficient length to hold a train, but traffic would not warrant placing a staff station at this point. That the usefulness of this siding may not be lost, a special instrument is placed at the siding which enables it to be used for meeting or passing trains.

A junction or diverging line may be situated between two points most suitable for staff stations, but, on account of the small amount of traffic over the diverging line, it would not be desirable to make it a staff station. Such a point can be controlled in a similar manner. The circuits and operation of both the siding and junction instruments are the same.

To move trains between "X" and "Y" the manipulation of the instruments is the same as that previously described in connection with the absolute instruments.

To move a train from "X" to the siding or junction, a staff is released at "X" by "Y" in the regular manner (see circuits Plate No. 6). The operator at "X" gives the staff to the train with instructions to proceed to the siding or junction. Unlocking the switch with the staff, the train takes the siding or junction, closes and locks the switch, places the staff in the siding or junction instrument, and turns the drum to the right. The staff is now locked in the instrument and the staff instruments at "X," "Y" and junction or siding are synchronized. (See circuits Plates Nos. 7 and 8.)

When a movement is to be made from the siding or junction to "X" or "Y" (all staffs being in the instruments), "X" and "Y" acting in conjunction, can release a staff at the siding or junction (see circuits Plate No. 9), which on being removed changes the circuits so that no other staff can be released either at "X," "Y," siding, or junction until this staff is replaced in one of the instruments. The train then unlocks the switch, passes out on the main track, locks switch and proceeds to "X" or "Y."

PUSHER ENGINE ATTACHMENT

Another adjunct to the staff system is known as the pusher engine attachment and staff which is used on heavy grades where pusher engines are required, and is intended to both obviate the necessity of the pusher engine proceeding through the entire staff section, and to better equalize the traffic. It can readily be seen from the foregoing description of the staff system, that under ordinary rules every train having a pusher engine attached would receive one staff to proceed up grade, as from "Y" to "X." On arrival at "X" pusher engine would necessarily have to receive a staff to return to "Y." Supposing the traffic up and down grade to be equal, and that each train going up grade requires a pusher, it is apparent that twice as many staffs would go down hill as came up, resulting eventually in all the staffs arriving at the foot of the grade "Y," from whence they could only be returned to "X" by some special person authorized to unlock the instruments and remove the staffs by hand.

Furthermore, the summit of the grade may be half way between "Y" and "X," but under the rules a pusher could not cut off at the summit and return to "Y," but would have to continue on to "X" and receive a staff to return.

To overcome these two objections the pusher attachment (see Plate 2319) is employed. It consists (like the permissive attachment) of a separate device which may be attached to any absolute instrument, and contains a staff of special design which can only be released by an absolute staff, though, unlike the permissive staff, it can be out of its receptacle at the same time as the absolute staff.

The operation is as follows: A train with a pusher engine wishes to proceed from "Y" to "X." "X" releases staff at "Y" (see circuit Plate No. 10) and "Y" uses this staff to release pusher staff. This operation opens the controlling circuits of the system and closes the circuits on the pusher bells (see circuits Plate No. 11). "Y" then hands the absolute staff to the train and the pusher staff to the pusher engine. The train passes through the section and delivers the absolute staff at "X." This is placed in the instrument there, the pusher engine retaining the pusher staff and returning to "Y." Until this latter staff is put into the pusher attachment at "Y" and locked, the staff circuits are not re-established and no other staff can be released.

CIRCUIT CONTROLLER ATTACHMENT

Another attachment called the circuit controller attachment (see Plate 2321) is used where electric signals are operated in place of mechanical. This attachment is arranged to control the staff and signal circuits. The signal circuits controlling the signals for a through movement cannot be closed until the staff has been used to release same, which staff can be taken out when said release is made.

STAFF SYSTEM ON THE SOUTHERN PACIFIC RAILWAY

The longest continuous staff blocking in this country was installed in February, 1906, on the Southern Pacific Railway between Truckee and Colfax, California, a distance of 98 miles, divided into 37 blocks. This portion of the Southern Pacific is in the Sierra Nevada Mountains, and 14 of the staff stations are located in the snow sheds. Here the staff station is at the center of a passing siding. The staff system is worked in conjunction with electric signals so that trains may pass with facility and safety.

Through the snow sheds it was found that neither the modern electric semaphore signal nor the ancient types of banner and banjo signals could be installed. Mr. W. W. Slater, Signal Engineer of the Southern Pacific, designed a neat and compact disc signal suitable for this particular condition.

The general arrangement of tracks and signals at each of the staff stations is shown on Plate No. 12. All signals in the horizontal position indicates "take siding." Upper blade of two-arm signal clear and independent distant clear indicates "stop at staff station," "staff not ready." All signals clear indicates "proceed, staff ready and in crane."

The circuits controlling the signals in the above described movements are clearly shown on Plates Nos. 13, 14 and 15. On Plate No. 13, "B" has staff circuits closed, releasing a staff at both "A" and "C." Upon the arrival of these trains at "B," the one from "A" will take the siding and the one from "C" the main track, the latter stopping at the staff station (see Plate No. 14). If the train from "A" should get into siding at "B" in time to enable operator to put the staff into the instrument and get another released and put in the crane, the signals for the train from "C" could be cleared as shown on Plate No. 15, thus preventing its stopping.

The home and independent distant signals can be cleared at any time by moving the handle of the circuit controller attachment from the normal or first position to

the middle or second position, allowing trains to approach the staff station, but the staff distant signal on the two-arm posts cannot be cleared until the circuit controller attachment has been released by a staff, when the handle can be moved from the middle or second position to the reverse or third position, thereby closing one point in the circuit of aforesaid staff distant signal, the other point in the circuit being closed by putting the staff in the crane ready for the train to take as it passes.

Two opposing signals cannot be given at the same time, the circuits of each being controlled by the other, making it necessary for one of the two to be in the normal or first position, as will be seen by referring to Plate No. 15.

The crane in use in this installation is shown on Plate 2339.

In conclusion we will state that although we have covered the main features of the staff system as minutely and clearly as this space will permit, yet the system embraces so many features that there may possibly remain many points upon which further explanation is necessary. We, therefore, beg to inform our customers and all others interested, that we shall be glad at any time to fully explain, from any of our offices, either by correspondence or personal interview, such points concerning this system as may not be entirely apparent.

The Union Switch & Signal Company.
Swissvale, Pa.

**CUTS ILLUSTRATING
PRECEDING DESCRIPTION,
SHOWING DIFFERENT
VIEWS OF ABSOLUTE STAFF
INSTRUMENT AND
METHODS OF DELIVERING STAFFS**

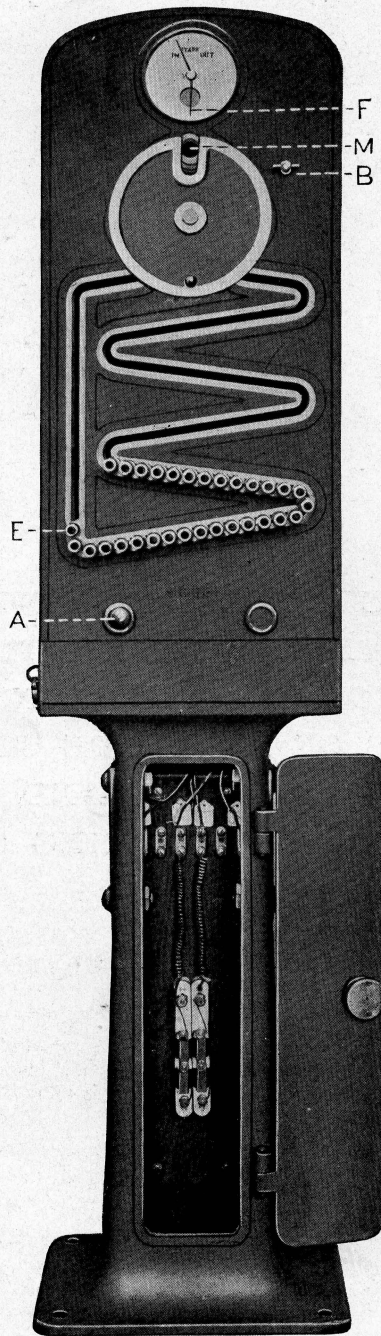


Fig. I
ABSOLUTE STAFF INSTRUMENT WITH PEDESTAL
FRONT VIEW SHOWING DOOR OF PEDESTAL OPEN

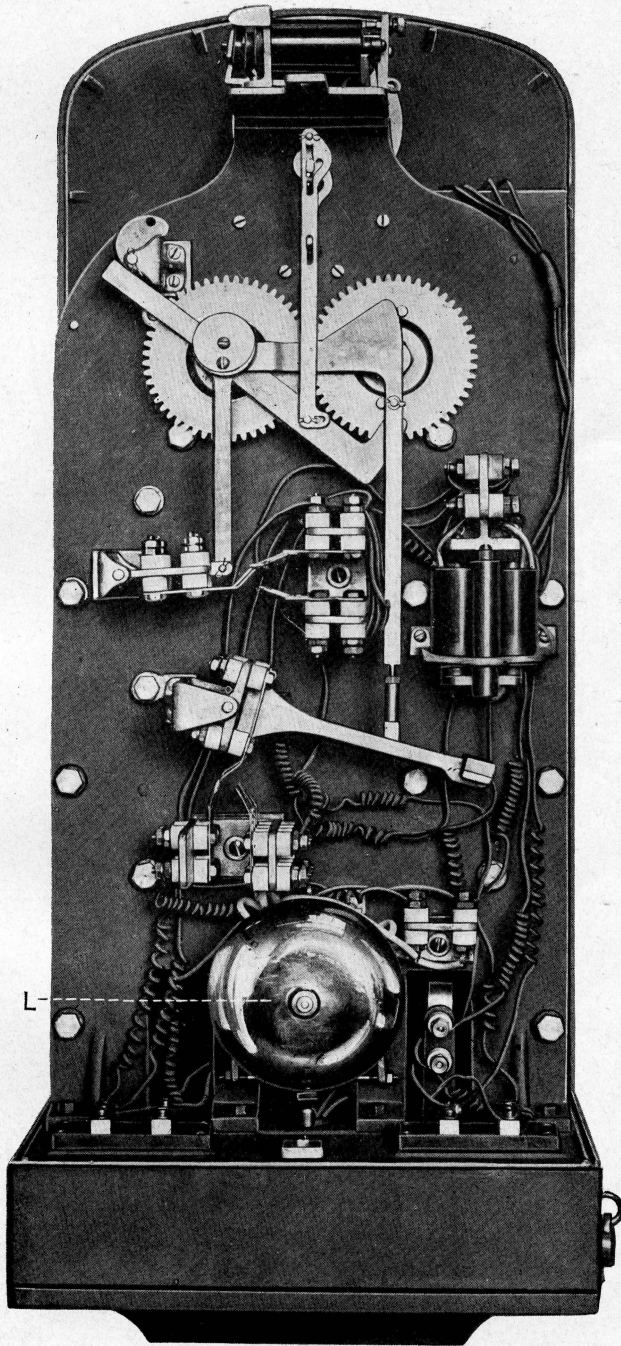


Fig. II
ABSOLUTE STAFF INSTRUMENT
REAR VIEW WITH COVER REMOVED SHOWING ARMATURE DROPPED

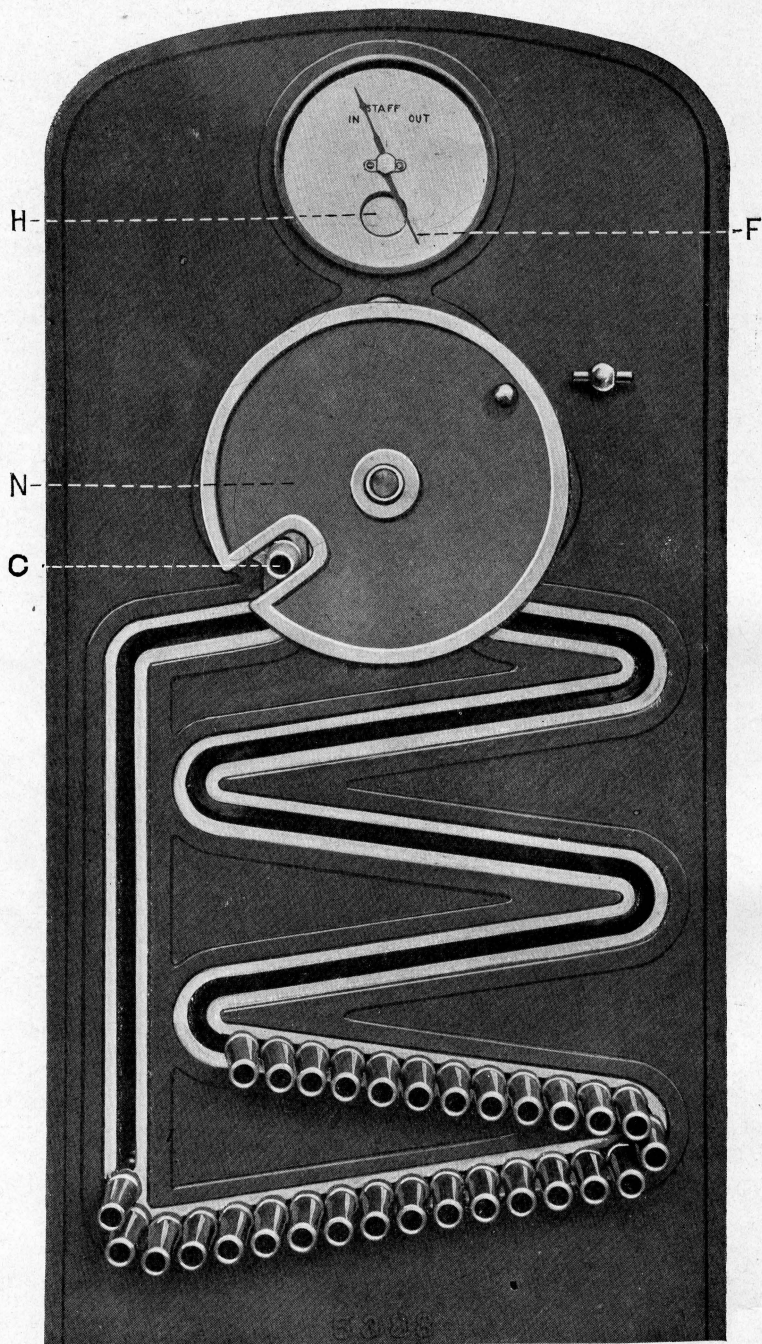


Fig. III
ABSOLUTE STAFF INSTRUMENT
FRONT VIEW OF INSTRUMENT IN CONDITION FOR REMOVAL OF A STAFF

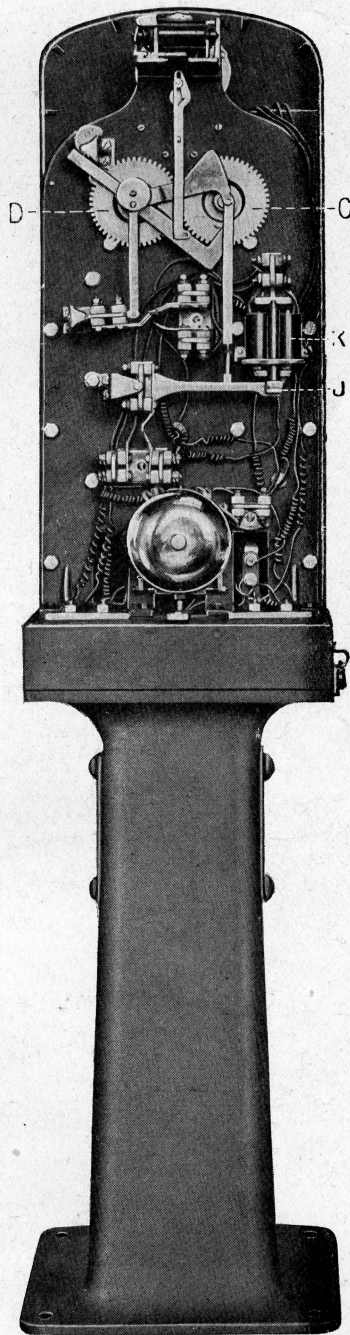


Fig. IV
ABSOLUTE STAFF INSTRUMENT WITH PEDESTAL
REAR VIEW WITH COVER REMOVED SHOWING ARMATURE RAISED

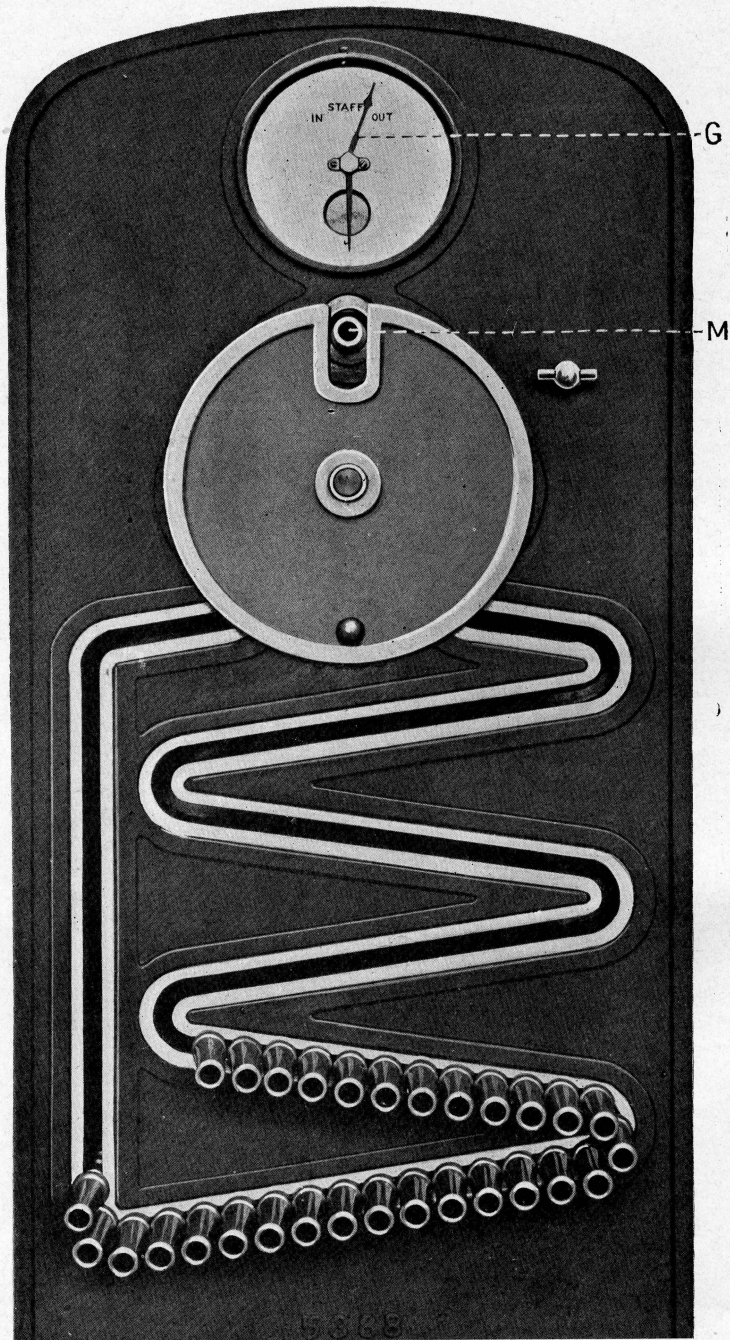


Fig. V
ABSOLUTE STAFF INSTRUMENT
 FRONT VIEW OF INSTRUMENT WHEN A STAFF IS RELEASED
 OR ABOUT TO BE REPLACED

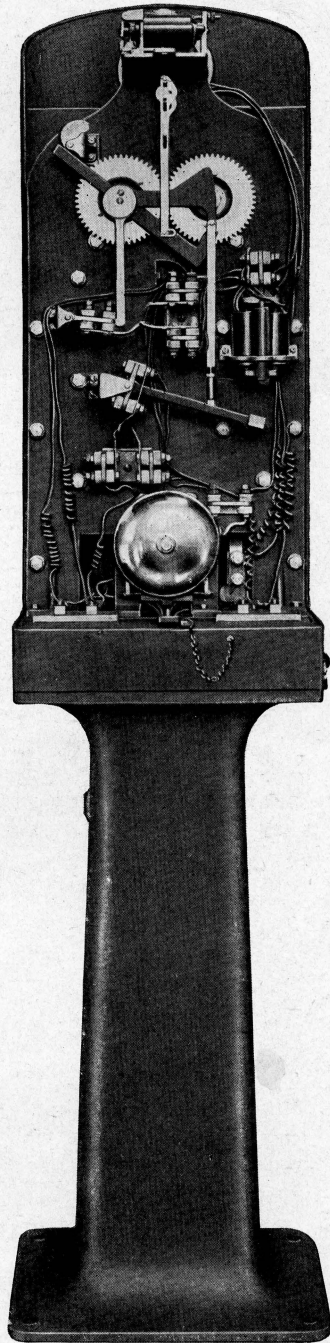


Fig. VI
ABSOLUTE STAFF INSTRUMENT WITH PEDESTAL
REAR VIEW WITH COVER REMOVED SHOWING
ARMATURE DROPPED

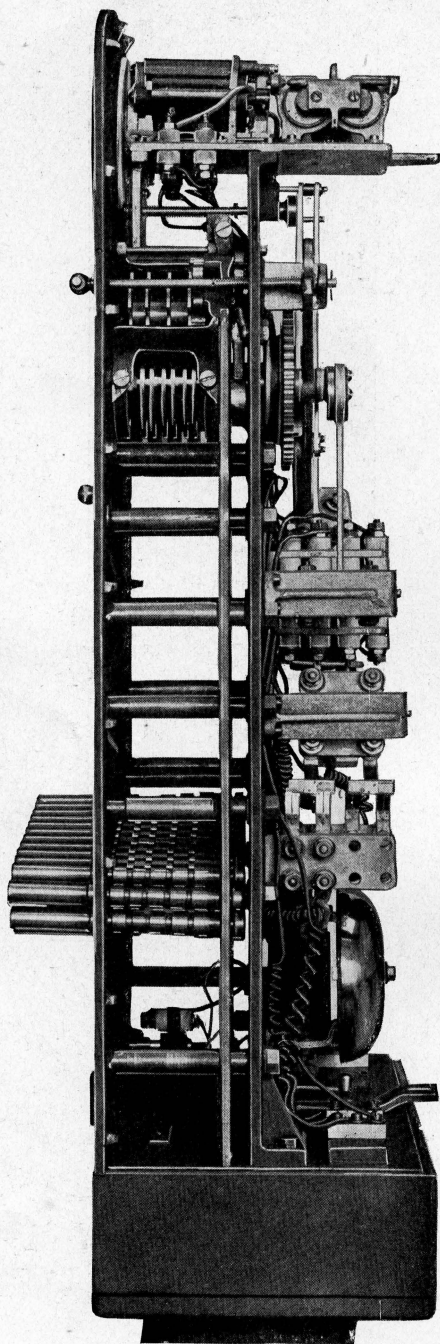


Fig. VII
ABSOLUTE STAFF INSTRUMENT
SIDE VIEW WITH COVER REMOVED

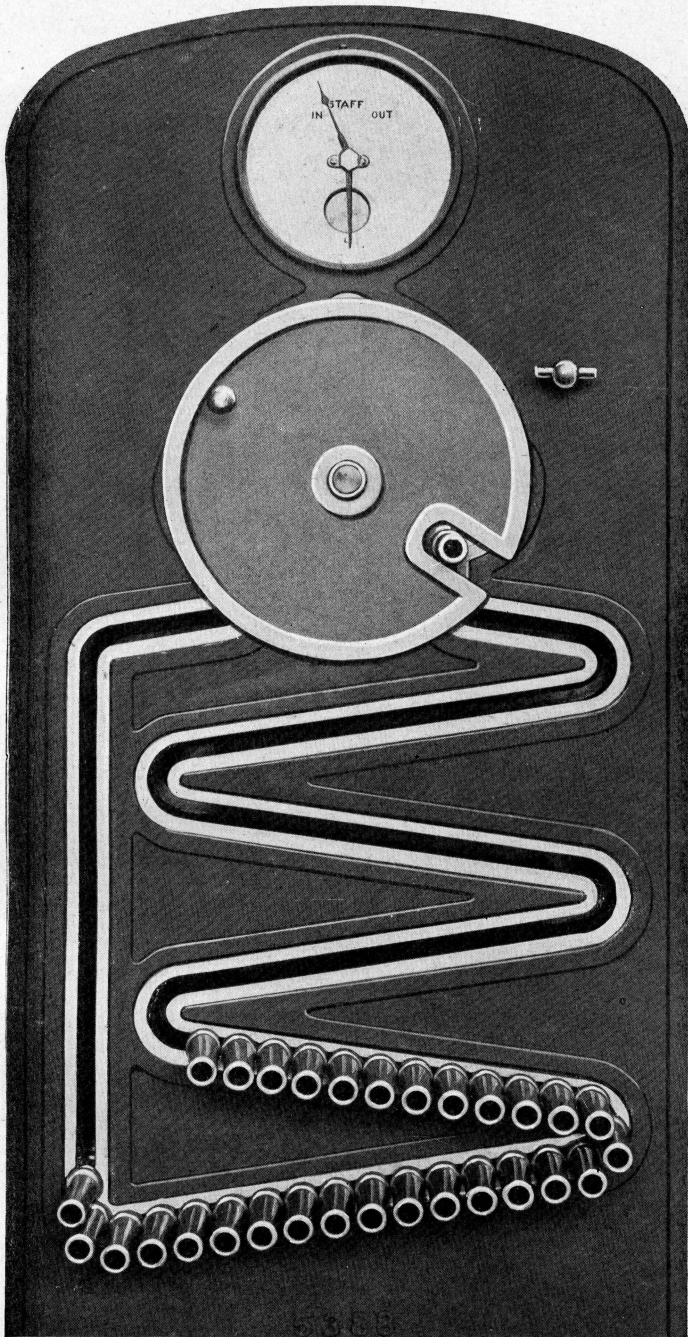


Fig. VIII
ABSOLUTE STAFF INSTRUMENT
FRONT VIEW OF INSTRUMENT WHEN A STAFF
HAS BEEN REPLACED



Fig. IX

VIEW SHOWING METHOD OF DELIVERING STAFF IN A RING STAFF POUCH BY HAND
TO A TRAIN PASSING AT A RATE OF 30 MILES PER HOUR



Fig. X

VIEW SHOWING STAFF IN CRANE STAFF DELIVERER READY TO BE
TAKEN BY A PASSING TRAIN

**PLATES SHOWING CIRCUITS FOR
THE ELECTRIC TRAIN STAFF SYSTEM**

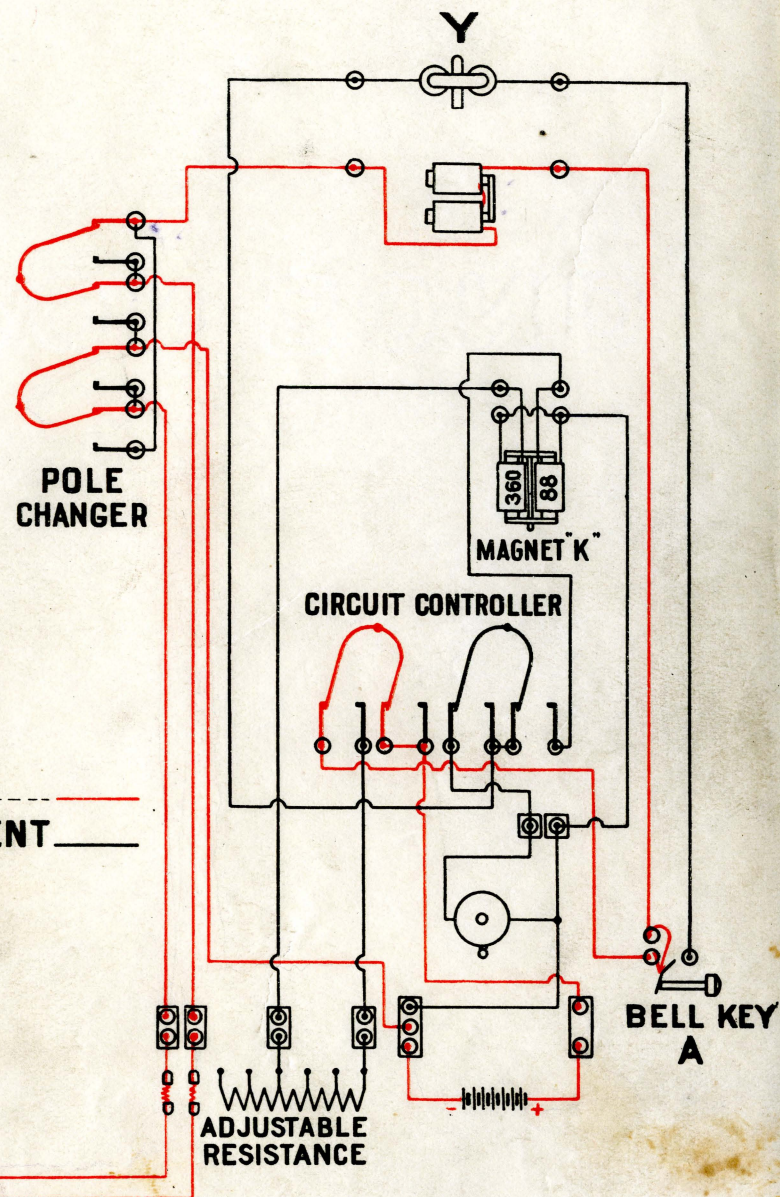
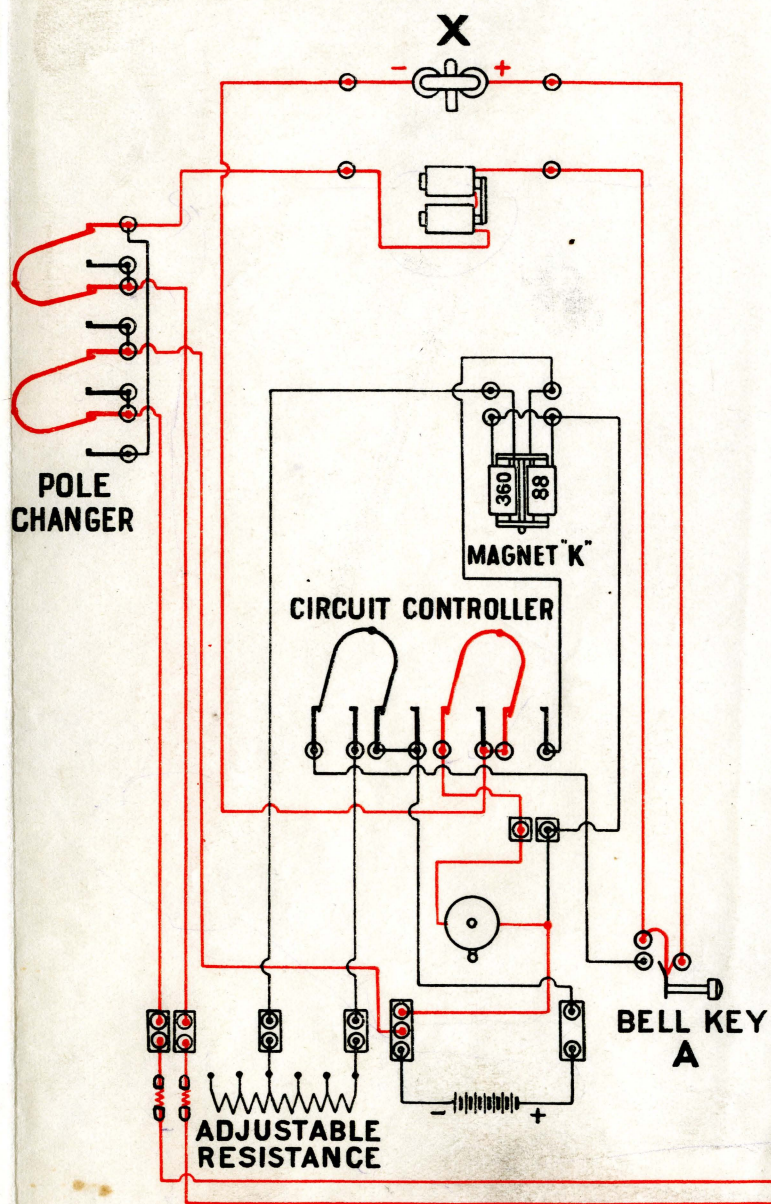
PLATES

The following plates represent diagrammatically the circuits of the different staff instruments and attachments mentioned in the previous description and shown in detail in the latter part of this catalogue. The first five plates show two absolute staff instruments which protect a block section between two successive staff stations. The circuits are given in colors for the conditions described at the bottom of each plate.

Plates 6 to 9 show a junction staff instrument in addition to the two absolute staff instruments protecting a block section. If, instead of a junction, there were a siding between these two absolute staff instruments, the circuits for the intermediate siding staff instrument would be the same as those shown for the junction staff instrument.

Plates 10 and 11 give the circuits for two absolute staff instruments with a pusher attachment at one end of the block section. This requires an additional bell key or push button circuit controller and an extra bell in each instrument. When the pusher staff is out of its attachment the ordinary circuits between the two instruments are opened but the circuits on the extra bells which are called the pusher bells, may then be closed by the extra keys, thus establishing communication between the two absolute staff instruments.

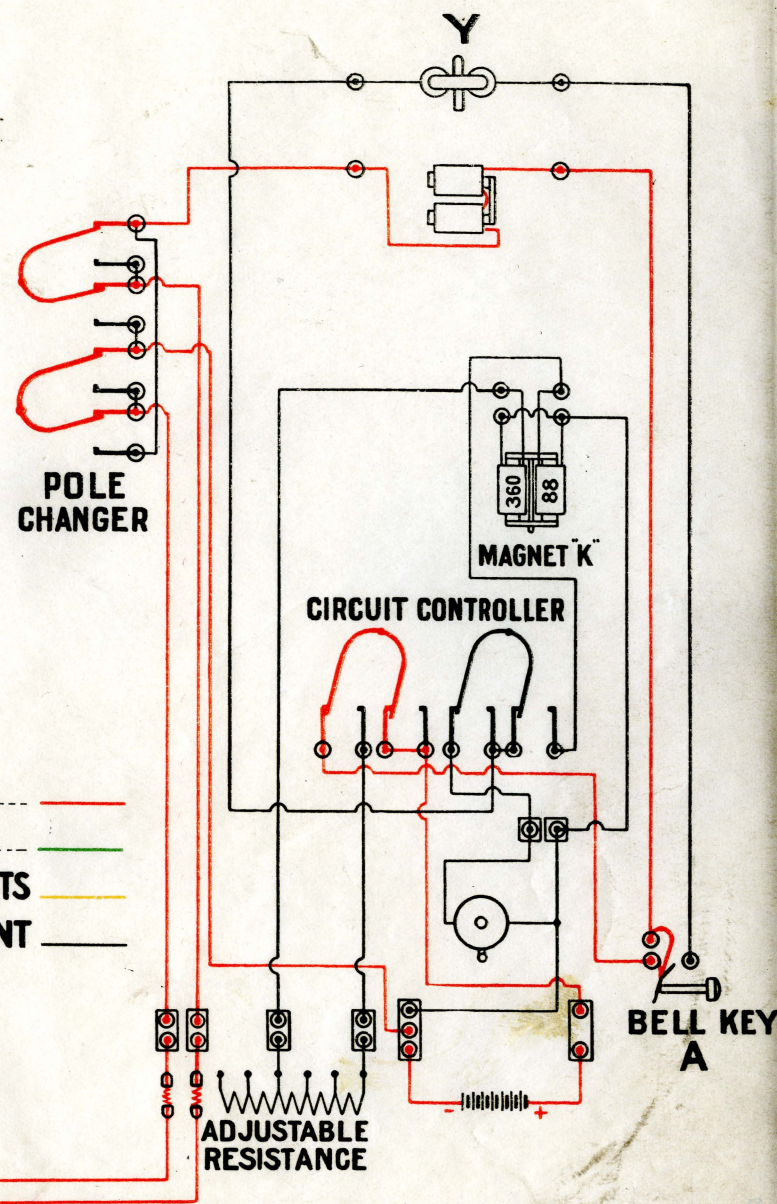
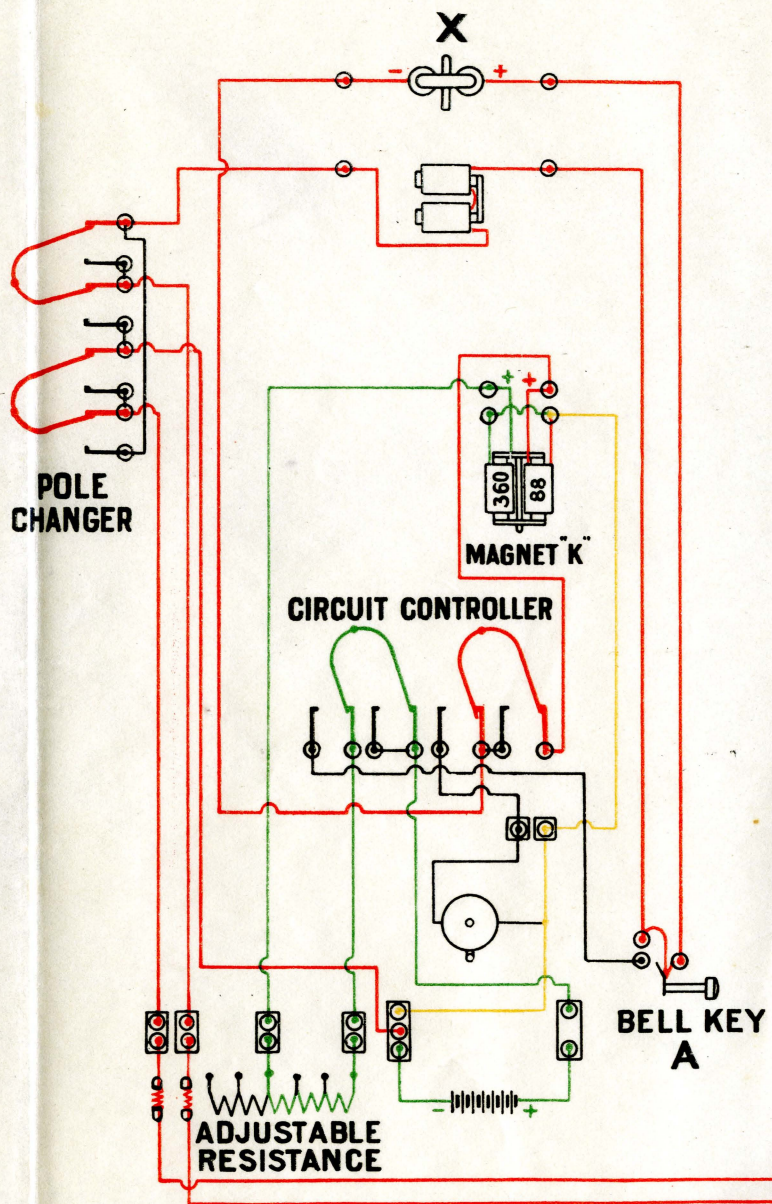
Plates 12 to 15 show the circuits at a staff station where circuit controller attachments are used to control electric signals, auxiliary to the staff system. The two absolute instruments shown on these plates are the instruments located at B, protecting the sections from B to C and from B to A respectively. On these plates the independent distant signals mentioned are the one-arm distant signals, which indicate the position of the home blades on the two-arm signals in advance. The staff distant signals are the bottom blades on these two-arm signals.



CIRCUIT OF BATTERY AT Y
 CIRCUITS NOT CARRYING CURRENT

PLATE N^o 1

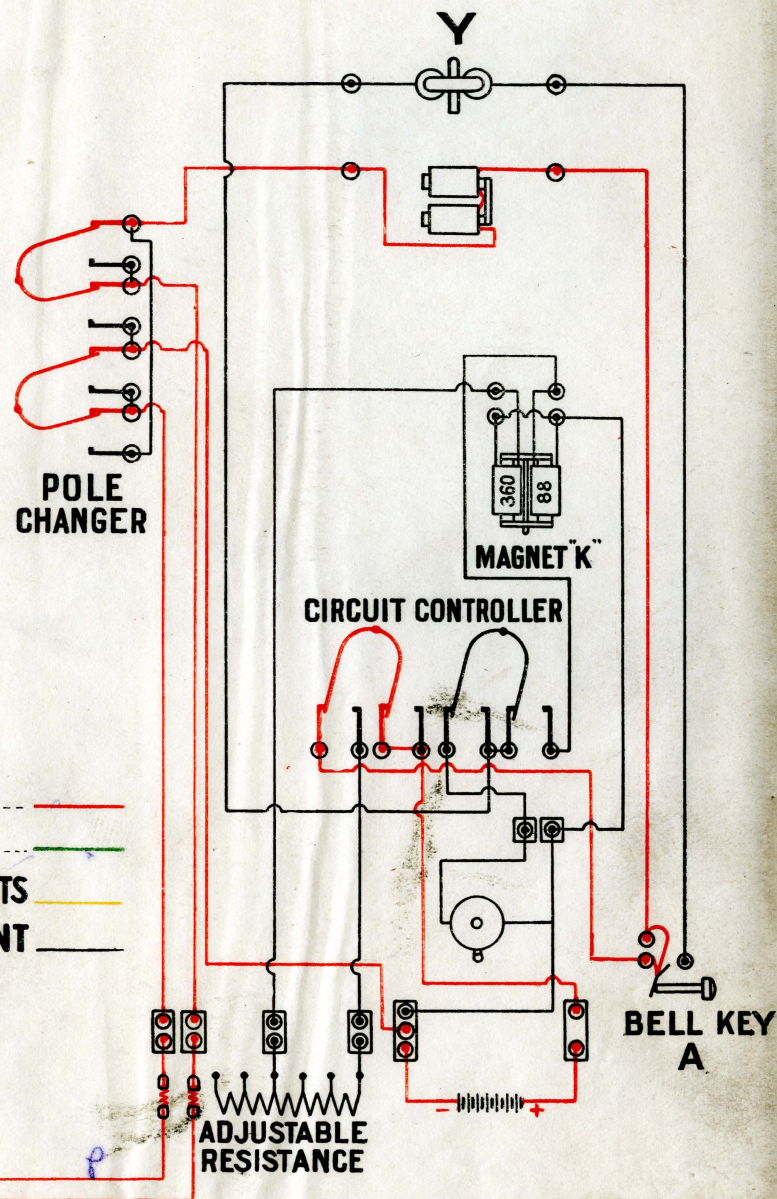
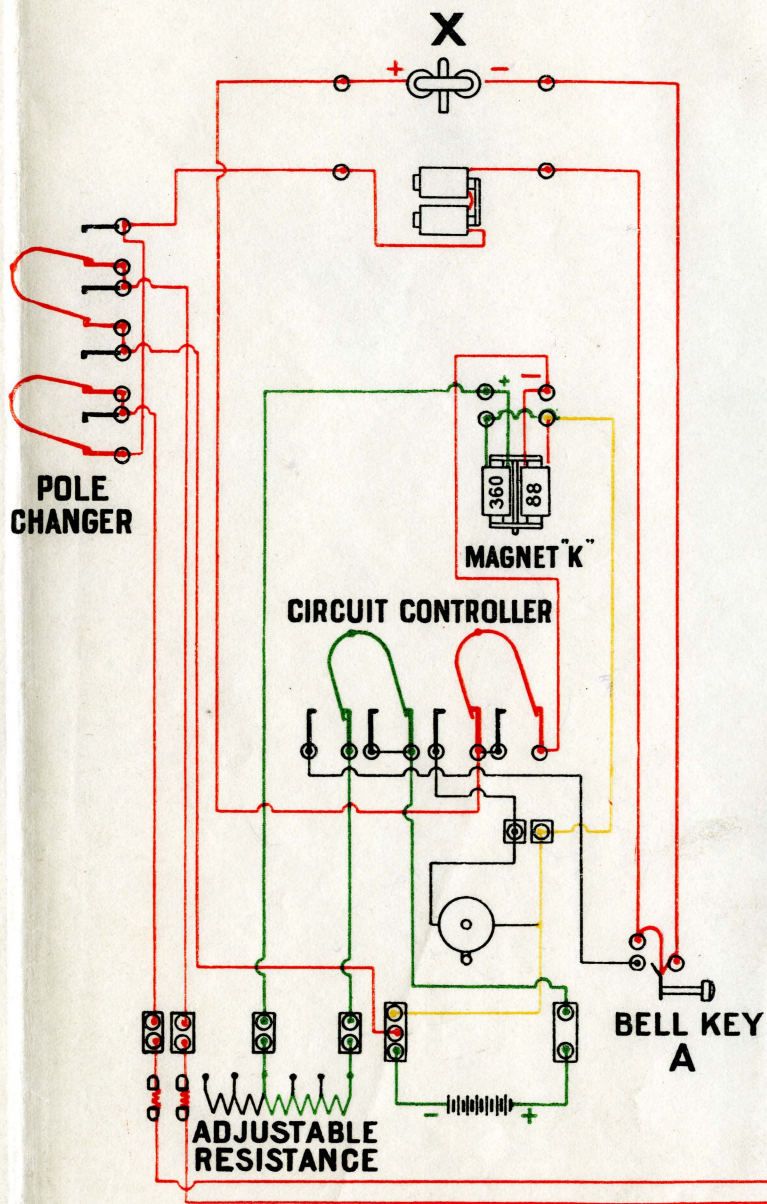
TWO ABSOLUTE STAFF INSTRUMENTS
 BELL CIRCUIT FROM Y TO X



CIRCUIT OF BATTERY AT Y -----
 CIRCUIT OF BATTERY AT X -----
 WIRES COMMON TO BOTH CIRCUITS -----
 CIRCUITS NOT CARRYING CURRENT -----

PLATE N^o 2

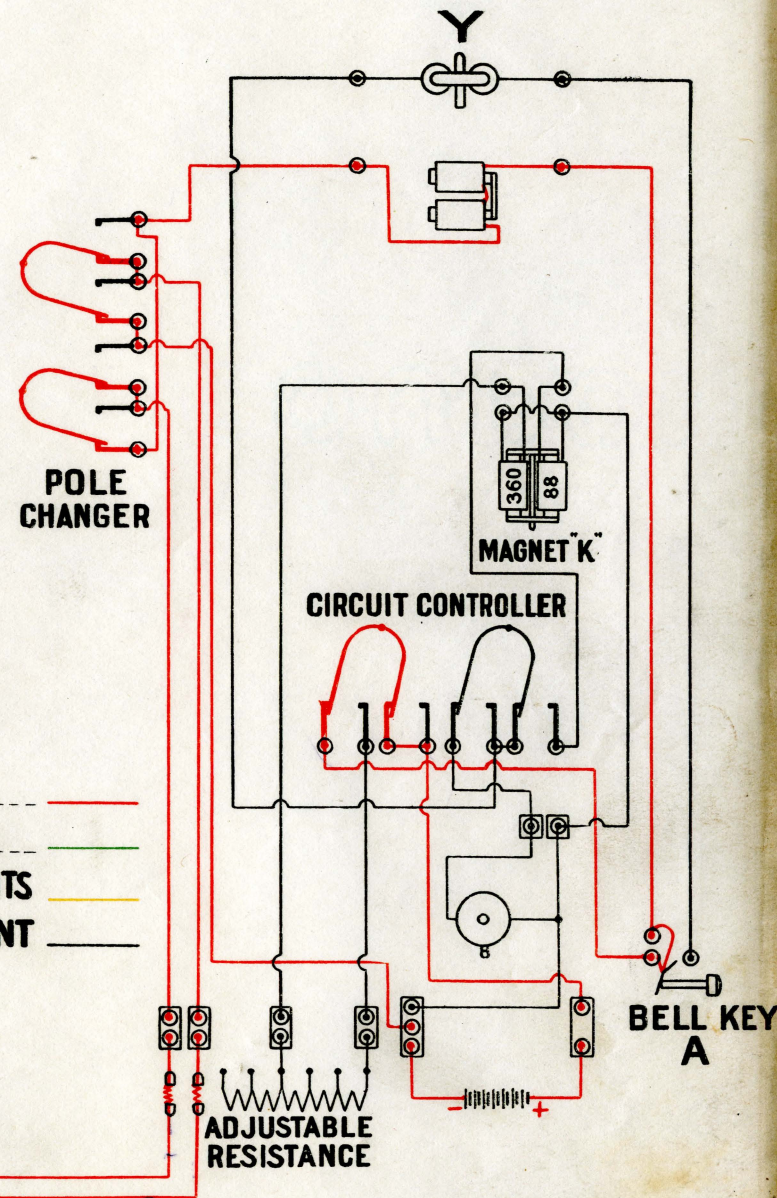
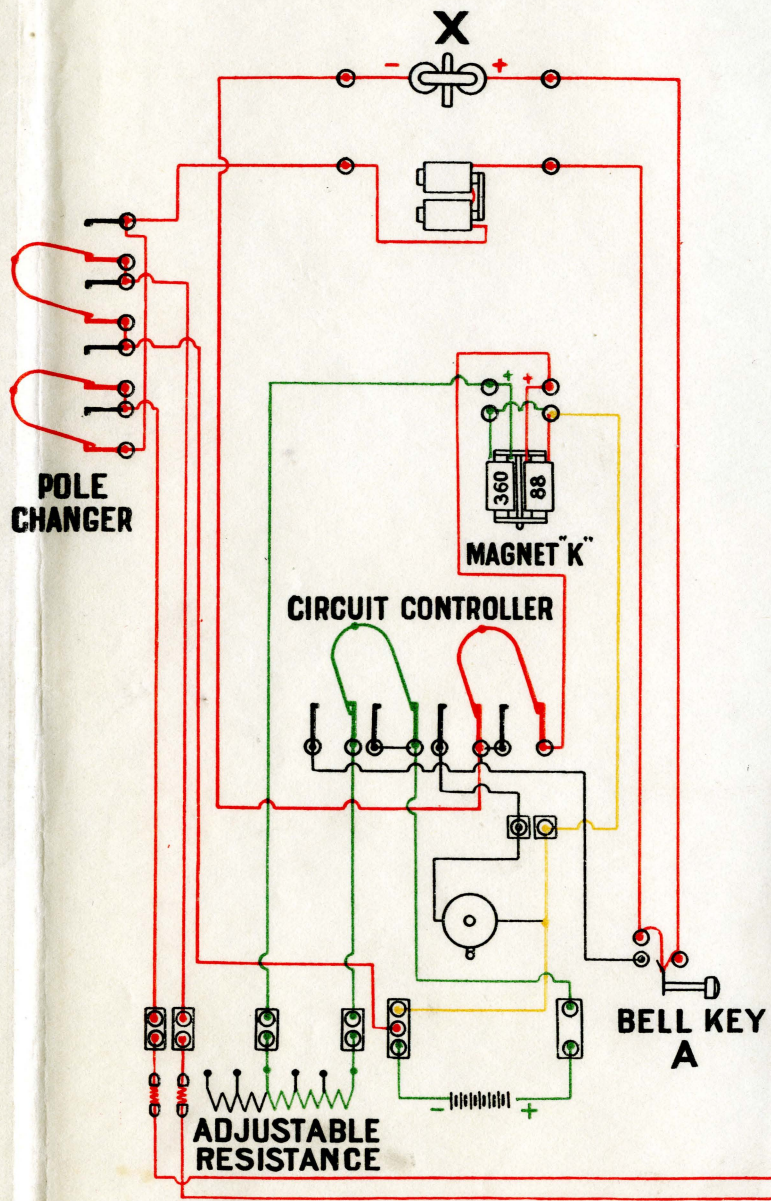
TWO ABSOLUTE STAFF INSTRUMENTS
 RELEASE CIRCUITS FROM Y TO X



CIRCUIT OF BATTERY AT Y
 CIRCUIT OF BATTERY AT X
 WIRES COMMON TO BOTH CIRCUITS
 CIRCUITS NOT CARRYING CURRENT

PLATE N^o 3

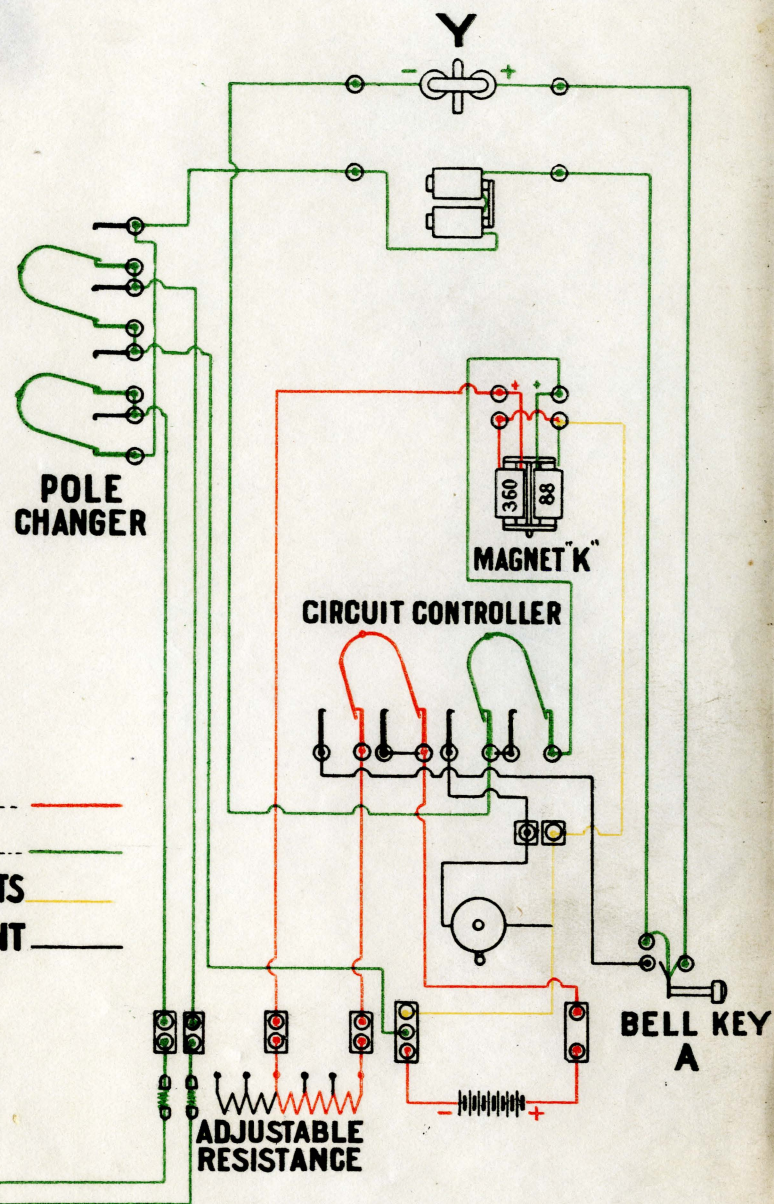
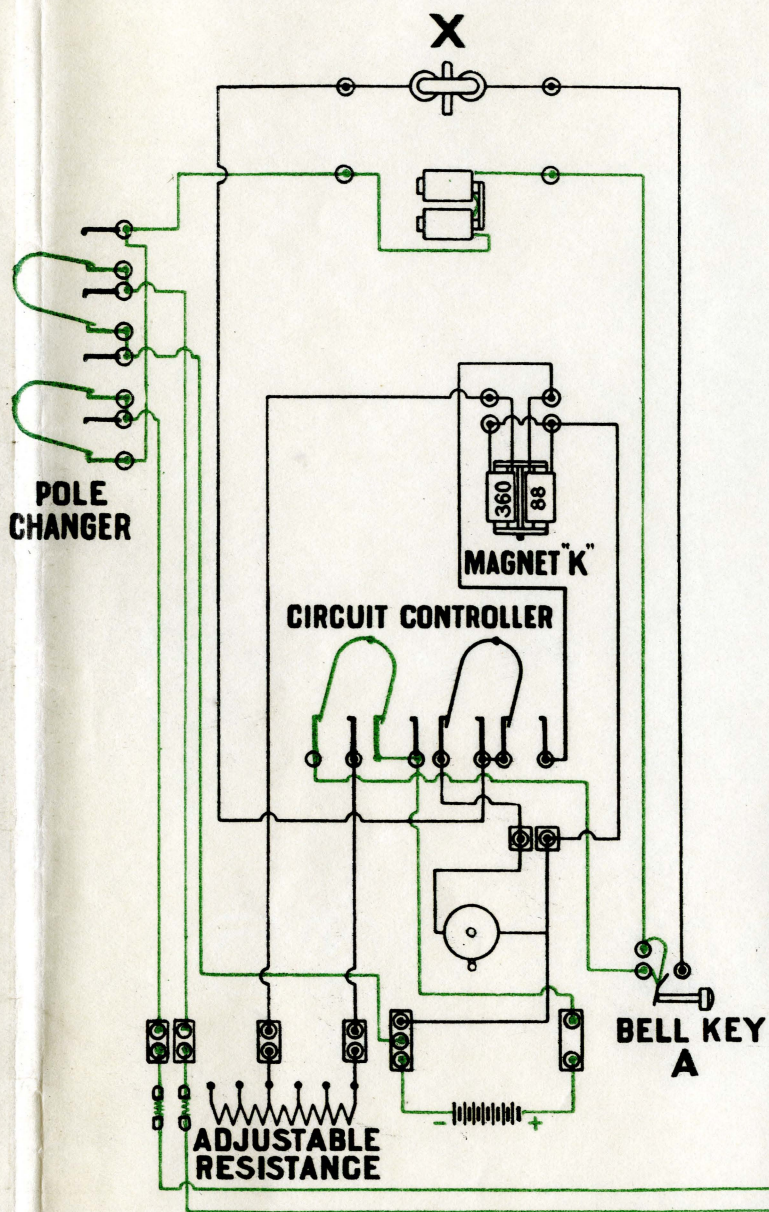
TWO ABSOLUTE STAFF INSTRUMENTS
 CIRCUITS WHEN AN ATTEMPT IS MADE TO RELEASE ANOTHER STAFF AT X AFTER A STAFF
 HAS BEEN REMOVED AT X AND HAS NOT BEEN REPLACED
 IN EITHER OF THE INSTRUMENTS



CIRCUIT OF BATTERY AT Y ————
 CIRCUIT OF BATTERY AT X ————
 WIRES COMMON TO BOTH CIRCUITS ————
 CIRCUITS NOT CARRYING CURRENT ————

PLATE N° 4

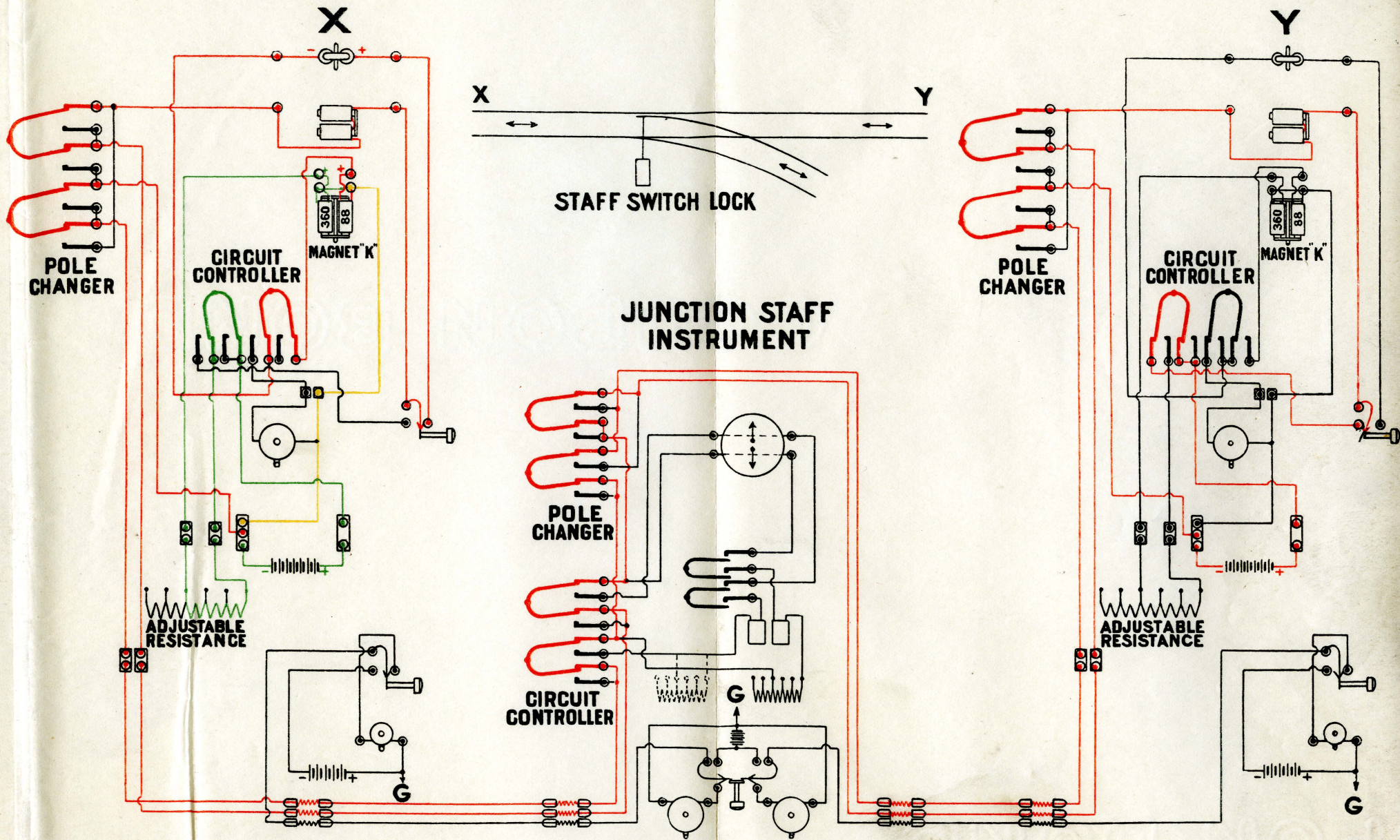
TWO ABSOLUTE STAFF INSTRUMENTS
 RELEASE CIRCUITS FROM Y TO X AFTER STAFF WHICH WAS REMOVED FROM INSTRUMENT AT
 X HAS BEEN REPLACED IN INSTRUMENT AT Y



CIRCUIT OF BATTERY AT Y ——— (red line)
 CIRCUIT OF BATTERY AT X ——— (green line)
 WIRES COMMON TO BOTH CIRCUITS ——— (yellow line)
 CIRCUITS NOT CARRYING CURRENT ——— (black line)

PLATE No 5

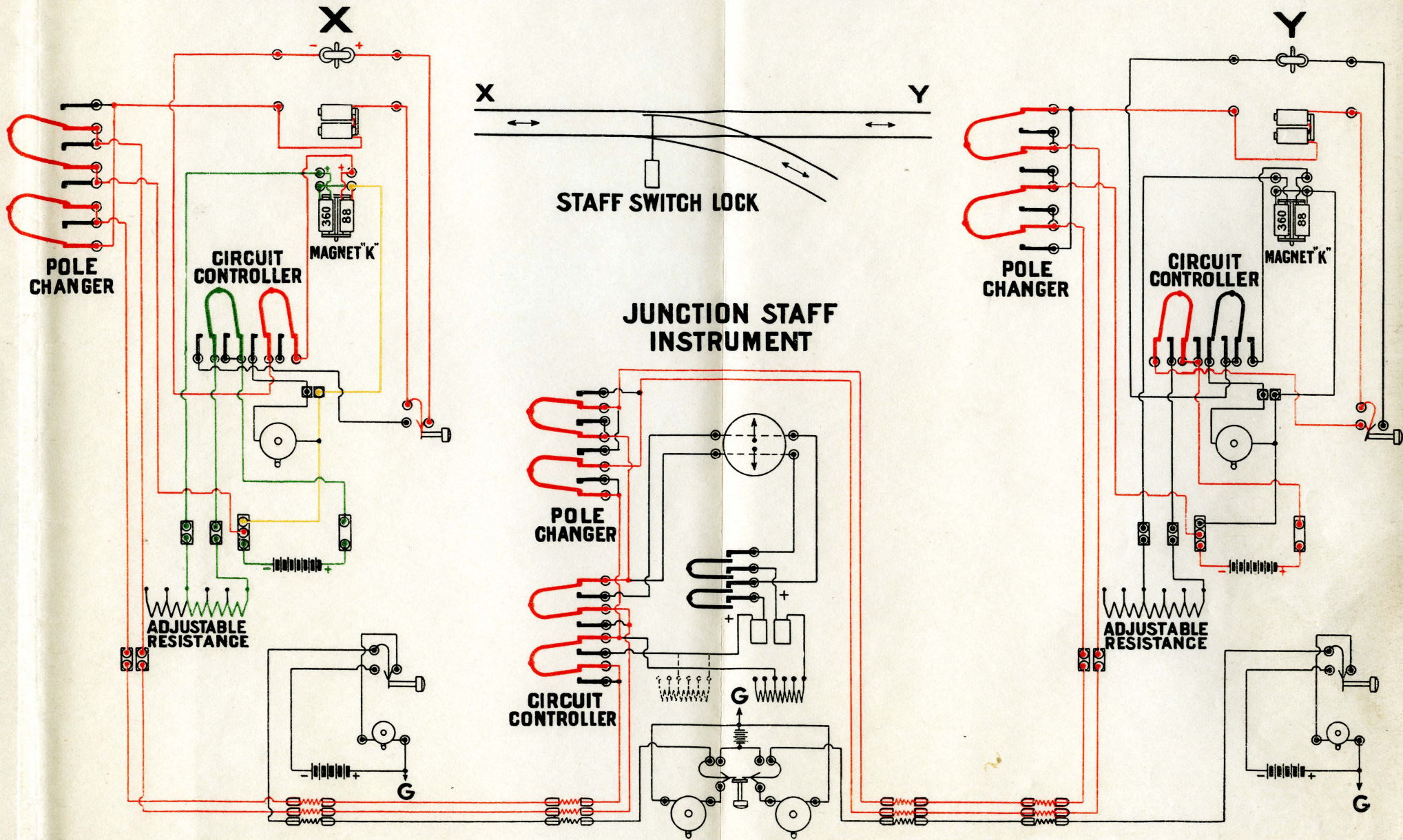
TWO ABSOLUTE STAFF INSTRUMENTS
 RELEASE CIRCUITS FROM X TO Y



CIRCUIT OF BATTERY AT Y ————
CIRCUIT OF BATTERY AT X ————
WIRES COMMON TO BOTH CIRCUITS ————
CIRCUITS NOT CARRYING CURRENT ————

PLATE No 6

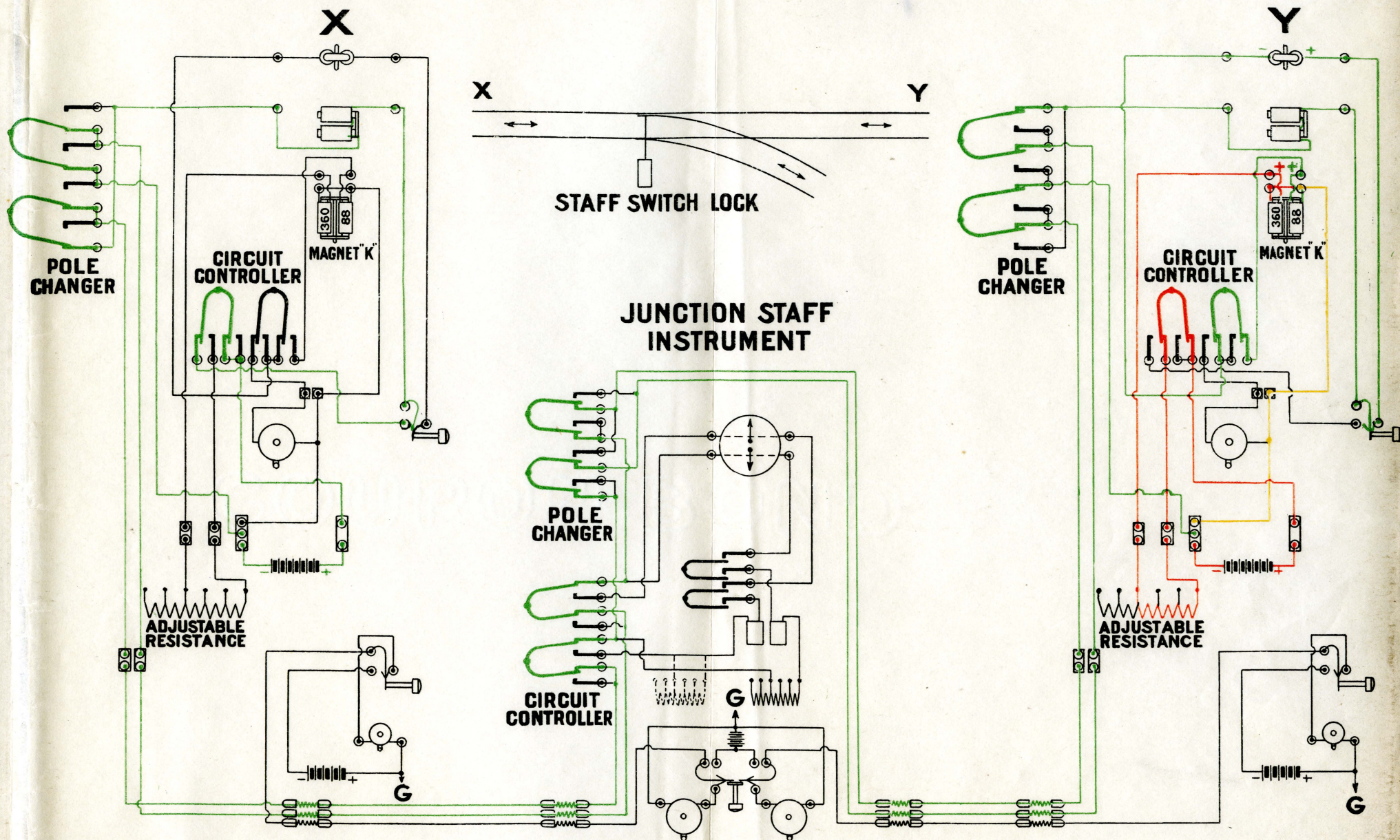
TWO ABSOLUTE STAFF INSTRUMENTS AND A JUNCTION STAFF INSTRUMENT
 RELEASE CIRCUITS FROM Y TO X



CIRCUIT OF BATTERY AT Y _____
CIRCUIT OF BATTERY AT X _____
WIRES COMMON TO BOTH CIRCUITS _____
CIRCUITS NOT CARRYING CURRENT _____

PLATE No 7

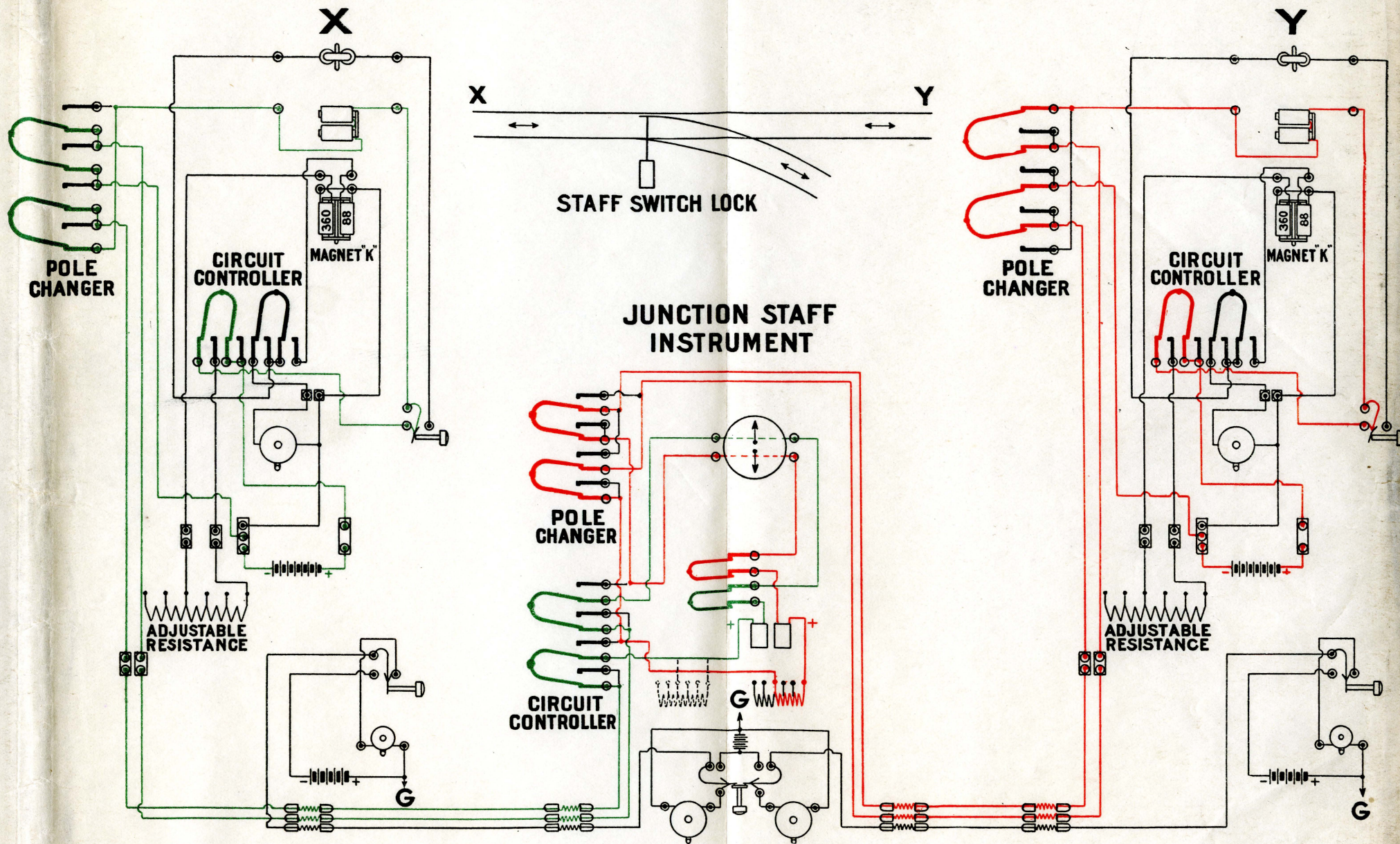
TWO ABSOLUTE STAFF INSTRUMENTS AND A JUNCTION STAFF INSTRUMENT
RELEASE CIRCUITS FROM Y TO X AFTER A STAFF HAS BEEN REMOVED FROM INSTRUMENT
AT X AND REPLACED IN JUNCTION STAFF INSTRUMENT



CIRCUIT OF BATTERY AT Y ———— —
CIRCUIT OF BATTERY AT X ———— —
WIRES COMMON TO BOTH CIRCUITS ———— —
CIRCUITS NOT CARRYING CURRENT ———— —

PLATE No 8

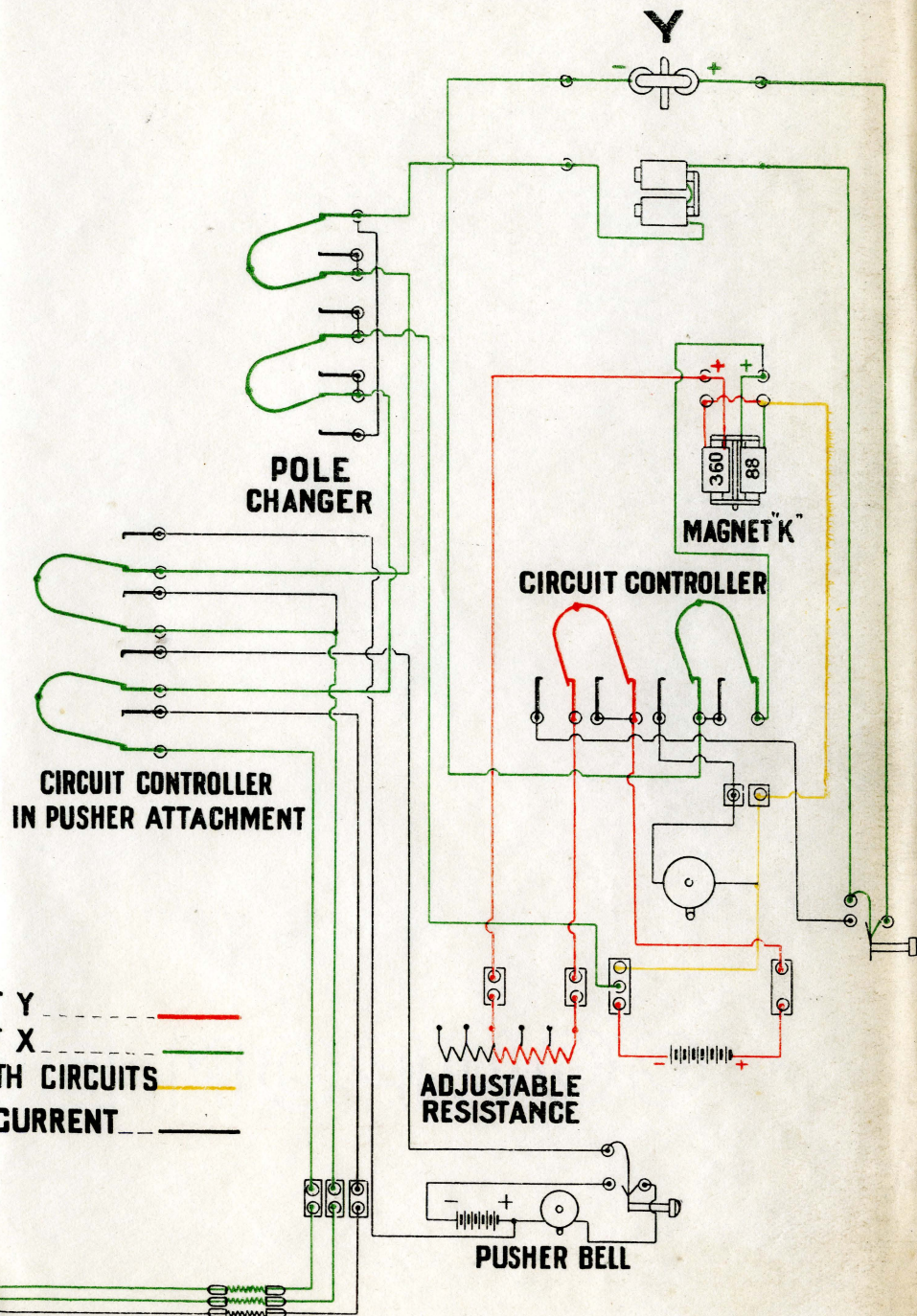
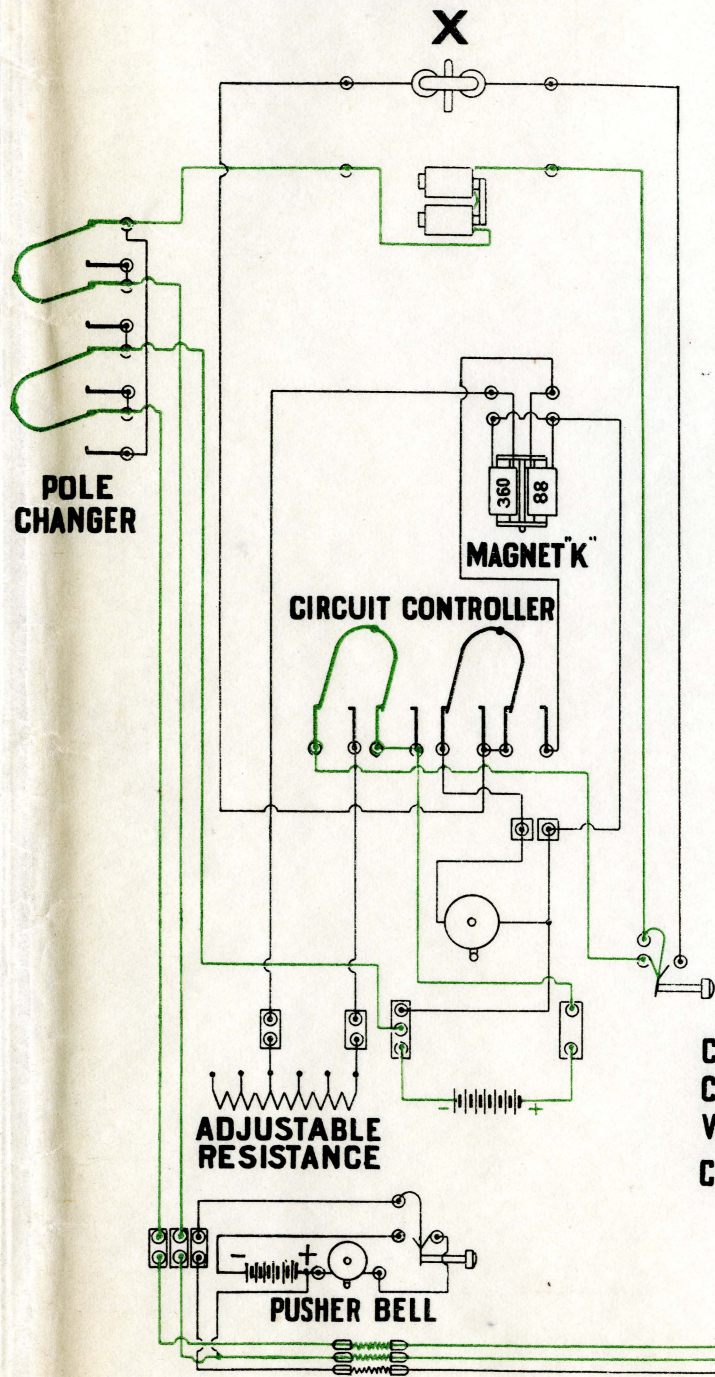
TWO ABSOLUTE STAFF INSTRUMENTS AND A JUNCTION STAFF INSTRUMENT
 RELEASE CIRCUITS FROM X TO Y



CIRCUIT OF BATTERY AT Y ——— —
CIRCUIT OF BATTERY AT X ——— —
CIRCUITS NOT CARRYING CURRENT ——— —

PLATE No 9

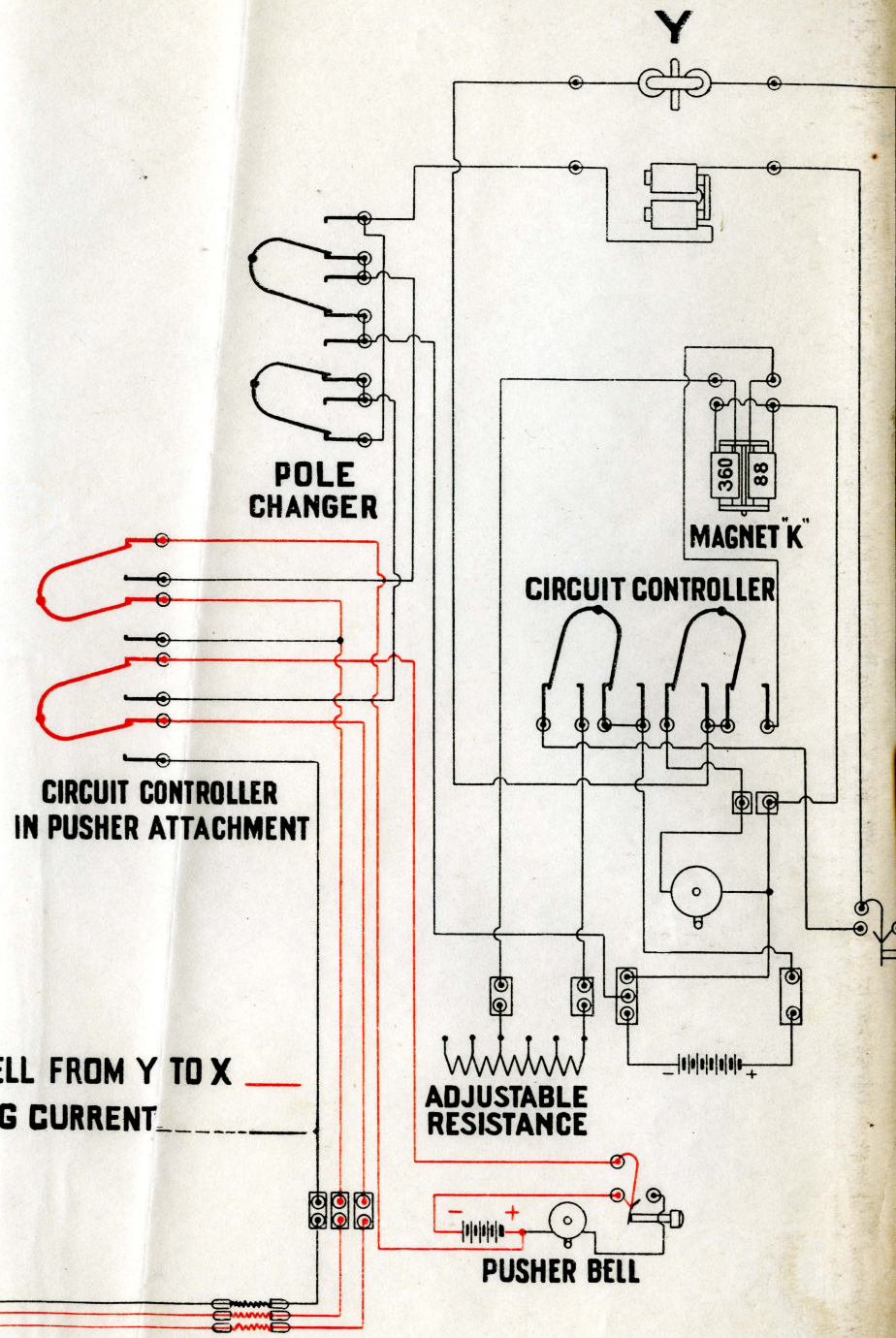
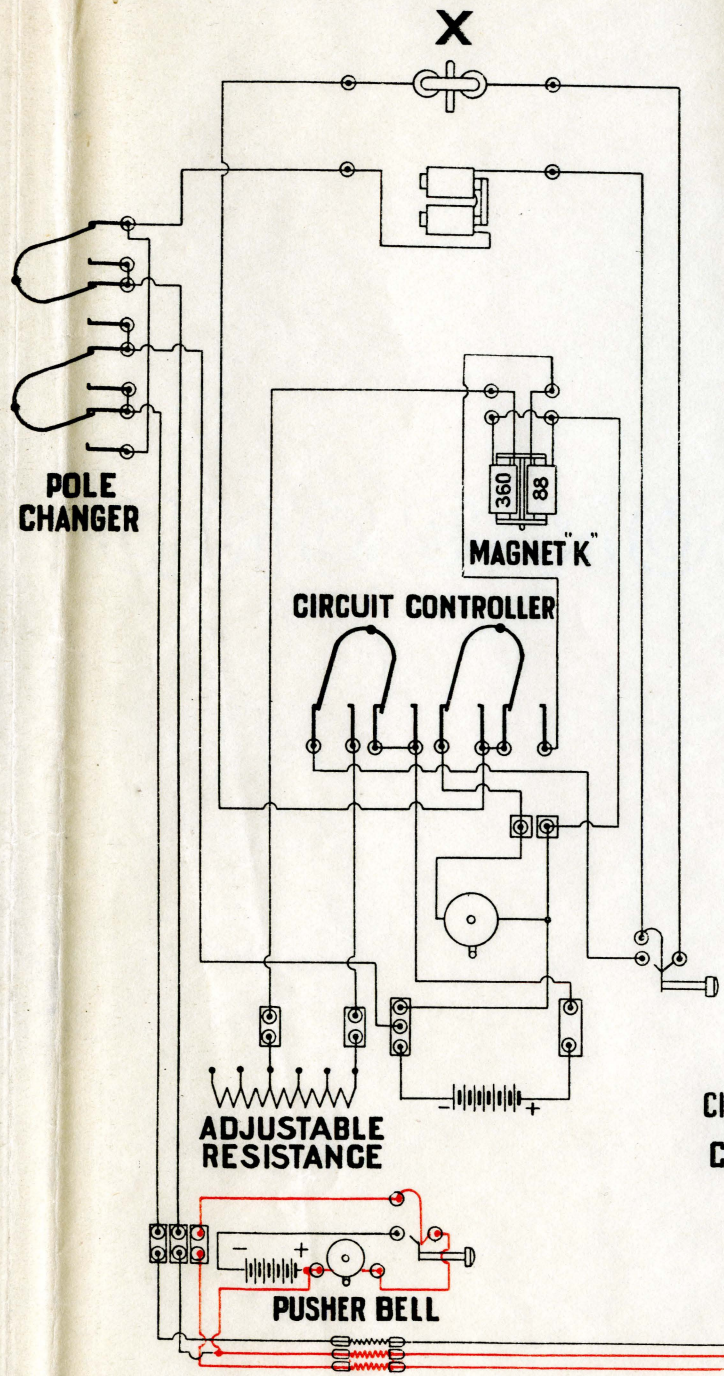
TWO ABSOLUTE STAFF INSTRUMENTS AND A JUNCTION STAFF INSTRUMENT
RELEASE CIRCUITS FROM X AND Y TO JUNCTION STAFF INSTRUMENT



CIRCUIT OF BATTERY AT Y ———— (red line)
 CIRCUIT OF BATTERY AT X ———— (green line)
 WIRES COMMON TO BOTH CIRCUITS ———— (yellow line)
 CIRCUITS NOT CARRYING CURRENT ———— (black line)

PLATE N° 10

TWO ABSOLUTE STAFF INSTRUMENTS WITH A PUSHER ATTACHMENT
 RELEASE CIRCUITS FROM X TO Y



CIRCUIT FOR PUSHER BELL FROM Y TO X ———
 CIRCUITS NOT CARRYING CURRENT - - - - -

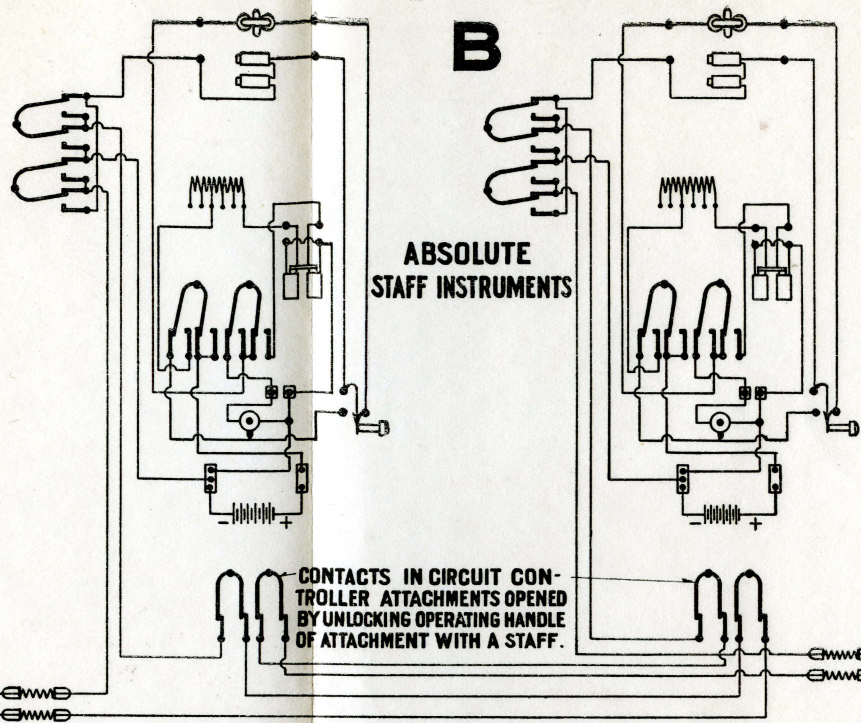
PLATE N^o 11

TWO ABSOLUTE STAFF INSTRUMENTS WITH A PUSHER ATTACHMENT
 CIRCUIT FOR PUSHER BELL FROM Y TO X

A ←

B

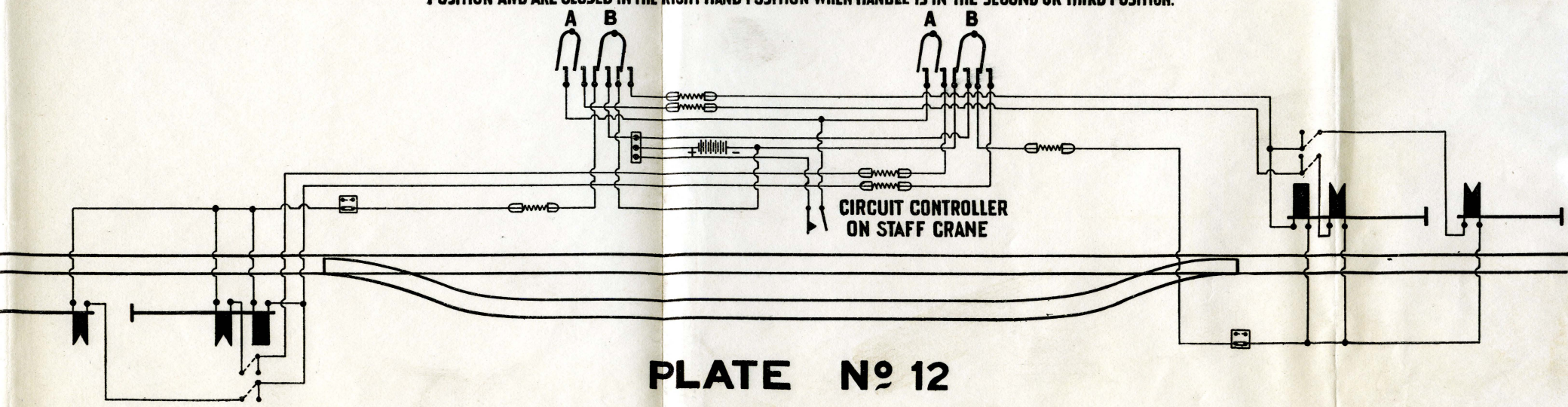
C →



ABSOLUTE
STAFF INSTRUMENTS

CONTACTS IN CIRCUIT CON-
TROLLER ATTACHMENTS OPENED
BY UNLOCKING OPERATING HANDLE
OF ATTACHMENT WITH A STAFF.

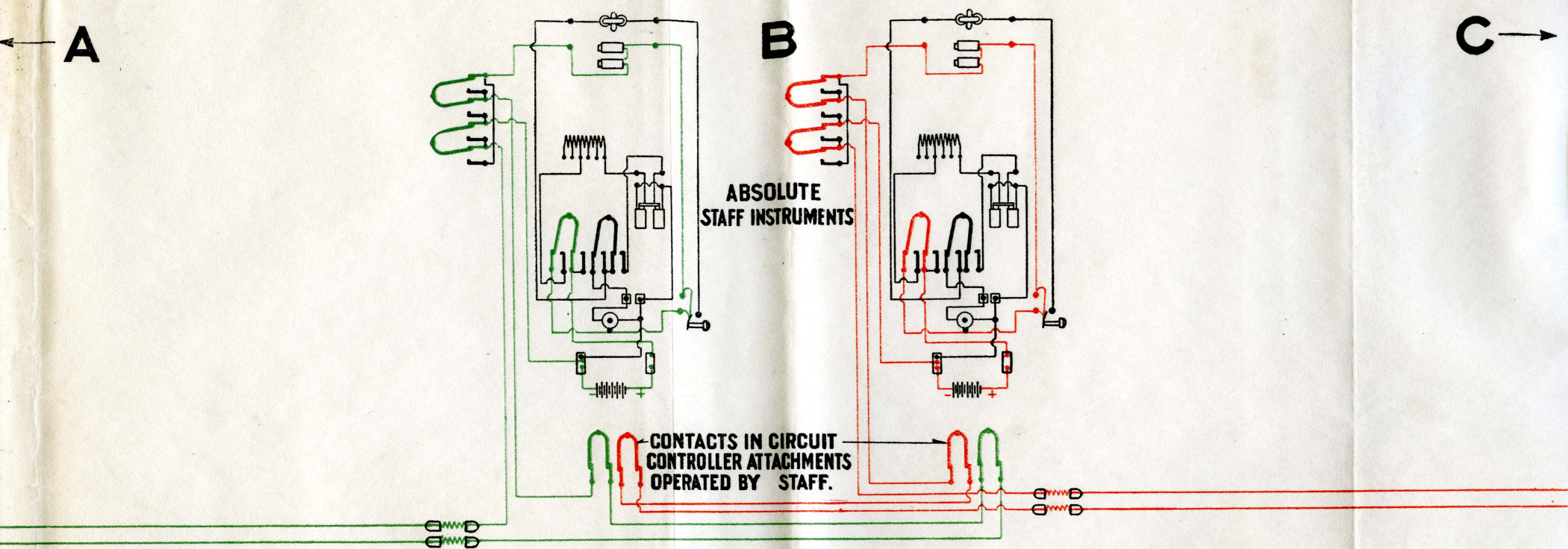
CONTACTS IN CIRCUIT CONTROLLER ATTACHMENTS
CONTACTS "A" ARE OPEN WHEN OPERATING HANDLE FIG. 26 PLATE 2321 IS IN THE FIRST
OR SECOND POSITION AND ARE CLOSED WHEN HANDLE IS IN THE THIRD POSITION.
CONTACTS "B" ARE CLOSED IN THE LEFT HAND POSITION (AS SHOWN) WHEN HANDLE IS IN THE FIRST
POSITION AND ARE CLOSED IN THE RIGHT HAND POSITION WHEN HANDLE IS IN THE SECOND OR THIRD POSITION.



CIRCUIT CONTROLLER
ON STAFF CRANE

PLATE No 12

TWO ABSOLUTE STAFF INSTRUMENTS WITH CIRCUIT CONTROLLER ATTACHMENTS
SIGNAL CONTROL CIRCUITS AT A STAFF STATION



RELEASE CIRCUIT FROM B TO C —
 RELEASE CIRCUIT FROM B TO A —
 CIRCUITS NOT CARRYING CURRENT —

CONTACTS IN CIRCUIT CONTROLLER ATTACHMENTS OPERATED BY HANDLE FIG.26 PLATE 2321.

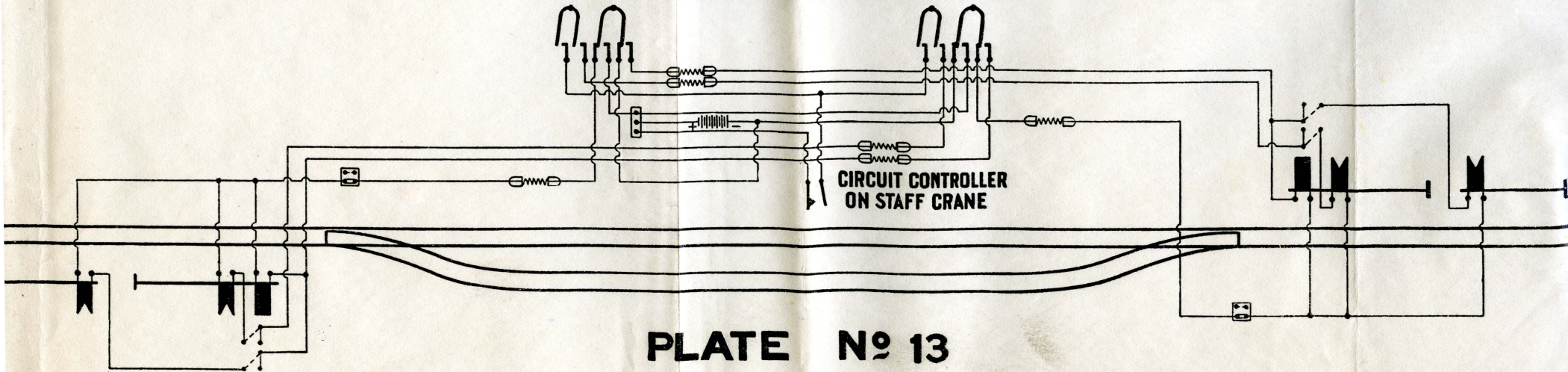


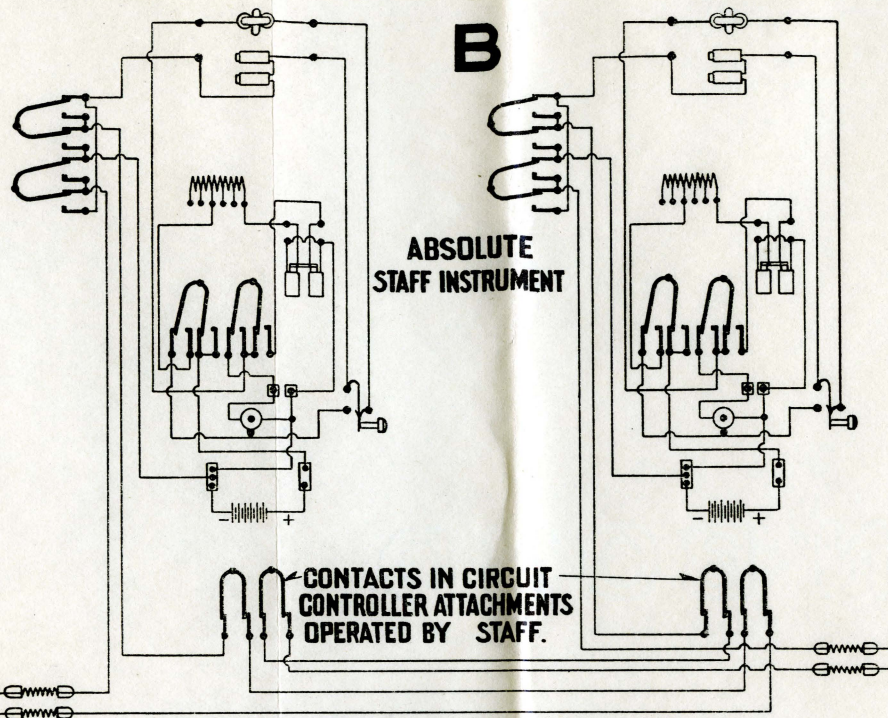
PLATE No 13

TWO ABSOLUTE STAFF INSTRUMENTS WITH CIRCUIT CONTROLLER ATTACHMENTS
RELEASE CIRCUITS FROM B TO C AND FROM B TO A

A ←

B

C →



CIRCUIT FOR HOME AND INDEPENDENT DISTANT SIGNALS ——— (red line)
CIRCUITS NOT CARRYING CURRENT ——— (black line)

CONTACTS IN CIRCUIT CONTROLLER ATTACHMENTS OPERATED BY HANDLE FIG.26 PLATE 2321.

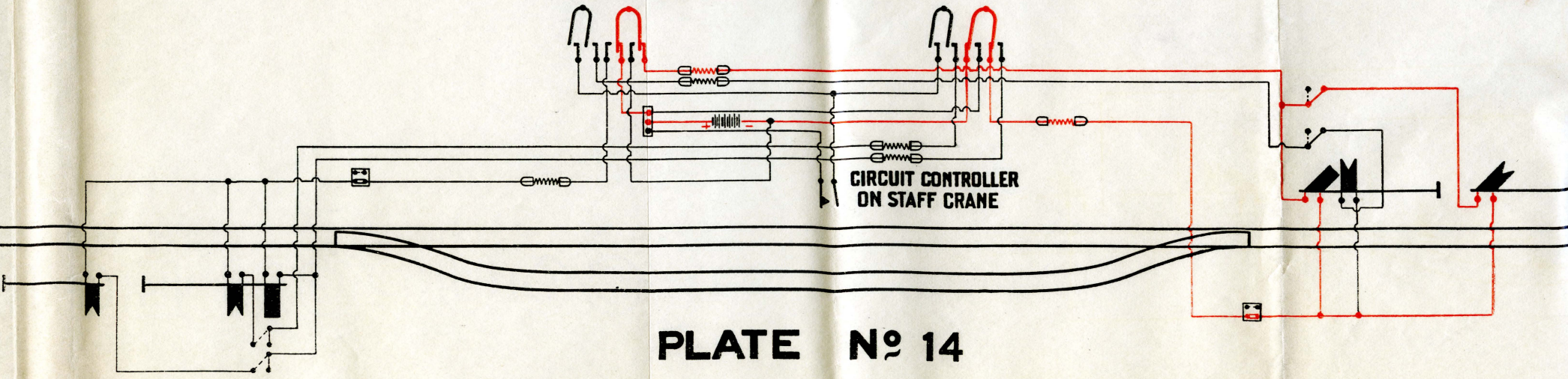
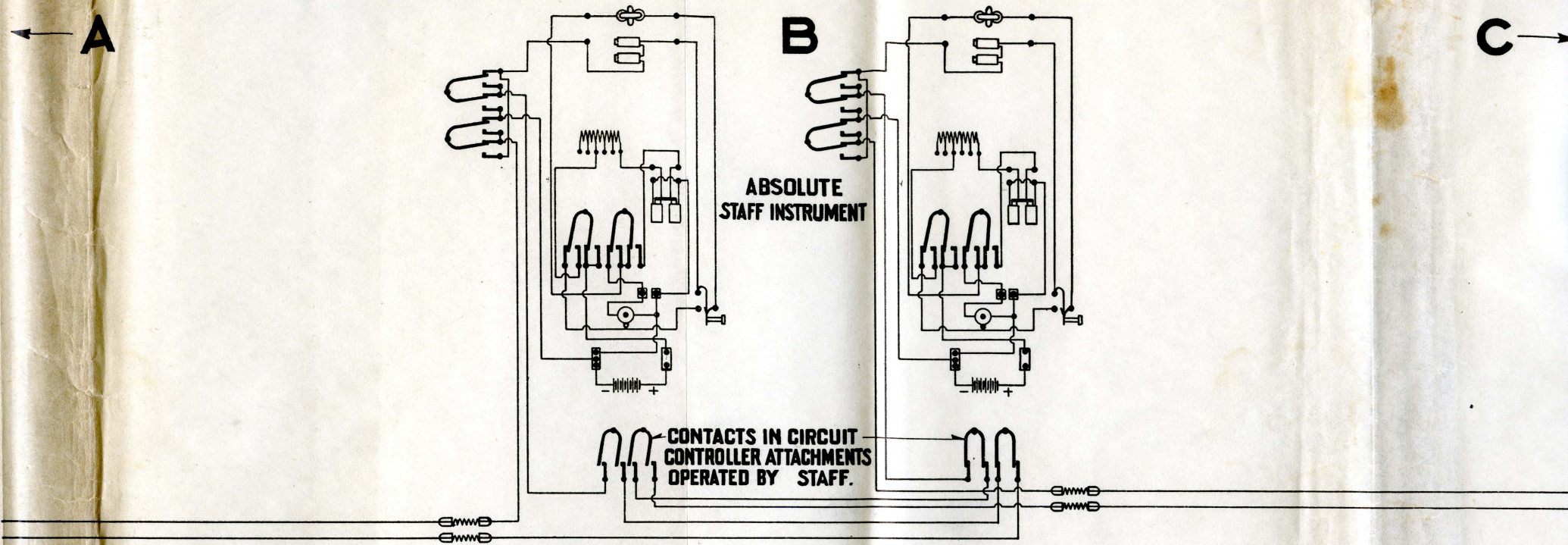


PLATE N° 14

**TWO ABSOLUTE STAFF INSTRUMENTS WITH CIRCUIT CONTROLLER ATTACHMENTS
 CIRCUIT FOR HOME AND INDEPENDENT DISTANT SIGNALS**



CIRCUIT FOR HOME AND INDEPENDENT DISTANT SIGNALS ——— (red line)
CIRCUIT FOR STAFF DISTANT SIGNAL ——— (green line)
WIRES COMMON TO BOTH CIRCUITS ——— (yellow line)
CIRCUITS NOT CARRYING CURRENT ——— (black line)

CONTACTS IN CIRCUIT CONTROLLER ATTACHMENTS OPERATED BY HANDLE FIG.26 PLATE 2321.

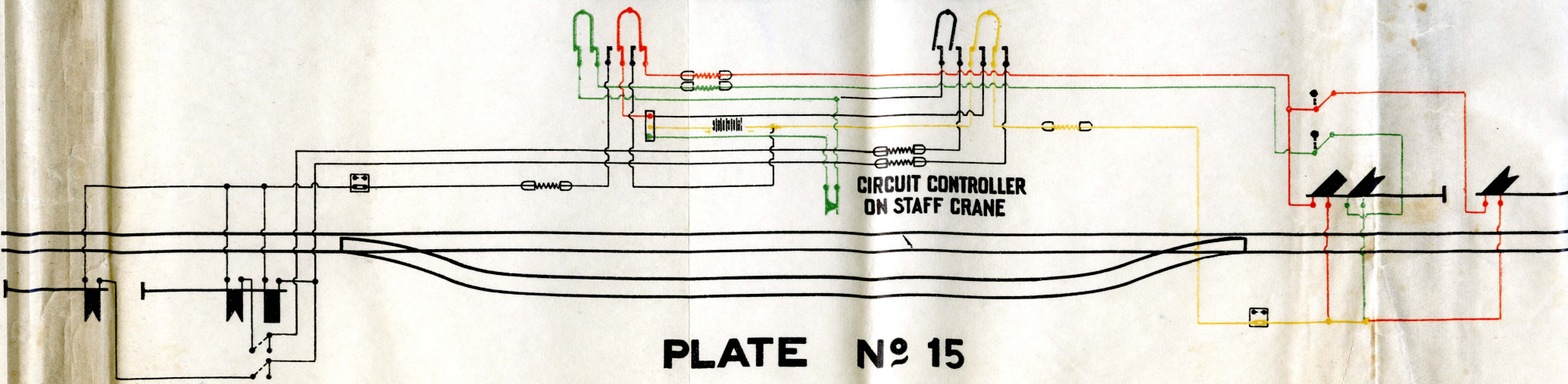
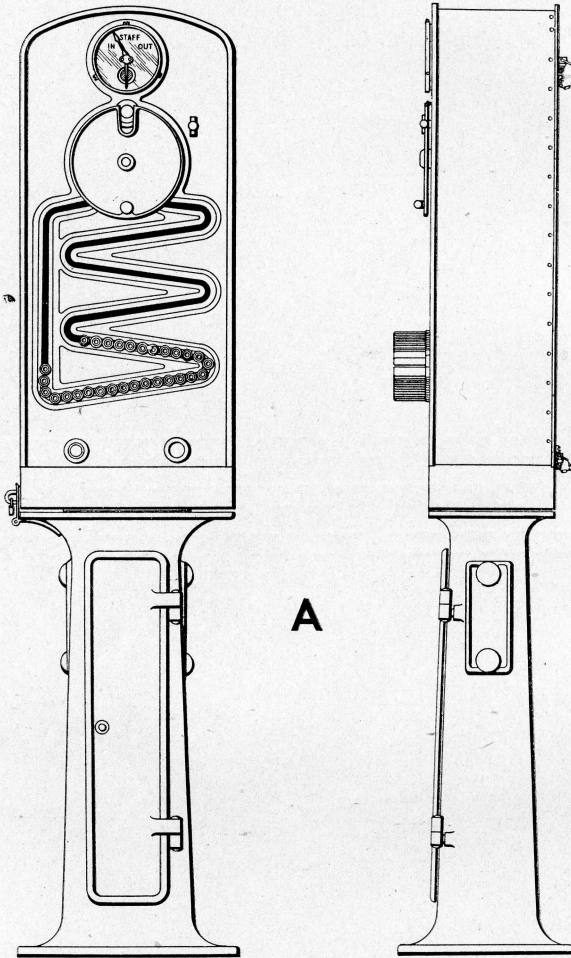


PLATE No 15

**TWO ABSOLUTE STAFF INSTRUMENTS WITH CIRCUIT CONTROLLER ATTACHMENTS
 CIRCUITS FOR HOME, INDEPENDENT DISTANT AND STAFF DISTANT SIGNALS**

**CATALOGUE AND PRICE LIST
OF DEVICES USED IN
THE ELECTRIC TRAIN STAFF SYSTEM**



ABSOLUTE STAFF INSTRUMENT

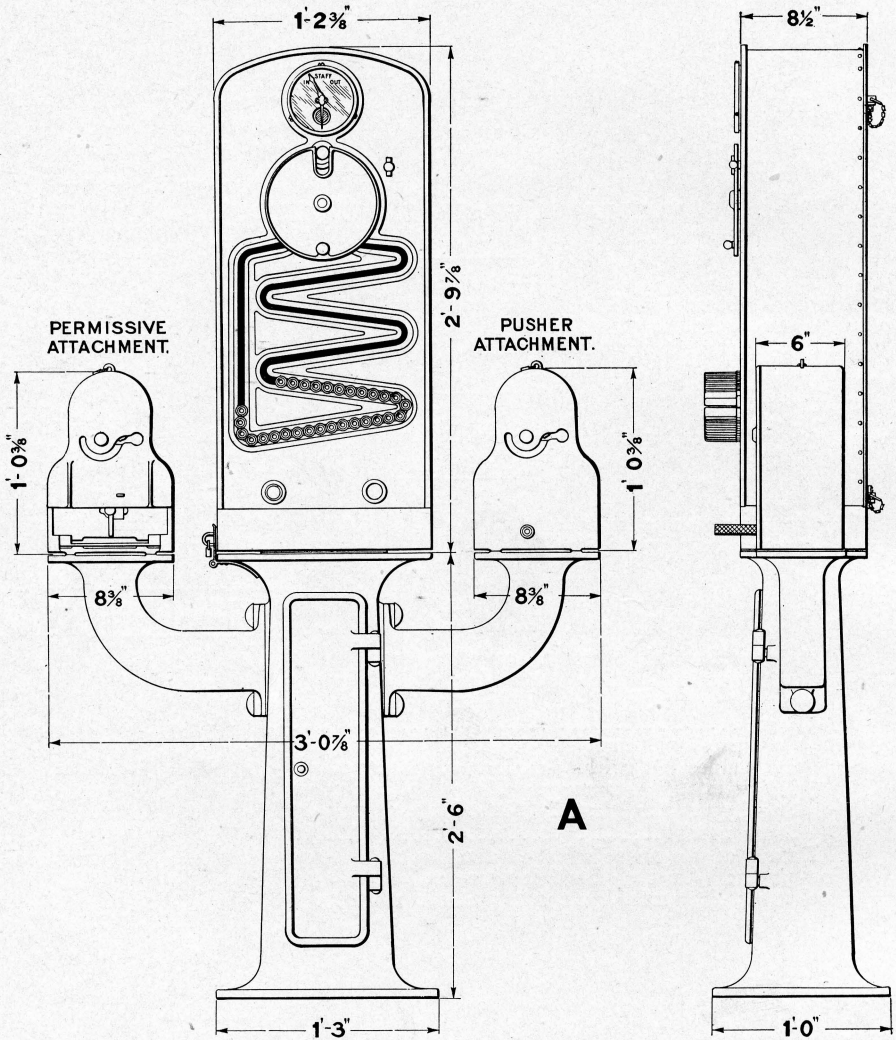
ABSOLUTE STAFF INSTRUMENT

The staff instruments listed below, complete, do not include staffs which must be ordered separately. For staffs see Plate 2337.
 When ordering specify number of staff to be used in the instrument.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Absolute Staff Instrument, complete, as shown, with pedestal. No staffs included. Specify number of staff (1-A, Plate 2307; 1-A, Plate 2311).....	1-C-4646	388 00
Aa	as above, complete, with pedestal, for use in connection with junction or intermediate siding staff instrument. No staffs included. Specify number of staff (1-Ab, Plate 2307; 1-B, Plate 2311).....	"	414 00
Details of the above will be found on the following plates: Absolute Staff Instrument, Plates 2307 and 2309; Pedestals, Plate 2311; Staffs, Plate 2337.			



ABSOLUTE STAFF INSTRUMENT WITH ATTACHMENTS

ABSOLUTE STAFF INSTRUMENT WITH ATTACHMENTS

The staff instruments listed below, complete, do not include staffs which must be ordered separately. For staffs see Plate 2337.

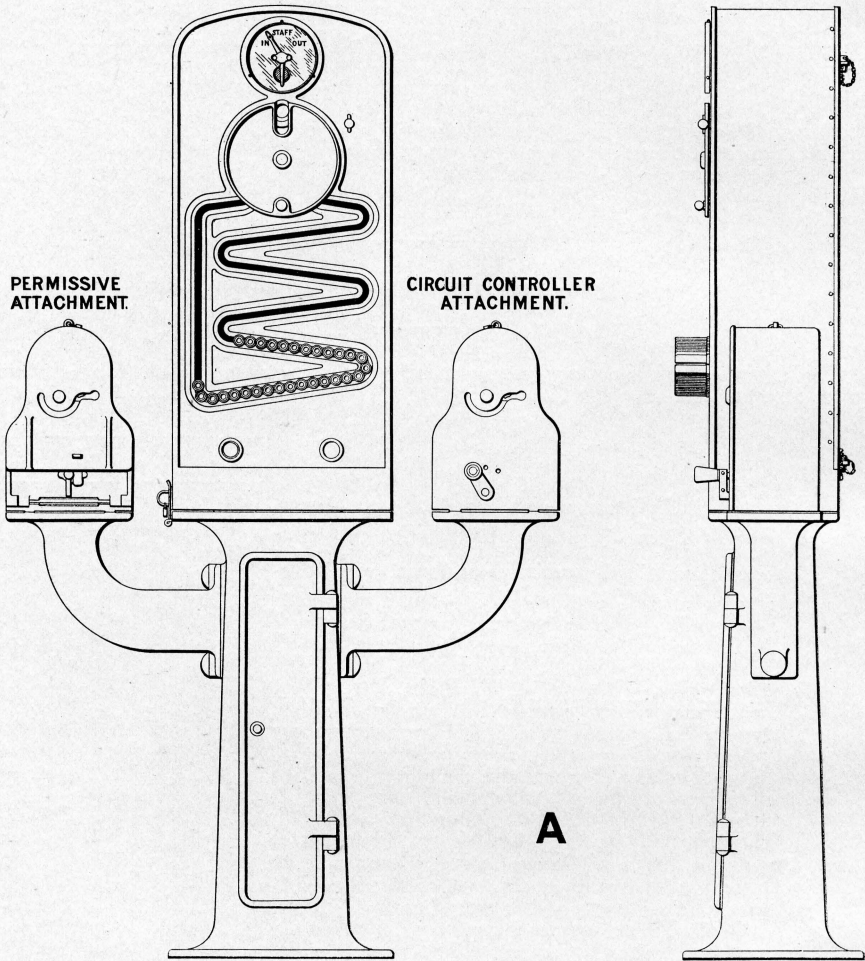
When ordering specify numbers of absolute, permissive and pusher staffs to be used.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Absolute Staff Instrument, complete, as shown, with pedestal, permissive attachment and pusher attachment. No staffs included. Specify numbers of absolute, permissive and pusher staffs (1-Ab, Plate 2307; 1-B, Plate 2311; 1-Aa, Plate 2317; 1-Aa, Plate 2319).....	1-C-6987	728 00
Aa	as above, complete, with pedestal and permissive attachment, without pusher attachment. No staffs included. Specify numbers of absolute and permissive staffs (1-A, Plate 2307; 1-A, Plate 2311; 1-Aa, Plate 2317).....	"	568 00
Ab	as above, complete, with pedestal and pusher attachment, without permissive attachment. No staffs included. Specify numbers of absolute and pusher staffs (1-Ab, Plate 2307; 1-B, Plate 2311; 1-Aa, Plate 2319).....	"	548 00

Details of the combinations listed above will be found on the following plates: Absolute Staff Instrument, Plates 2307 and 2309; Pedestals, Plate 2311; Staffs, Plate 2337; Permissive Attachment, Plate 2317; Pusher Attachment, Plate 2319.



ABSOLUTE STAFF INSTRUMENT WITH ATTACHMENTS

ABSOLUTE STAFF INSTRUMENT WITH ATTACHMENTS

The staff instruments listed below, complete, do not include staffs which must be ordered separately. For staffs see Plate 2337.

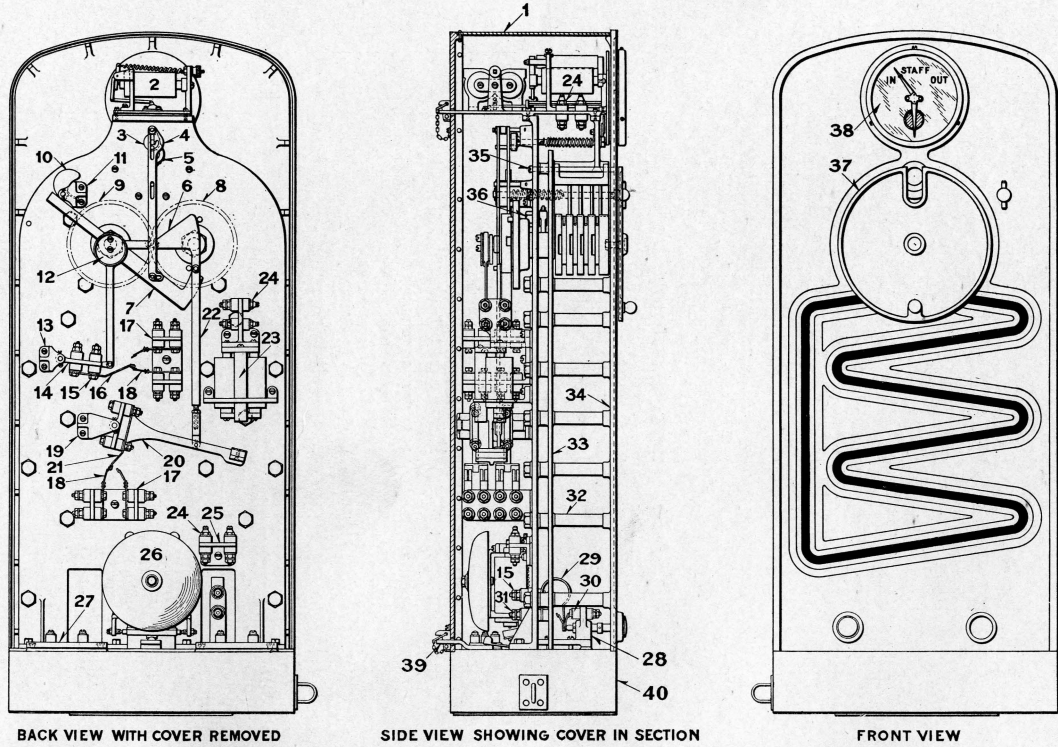
When ordering specify numbers of absolute, permissive and pusher staffs to be used.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Absolute Staff Instrument, complete, as shown, with pedestal, permissive attachment and circuit controller attachment. No staffs included. Specify numbers of absolute and permissive staffs (1-A, Plate 2307; 1-Aa, Plate 2311; 1-Aa, Plate 2317; 1-Aa, Plate 2321).....	1-C-6988	687 00
Ab	as above, complete, with pedestal, pusher attachment and circuit controller attachment. No staffs included. Specify numbers of absolute and pusher staffs (1-Ab, Plate 2307; 1-Ba, Plate 2311; 1-Aa, Plate 2319; 1-Aa, Plate 2321).....	"	665 00
Ac	as above, complete, with pedestal and circuit controller attachment, without permissive attachment or pusher attachment. No staffs included. Specify number of absolute staff (1-A, Plate 2307; 1-Aa, Plate 2311; 1-Aa, Plate 2321).	"	507 00

Details of the combinations listed above will be found on the following plates: Absolute Staff Instrument, Plates 2307 and 2309; Pedestals, Plate 2311; Staffs, Plate 2337; Permissive Attachment, Plate 2317; Pusher Attachment, Plate 2319; Circuit Controller Attachment, Plate 2321.



BACK VIEW WITH COVER REMOVED

SIDE VIEW SHOWING COVER IN SECTION

FRONT VIEW

A

ABSOLUTE STAFF INSTRUMENT

ABSOLUTE STAFF INSTRUMENT

The staff instruments listed below, complete, do not include staffs which must be ordered separately. For staffs see Plate 2337.
 When ordering specify number of staff to be used in the instrument.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Absolute Staff Instrument, complete, as shown. No staffs included. Specify number of staff.....	D-992	350 00
Aa	as above, complete, with pedestal. No staffs included. Specify number of staff. For pedestal see Plate 2311, Fig. A.....	C-4646	388 00
Ab	as above, complete, with two one-way push button circuit controllers Fig. 28, without pedestal, for use in connection with pusher attachment and junction or intermediate siding staff instrument. No staffs included. Specify number of staff	D-992	357 00
Ac	as above, complete, with two one-way push button circuit controllers Fig. 28 and pedestal for use in connection with pusher attachment and junction or intermediate siding staff instrument. No staffs included. Specify number of staff. For pedestal see Plate 2311, Fig. B.....	C-4646	414 00
1	Back and Cover for staff instrument, complete, with lock wedges, chains and machine screws.....	1-C-4251	13 00
2	Indicator, complete, with magnets, terminal posts, dial, pointers, base and machine screws for fastening to supports	1-C-4629	40 00
2a	Polarized Magnet for indicator, complete, with permanent magnet, magnet coils, back strap and machine screws	18-B-8133	6 80
2b	Neutral Magnet for indicator, complete, with magnet coils, back strap and machine screws.....	19-B-8133	5 70
2c	Coil Spring for releasing armature of magnet Fig. 2b	7-B-8124	12
3	Indicator Disc Shaft and Collar, complete, with pin, coil spring, machine screws, indicator disc and dowel pins	14-B-8063	90
4	Locking Bar for disc indicator, operated by lever, Fig. 7	7-C-4764	50
5	Connecting Bar for disc indicator, operated by lever, Fig. 6	6-C-4764	40
6	Drum Locking Lever, complete, with studs, washer and cotters	2-C-4763	70
7	Armature Raising Lever, complete, with stud, washer and cotter	4-C-4763	90

ABSOLUTE STAFF INSTRUMENT

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
8	Gear for locking drum, complete, with locking pins.	2-C-4253	2 40
9	Gear for receiving drum.....	1-C-4253	1 90
10	Cam for operating lever Fig. 7, complete, with shaft, knob, coil spring, cotter and dowel pin.....	3-C-4763	70
11	Bracket for supporting cam Fig. 10, complete, with dowel pins and machine screws for fastening to supporting plate	8-C-4253	50
12	Eccentric, complete, with sheave, plate, strap and machine screws for fastening to receiving drum.	11-C-4764	1 00
13	Bracket for supporting lever Fig. 14, complete, with pin, cotter, dowel pins and machine screws for fastening to supporting plate.....	3-C-4253	80
14	Lever for pole changer contact springs, complete, with pin and cotter for eccentric strap, terminal posts and contact springs, (4-15, 2-16, Plate 2307)	5-C-4253	3 20
15	Terminal Posts for contact springs Figs. 16, 18 and 21, and circuit controller Fig. 28, complete, with insulating bushings, plate washers and nuts....	38-B-8094	30
16	Contact Spring for pole changer.....	36-B-8385	60
17	Bracket for pole changer and circuit controller contact springs, complete, with terminal posts, contact springs, dowel pins and machine screw for fastening to supporting plate, (16-15, 8-18, Plate 2307)	4-C-4253	9 50
18	Contact Spring for pole changer and circuit controller	37-B-8385	46
19	Bracket for supporting lever Fig. 20, complete, with pin, dowel pins and machine screws, for fastening to supporting plate.....	6-C-4253	80
20	Armature Lever, complete, with armature, machine screws, stud, washer, cotter, terminal posts and contact springs, (4-15, 2-21, Plate 2307).....	7-C-4253	4 50
21	Contact Spring for circuit controller.....	35-B-8385	60
22	Connecting Bar between lever Fig. 20, and lever Fig. 6, complete, with screw eye and lock nut...	5-C-4764	50
23	Magnet, complete, with back strap bracket, magnet bracket, four terminal posts Fig. 24, back strap, front strap, third leg, dowel pins and machine screws for fastening to supporting plate.....	21-B-8133	10 70

ABSOLUTE STAFF INSTRUMENT

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
23a	Magnet, complete, with magnet third leg, magnet coils, front strap, back strap and machine screws for holding together	21-B-8133	7 90
24	Terminal Post, for back strap bracket of magnet Fig. 23, for indicator Fig. 2, and for bracket Fig. 25, complete, with insulating bushings, plate washers, machine screw and nuts.....	14-B-8094	34
25	Bracket for bell terminals, complete, with two terminal posts Fig. 24, dowel pins and machine screws for fastening to supporting plate.....	7-C-4763	90
26	Single Stroke Bell, with 5-inch gong, complete, with magnet, brackets and machine screws for fastening to supporting plate.....	1-C-4257	15 60
26a	Magnet for bell, complete, with magnet coils, back strap and cap screws for holding together.....	20-B-8133	9 10
26b	Coil Spring for releasing armature of magnet Fig. 26a	7-B-8124	12
26c	5-inch Gong for bell Fig. 26.....		1 40
27	Terminal Board, complete, with two-way and three-way terminals and machine screws for fastening to base	2-C-4765	1 90
28	One-Way Push Button Circuit Controller, complete, with terminal posts, contact spring, push button, dowel pins and machine screws for fastening to base	1-C-4258	7 00
29	Contact Spring for above.....	257-B-8385	1 00
30	Short Contact Terminal Post for circuit controller Fig. 28, complete, with insulating bushings, plate washers and nuts.....	233-B-8094	1 88
31	Long Contact Terminal Post for circuit controller Fig. 28, complete, with insulating bushings, plate washers and nuts	232-B-8094	1 92
32	Sleeve and Tap Bolt, $\frac{3}{8}$ "x4", for fastening guide plates to supporting plate.....	5-B-8131	12
33	Outside Rear Guide Plate.....	1-C-4762	18 40
33a	Inside Rear Guide Plate.....	3-C-4761	12 30
34	Outside Front Guide Plate, complete, with glass, ring and machine screws, for staff instrument Fig. A	1-C-4761	23 70
34a	as above, for staff instrument Fig. Ab.....	5-C-4761	23 70

ABSOLUTE STAFF INSTRUMENT

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

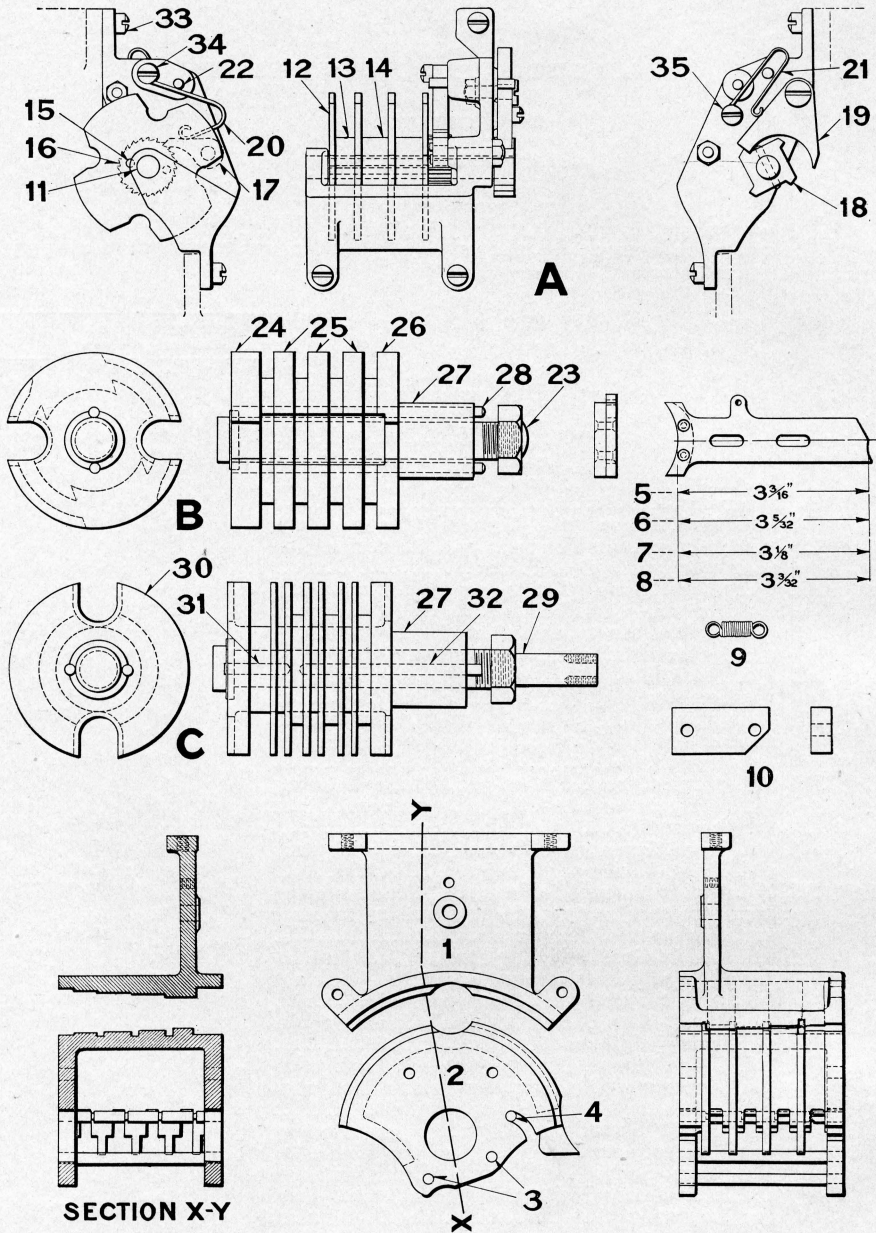
Fig.		Drawing Reference	List Price
34b	Inside Front Guide Plate.....	2-C-4761	15 00
35	Machine Screw, No. 10-32x4 1/16", for fastening guide plates and staff guides Figs. 1 and 2, Plate 2309, to supporting plate.....	47-B-8098	10
36	Staff Pawl, complete, with stud and nut for fastening to supporting plate.....	6-C-4763	50
36a	Coil Spring for above, complete, with machine screw for fastening to supporting plate.....	50-B-7770	16
37	Shield Plate, complete, with knob, spring washer, escutcheon pins and stud with nut and cotter for fastening to inside front guide plate Fig. 34b	9-C-4253	3 60
38	Glass for indicator opening in outside front guide plates Figs. 34 and 34a.....	25-C-3561	50
39	Hasp for cover, with machine screws for fastening to base	2-C-4251	40
40	Base, with staple.....	6-C-4251	10 30
41	Fil. Hd. Mach. Screw, 1/4"x3/8", for brackets Figs. 17 and 25. Price per hundred.....		4 00
42	Fil. Hd. Mach. Screw, 1/4"x3/8", for coil spring Fig. 36a. Price per hundred.....		2 00
43	Fil. Hd. Mach. Screw, No. 10-32x3/4", for bracket of push button circuit controller Fig. 28. Price per hundred		2 00
44	Fil. Hd. Mach. Screw, No. 10-32x5/8", for fastening bell Fig. 26, magnet Fig. 23, and brackets Figs 13 and 19 to supporting plate. Price per hundred..		2 00
45	Fil. Hd. Mach. Screw, No. 10-32x1/2", for eccentric Fig. 12, and for fastening indicator Fig. 2 to support, terminal board Fig. 27 to base and bracket Fig. 11 to supporting plate. Price per hundred		2 00
46	Fil. Hd. Mach. Screw, No. 10-32x3/8", for armature of neutral magnet of Fig. 2, for gong support of bell mechanism Fig. 26, and for holding terminals of Fig. 27. Price per hundred.....		2 00
47	Fil. Hd. Mach. Screw, No. 10-32x1/4", for fastening chain of lock wedge to back Fig. 1, and for terminals of Fig. 27. Price per hundred.....		2 00

ABSOLUTE STAFF INSTRUMENT

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
48	Fil. Hd. Mach. Screw, No. 8-32x $\frac{3}{8}$ "		
	for fastening magnet brackets of indicator Fig. 2 to base.		
	Price per hundred		2 00
49	Fil. Hd. Mach. Screw, No. 8-32x $\frac{1}{4}$ "		
	for fastening bearings of indicator shafts to base. Price per		
	hundred		2 00
50	Fil. Hd. Mch. Screw, No. 6-32x $\frac{1}{4}$ "		
	for armature bracket of polarized magnet of indicator Fig. 2.		
	Price per hundred		2 00
51	Fil. Hd. Mach. Screw, No. 4-40x $\frac{1}{4}$ "		
	for fastening shaft bearing of indicator Fig. 2 to indicator		
	dial, coil spring to indicator disc shaft Fig. 3		
	and for terminal Fig. 24. Price per hundred...		2 00
52	Fil. Hd. Mach. Screw, No. 4-40x $\frac{3}{16}$ "		
	for retaining ring for glass Fig. 38. Price per hundred.....		2 00
53	Fil. Hd. Mach. Screw, No. 4-40x $\frac{1}{8}$ "		
	for neutral magnet crank of indicator Fig. 2. Price per		
	hundred		2 00
54	Rd. Hd. Mach. Screw, No. 10-32x $\frac{7}{8}$ "		
	for fastening back strap of magnet Fig. 23 to bracket. Price		
	per hundred		2 00
55	Rd. Hd. Mach. Screw, No. 10-32x $\frac{3}{4}$ "		
	for front strap of Fig. 23. Price per hundred.....		2 00
56	Rd. Hd. Mach. Screw, No. 10-32x $\frac{5}{8}$ "		
	for fastening back straps of magnets Figs. 2 and 23 to cores		
	and third leg. Price per hundred.....		2 00
57	Rd. Hd. Mach. Screw, No. 10-32x $\frac{7}{16}$ "		
	for fastening back strap of neutral magnet of indicator		
	Fig. 2 to support. Price per hundred.....		2 00
58	Fl. Hd. Mach. Screw, No. 10-32x $\frac{1}{2}$ "		
	for hasp Fig. 39. Price per hundred.....		2 00
59	Fl. Hd. Mach. Screw, No. 10-32x $\frac{7}{16}$ "		
	for fastening back strap of polarized magnet of indicator		
	Fig. 2 to support. Price per hundred.....		2 00
60	Fl. Hd. Mach. Screw, No. 8-32x $\frac{1}{2}$ "		
	for fastening armature to lever Fig. 20. Price per hundred..		2 00
61	Fl. Hd. Mach. Screw, No. 8-32x $\frac{7}{16}$ "		
	for fastening dial of indicator Fig. 2 to indicator base. Price		
	per hundred		2 00



STAFF GUIDES, LOCKING DRUM AND DETAILS FOR ABSOLUTE AND JUNCTION STAFF INSTRUMENTS

**STAFF GUIDES, LOCKING DRUM AND DETAILS FOR
ABSOLUTE AND JUNCTION STAFF INSTRUMENTS**

When ordering staff guides Figs. 1 and 2 specify number of staff used in the instrument. For staffs see Plate 2337.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Bracket for guard discs, complete, as shown, with shaft, guard discs, separators, ratchets, pawls, springs and machine screws for fastening to guide plates Figs. 33 and 34, Plate 2307.....	D-992	7 10
B	Locking Drum, complete, as shown, with shaft, plates, bushings, pins and nut.....	"	14 50
C	Receiving Drum, complete, as shown, with shaft, bushing, pins and nut.....	11-C-4762	12 00
1	Top Staff Guide. Specify number of staff.....	1-C-4764	9 60
2	Bottom Staff Guide. Specify number of staff.....	5-C-4762	6 80
2a	as above, complete, with pins, locking dogs and drivers, springs and fillers. Specify number of staff, (1-2, 2-3, 1-4, 1-5, 1-6, 1-7, 1-8, 4-9, 3-10, 1-10a, Plate 2309).....	"	16 60
3	Pin for supporting locking dogs Figs. 5, 6, 7 and 8..	17-B-8097	04
4	Pin for supporting coil springs Fig. 9.....	16-B-8097	08
5	Locking Dog and Driver "a", complete, with rivets..	4-C-4762	1 90
6	Locking Dog and Driver "b", complete, with rivets..	4-C-4762	1 90
7	Locking Dog and Driver "c", complete, with rivets..	4-C-4762	1 90
8	Locking Dog and Driver "d", complete, with rivets..	4-C-4762	1 90
9	Coil Spring for locking dogs Figs. 5, 6, 7 and 8....	59-B-7770	10

**STAFF GUIDES, LOCKING DRUM AND DETAILS FOR
ABSOLUTE AND JUNCTION STAFF INSTRUMENTS**

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

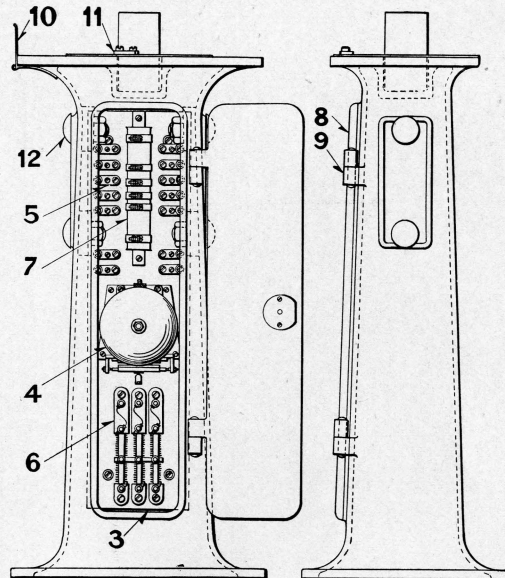
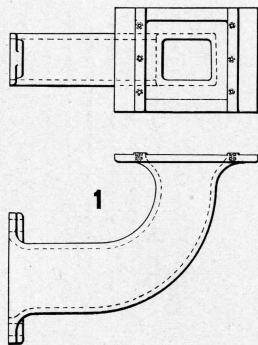
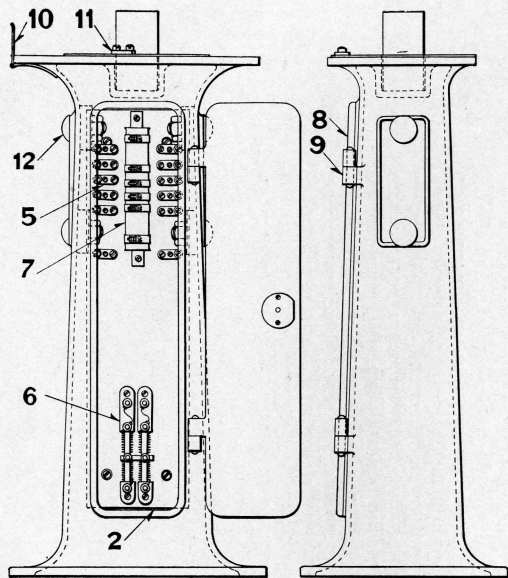
Fig.		Drawing Reference	List Price
10	Intermediate Filler for locking dogs Figs. 5, 6, 7 and 8	3-C-4762	34
10a	End Filler for locking dogs Figs. 5, 6, 7 and 8....	10-C-4762	30
11	Shaft for bracket Fig. A.....	17-B-8079	04
12	Guard Disc for bracket Fig. A.....	3-C-5028	14
13	Narrow Separator for shaft Fig. II.....	21-B-8350	22
14	Wide Separator, with dowel pin, for shaft Fig. II..	22-B-8350	40
15	Pin for fastening together guard discs Fig. 12, ratchet Fig. 16, and separators Figs. 13 and 14.....	34-B-8097	02
16	Forward Ratchet for shaft Fig. II.....	4-C-5028	40
17	Forward Pawl for ratchet Fig. 16, complete, with pivot screw and nut for fastening to bracket Fig. A	6-C-5028	16
18	Reverse Ratchet, with dowel pin, for shaft Fig. II..	5-C-5028	60
19	Reverse Pawl for ratchet Fig. 18, complete, with pivot screw and nut for fastening to bracket Fig. A	7-C-5028	20
20	Spring for forward pawl Fig. 17, complete, with machine screw for fastening to bracket Fig. A..	25-B-8735	08
21	Spring for reverse pawl Fig. 19, complete, with machine screw for fastening to bracket Fig. A..	24-B-8735	08

**STAFF GUIDES, LOCKING DRUM AND DETAILS FOR
ABSOLUTE AND JUNCTION STAFF INSTRUMENTS**

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
22	Pin for springs Figs. 20 and 21.....	37-B-8097	02
23	Shaft for locking drum, complete, with nut.....	3-B-8277	1 80
24	Front Plate for locking drum.....	8-C-4764	1 80
25	Intermediate Plate for locking drum.....	9-C-4762	2 00
26	Back Plate for locking drum.....	13-C-4762	2 00
27	Bushing for shafts Figs. 23 and 29.....	26-B-8072	80
28	Pin for fastening together parts of locking drum...	21-B-8097	06
29	Shaft for receiving drum, complete, with nut.....	5-B-8277	2 30
30	Receiving Drum	11-C-4762	8 00
31	Pin for fastening receiving drum Fig. 30 to shaft Fig. 29	38-B-8097	02
32	Pin for fastening bushing Fig. 27 to receiving drum Fig. 30	22-B-8097	06
33	Fil. Hd. Mach. Screw, No. 10-32x $\frac{1}{2}$ ", for fastening bracket Fig. A to guide plates Figs. 33 and 34, Plate 2307. Price per hundred.....		2 00
34	Fil. Hd. Mach. Screw, No. 10-32x $\frac{5}{8}$ ", for fastening spring Fig. 20 to bracket Fig. A. Price per hundred		2 00
35	Fil. Hd. Mach. Screw, No. 10-32x9/16", for fasten- ing spring Fig. 21 to bracket Fig. A. Price per hundred		2 00



A

B

PEDESTALS FOR STAFF INSTRUMENTS AND BRACKET FOR ATTACHMENTS

**PEDESTALS FOR STAFF INSTRUMENTS AND BRACKET
FOR ATTACHMENTS**

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Pedestal for absolute staff instrument, complete, as shown, with two lightning arresters and adjustable resistance tube	1-C-7237	38 00
Aa	Pedestal for intermediate siding staff instrument, complete, with six lightning arresters and adjustable resistance tube	3-C-7237	45 00
B	Pedestal for absolute staff instrument for use in connection with a pusher attachment, junction or intermediate siding staff instrument, complete, as shown, with single stroke bell, three lightning arresters and adjustable resistance tube	2-C-7237	57 00
Ba	Pedestal for junction staff instrument, complete, with single stroke bell, six lightning arresters and adjustable resistance tube.....	4-C-7237	62 00
1	Bracket for supporting attachments to absolute staff instrument	6-C-5831	4 00
2	Terminal Board for pedestal Fig. A, complete, with terminals, lightning arresters, adjustable resistance tube and machine screws for fastening to pedestal, (12-5, 2-6, 1-7, Plate 2311).....	11-C-4765	12 60
2a	Terminal Board for pedestal Fig. Aa, complete, as above, (12-5, 6-6, 1-7, Plate 2311).....	"	19 10
3	Terminal Board for pedestal Fig. B, complete, with single stroke bell, terminals, lightning arresters, adjustable resistance tube and machine screws for fastening to pedestal, (1-4, 14-5, 3-6, 1-7, Plate 2311)	"	31 70
3a	Terminal Board for pedestal Fig. Ba, complete, as above, (1-4, 14-5, 6-6, 1-7, Plate 2311).....	"	36 20

**PEDESTALS FOR STAFF INSTRUMENTS AND BRACKET
FOR ATTACHMENTS**

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

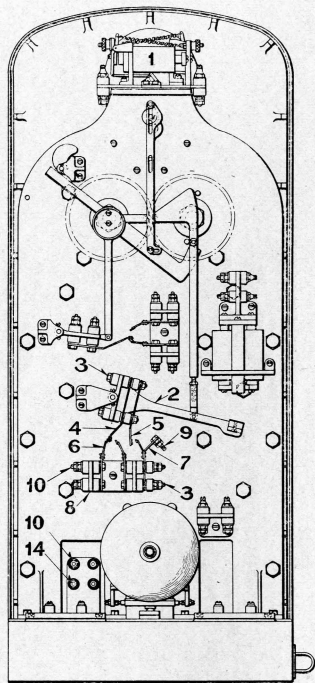
Fig.		Drawing Reference	List Price
4	Single Stroke Bell with 4½-inch gong, complete, with brass plate, magnet, brackets, armature, wood and machine screws for fastening to supporting plate	10-C-4257	16 80
4a	Magnet, complete, with magnet coils, back strap and cap screws for holding together.....	20-B-8133	9 10
4b	Coil Spring for releasing armature of magnet Fig. 4a	7-B-8124	12
4c	4½-inch Gong for bell Fig. 4.....		1 40
5	Terminal, Two-Way, complete, with machine screws, washers and wood screw for fastening to terminal board	5-B-8064	16
6	Lightning Arrester, One-Way Argus, complete, with wood screws for fastening to terminal board...		1 50
7	Adjustable Resistance Tube, complete, with wood screws for fastening to terminal board.	13 B-9065	5 60
8	Door for pedestal, complete, with lock and hinge pins for fastening to stud hinges Fig. 9.....	4-B-5953	2 60
9	Stud Hinge for fastening door to pedestal.....	1-C-4213	40
10	3-inch Hasp for fastening staff instruments to pedestals, complete, with rivets.....		10
11	Stop for base of staff instrument, complete, with machine screws for fastening to pedestal.	3-C-4765	30
12	Special Bolt, ¾"x2¼", with nut and wood filler block for opening in side of pedestal.....	8-C-4765	24
12a	as above, without wood filler block for fastening bracket Fig. 1 to pedestal.....	12-B-8132	06

PEDESTALS FOR STAFF INSTRUMENTS AND BRACKET FOR ATTACHMENTS

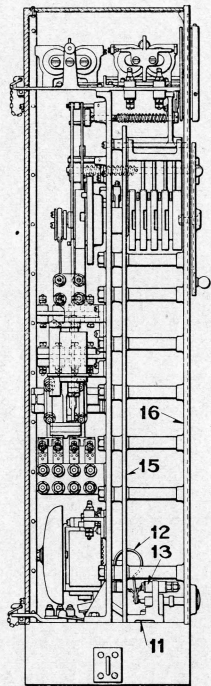
Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

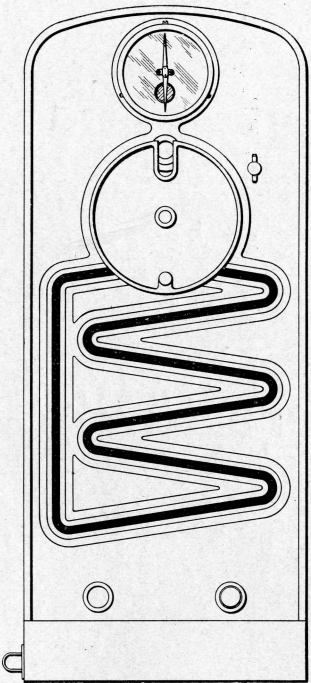
Fig.	Drawing Reference	List Price
13	Fil. Hd. Mach. Screw, $\frac{1}{4}$ "x $\frac{3}{4}$ ", for stop Fig. 11. Price per hundred	2 00
14	Fil. Hd. Mach. Screw, No. 12-32x $\frac{3}{8}$ ", for terminal Fig. 5. Price per hundred.....	2 00
15	Fil. Hd. Mach. Screw, No. 10-32x $\frac{7}{16}$ ", for armature of bell mechanism Fig. 4. Price per hundred	2 00
16	Fil. Hd. Mach. Screw, No. 10-32x $\frac{3}{8}$ ", for fastening bell mechanism Fig. 4 to brass plate of terminal board and gong support to brackets. Price per hundred	2 00
17	Fl. Hd. Mach. Screw, No. 8-32x $\frac{5}{8}$ ", for lock of door Fig. 8. Price per hundred.....	2 00
18	Rd. Hd. Mach. Screw, No. 12-32x $1\frac{1}{4}$ ", for fastening terminal board to pedestal. Price per hundred..	2 00
19	Rd. Hd. Mach. Screw, No. 6-32x $\frac{3}{8}$ ", with three nuts for adjustable resistance tube Fig. 7. Price per hundred	8 00
20	Fl. Hd. Wood Screw, No. 8x1", for fastening brass plate for bell mechanism to terminal boards Figs. 3 and 3a. Price per hundred.....	2 00
21	Fl. Hd. Wood Screw, No. 7x $1\frac{5}{8}$ ", for Argus Lightning Arrester Fig. 6. Price per hundred.....	2 00
22	Fl. Hd. Wood Screw, No. 6x $\frac{3}{4}$ ", for fastening terminals Fig. 5 to board. Price per hundred.....	1 00
23	Rd. Hd. Wood Screw, $\frac{1}{4}$ "x1", for fastening adjustable resistance tube to board. Price per hundred	1 00



BACK VIEW WITH COVER REMOVED



SIDE VIEW SHOWING COVER IN SECTION



FRONT VIEW

A

JUNCTION STAFF INSTRUMENT

JUNCTION STAFF INSTRUMENT

The staff instrument listed below, complete, does not include staffs which must be ordered separately. For staffs see Plate 2337.
 When ordering specify number of staff to be used in the instrument.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Junction Staff Instrument, complete, as shown. No staffs included. Specify number of staff.....	1-C-6995	392 00
Aa	as above, complete, with pedestal. No staffs included. Specify number of staff. For pedestal see Plate 2311, Fig. Ba.....	"	454 00
1	Indicator, complete, with magnets, terminal posts, dial, pointers, base and machine screws for fastening to supports	1-C-5925	34 00
1a	Magnet for indicator, complete, with magnet coils, back strap and machine screws for holding together	19-B-8133	5 70
1b	Coil Spring for releasing armature of magnet Fig. 1a	7-B-8124	12
2	Armature Lever, complete, with armature, machine screws, stud, washer and cotter; terminal posts and contact springs, (4-3, 2-4, 2-5, Plate 2313) ..	1-C-5992	5 90
3	Terminal Post for contact springs Figs. 4, 5, 6 and 7, complete, with insulating bushings, plate washers and nuts	183-B-8094	36

JUNCTION STAFF INSTRUMENT

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
4	Contact Spring with four contact tips for lever Fig. 2	199-B-8385	66
5	Contact Spring with two contact tips for lever Fig. 2	201-B-8385	54
6	Contact Spring for bracket Fig. 8.....	37-B-8385	46
7	Contact Spring with terminal post Fig. 9, for bracket Fig. 8	200-B-8385	70
8	Bracket for contact springs, complete, with terminal posts, contact springs, dowel pins and machine screw for fastening to supporting plate, (8-3, 8-10, 8-6, 4-7, Plate 2313).....	1-C-5992	13 30
9	Terminal Post for contact spring Fig. 7, complete, with nuts and plate washer.....	188-B-8094	18
10	Terminal Post for contact springs Fig. 6 and circuit controller Fig. 11, complete, with insulating bushings, plate washers and nuts.....	38-B-8094	30

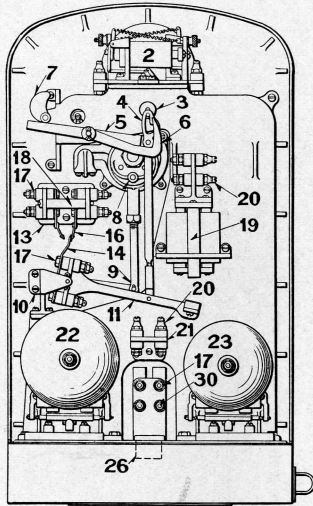
JUNCTION STAFF INSTRUMENT

Order by Plate and Figure

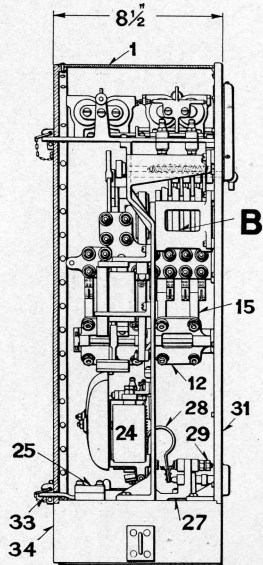
The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
11	Two-Way Push Button Circuit Controller, complete, with terminal posts, contact springs, dowel pins and machine screws for fastening to base..	1-B-9129	15 60
12	Contact Spring, for above.....	257-B-8385	1 10
13	Short Contact Terminal Post, for circuit controller Fig. 11, complete, with insulating bushings, plate washers and nuts.....	233-B-8094	1 88
14	Long Contact Terminal Post, for circuit controller Fig. 11, complete, with insulating bushings, plate washers and nuts.....	232-B-8094	1 92
15	Outside Rear Guide Plate.....	1-C-4762	18 40
16	Outside Front Guide Plate, with glass, ring and machine screws	4-C-4761	23 70

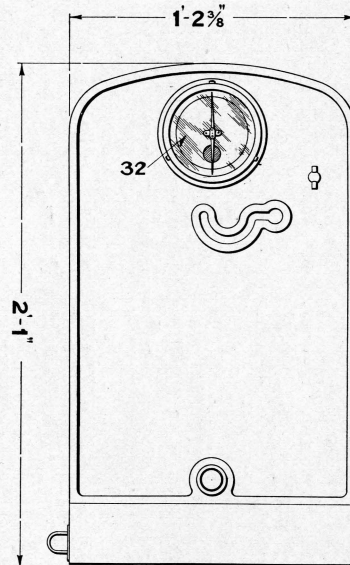
Except for the details listed above, the junction staff instrument is identical with the absolute staff instrument, for details of which see Plates 2307 and 2309.



BACK VIEW WITH COVER REMOVED



SIDE VIEW SHOWING COVER IN SECTION



FRONT VIEW

A

INTERMEDIATE SIDING STAFF INSTRUMENT

INTERMEDIATE SIDING STAFF INSTRUMENT

The staff instrument listed below, complete, does not include staffs which must be ordered separately. For staffs see Plate 2337.
When ordering specify number of staff to be used in the instrument.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.	Description	Drawing Reference	List Price
A	Intermediate Siding Staff Instrument, complete, as shown. No staffs included. Specify number of staff	D-1119	304 00
Aa	as above, complete, with pedestal. No staffs included. Specify number of staff. For pedestal see Plate 2311 Fig. Aa.....	"	349 00
B	Locking Drum and Frame, complete. Specify number of staff. See Plate 2327 Fig. Ba.....	1-B-9901	45 30
1	Back and Cover for staff instrument, complete, with lock wedges, chains and machine screws.....	1-C-5929	9 60
2	Indicator, complete, with magnets, terminal posts, dial, pointers, base and machine screws for fastening to supports.....	1-C-5925	34 00
2a	Magnet for indicator, complete, with magnet coils, back straps and machine screws for holding together	10-B-8133	5 70
2b	Coil Spring for releasing armature of magnet Fig. 2a	7-B-8124	12
3	Indicator Disc Shaft and Collar, complete, with pin, coil spring, machine screw, indicator disc and dowel pins	14-B-8063	1 00
4	Connecting Bar for disc indicator, complete, with screw eye	4-C-5924	2 40
5	Drum Locking Lever, complete, with stud.....	3-C-5924	1 30
6	Drum Locking and Armature Raising Lever.....	8-C-5924	2 60
7	Cam for operating lever Fig. 6, complete, with shaft, knob, coil spring and dowel pin.....	3-C-4763	70
8	Eccentric, complete, with sheave, plate, studs and strap	10-C-5924	9 10
9	Eccentric Rod and Lock Nut.....	5-C-5924	80
10	Bracket for supporting levers Figs. 11 and 12, complete, with pin, cotter, dowel pins and machine screw for fastening to supporting plate and front plate	2-C-5924	4 00

INTERMEDIATE SIDING STAFF INSTRUMENT

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
11	Armature Lever, complete, with armature, machine screws, stud and cotters; terminal posts and circuit controller contact springs, (8-17, 4-14, Plate 2315)	1-C-5924	7 10
12	Lever for pole changer contact springs, complete, with stud and cotter for eccentric rod Fig. 9; terminal posts and contact springs, (4-17, 2-15, Plate 2315)	6-C-5924	5 60
13	Bracket for pole changer and circuit controller contact springs, complete, with terminal posts, contact springs, machine screw and sleeve; dowel pins and machine screws for fastening to front plate, (32-17, 16-16, 1-18, Plate 2315).....	9-C-5924	22 20
14	Contact Spring for lever Fig. 11.....	189-B-8385	14
15	Contact Spring for lever Fig. 12.....	35-B-8385	60
16	Contact Spring for bracket Fig. 13.....	37-B-8385	46
17	Terminal Post for levers Figs. 11 and 12, bracket Fig. 13 and circuit controller Fig. 27, complete, with insulating bushings, plate washers and nuts.	38-B-8094	30
18	Sleeve and Machine Screw for bracket Fig. 13.....	57-B-8350	22
19	Magnet, complete, with back strap bracket, magnet bracket, four terminal posts Fig. 20, back strap, front strap, third leg, dowel pin and machine screws for fastening to supporting plate.....	21-B-8133	10 70
19a	Magnet, complete, with third leg, magnet coils, front coils, front strap, back strap and machine screws for holding together.....	"	7 90
20	Terminal Post for back strap bracket of magnet Fig. 19, for indicator Fig. 2, and for bracket Fig. 21, complete, with insulating bushings, plate washers and nuts.....	14-B-8094	30

INTERMEDIATE SIDING STAFF INSTRUMENT

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
21	Bracket for bell terminals, complete, with two terminal posts Fig. 20, dowel pins and machine screw for fastening to supporting plate.....	7-C-4763	1 00
22	Single Stroke Bell with 5-inch gong, complete, with magnet, brackets and machine screws for fastening to supporting plate.....	1-C-4257	15 60 1 40
22a	5-inch Gong for above.....		
23	Single Stroke Bell with 4½-inch gong, complete, with magnet, brackets and machine screws for fastening to supporting plate.....	10-C-4257	15 60 1 40
23a	4½-inch Gong for above.....		
24	Magnet for bells Figs. 22 and 23, complete, with magnet coils, back strap and cap screws for holding together	20-B-8133	9 10
24a	Coil Spring for releasing armature of magnet Fig. 24	7-B-8124	12
25	Terminal Board, complete, with two-way and three-way terminals and machine screws for fastening to base	2-C-4765	1 90
26	Insulating Bushing for wire opening in base.....	47-B-8095	28
27	Two-Way Push Button Circuit Controller, complete, with terminal posts, contact springs, dowel pins and machine screws for fastening to base..	1-B-9129	15 60
28	Contact Spring, for above.....	257-B-8385	1 10
29	Short Contact Terminal Post for circuit controller Fig. 27, complete, with insulating bushings, plate washers and nuts	233-B-8094	1 88
30	Long Contact Terminal Post for circuit controller Fig. 27, complete, with insulating bushings, plate washers and nuts	232-B-8094	1 92
31	Front Plate, complete, with glass, ring and machine screws	1-C-5923	12 40

INTERMEDIATE SIDING STAFF INSTRUMENT

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

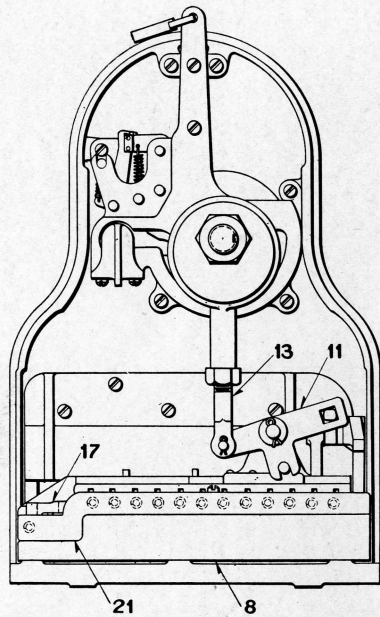
Fig.		Drawing Reference	List Price
32	Glass for indicator opening in front plate.....	25-C-3561	50
33	Hasp for cover, with machine screws for fastening to base		
34	Base with staple		
35	Fil. Hd. Mach. Screw, $\frac{1}{4}$ "x $\frac{5}{8}$ ", for bracket Fig. 21. Price per hundred	2-C-4251	40
36	Fil. Hd. Mach. Screw, $\frac{1}{4}$ "x $\frac{9}{16}$ ", for fastening supporting plate and bracket Fig. 13 to front plate. Price per hundred	6-C-4251	10 30
37	Fil. Hd. Mach. Screw, No. 10-32x $\frac{3}{4}$ ", for bracket of push button circuit controller Fig. 27. Price per hundred		2 00
38	Fil. Hd. Mach. Screw, No. 10-32x $\frac{5}{8}$ ", for fastening brackets of Fig. 19 to supporting plate. Price per hundred		2 00
39	Fil. Hd. Mach. Screw, No. 10-32x $\frac{9}{16}$ ", for fastening supporting plate to front plate. Price per hundred		2 00
40	Fil. Hd. Mach. Screw, No. 10-32x $\frac{1}{2}$ ", for fastening bracket Fig. 10 to front plate, terminal board Fig. 25 to base and for base plate of indicator Fig. 2. Price per hundred.....		2 00
41	Fil. Hd. Mach. Screw, No. 10-32x $\frac{7}{16}$ ", for fastening bracket Fig. 10 and the brackets in Figs. 22 and 23 to supporting plate. Price per hundred..		2 00
42	Fil. Hd. Mach. Screw, No. 10-32x $\frac{3}{8}$ ", for gong support of bell mechanisms Figs. 22 and 23 and for armatures of indicator Fig. 2. Price per hundred		2 00
43	Fil. Hd. Mach. Screw, No. 10-32x $\frac{1}{4}$ ", for terminals Fig. 25 and for fastening chain of lock wedge to back Fig. 1. Price per hundred.....		2 00

INTERMEDIATE SIDING STAFF INSTRUMENT

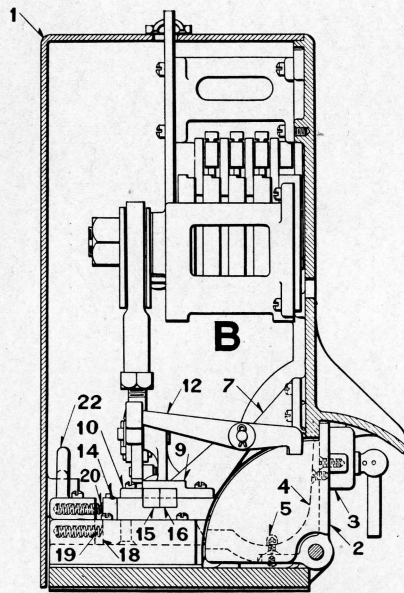
Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

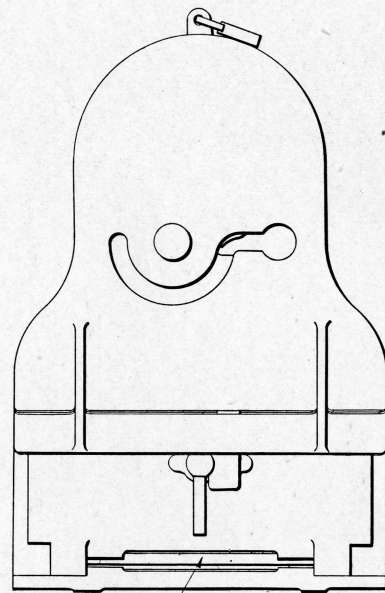
Fig.		Drawing Reference	List Price
44	Fil. Hd. Mach. Screw, No. 8-32x $\frac{1}{2}$ "		
	of Fig. 11. Price per hundred.....		2 00
45	Fil. Hd. Mach. Screw, No. 8-32x $\frac{3}{8}$ "		
	for fastening magnet brackets and dial plate of indicator Fig. 2 to base. Price per hundred.....		2 00
46	Fil. Hd. Mach. Screw, No. 8-32x $\frac{5}{16}$ "		
	for fastening bearing of shaft of indicator Fig 2 to base. Price per hundred		2 00
47	Fil. Hd. Mach. Screw, No. 8-32x $\frac{1}{4}$ "		
	for fastening bearing of shaft of indicator Fig. 2 and coil spring of Fig. 3 to indicator base plate. Price per hundred		2 00
48	Fil. Hd. Mach. Screw, No. 4-40x $\frac{1}{4}$ "		
	for fastening bearing of indicator Fig. 2 to dial plate, coil spring to indicator disc shaft Fig. 3 and for terminals Fig. 20. Price per hundred.....		2 00
49	Fil. Hd. Mach. Screw, No. 4-40x $\frac{3}{16}$ "		
	for retaining ring for glass Fig. 32. Price per hundred.....		2 00
50	Fil. Hd. Mach. Screw, No. 4-40x $\frac{1}{8}$ "		
	for fastening arms to shafts of indicator Fig. 2. Price per hundred		2 00
51	Rd. Hd. Mach. Screw, No. 10-32x $\frac{7}{8}$ "		
	for fastening magnet back strap to bracket of Fig. 19. Price per hundred		2 00
52	Rd. Hd. Mach. Screw, No. 10-32x $\frac{3}{4}$ "		
	for front straps of Fig. 19. Price per hundred.....		2 00
53	Rd. Hd. Mach. Screw, No. 10-32x $\frac{5}{8}$ "		
	for third leg of Fig. 19 and for back straps of indicator Fig. 2. Price per hundred.....		2 00
54	Fl. Hd. Mach. Screw, No. 10-32x $\frac{1}{2}$ "		
	for hasp Fig. 33. Price per hundred.....		2 00



BACK VIEW WITH COVER REMOVED



SIDE VIEW IN SECTION



FRONT VIEW

A
PERMISSIVE ATTACHMENT

PERMISSIVE ATTACHMENT

Permissive attachment listed below, complete, does not include staffs which must be ordered separately. For staffs see Plate 2337.
 When ordering specify numbers of absolute and permissive staffs.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Permissive Attachment, complete, as shown, with cover and padlock. No staffs included. Specify numbers of absolute and permissive staffs...	1-C-5831	176 00
Aa	as above, complete, with bracket Fig. 1, Plate 2311, for fastening to pedestal of staff instrument and machine screws for fastening to bracket. No staffs included. Specify numbers of absolute and permissive staffs.....	"	180 00
B	Locking Drum and Frame, complete, with eccentric and machine screws for fastening to case. Specify number of absolute staff. See Plate 2327 Fig. A	1-B-9901	48 00
1	Cover	1-C-5833	4 50
2	Drawer only	2-C-5833	9 30
2a	as above, complete, with lock, cradle and guard bar. Specify number of permissive staff, (1-2, 1-3, 1-4, 1-5, Plate 2317).....	"	33 50
3	Drawer Lock, complete, with machine screws for fastening to drawer Fig. 2.....	2-C-5831	5 80
4	Cradle, with machine screws for fastening to drawer Fig. 2. Specify number of permissive staff....	3-C-5833	11 50
4a	as above, complete, with guard bar. Specify number of permissive staff, (1-4, 1-5, Plate 2317)	"	14 10
5	Guard Bar for permissive staff, with machine screws for fastening to cradle Fig. 4. Specify number of permissive staff	5-C-5833	1 90

PERMISSIVE ATTACHMENT

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

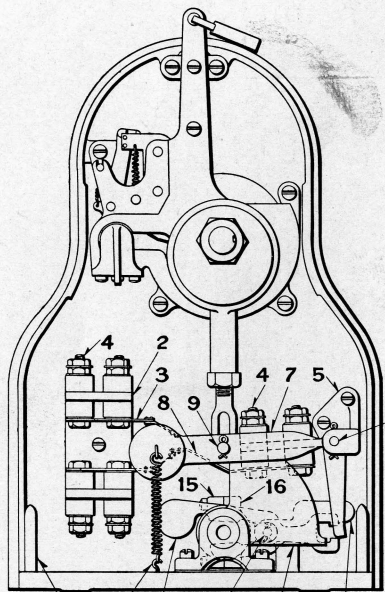
Fig.		Drawing Reference	List Price
6	Hinge Pin, 5/16"x8 3/8", for fastening drawer Fig. 2 to case	6-B-8184	06
6a	Set Screw, No. 8-32x 1/4", for holding pin Fig. 6 in case. Price per hundred.....		2 00
7	Shield for permissive staff, with machine screws for fastening to case	1-B-8129	90
8	Bed Plate, with stud for crank Fig. 17 and machine screws for fastening to case.....	1-C-5834	10 10
9	Cover Plate, with studs, washer and cotters for levers Figs. 11 and 12 and machine screws for fastening to bed plate Fig. 8.....	2-C-5834	1 90
10	Cover Bar, with dowel pins and machine screws for fastening to bed plate Fig. 8.....	7-C-5834	40
11	Eccentric Lever	6-C-5834	1 20
12	Lock Lever	5-C-5834	70
13	Eccentric Rod, with lock nut, pin and cotter.....	9-C-5834	80
14	Lock Bar, with stop pin, operated by permissive staff. Specify letter on lock bar to be replaced..	10-C-5834	1 00
15	Lock Bar, operated by eccentric, complete, with lug, driving stud and rivets.....	13-C-5834	2 10
16	Lock Bar, operated by drawer Fig. 2, complete, with driving stud	12-C-5834	1 40
17	Crank for operating lock bar Fig. 16.....	3-C-5834	70
18	Dog for operating crank Fig. 17, complete, with stud and stop pin	8-C-5834	30

PERMISSIVE ATTACHMENT

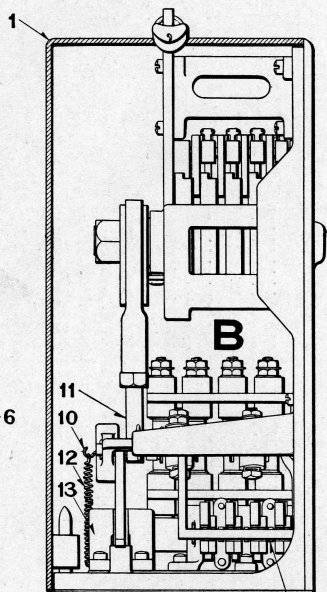
Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

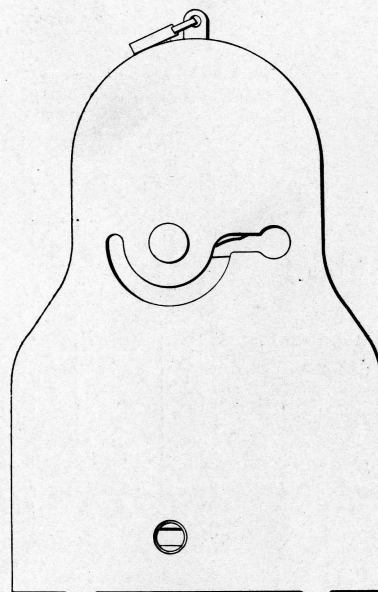
Fig.		Drawing Reference	List Price
19	Spring for dog Fig. 18.....	74-B-7770	12
20	Spring for lock bar Fig. 14.....	75-B-7770	12
21	Socket for springs Figs. 19 and 20, with machine screw for fastening to bed plate Fig. 8.....	4-C-5834	80
22	Stud for holding cover in place.....	16-B-8114	04
23	Fil. Hd. Mach. Screw, No. 10-32x1 $\frac{3}{8}$ ", for fastening bed plate Fig. 8 to case. Price per hundred....		4 00
24	Fil. Hd. Mach. Screw, No. 10-32x $\frac{7}{8}$ ", for fastening socket Fig. 21 to bed plate. Price per hundred..		2 00
25	Fil. Hd. Mach. Screw, No. 10-32x1 $\frac{3}{16}$ ", for fastening bed plate Fig. 8 to case. Price per hundred.		2 00
26	Fil. Hd. Mach. Screw, No. 10-32x $\frac{1}{2}$ ", for fastening cover plate Fig. 9 and cover bar Fig. 10 to bed plate. Price per hundred.....		2 00
27	Fil. Hd. Mach. Screw, No. 10-32x $\frac{7}{16}$ ", for fastening shield Fig. 7 to case. Price per hundred....		2 00
28	Fl. Hd. Mach. Screw, $\frac{1}{4}$ "x $\frac{7}{8}$ ", for fastening permissive attachment to bracket Fig. 1 Plate 2311. Price per hundred		2 00
29	Fl. Hd. Mach. Screw, No. 10-32x $\frac{7}{16}$ ", for fastening lock Fig. 3 to drawer. Price per hundred.....		2 00
30	Fl. Hd. Mach. Screw, No. 10-32x $\frac{5}{16}$ ", for fastening cradle Fig. 4 to drawer. Price per hundred....		2 00
31	Fl. Hd. Mach. Screw, No. 8-32x $\frac{1}{4}$ ", for fastening guard bar Fig. 5 to cradle. Price per hundred..		2 00



21 10 19 17 14 20
BACK VIEW WITH COVER REMOVED



11 10 12 13 18
SIDE VIEW SHOWING COVER IN SECTION



FRONT VIEW

A

PUSHER ATTACHMENT

PUSHER ATTACHMENT

Pusher Attachment listed below, complete, does not include staffs which must be ordered separately. For staffs see Plate 2337.
 When ordering specify numbers of absolute and pusher staffs.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Pusher Attachment, complete, as shown, with cover and padlock. No staffs included. When ordering specify numbers of absolute and pusher staffs	1-C-5790	130 00
Aa	as above, complete, with bracket Fig. 1 Plate 2311, for fastening to pedestal of staff instrument and machine screws for fastening to bracket. No staffs included. Specify numbers of absolute and pusher staffs.....	"	134 00
B	Locking Drum, complete, with eccentric and machine screws for fastening to case. Specify number of absolute staff. See Plate 2327 Fig. A.	1-B-9901	48 00
1	Cover	2-C-5788	3 60
2	Bracket for contact springs, complete, with contact springs, terminal posts, dowel pins and machine screw for fastening to case, (8-3, 16-4, Plate 2319)	4-C-4253	9 50
3	Contact Spring for bracket Fig. 2.....	37-B-8385	46
4	Terminal Post for contact springs Figs. 3 and 8, complete, with insulating bushings, plate washers and nuts	38-B-8094	30
5	Bracket for contact lever Fig. 7, complete, with pin and cotter Fig. 6 and machine screws for fastening to case	4-C-5790	60

PUSHER ATTACHMENT

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

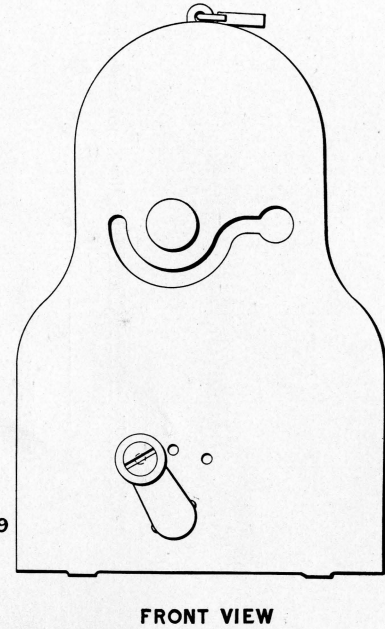
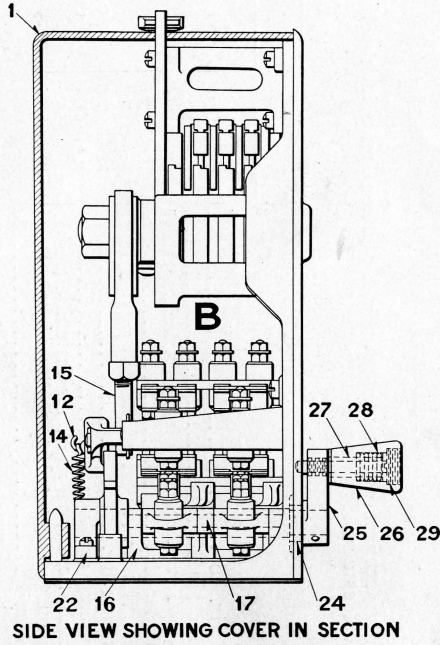
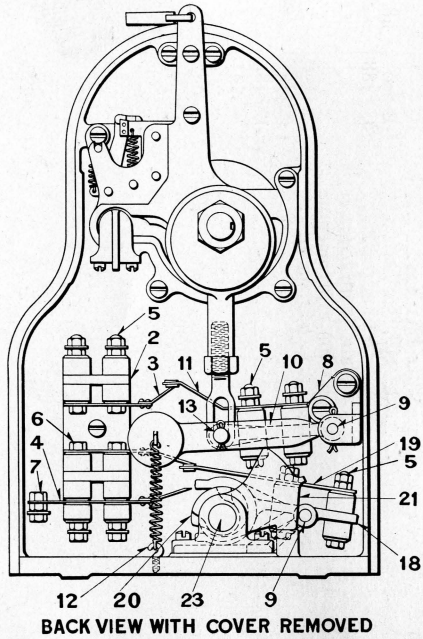
Fig.		Drawing Reference	List Price
6	Pin, with cotter, for fastening lever Fig. 7 to bracket Fig. 5	51-B-8063	04
7	Lever for contact springs, complete, with contact springs, terminal posts, hook, pin and cotters, (2-8, 4-4, 1-10, 1-9, Plate 2319)	3-C-5790	7 10
8	Contact Spring for lever Fig. 7	36-B-8385	60
9	Pin with cotters for connecting lever Fig. 7 and eccentric rod Fig. 11	52-B-8063	06
10	Hook for fastening spring Fig. 12 to case and lever Fig. 7	8-C-5788	30
11	Eccentric Rod and Lock Nut	4-C-5788	90
12	Spring for releasing lever Fig. 7	86-B-7770	20
13	Bearing for locking dog Fig. 14 with machine screws for fastening to case	13-C-5791	60
14	Locking Dog	3-C-5788	1 00
15	Socket, R. H. Half, for pusher staff. Specify number of pusher staff	2-C-5791	6 80
15a	Socket for pusher staff, complete, with machine screws for holding together and for fastening to case. Specify number of pusher staff. (1-15, 1-16, Plate 2319)	"	14 00
16	Socket, L. H. Half, for pusher staff. Specify number of pusher staff	1-C-5791	6 80

PUSHER ATTACHMENT

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
17	Pin, with cotters, for fastening locking levers to socket Fig. 16	72-B-8097	04
18	Separator for pin Fig. 17.....	20-B-8350	02
19	Long Locking Lever. Specify letter on locking lever to be replaced	9-C-5791	1 50
20	Short Locking Lever. Specify letter on locking lever to be replaced	14-C-5791	1 50
21	Stud for holding cover in place.....	13-B-8114	02
22	Fil. Hd. Mach. Screw, $\frac{1}{4}$ "x $\frac{7}{8}$ ", for fastening pusher attachment to bracket Fig. 1 Plate 2311. Price per hundred		4 00
23	Fil. Hd. Mach. Screw, $\frac{1}{4}$ "x7/16", for fastening bracket Fig. 2 to case. Price per hundred.....		2 00
24	Fil. Hd. Mach. Screw, No. 10-32x13/16", for holding together socket Fig. 15a. Price per hundred....		2 00
25	Fil. Hd. Mach. Screw, No. 10-32x9/16", for fastening socket Fig. 15a and bearings Fig. 13 to case. Price per hundred		2 00
26	Fil. Hd. Mach. Screw, No. 10-32x7/16", for fastening bracket Fig. 5 to case. Price per hundred..		2 00



A

CIRCUIT CONTROLLER ATTACHMENT

CIRCUIT CONTROLLER ATTACHMENT

Circuit Controller Attachment listed below, complete, does not include staffs which must be ordered separately. For staffs see Plate 2337.
 When ordering specify number of staff to be used in the staff lock.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Circuit Controller Attachment, complete, as shown, with cover and padlock. No staffs included. When ordering specify number of staff to be used in staff lock.....	1-C-6012	108 00
Aa	as above, complete, with bracket Fig. 1 Plate 2311 for fastening to pedestal of staff instrument and machine screws for fastening to bracket. No staffs included. Specify number of staff to be used in staff lock.....	"	112 00
B	Locking Drum and Frame, complete, with eccentric and machine screws for fastening to case. See Plate 2327 Fig. A.....	1-B-9901	48 00
1	Cover	2-C-5788	3 60
2	Bracket for contact springs, complete, with contact springs, terminal posts, dowel pins and machine screws for fastening case, (8-3, 2-4, 12-5, 4-6, Plate 2321)	4-C-4253	11 00
3	Contact Spring for bracket Fig. 2.....	37-B-8385	46
4	Contact Spring, with terminal post Fig. 7.....	522-B-8385	56
5	Terminal Post for contact springs Figs. 3, 11 and 19, complete, with insulating bushings, plate washers and nuts	38-B-8094	30

CIRCUIT CONTROLLER ATTACHMENT

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

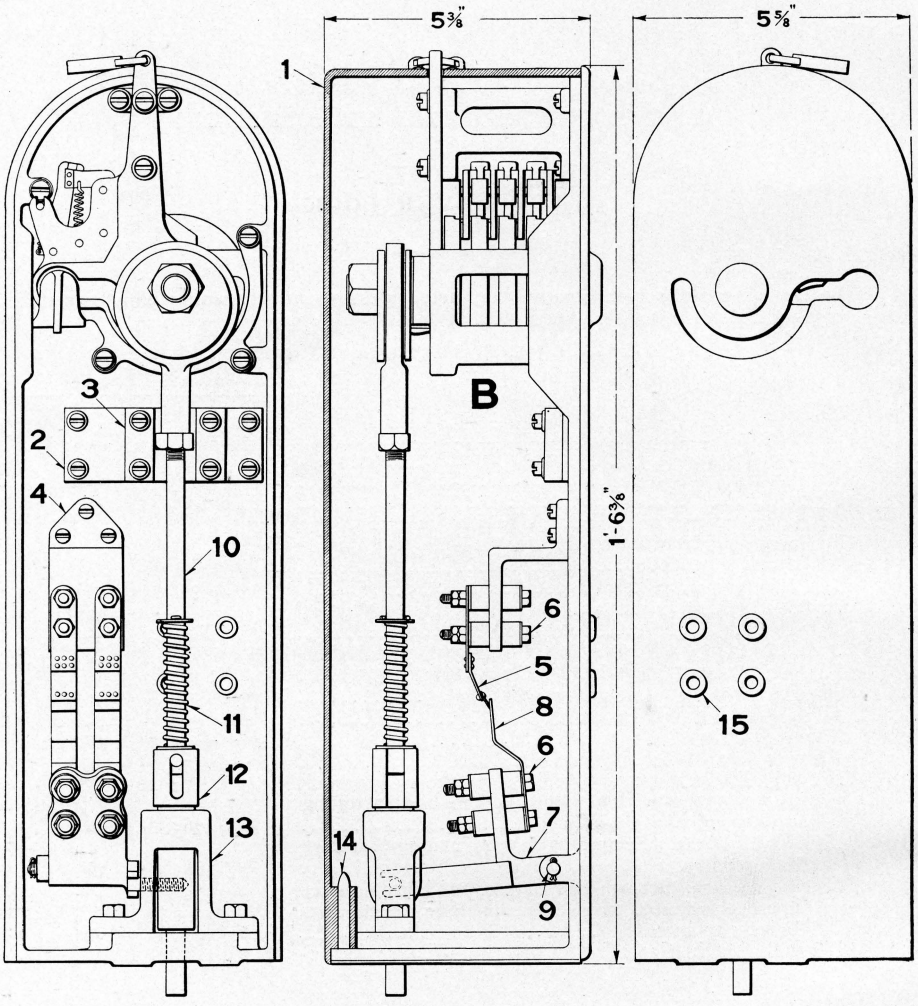
Fig.		Drawing Reference	List Price
6	Long Terminal Post for contact spring Fig. 4, complete, as above	183-B-8094	36
7	Short Terminal Post for contact spring Fig. 4, complete, with plate washer and nuts.....	188-B-8094	16
8	Bracket for contact lever Fig. 10, complete, with pin and cotter Fig. 9 and machine screws for fastening to case.....	4-C-5790	60
9	Pin with cotter for fastening lever Fig. 10 to bracket Fig. 8 and for fastening lever Fig. 18 to bracket Fig. 16	51-B-8063	04
10	Lever for contact springs, complete, with contact springs, terminal posts, hook, pin and cotters, (2-11, 4-5, 1-12, 1-13, Plate 2321).....	6-C-6013	3 70
11	Contact Spring for lever Fig. 10.....	36-B-8385	60
12	Hook for fastening spring Fig. 14 to base and lever Fig. 10	8 C-5788	30
13	Pin, with collar and cotters, for connecting lever Fig. 10 and eccentric rod Fig. 15.....	52-B-8063	06
14	Spring for releasing lever Fig. 10.....	86-B-7770	20
15	Eccentric Rod and Lock Nut.....	4-C-5788	90
16	Bracket for contact levers Fig. 18, with machine screws for fastening to base.....	1-C-6013	60
17	Separator for pin Fig. 9.....	126-B-8350	06
18	Lever for contact spring, complete, with contact spring and terminal posts, (1-19, 2-5, Plate 2321)	2-C-6013	1 70
19	Contact Spring for lever Fig. 18.....	204-B-8385	60
20	Cam for operating lever Fig. 18 with dowel pin for fastening to shaft Fig. 23.....	3 C-6013	50

CIRCUIT CONTROLLER ATTACHMENT

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
21	Locking Dog, with dowel pin for fastening to shaft Fig. 23	5-C-6013	50
22	Bearing for shaft Fig. 23, with machine screws for fastening to case	4-C-6013	60
23	Shaft	64-B-8057	20
23a	Shaft, complete, with cams, locking dog, bushing, arm and handle, (2-20, 1-21, 1-24, 1-25a. Plate 2321)	"	5 90
24	Bushing for shaft Fig. 23.....	125-B-8350	08
25	Arm, with dowel pin and set screw for shaft Fig. 23	43-B-8192	1 00
25a	Arm, complete, with handle, sleeve, spring and plunger, (1-25, 1-26, 1-27, 1-28, 1-29, Plate 2321)....	"	4 10
26	Handle, with set screw for arm Fig 25.....	19-B-8311	90
27	Sleeve for handle Fig. 26.....	5-C-3980	30
28	Spring for handle Fig. 26.....	37-B-8124	22
29	Plunger for handle Fig. 26.....	6-C-3980	90
30	Fil. Hd. Mach. Screw, 1/4"x7/8", for fastening circuit controller attachment to bracket Fig. 1, Plate 2311. Price per hundred.....		4 00
31	Fil. Hd. Mach. Screw, 1/4"x7/16", for fastening bracket Fig. 2 to case. Price per hundred.....		2 00
32	Fil. Hd. Mach. Screw, No. 10-32x9/16", for fastening bracket Fig. 16 and bearing Fig. 22 to case. Price per hundred		2 00
33	Fil. Hd. Mach. Screw, No. 10-32x7/16", for fastening bracket Fig. 8 to case. Price per hundred..		2 00
34	Fl. Hd. Mach. Screw, No. 10-32x9/16", for fastening bracket Fig. 16 to case. Price per hundred..		2 00



BACK VIEW WITH COVER REMOVED

SIDE VIEW SHOWING COVER IN SECTION

FRONT VIEW

A

STAFF LEVER LOCK

STAFF LEVER LOCK

The staff lever lock listed below, complete, does not include staffs which must be ordered separately. For staffs see Plate 2337.

When ordering specify number of staff to be used in the lock.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Staff Lever Lock, complete, as shown, with cover and padlock. Specify number of staff.....	1-C-5093	80 00
B	Locking Drum and Frame, complete, with eccentric and machine screws for fastening to case. Specify number of staff. See Plate 2327, Fig. A....	1-B-9901	48 00
1	Cover	2-C-5763	4 10
2	Terminal Board, complete, with two two-way terminals Fig. 3 and machine screws for fastening to case	2-C-4765	1 50
3	Two-Way Terminal, complete, with machine screws and washers	5-C-4765	38
4	Bracket for contact springs, complete, with contact springs, terminal posts and machine screws for fastening to case, (2-5, 4-6, Plate 2323).....	2-B-8966	3 90

STAFF LEVER LOCK

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

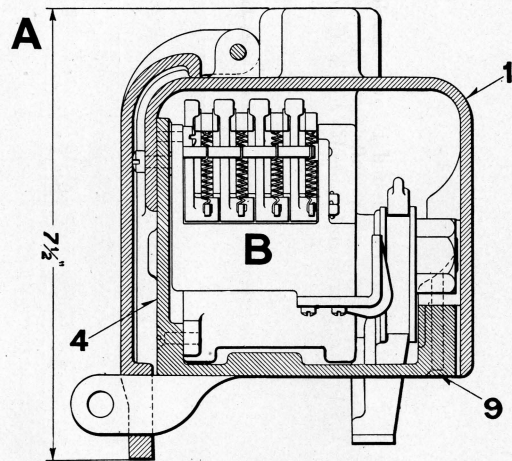
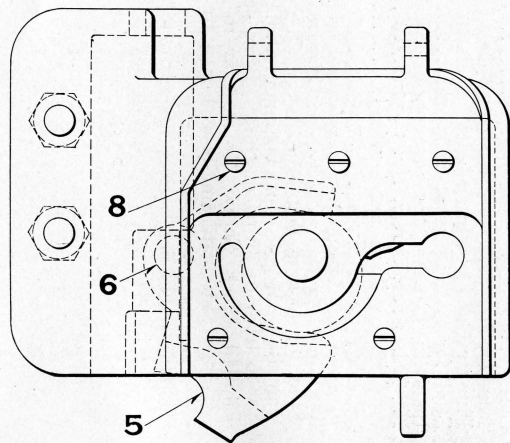
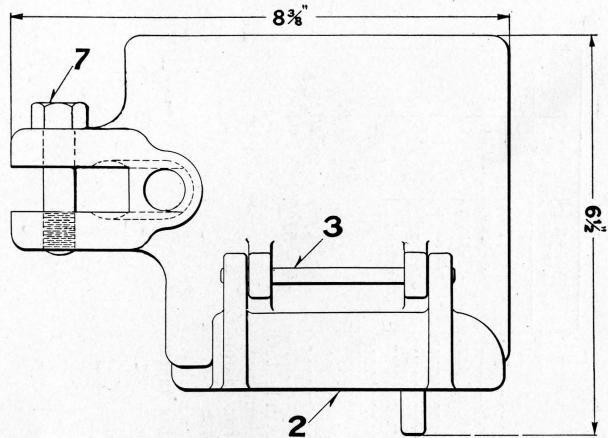
Fig.		Drawing Reference	List Price
5	Contact Spring for bracket Fig. 4.....	130-B-8385	84
6	Terminal Post, complete, with insulating bushings, plate washers and nuts.....	38-B-8094	30
7	Lever for contact springs, complete, with contact springs, terminal posts, pin and cotters, (2-8, 4-6, 1-9, Plate 2323).....	9-C-5094	2 80
8	Contact Spring for lever Fig. 7.....	131-B-8385	28
9	Pin, 1/4"x2-5/16", with cotters for fastening lever Fig. 7 to case.....	31-B 8063	06
10	Eccentric Rod, complete, with lock nut, washers and cotter for spring Fig. 11, pin for operating plunger Fig. 12, and dowel pin.....	8-C-5094	20

STAFF LEVER LOCK

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
11	Spring for eccentric rod Fig. 10.....	66-B-7770	26
12	Plunger, complete, with studs and dowel pins.....	5-C-5094	2 10
13	Plunger Guide, with tap bolts for fastening to case..	3-C-5094	1 40
14	Stud for holding cover in place.....	13-B-8114	04
15	Insulating Bushing for wire openings in case.....	75-B-8100	04
16	Fil. Hd. Mach. Screw, No. 10-32x11/16", for bracket Fig. 4. Price per hundred.....		2 00
17	Fil. Hd. Mach. Screw, No. 10-32x3/8", for fastening terminal board Fig. 2 to case and for holding terminals Fig. 3. Price per hundred.....		2 00
18	Fil. Hd. Mach. Screw, No. 10-32x1/4", for terminals Fig. 3. Price per hundred.....		2 00



FRONT VIEW WITH COVER REMOVED

SIDE VIEW IN SECTION

STAFF SWITCH LOCK

STAFF SWITCH LOCK

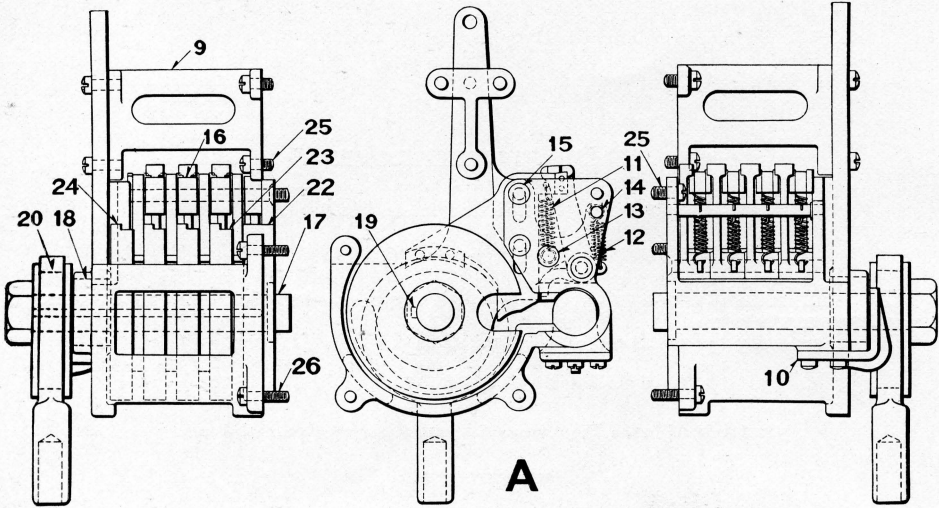
For application see Plate 2335

The staff switch lock listed below, complete, does not include staffs which must be ordered separately. For staffs see Plate 2337.
When ordering specify number of staff to be used in the lock.

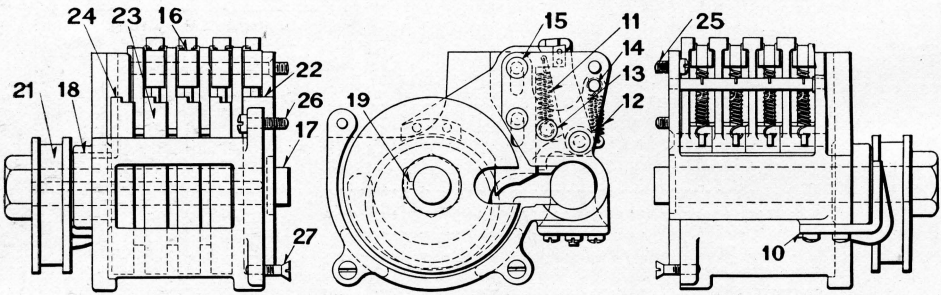
Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

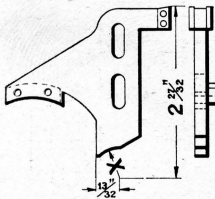
Fig.		Drawing Reference	List Price
A	Staff Switch Lock, complete, with padlock and chain. Specify number of staff.....	1-C-5789	76 00
B	Locking Drum and Frame, complete, with eccentric and machine screws for fastening to front plate. Specify number of staff. See Plate 2327, Fig. B.	1-B-9901	46 90
1	Case only	1-C-5787	5 30
2	Cover	2-C-5789	40
3	Hinge Pin for cover.....	5-C-5787	02
4	Front Plate and Base only.....	2-C-5787	8 40
4a	as above, complete, with locking drum and frame, locking dog, stud and machine screws for fastening to case, (1-4, 1-B, 1-5, 1-6, 1-9b, 3-8, 2-9, 1-9a, Plate 2325).....	"	65 00
5	Locking Dog	3-C-5787	4 20
6	Stud for locking dog.....	4-C-5787	04
7	Tap Bolt, 1/2"x2", for fastening staff switch lock to lever of dwarf machine. Price per hundred..		4 00
8	Fil. Hd. Mach. Screw, No. 10-32x7/16", for fastening front plate and base Fig. 4 to case Fig. 1. Price per hundred.....		2 00
9	Fl. Hd. Mach. Screw, No. 10-32x1-9/16", for fastening front plate and base Fig. 4 to case Fig. 1. Price per hundred		2 00
9a	Fl. Hd. Mach. Screw, No. 10-32x1", for fastening front plate and base Fig. 4 to case Fig. 1. Price per hundred		2 00
9b	Fl. Hd. Mach. Screw, No. 10-32x3/8", for holding stud Fig. 6 in front plate and base Fig. 4. Price per hundred		2 00



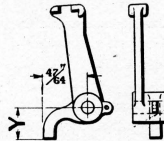
A



B



- 1 - X - $\frac{1}{32}$ "
- 2 - X - $\frac{3}{16}$ "
- 3 - X - $\frac{1}{32}$ "
- 4 - X - $\frac{5}{8}$ "



- 5 - Y - $\frac{1}{2}$ "
- 6 - Y - $\frac{15}{32}$ "
- 7 - Y - $\frac{3}{16}$ "
- 8 - Y - $\frac{1}{32}$ "

**LOCKING DRUM AND FRAME FOR INTERMEDIATE SIDING
STAFF INSTRUMENT, PERMISSIVE, PUSHER AND
CIRCUIT CONTROLLER ATTACHMENTS,
STAFF LEVER LOCK AND STAFF
SWITCH LOCK**

**LOCKING DRUM AND FRAME FOR INTERMEDIATE SIDING
STAFF INSTRUMENT, PERMISSIVE, PUSHER AND CIR-
CUIT CONTROLLER ATTACHMENTS, STAFF LEVER
LOCK AND STAFF SWITCH LOCK**

When ordering specify number of staff

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Locking Drum and Frame, complete, as shown, with eccentric sheave, eccentric plate and strap; for staff lever lock, permissive, pusher and circuit controller attachments. Specify number of staff	1-B-9901	48 00
B	Locking Drum and Frame, complete, as shown, with eccentric sheave and eccentric plate for staff switch lock. Specify number of staff.....	6-C-5094	46 90
Ba	Locking Drum and Frame, complete, without eccentric sheave or eccentric plate, for intermediate siding staff instrument. Specify number of staff.	"	45 30
1	Locking Dog and Driver "a", complete, with rivets..	14-C-5094	3 20
2	Locking Dog and Driver "b", complete, with rivets..	14-C-5094	3 20
3	Locking Dog and Driver "c", complete, with rivets..	14-C-5094	3 20
4	Locking Dog and Driver "d", complete, with rivets..	14-C-5094	3 20
5	Driver Locking Lever "a".....	15-C-5094	60
6	Driver Locking Lever "b".....	15-C-5094	60
7	Driver Locking Lever "c".....	15-C-5094	60
8	Driver Locking Lever "d".....	15-C-5094	60

**LOCKING DRUM AND FRAME FOR INTERMEDIATE SIDING
STAFF INSTRUMENT, PERMISSIVE, PUSHER AND CIR-
CUIT CONTROLLER ATTACHMENTS, STAFF LEVER
LOCK AND STAFF SWITCH LOCK**

When ordering specify number of staff

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
9	Frame Brace for Fig. A, with machine screws for fastening to locking frame and case of instrument	3-C-5763	50
10	Staff Stop, with machine screws for fastening to locking frame	2-C-5094	30
11	Spring for locking dogs and drivers Figs. 1, 2, 3 and 4	59-B-7770	08
12	Spring for driver locking levers Figs. 5, 6, 7 and 8..	65-B-7770	08
13	Pin for holding springs Fig. 11.....	43-B-8097	10
14	Pin for supporting springs Fig. 12.....	45-B-8097	06
15	Pin for supporting locking dogs and drivers Figs. 1, 2, 3 and 4 and driver locking levers Figs. 5, 6, 7 and 8.....	44-B-8097	02
16	Separator for pin Fig. 15.....	49-B-8072	04
17	Shaft, with nut, for locking drum.....	13-C-5094	1 90
17a	Locking Drum, complete, with shaft, nut, plates, key and bushing, (1-17, 1-22, 3-23, 1-24, 1-19, 1-18, Plate 2327)	"	15 00
18	Bushing for shaft Fig. 17.....	65-B-8072	56
19	Key for shaft Fig. 17.....	4-B-8966	10

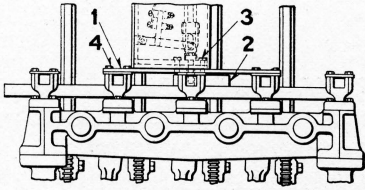
**LOCKING DRUM AND FRAME FOR INTERMEDIATE SIDING
STAFF INSTRUMENT, PERMISSIVE, PUSHER AND CIR-
CUIT CONTROLLER ATTACHMENTS, STAFF LEVER
LOCK AND STAFF SWITCH LOCK**

When ordering specify number of staff

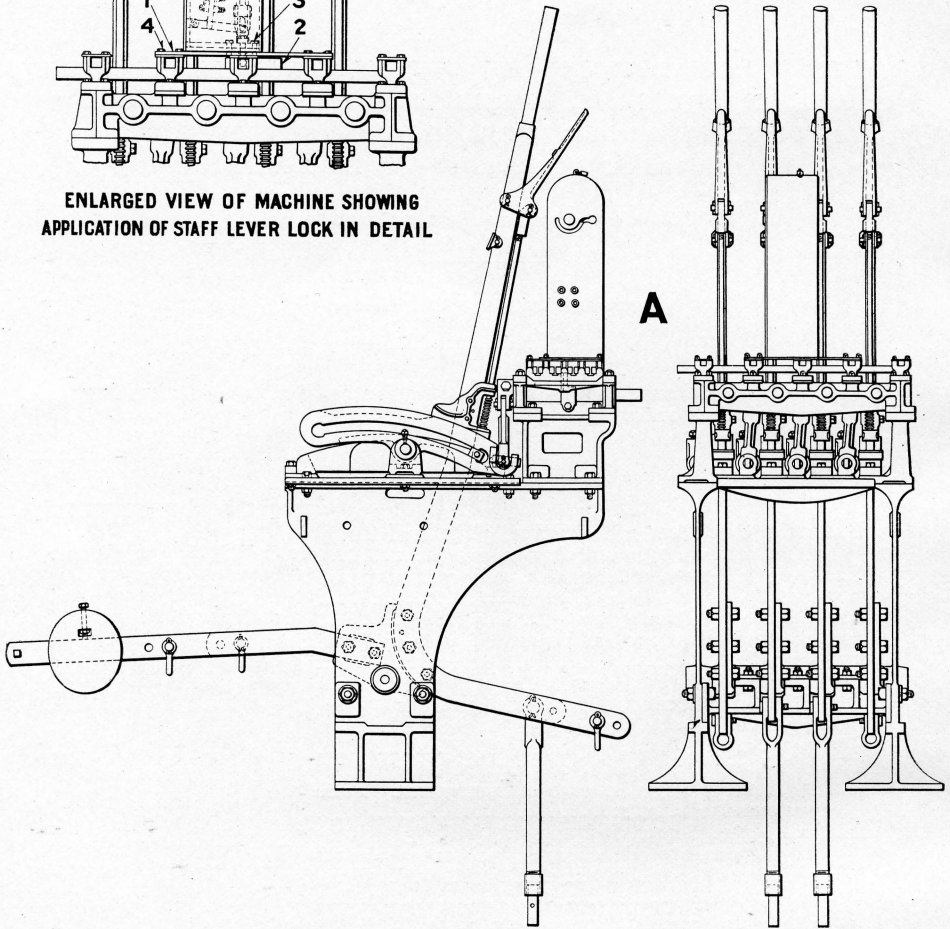
Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
20	Eccentric, complete, with sheave, plate and strap, for shaft Fig. 17, used only in Fig. A.....	1-B-8966	2 90
21	Eccentric, complete, with sheave and plate, for shaft Fig. 17, used only in Fig. B.....	"	1 70
22	Front Plate for locking drum.....	10-C-5094	1 50
23	Intermediate Plate for locking drum, with stop and rivets	12-C-5094	2 60
24	Back Plate for locking drum, with stop and rivets..	11-C-5094	2 60
25	Fil. Hd. Mach. Screw, No. 10-32x7/16", for fastening frame brace and locking frame to case of instrument. Price per hundred.....		2 00
26	Fil. Hd. Mach. Screw, No. 10-32x11/16", for fastening locking frame to case of instrument. Price per hundred		2 00
27	Fil. Hd. Mach. Screw, No. 10-32x11/16", for fastening bottom lugs of locking frame to case of staff switch lock, used only in staff lock Fig. B. Price per hundred		2 00



ENLARGED VIEW OF MACHINE SHOWING
APPLICATION OF STAFF LEVER LOCK IN DETAIL



STAFF LEVER LOCK APPLIED TO SAXBY AND FARMER
INTERLOCKING MACHINE

**STAFF LEVER LOCK APPLIED TO SAXBY AND
FARMER INTERLOCKING MACHINE**

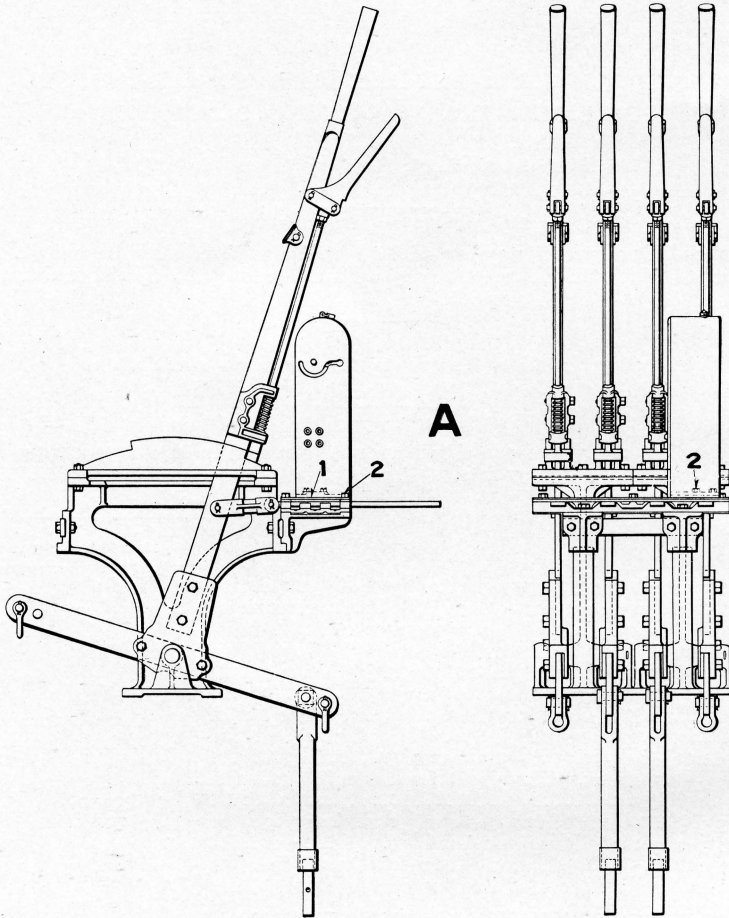
For Staff Lever Lock and Details see Plate 2323

When ordering specify number of staff to be used in staff lever lock, number of the lever to which the lock is to be applied and the size of the interlocking machine.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Staff Lever Lock, complete, with base plate, tap bolts, cap screws and lock bolt block with rivets for locking bar. Specify number of staff, number of lever to which the lock is to be applied and size of interlocking machine. For details of staff lever lock see Plate 2323.....	5-C-5837	81 50
1	Base Plate for staff lever lock. Specify number of the lever to which the lock is to be applied and size of interlocking machine.....	2-C-5842	1 00
2	Lock Bar Block, with rivets for fastening to locking bar	3-C-5842	30
3	Tap Bolt, $\frac{3}{8}$ "x $\frac{7}{8}$ ", for fastening staff lever lock to base plate. Price per hundred.....		2 00
4	Tap Bolt, $\frac{1}{4}$ "x $\frac{3}{4}$ ", for fastening base plate to locking brackets of interlocking machine. Price per hundred		2 00



STAFF LEVER LOCK APPLIED TO STEVENS
INTERLOCKING MACHINE

**STAFF LEVER LOCK APPLIED TO STEVENS
INTERLOCKING MACHINE**

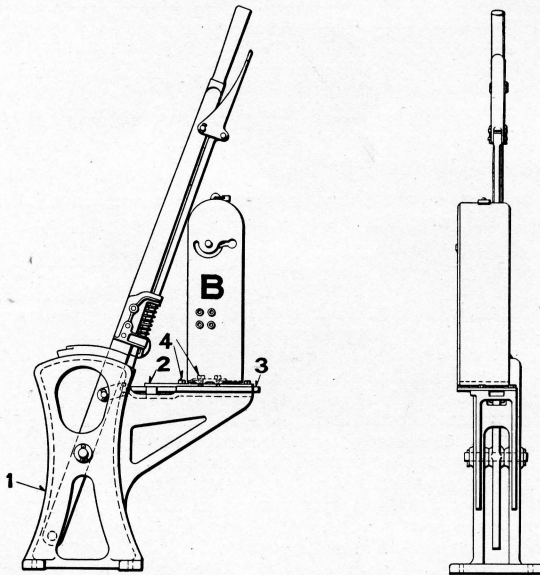
For Staff Lever Lock and Details see Plate 2323

When ordering specify number of staff to be used in staff lever, lock and number of the lever to which the lock is to be applied.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Staff Lever Lock, complete, with base plate and tap bolts, for two-lever Stevens machine having three-way locking plate. Specify number of staff to be used in staff lever lock and number of lever to which lock is to be applied. For details of staff lever lock see Plate 2323.....	12-C-5837	81 10
Aa	as above, complete, for two-lever Stevens machine having six-way locking plate.....	"	81 30
Ab	as above, complete, for four-lever Stevens machine having three-way locking plate.....	"	81 70
Ac	as above, complete, for six-lever Stevens machine having six-way locking plate.....	13-C-5837	82 10
1	Base Plate for two lever Stevens machine having three-way locking plate. Specify lever to which lock is to be applied.....	1-C-5866	1 00
1a	as above, for two-lever Stevens machine having six-way locking plate.....	17-C-5866	1 20
1b	as above, for four-lever Stevens machine having three-way locking plate.....	16-C-5866	1 60
1c	as above, for six-lever Stevens machine having six-way locking plate.....	7-C-5866	2 00
2	Tap Bolt, $\frac{3}{8}$ "x $\frac{7}{8}$ ", for fastening staff lever lock to base plate and base plate to locking plate. Price per hundred		2 00
2a	Fl. Hd. Mach. Screw, $\frac{3}{8}$ "x $\frac{7}{8}$ ", for fastening base plate to locking plate when staff lever lock interferes with use of tap bolts. Price per hundred		4 00



A

STAFF LEVER LOCK APPLIED TO DWARF MACHINE

STAFF LEVER LOCK APPLIED TO DWARF MACHINE

This plate shows application of the staff lever lock to a special dwarf machine, and if the staff lever lock is to be applied to the dwarf machine shown in the mechanical catalogue, other fittings will be required.

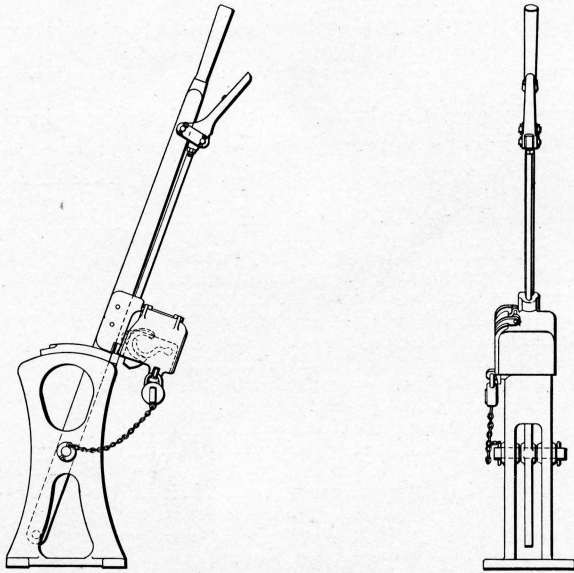
Levers and details of dwarf machines not listed below are standard and will be found in the mechanical catalogue.

When ordering specify number of staff to be used in staff lever lock.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	One-Lever Dwarf Machine, complete, as shown, with staff lever lock. Specify number of staff to be used in staff lever lock.....	2-C-5837	110 00
Aa	Two-Lever Dwarf Machine, complete, with two staff lever locks. Specify number of staff to be used in the staff lever lock.....	4-C-5837	214 00
Ab	Two-Lever Dwarf Machine, complete, with one staff lever lock on right hand lever. Specify number of staff to be used in staff lever lock.....	"	134 00
Ac	Two-Lever Dwarf Machine, complete, with one staff lever lock on left hand lever. Specify number of staff to be used in staff lever lock.....	"	134 00
B	Staff Lever Lock, complete, with tap bolts for fastening to base plates Figs. 2 and 2a. Specify number of staff. For details see Plate 2323.....	1-C-5093	80 00
1	Stand only, for one-lever dwarf machine.....	20-C-4942	13 10
1a	Stand only, for two-lever dwarf machine.....	21-C-4942	19 30
2	Base Plate for staff lever lock applied to a one-lever dwarf machine	1-C-6809	1 00
2a	Base Plate for staff lever lock applied to a two-lever dwarf machine	3-C-6809	1 70
3	Tappet for a one-lever dwarf machine and right hand lever of a two-lever dwarf machine.....	2-C-6809	1 10
3a	Tappet for left hand lever of a two-lever dwarf machine	4-C-6809	1 10
4	Tap Bolt, $\frac{3}{8}$ " x $\frac{7}{8}$ ", for fastening staff lever lock to base plate and base plate to stand. Price per hundred		2 00



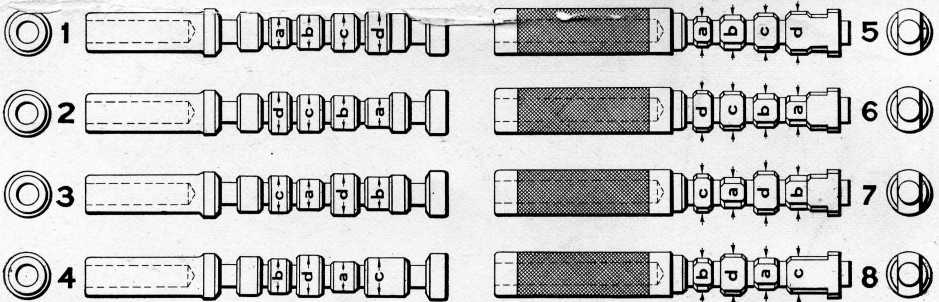
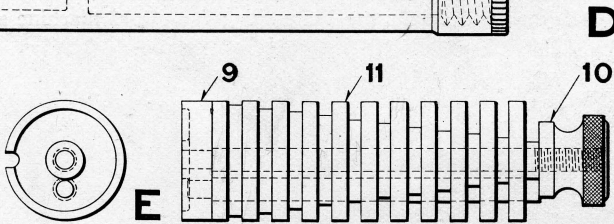
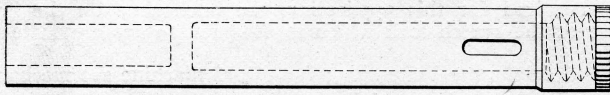
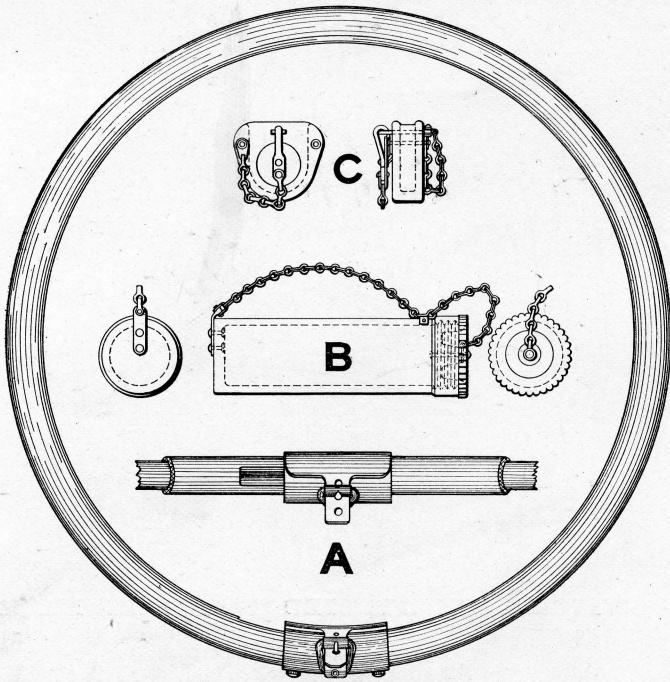
STAFF SWITCH LOCK APPLIED TO DWARF MACHINE

STAFF SWITCH LOCK APPLIED TO DWARF MACHINE

Plate on the opposite page shows the application of the staff switch lock to a dwarf machine.

No extra fittings are required for this application, the latch shoe on the lever being replaced by the case of the switch lock which is designed to accommodate the latch spring.

For staff switch lock and details see Plate 2325; for dwarf machine see mechanical catalogue.



STAFFS AND STAFF POUCHES

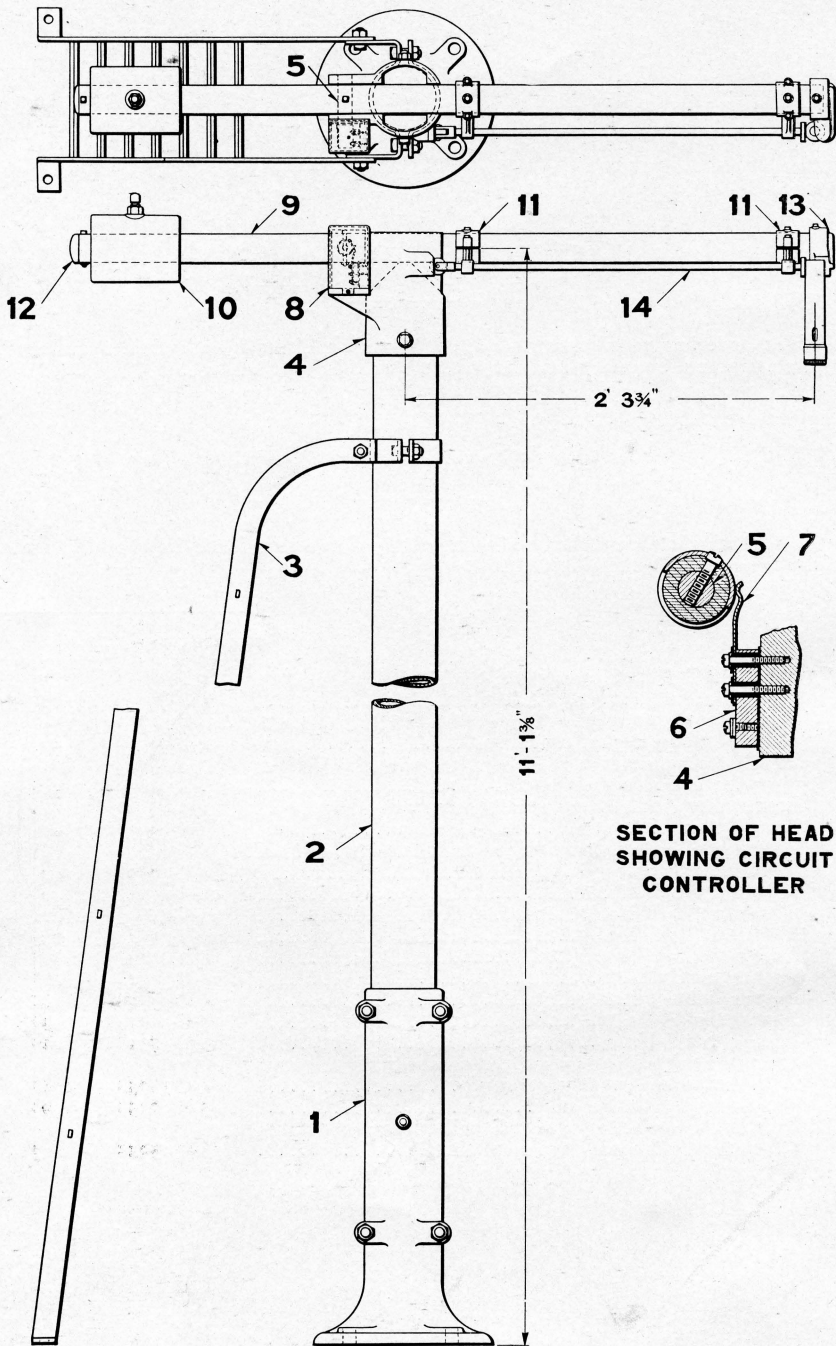
STAFFS AND STAFF POUCHES

When ordering permissive staff specify number of staff, and when ordering discs for permissive staff specify number of staff and number of disc.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Ring Staff Pouch, complete, as shown, with strap and rivets	1-B-9139	9 00
B	Pouch for permissive staff, complete, as shown, with stopper and chain	4-B-9105	4 80
C	Pouch for permissive staff disc, complete, as shown, with chains and snap	1-B-9105	1 50
D	Pouch for absolute staff, complete, as shown, with stopper	1-B-8997	2 00
E	Permissive Staff, complete, with discs and knob. Specify number of staff.....	4-C-5833	20 00
1	Absolute Staff No. 1.....	12-C-4764	2 00
2	Absolute Staff No. 2.....	13-C-4764	2 00
3	Absolute Staff No. 3.....	14-C-4764	2 00
4	Absolute Staff No. 4.....	15-C-4764	2 00
5	Pusher Staff No. 1.....	19-C-5791	5 40
6	Pusher Staff No. 2.....	20-C-5791	5 40
7	Pusher Staff No. 3.....	18-C-5791	5 40
8	Pusher Staff No. 4.....	21-C-5791	5 40
9	End Disc with spindles for permissive staff. Specify number of permissive staff.....	4-C-5833	1 10
10	Knob for permissive staff.....	23-B-8235	90
11	Disc for permissive staff. Specify number of disc and number of permissive staff.....	2-C-5832	1 10



CRANE STAFF DELIVERER

CRANE STAFF DELIVERER

The staff deliverer listed below, complete, does not include staff pouches, which must be ordered separately. For staff pouches see Plate 2337.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Crane Staff Deliverer, complete, as shown, without staff pouch	6-C-5097	60 00
1	Base, complete, with bolts for holding together.....	12-C-7251	3 00
2	Mast, 4-inch casing, complete, with bolt for fastening to base	6-C-7251	9 40
3	Ladder, complete, with stay and bolts.....	136-B-8363	3 20
4	Head only, with bolt for fastening to mast.....	11-C-7251	3 90
4a	as above, complete, with stud, contact blocks and cover	"	9 30
5	Stud, for holding arm, complete, with hard rubber collar, contact band and set screw.....	73-B-8090	1 80
6	Contact Block, complete, with two contact springs Fig. 7 insulation, terminal post and machine screws for fastening to head Fig. 4.....	9-C-7251	1 60
7	Contact Spring only for circuit controller.....	533-B-8385	50
8	Cover for circuit controller with machine screw for fastening to head Fig. 4.....	13-C-7251	70
9	Arm only, with bolt for fastening to stud Fig. 5....	4-C-7251	2 40
9a	as above, complete, with counterweight, bearings, cap, pouch holder, lock rod and bolts, (1-9, 1-10, 2-11, 1-12, 1-13, 1-14, Plate 2339).....	"	20 50

CRANE STAFF DELIVERER

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

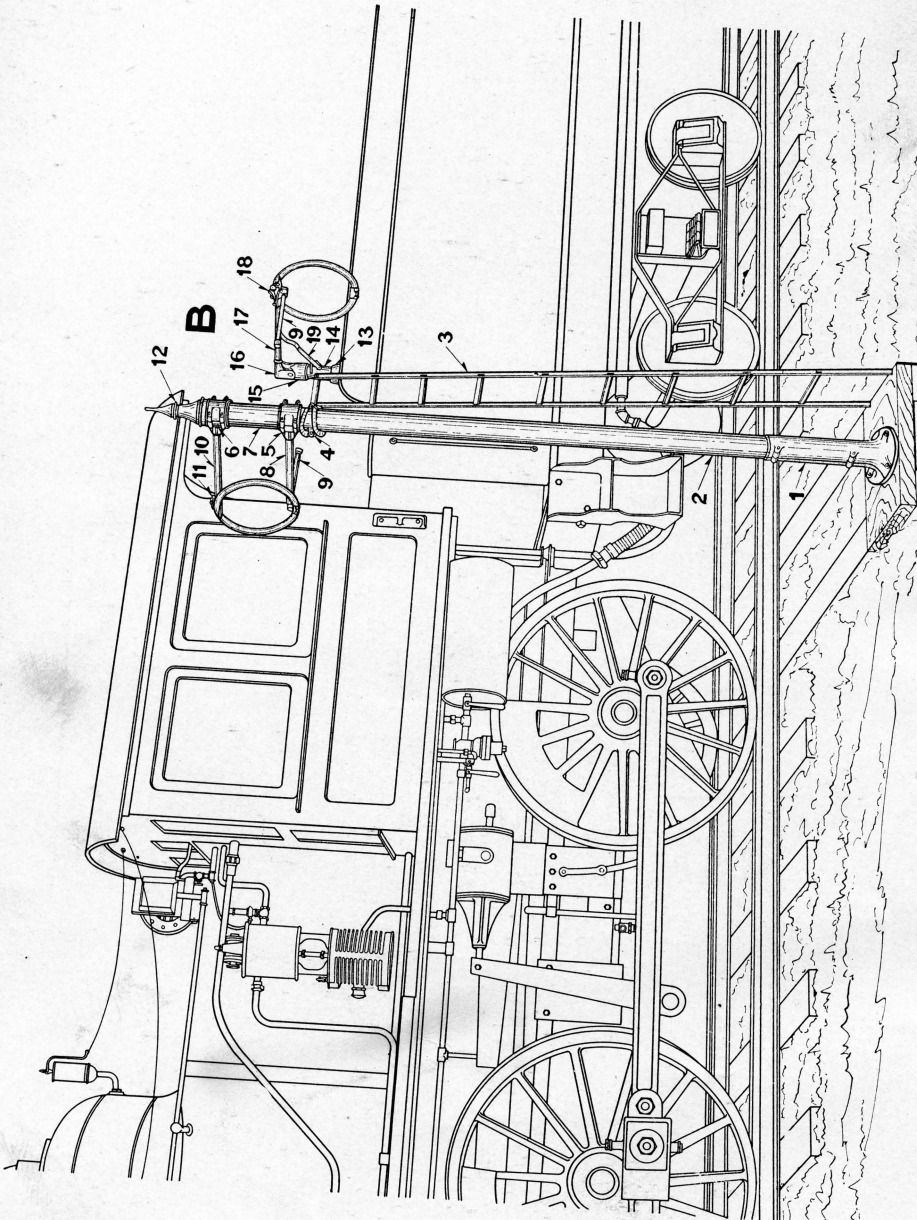
Fig.		Drawing Reference	List Price
10	Counterweight, with set screw.....	33-B-8137	2 00
11	Bearing for lock rod Fig. 13, complete, with cap and bolts for holding together and fastening to arm.	1-C-7251	3 60
12	Cap, complete, with bolt, for fastening to arm Fig. 9.	3-C-7251	24
13	Pouch Holder with bolt for fastening to arm Fig. 9.	5-C-7251	2 30
14	Lock Rod, complete, with roller, pin and cotters....	10 C-7251	6 30
15	Sq. Hd. Mach. Bolt and Hex. Nut, $\frac{5}{8}$ "x $\frac{1}{4}$ ", for holding together base Fig. 1. Price per hundred.		10 00
16	Sq. Hd. Mach. Bolt and Hex. Nut, $\frac{1}{2}$ "x6", for holding mast Fig. 2 in base. Price per hundred....		8 00
17	Sq. Hd. Mach. Bolt and Hex. Nut, $\frac{1}{2}$ "x $5\frac{3}{4}$ ", for fastening head Fig. 4 to mast. Price per hundred.....		8 00
18	Sq. Hd. Mach. Bolt and Hex. Nut, $\frac{1}{2}$ "x $1\frac{1}{2}$ ", for holding together ladder stays. Price per hundred.....		6 00
19	Sq. Hd. Mach Bolt and Hex. Nut, $\frac{1}{2}$ "x1", for fastening ladder to stays. Price per hundred.....		6 00

CRANE STAFF DELIVERER

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
20	Sq. Hd. Mach. Bolt and Hex. Nut, $\frac{1}{4}$ "x3", for fastening bearing Fig. 11 and pouch holder Fig. 13 to arm. Price per hundred.....		4 00
21	Sq. Hd. Mach. Bolt and Hex. Nut, $\frac{1}{4}$ "x2 $\frac{1}{4}$ ", for fastening arm to stud Fig. 5 and cap Fig. 12 to arm. Price per hundred.....		4 00
22	Sq. Hd. Mach. Bolt and Hex. Nut, $\frac{1}{4}$ "x2", for holding cap to bearing Fig. 11. Price per hundred..		4 00
23	Set Screw and Hex. Nut, $\frac{5}{8}$ "x2 $\frac{1}{2}$ ", for counterweight Fig. 10. Price per hundred.....		10 00
24	Fil. Hd. Mach. Screw, No. 8-32x13/16", for fastening contact block Fig. 6 to head. Price per hundred		2 00
25	Fil. Hd. Mach. Screw, No. 8-32x $\frac{7}{8}$ ", for fastening collar and contact band to stud Fig. 5. Price per hundred		2 00
26	Fil. Hd. Mach. Screw, No. 8-32x $\frac{1}{2}$ ", for cover Fig. 8. Price per hundred.....		2 00
27	Fil. Hd. Mach. Screw, No. 8-32x $\frac{3}{8}$ ", for contact block Fig. 6. Price per hundred.....		2 00



A
STAFF CATCHER AND DELIVERER

STAFF CATCHER AND DELIVERER

The catchers and deliverers, listed below, complete, do not include ring staff pouches which must be ordered separately. For ring staff pouch see Plate 2337, Fig. A.

Order by Plate, Figure and Instructions given above

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
A	Ground Catcher and Deliverer, complete, with base, mast, ladder, arms, sockets, pinnacle and bolts..	1-C-5097	48 00
B	Engine Catcher and Deliverer, complete, with base, mast, head, arms, brace and bolts.....	2-C-5097	30 00
1	Base for ground catcher and deliverer Fig. A, complete, with bolts for holding together.....	12-C-7251	5 40
2	Mast for ground catcher and deliverer Fig. A.....	3-C-5099	8 60
3	Ladder for ground catcher and deliverer Fig. A, complete, with stays and bolts.....	20-B-8365	3 20
4	Incline Casting, complete, with bolts for holding together and for fastening to mast Fig. 2.....	1-C-5098	2 10
5	Socket for catching arm Fig. 8, complete, with cap, bolts, roller, pin, washer and cotter.....	2-C-5098	3 00
5a	as above, complete, with arm Fig. 8 and catch rod Fig. 9.....	"	4 70
6	Socket for delivering arm, complete, with cap and bolts for holding together.....	11-C-5098	2 60
6a	as above, complete, with arm Fig. 10 and ring holder Fig. 11.....	"	5 10

STAFF CATCHER AND DELIVERER

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
7	Sleeve for sockets Figs. 5 and 6.....	2-C-5099	1 70
8	Arm for catching rod Fig. 9, complete, with tee, pins and cotters	8-C-5099	1 00
9	Catching Rod for arms Figs. 8 and 17, with pipe caps	12-C-5099	40
10	Delivering Arm with pin for fastening to socket Fig. 6	5-C-5099	70
11	Ring Holder for arm Fig. 10, complete, with clamps, spring, pins and cotters.....	2-B-9031	1 60
12	Pinnacle, with tap bolt, for mast Fig. 2.....	1-B-8121	1 70
13	Base for engine catcher and deliverer, complete, with bolts for holding together.....	1-B-9527	3 90
14	Mast for engine catcher and deliverer.....	18-C-5099	4 00
15	Head, with bolts for fastening to mast Fig. 14.....	6-C-5098	3 20
15a	as above, complete, with jaw, arm, ring holder, catching rod, toggle brace, bolts, pins and cotters, (1-15, 1-16, 1-17, 1-18, 1-9, 1-19, Plate 2341)	"	16 20
16	Jaw for arm Fig. 17, complete, with pins and cotters for fastening to head Fig. 15 and for holding arm Fig. 17	9-C-5098	2 20
17	Catching and Delivering Arm.....	13-C-5099	60
18	Ring Holder, complete, with clamp, spring, pins and cotters	1-B-9031	1 50

STAFF CATCHER AND DELIVERER

Order by Plate and Figure

The drawing references are shown merely for convenience in checking material against invoices and shipping lists.

Fig.		Drawing Reference	List Price
19	Toggle Brace, complete, with bars, pivots, cotters, dog and toggle bracket with bolts for fastening to mast Fig. 14.....	1-C-5099	1 20
20	Hex. Hd. Bolt and Nut, $\frac{5}{8}$ "x $5\frac{3}{8}$ ", for fastening incline casting Fig. 4 to mast. Price per hundred.....		12 00
21	Hex. Hd. Bolt and Nut, $\frac{5}{8}$ "x $4\frac{3}{8}$ ", for holding together base Fig. 1. Price per hundred.....		12 00
22	Hex. Hd. Bolt and Nut, $\frac{5}{8}$ "x4", for holding together incline casting Fig. 4 and base Fig. 13. Price per hundred		10 00
23	Hex. Hd. Bolt and Nut, $\frac{5}{8}$ "x $3\frac{3}{4}$ ", for fastening caps to sockets Figs. 5 and 6. Price per hundred....		10 00
24	Hex. Hd. Bolt and Nut, $\frac{1}{2}$ "x1", for fastening ladder Fig. 3 to stay. Price per hundred.....		6 00
25	Hex. Hd. Bolt and Nut, $\frac{3}{8}$ "x $4\frac{3}{4}$ ", for fastening head Fig. 15 to mast. Price per hundred.....		6 00
26	Hex. Hd. Tap Bolt, $\frac{3}{8}$ "x $5\frac{3}{8}$ ", for toggle brace Fig. 19. Price per hundred.....		2 00
27	Sq. Hd. Tap Bolt, $\frac{1}{2}$ "x $1\frac{1}{4}$ ", for pinnacle Fig. 12. Price per hundred		4 00

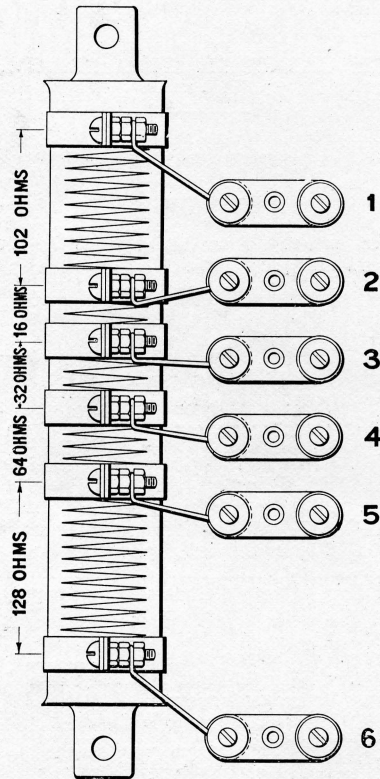


DIAGRAM OF ADJUSTABLE RESISTANCE TUBE

TABLE OF RESISTANCES FOR ELECTRIC TRAIN STAFF SYSTEM

The distance between two staff instruments depends upon traffic conditions and therefore the resistance of the line wire in series with the line coil of the lock magnet varies considerably. The local coil of the lock magnet should have a variable resistance in series with it in order that it may balance perfectly with the line coil. This is accomplished by using the adjustable resistance tube shown diagrammatically on the opposite page.

The table below gives the required information for connecting up the adjustable resistance tube for any ordinary condition.

Column 1 represents the total resistance of the two line wires connecting a pair of instruments.

Column 2 shows the normal voltage required to operate. (This is 50% above the minimum voltage required and gives a large working margin.)

Column 3 shows the corresponding number of dry cells required to secure the voltages shown in Column 2.

Column 4 shows the ohms resistance to be inserted in series with the local coil to balance the line resistances as given in Column 1.

Column 5 shows the proper terminal to which one wire leading from the local coil of the lock magnet should be connected to get the resistance shown in Column 4. **THE OTHER SHOULD ALWAYS BE CONNECTED TO TERMINAL 1.**

Column 6 shows the additional connections to be made in order to get the resistances shown in Column 4.

EXAMPLE. Two staff instruments are $5\frac{3}{4}$ miles apart. No. 12 B. & S. copper line wire is used. Total length of line wire will be $11\frac{1}{2}$ miles. Total resistance of line will be 96 ohms. Consulting the table we see that 30 cells of dry battery should be used to operate and that 262 ohms should be put in series with the local coil. Columns 5 and 6 show that to get this resistance we connect terminals 2 and 3 together and also terminals 4 and 5 together. We then connect terminals 1 and 6 into the local circuit.

	2	3	4	5	6
Ohms Resistance in Line	Volts Required to Operate	No. Cells of Dry Battery Required to Operate	Ohms Resistance to be Added to Local Circuit	Terminal of Adjustable Resistance Tube to be Connected in Local Circuit	Terminals of Adjustable Resistance Tube to be Connected Together
16	30.2	22	102	2	None
24	31.4	22	118	3	None
32	32.5	23	134	4	2 & 3
40	33.6	24	150	4	None
48	34.8	25	166	5	2 & 4
56	35.9	26	182	5	3 & 4
64	37.	26	198	5	2 & 3
72	38.2	27	214	5	None
80	39.3	28	230	6	2 & 5
88	40.5	29	246	6	3 & 5
96	41.6	30	262	6	2 & 3-4 & 5
104	42.7	30	278	6	4 & 5
112	43.9	31	294	6	2 & 4
120	45.	32	310	6	3 & 4
128	46.1	33	326	6	2 & 3

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