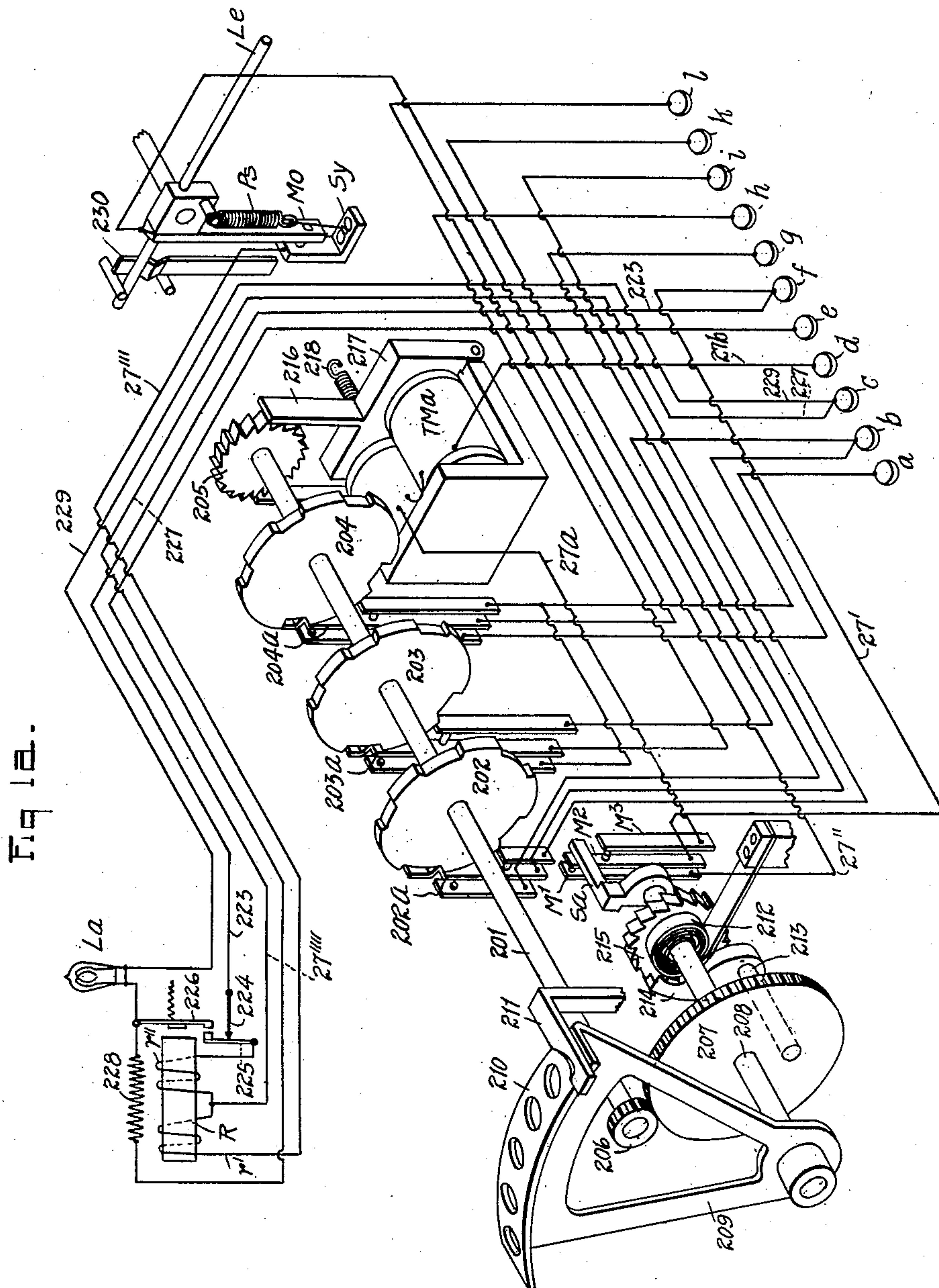


W. A. HOUGHTALING.
 AUXILIARY SIGNAL ARRANGEMENT FOR PRINTING TELEGRAPH SYSTEMS.
 APPLICATION FILED MAY 8, 1915.

1,275,559.

Patented Aug. 13, 1918.

6 SHEETS—SHEET 1.



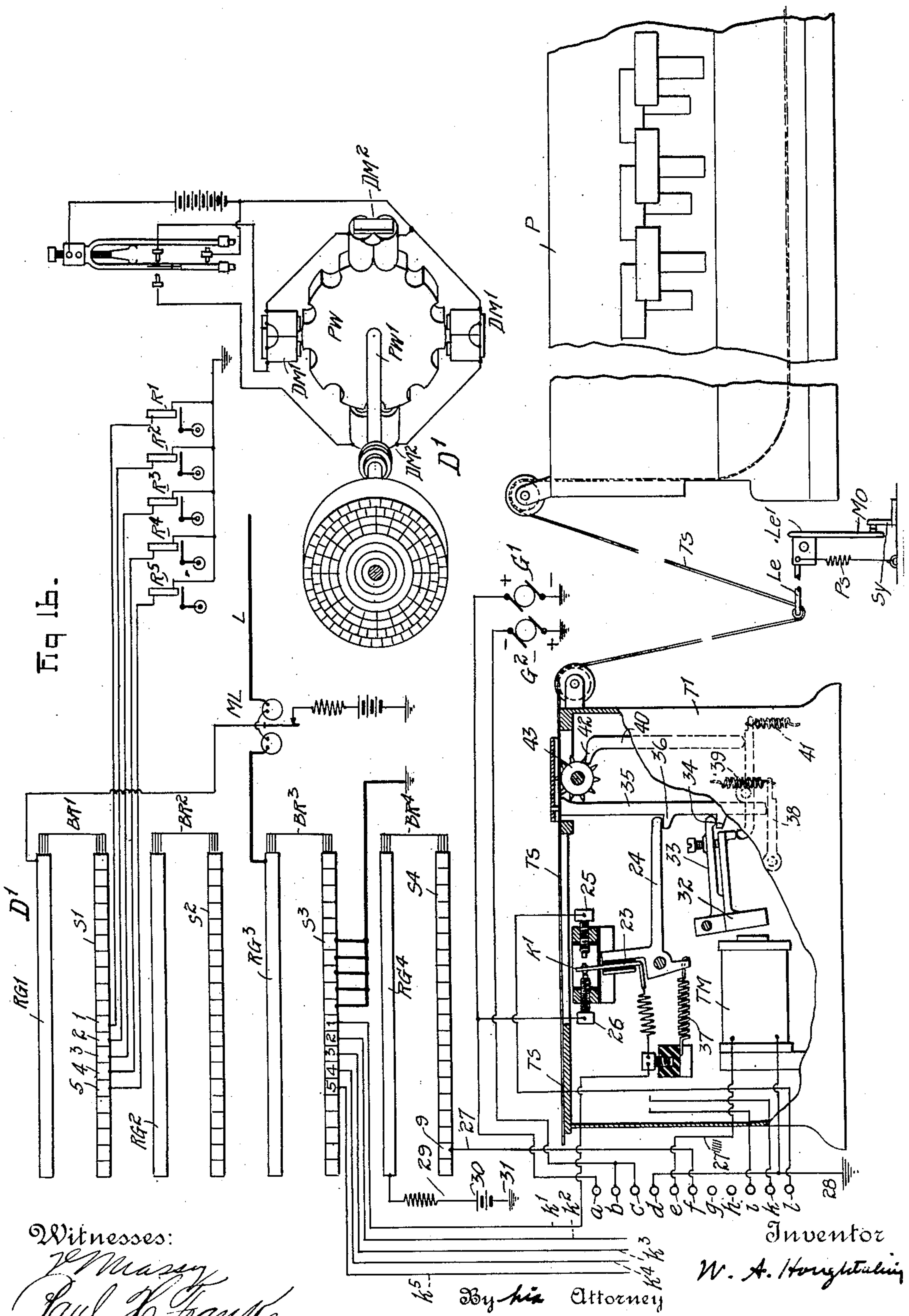
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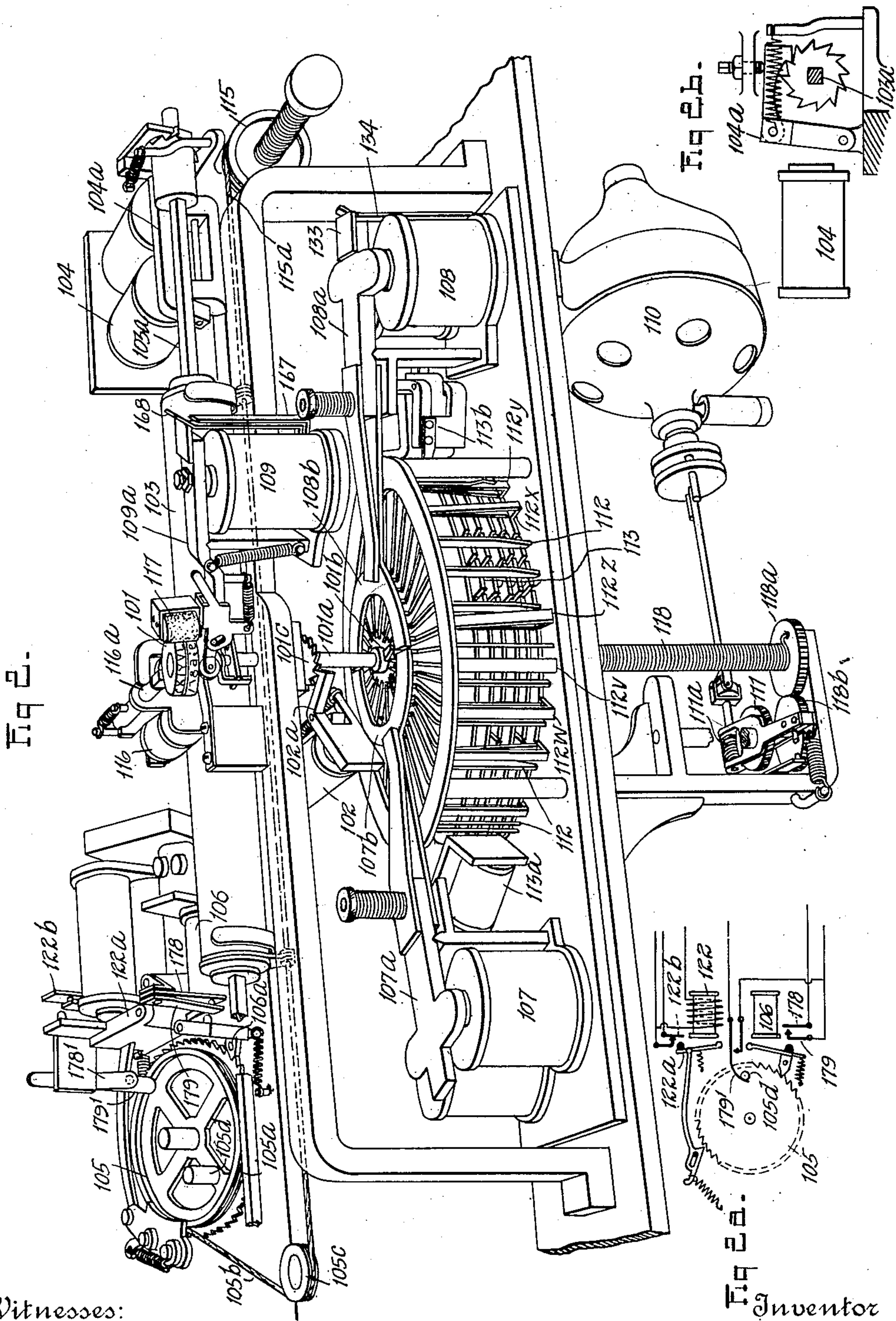
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6 SHEETS—SHEET 3.



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6 SHEETS—SHEET 4.

Fig 3.

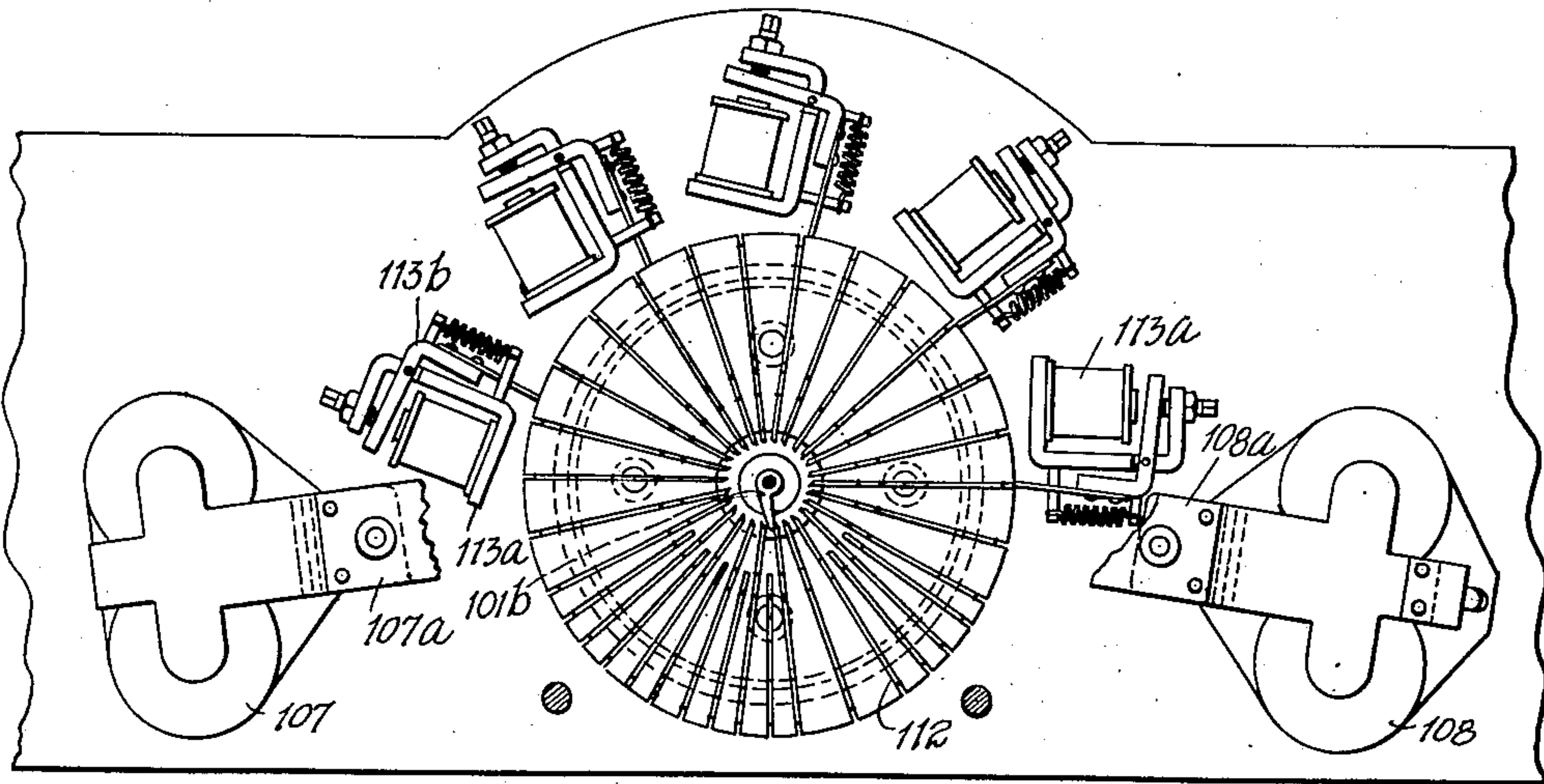


Fig 4.

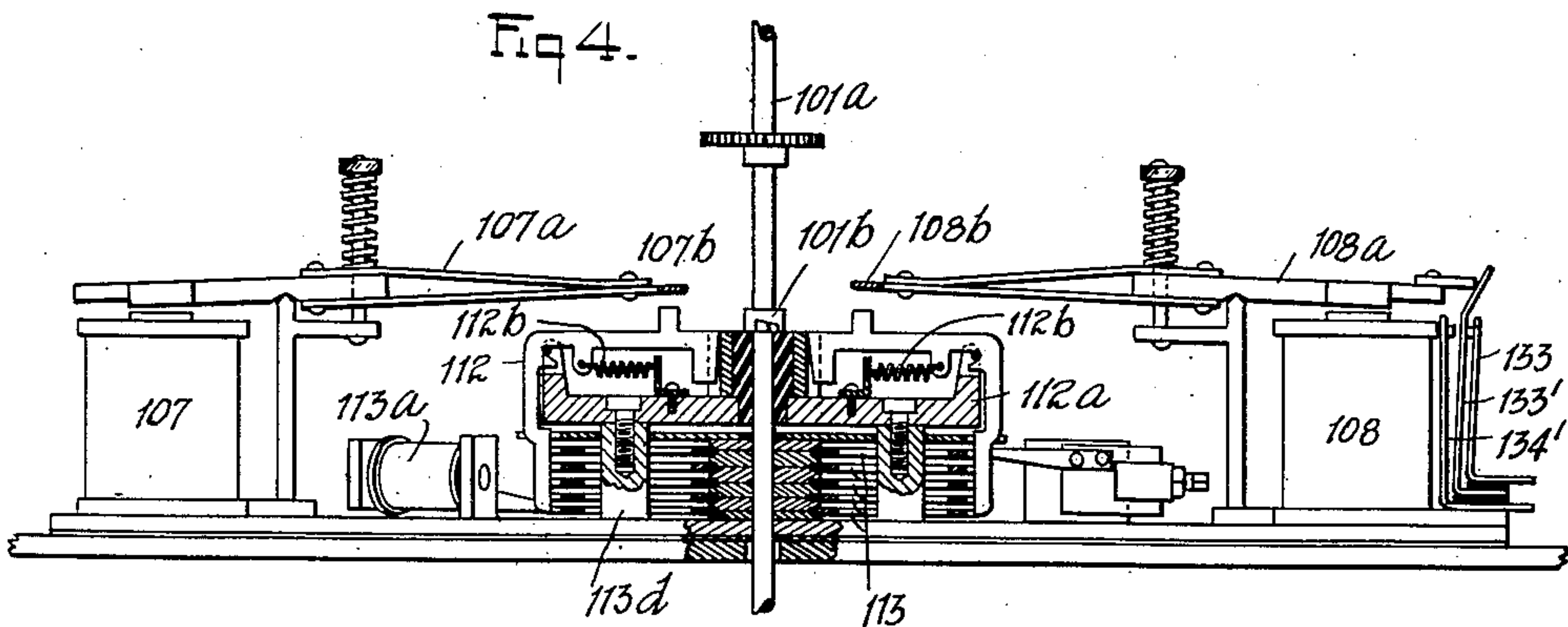


Fig 5.

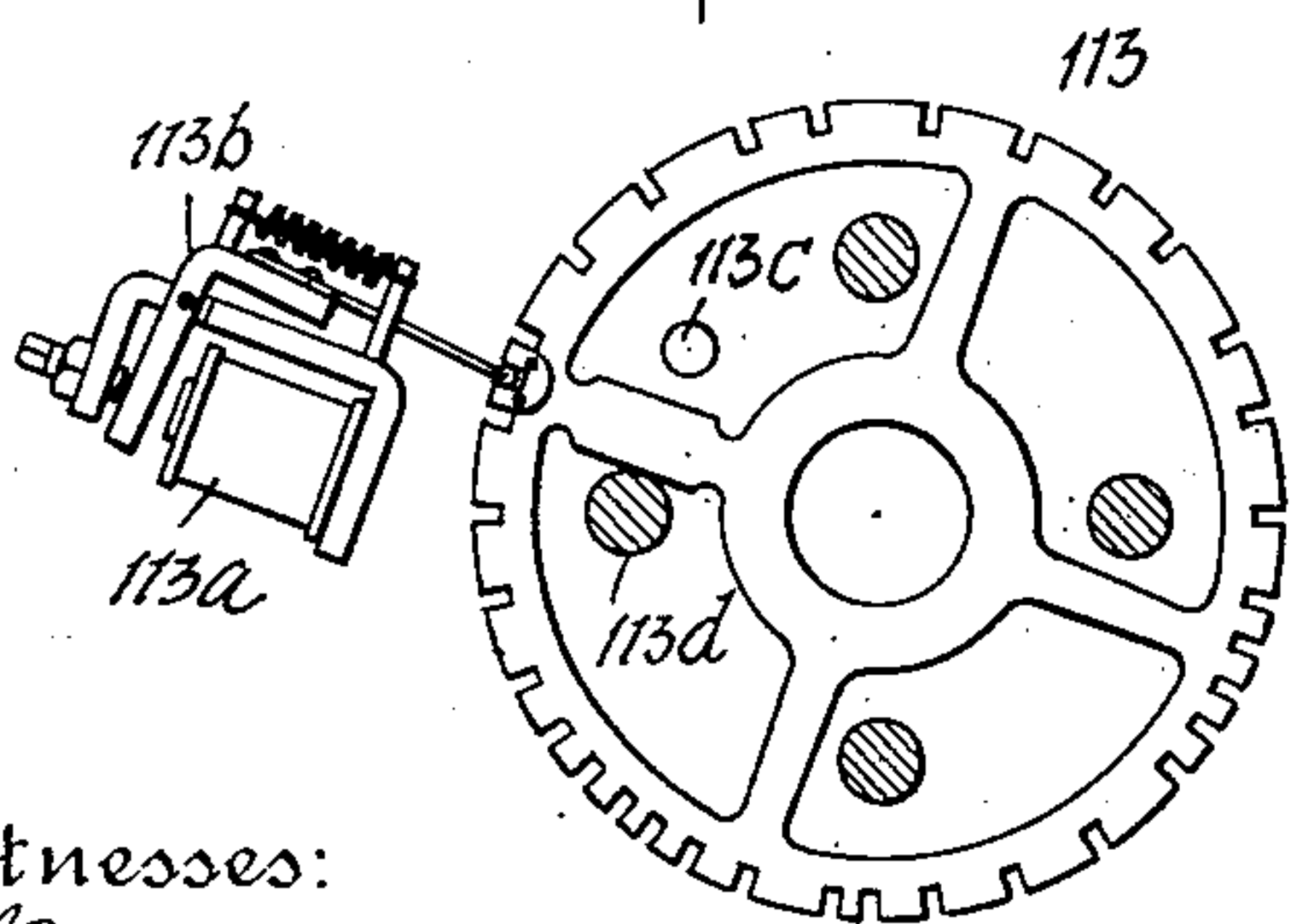
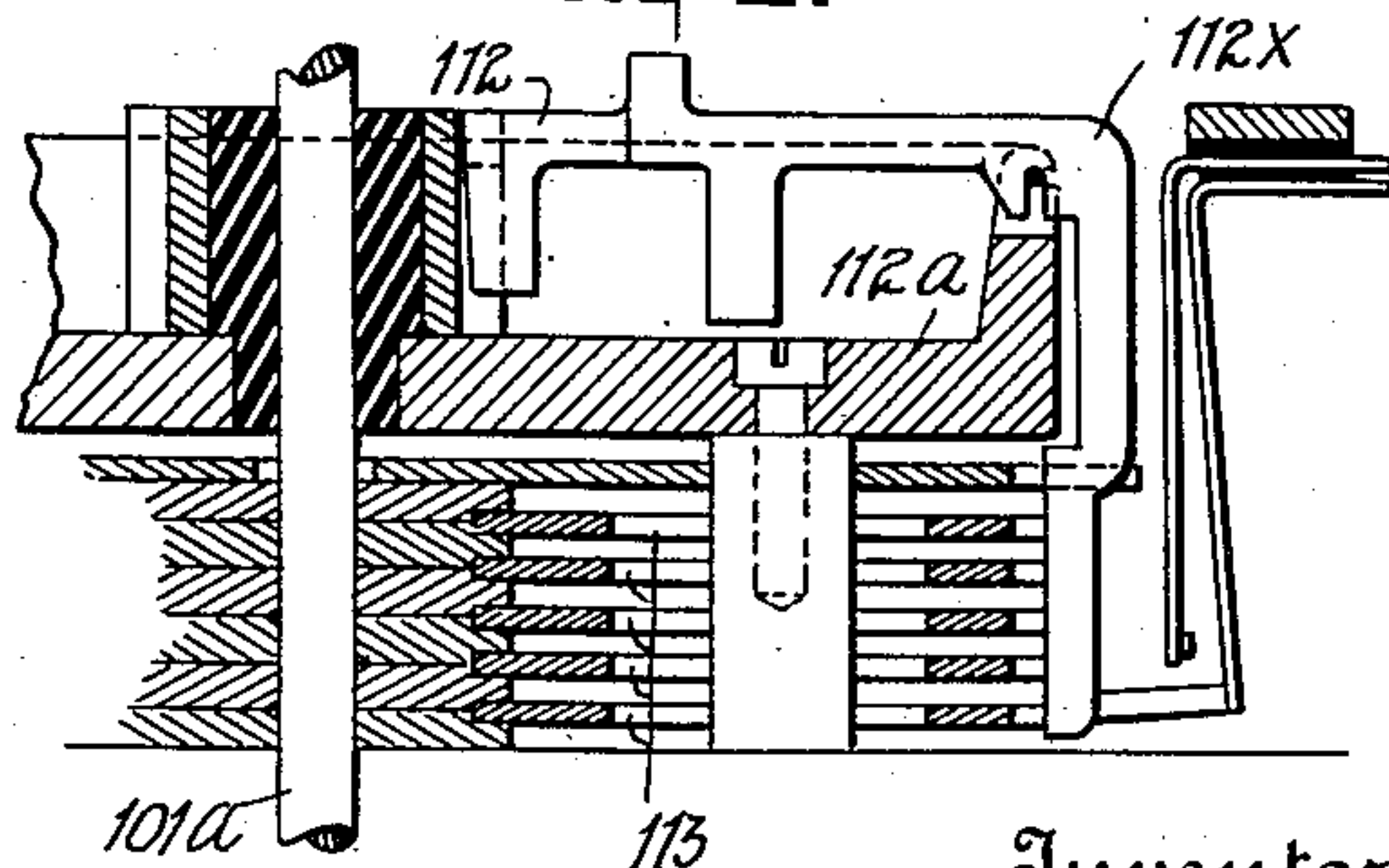


Fig 6.



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AUXILIARY SIGNAL ARRANGEMENT FOR PRINTING TELEGRAPH SYSTEMS.

Patented Aug. 13, 1918.

6 SHEETS—SHEET 5.

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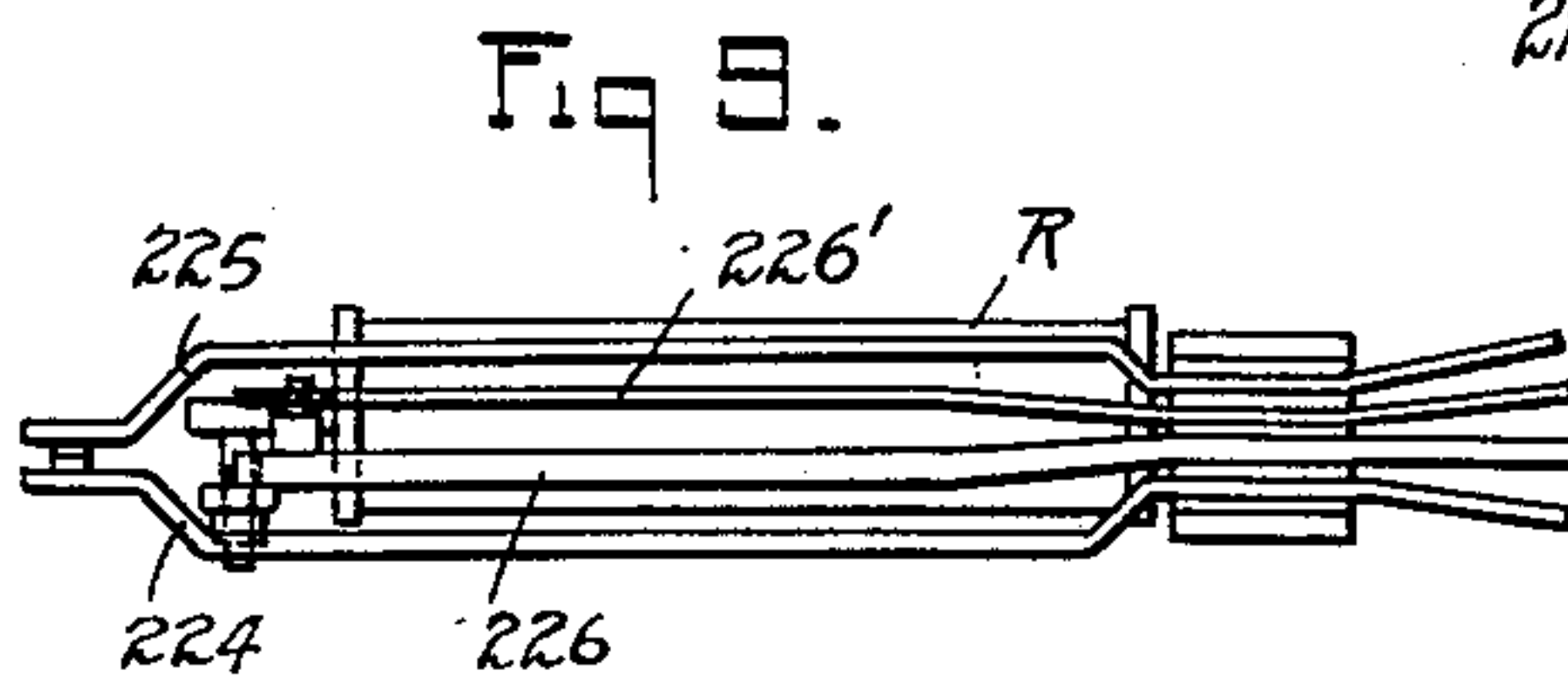
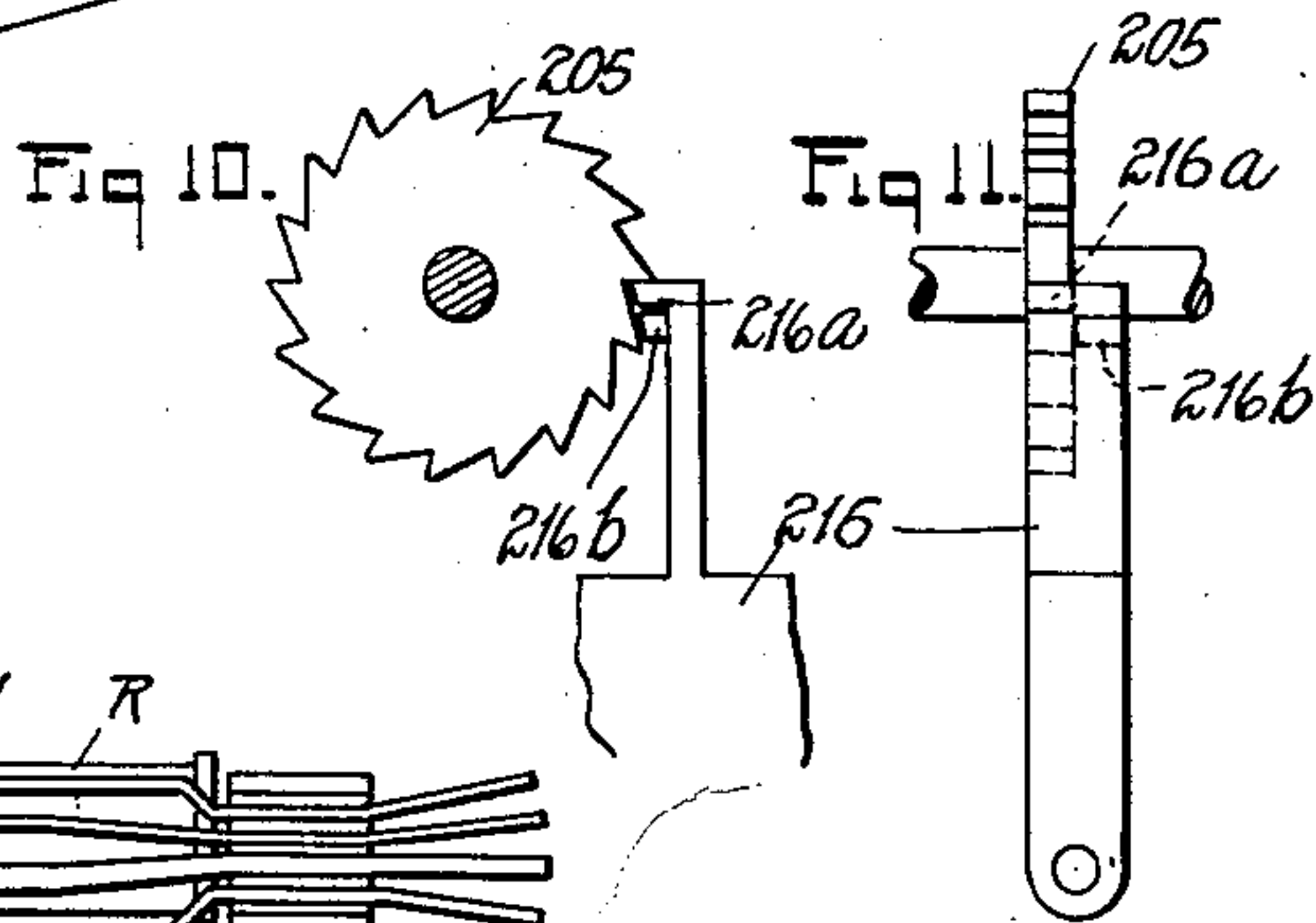
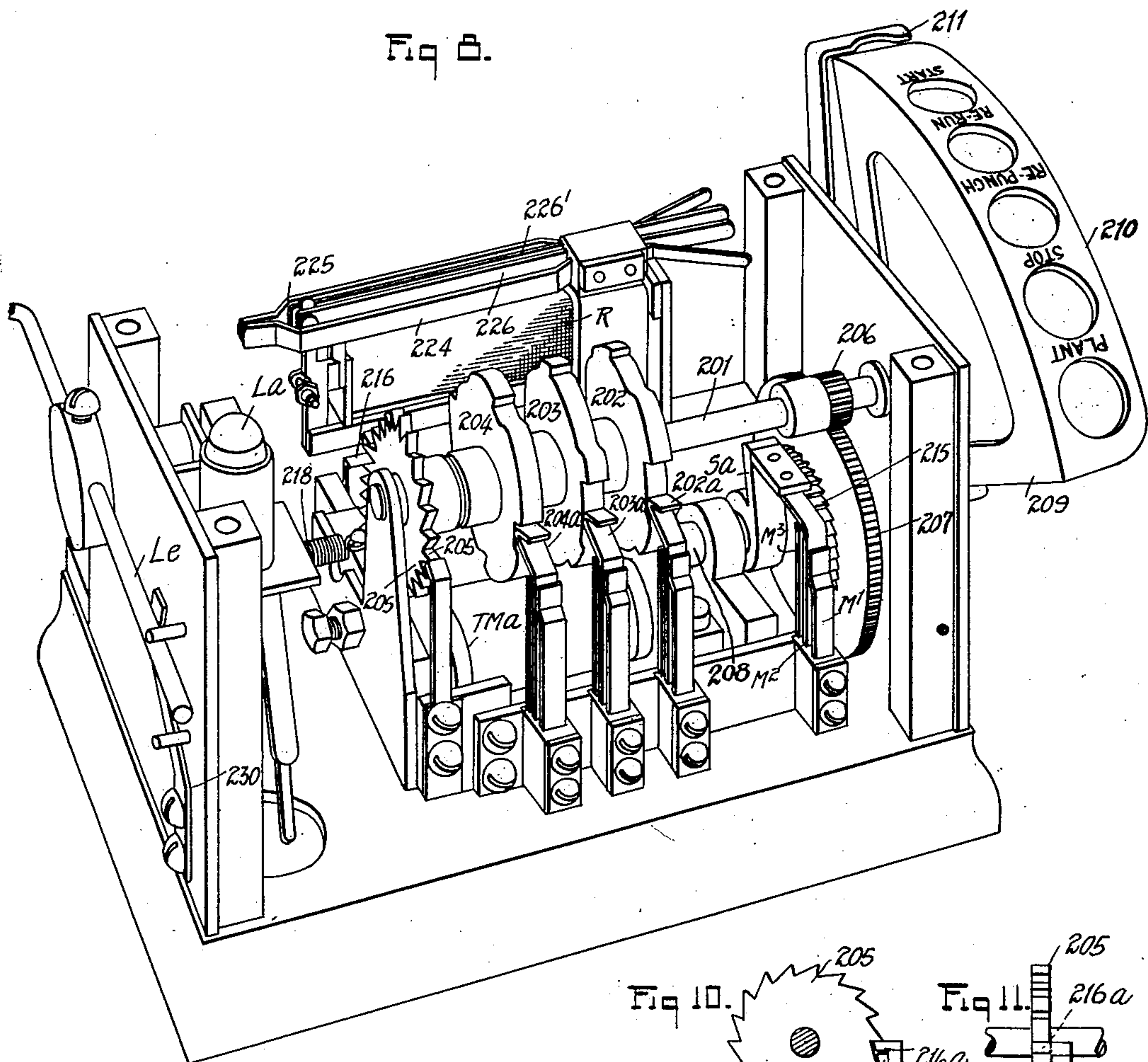
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6 SHEETS—SHEET 6.



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UNITED STATES PATENT OFFICE.

WALTER A. HOUGHTALING, OF DUNELLEN, NEW JERSEY, ASSIGNOR TO THE WESTERN UNION TELEGRAPH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

AUXILIARY SIGNAL ARRANGEMENT FOR PRINTING-TELEGRAPH SYSTEMS.

1,275,559.

Specification of Letters Patent.

Patented Aug. 13, 1918.

Application filed May 8, 1915. Serial No. 26,812.

To all whom it may concern:

Be it known that I, WALTER A. HOUGHTALING, a citizen of the United States of America, and a resident of Dunellen, county of Middlesex, and State of New Jersey, have invented certain new and useful Auxiliary Signal Arrangements for Printing-Telegraph Systems, of which the following is a specification.

My invention relates generally to printing telegraph systems, and particularly to auxiliary signaling arrangements for printing telegraph systems, more especially multiplex printing telegraph systems of the Baudot and similar types. My invention comprises means whereby the more usual service signals such as "start", "stop", "rerun", "repunch", etc., and like service signals of frequent occurrence, may be transmitted easily and rapidly and with minimum of interference with the regular operation of the circuit.

The application for Letters Patent of G. M. Yorke and G. R. Benjamin, filed January 5, 1915, Sr. No. 654, illustrates and describes a multiplex printing telegraph system of the Baudot type, typical of the systems with which my invention is more particularly intended to be used; though my invention is by no means restricted to use with that particular Yorke-Benjamin system. In the system disclosed in such Yorke-Benjamin application, at each end of a line circuit there is a rotary distributor having a plurality of main sub-divisions (usually four, though the number may be greater or less) to each of which main sub-divisions a separate transmitting apparatus and a separate receiving apparatus are connected; means being provided for operating the two distributors in synchronism, to the end that all four transmitting and receiving apparatus at each end of the line may operate simultaneously, each transmitting apparatus at one end of the line, and the corresponding receiving apparatus at the other end of the line, having use of the line during a portion of each rotation of the distributor. The transmitters employed in such systems are, customarily, automatic perforated-tape-controlled transmitters; one such transmitter being illustrated diagrammatically in the said Yorke-Benjamin application, and being illustrated more fully in the Benjamin application Serial No. 23,791, filed April 26, 1915. One form of

automatic receiving apparatus of the printer type, adapted for use in such a system, is illustrated and described in the Yorke application Serial No. 23,815, filed April 26, 1915. It will be obvious that in the operation of such a system, there will be frequent occasion for each of the several transmitting operators to send service signals to the corresponding receiving operator. Obviously, such signals might be sent by means of ordinary Morse telegraph instruments; but this is not desirable, since, in general, the use of such Morse instruments would interfere momentarily with the operation of all of the various channels of communication pertaining to that circuit. It is of course practicable to have the various service signals punched in the transmitting tape; but this is undesirable, since it may be necessary to send a service signal at an intermediate point in the transmission of messages already punched in the tape; in which case it will be necessary to remove the already perforated tape from the transmitter, possibly at an intermediate point in the transmission of a message, to substitute a tape perforated according to the desired service signal, and then, after transmission of such service signal, to return the message tape to the transmitter. Obviously such method of sending service signals affords great possibilities for mutilation of words, omission of words, and repetition of words, in the messages transmitted.

According to my invention, I provide, for the transmission of such service signals, a small supplemental transmitter provided with means whereby the more usual service signals may be transmitted practically automatically, with only momentary interruption of the operation of the corresponding regular transmitter, and without removal of the message tape from that regular transmitter; and, in the receiving apparatus, means are provided whereby such service signals are not printed upon the message blank, but are reproduced, automatically, by means of a sounder, or bell, or other suitable auxiliary service-signal receiving means.

My invention comprises the combination with the regular message-transmitting and receiving apparatus, of auxiliary service-signal transmitting and receiving apparatus; in means whereby upon operation of the service-signal apparatus, the operation of the regular message-transmitting and re-

ceiving apparatus is automatically interrupted, without disturbance of the message tape, or of the message blank in the receiving apparatus, and without any interference
 5 with the operation of the transmitting and receiving apparatus of other channels of communication over the same circuit than that channel to which the particular service-signal apparatus operated belongs; and
 10 other features, all as hereinafter described and particularly pointed out in the appended claims.

The objects of my invention are to facilitate the sending of service signals; to
 15 eliminate opportunities for errors in the transmission and receiving of regular messages, due to interruption of such transmission and receiving for the sending of service signals; and generally to make the
 20 auxiliary or service-signal transmitting and receiving apparatus simple, free from liability to derangement, and relatively inexpensive.

I will now proceed to describe my invention with reference to the accompanying drawings, and will then point out the novel features in claims. In said drawings:

Figures 1^a and 1^b (which together constitute one complete figure) illustrate diagrammatically transmitting apparatus such
 30 as may be located at one end of a line circuit, and comprising a rotary distributor, a tape-controlled transmitter therefor, a perforator for supplying perforated message tape to that transmitter, and auxiliary
 35 or service-signal transmitting means, (the latter shown principally in Fig. 1^a). Selecting relays forming a part of receiving apparatus through which signals from the
 40 distant end of the line may be received at the end of the line shown in Fig. 1^b, are also shown in that Fig. 1^b.

Fig. 2 shows a fragmentary perspective elevation of the upper portions of a telegraph printer such as hereinafter referred to.

Fig. 2^a is a diagrammatic plan view of the letter-space and carriage-release mechanism of said printer.

Fig. 2^b is a detail side elevation and partial section of the line spacing mechanism of such printer.

Fig. 3 shows a top view of the selecting device and associated parts of the printer.

Fig. 4 shows a side elevation of the parts shown in Fig. 3, the selecting device itself being shown in central vertical section.

Fig. 5 is a detail top view of one of the selecting disks and its actuating magnet.

Fig. 6 shows a fragmentary vertical section of the selector on a larger scale than that of Fig. 3, certain associated parts also being shown in elevation.

Fig. 7 is a diagrammatic view showing diagrammatically, at one end of the line
 65 wire, the essential portions of a distributor,

main transmitter, and auxiliary or service-signal transmitting device, required for transmission from that end of the line, and showing, at the other end of the line, the essential portions of the distributor and a
 70 diagram of the electrical portions of the printer illustrated in Figs. 2-6 inclusive.

Fig. 8 shows a perspective elevation from the rear of the auxiliary signal device and automatic stop device embodied in a single
 75 instrument; the cover of the case of the instrument having been removed.

Fig. 9 shows a top view of the relay R, forming a part of the automatic stop device.
 80

Fig. 10 shows a detail side elevation of the escapement of the auxiliary or service-signal device; and

Fig. 11 shows a front view of that escapement.
 85

In Figs. 1^a and 1^b (which constitute one continuous figure or diagram) I have indicated (in Fig. 1^b) the distributor at one end of a main line and one ordinary or main tape-controlled message transmitter
 90 connected to that distributor, and (in Fig. 1^a) I have indicated the auxiliary or service-signal transmitter associated with that message-transmitter. Referring first to Fig. 1^b, in order that the nature of the regular message transmitting apparatus may be understood; D¹ designates the transmitting distributor (shown twice in that figure, once with its commutator rings "developed", and again in perspective and in connection with
 100 its driving motor, but without circuit connections or brushes). This distributor comprises a plurality of rings (eight rings in the construction shown) which are connected in pairs by suitable brushes, one ring of each pair being segmented and one ring of each pair being plain or continuous. Rings S¹ and RG¹ form one pair of rings, of which ring S¹ is segmented, these rings being connected by brushes BR¹; these two rings and their brushes being employed for receiving.
 105 Rings S² and RG² form another pair of rings of which S² is segmented, these two rings being employed for synchronization or correction, and being connected by brushes BR². Rings S³ and RG³ form another pair of rings, employed for transmission, and are connected by brushes BR³; rings S³ being segmented as shown; and rings S⁴ and RG⁴ form another pair of
 120 rings employed for the control as hereinafter described of the automatic transmitting apparatus, and other local purposes, and are connected by brushes BR⁴.

T¹ designates an automatic transmitting
 125 apparatus, arranged to be controlled by a suitable perforated tape such as the tape TS. This transmitter comprises a plurality of current reversing transmitting contacts (in the construction shown, five such sets of
 130

transmitting contacts—see Fig. 7— K^1 , K^2 , K^3 , K^4 , and K^5) each connected as herein-
 after described by an appropriate conductor
 to a correspondingly numbered segment of
 5 transmitting ring S^3 of the corresponding
 distributor. The particular tape-controlled
 transmitting apparatus T^1 illustrated, forms
 no portion of the present invention; and as
 various tape-operated transmitting appa-
 10 ratus are known in the art, and may be
 employed in connection with the present
 invention, I have illustrated the transmit-
 ting apparatus schematically only, and only
 to such extent as seems to be desirable for
 15 the description of apparatus embodying the
 present invention.

I have indicated dynamo generators G^1
 and G^2 for supplying the line current for
 the transmitter, the polarities of these gen-
 20 erators being opposite, as is common when
 dynamo generators are employed for sup-
 plying current to a telegraph line; however,
 the particular means for supplying current
 to the line is unimportant, as is the par-
 25 ticular means employed for supplying cur-
 rent of one sign or the other to the line, as
 desired.

ML (in Fig. 1^b) designates a main line
 relay included in the main line circuit L and
 30 employed for receiving. R^1 , R^2 , R^3 , R^4 and
 R^5 designate selecting relays, of which there
 are in practice one set for each channel of
 communication through line wire L, said
 selecting relays being connected to corre-
 35 sponding segments numbered 1–5 inclusive
 of ring S^1 of distributor D^1 ; which relays
 R^1 – R^5 inclusive, are, in practice, em-
 ployed for the control of an electromagnet-
 ically operated mechanical selecting device of
 40 a telegraph printer, as illustrated in Figs.
 2–7 inclusive.

The brush structure of the distributor D^1
 is commonly driven by a so-called La Cour
 wheel PW (Fig. 1^b) mounted to rotate upon
 45 a shaft PW^1 and having suitable teeth and
 also two pairs of electromagnets DM^1 and
 DM^2 , the magnets of each pair being con-
 nected in series. This La Cour wheel is
 itself a well known form of electric motor,
 50 of which it is only necessary to say here
 that its nature is such that if the magnets
 DM^1 and DM^2 be energized and deenergized
 in alternation, and if the wheel PW be once
 started in rotation, at a speed corresponding
 55 (with respect to the number of its teeth)
 to the speed of energizaion and deenergiza-
 tion of such magnets, the wheel will con-
 tinue to rotate at such speed, under the in-
 fluence of such magnets.

60 In practice, the various commutator rings
 of the distributors are stationary, and the
 brushes BR^1 , BR^2 , BR^3 and BR^4 are rotated
 by the La Cour motor over and in contact
 with the commutator rings of that dis-
 65 tributer,

The contacts K^1 , K^2 , etc., (see Figs. 1^b and
 7) of the automatic tape-controlled trans-
 mitting device T^1 comprise each a contact
 tongue 23 mounted upon a spring actuated
 rocking lever 24, and two contact stops, 25 70
 and 26; of which contact stops, those num-
 bered 25 are connected to generator G^2 , and
 those numbered 26 are connected to genera-
 tor G^1 , while the contact tongues 23 are each
 connected by a conductor k^1 , k^2 , etc., to the 75
 corresponding segment, 1, 2, etc., of distribu-
 ter ring S^3 . The transmitting device is pro-
 vided with an electromagnet TM. The dis-
 tributer ring S^4 is provided with segments
 corresponding to the segments of distributor 80
 ring S^3 and to one of these segments of ring
 S^4 (any one of those segments, so long as it
 is a segment spaced well away angularly
 from the segments 1–5 inclusive of ring S^3
 to which the corresponding transmitter is 85
 connected) is connected a conductor 27 lead-
 ing through the magnet TM and through
 certain conductors shown in Fig. 1^a to
 ground at 28. The circuit of conductor 27,
 in the other direction, passes through that 90
 particular segment of ring S^4 to which it is
 connected, and through brush BR^4 (when
 that brush is in contact with such segment
 of ring S^4) to ring RG^4 and thence through
 conductor 29 and battery 30, or other suit- 95
 able source of current supply, to ground at
 31. 32 designates a pivoted armature for
 magnet TM, upon which is mounted a plate
 33 adapted to engage lugs 34 on a plurality
 of pins 35 the upper ends of which pins are 100
 adapted to enter corresponding perforations
 in the tape TS. There is one such pin 35
 for each of the keys K^1 – K^5 inclusive; and
 each of the pins 35 is provided with a fur-
 105 ther lug 36 against which rests normally the
 end of the corresponding rocking lever 24 of
 the corresponding transmitting key K^1 – K^5
 inclusive. These rocking levers are pro-
 vided with spring 37 tending to depress
 them. Each pin 35 rests at its lower end, 110
 upon a pivoted lever 38 having a spring 39,
 tending to raise that lever; the springs 39
 being adjusted to be somewhat stronger than
 the springs 37. A further spring actuated
 rocking lever 40 is provided, the lever being 115
 arranged to be engaged by armature 32,
 when that armature is attracted, thereby
 moving lever 40 against the tension of its
 spring 41; and this lever 40 carries a projec-
 120 tion 42 adapted to engage a star wheel 43
 and move the same forward step by step.
 The star wheel is arranged to engage a cen-
 tral row of perforations of tape TS, in the
 manner well known in the art, and thereby
 to advance such tape step by step. It will 125
 be seen from the above explanation that the
 operation of the transmitting apparatus is
 as follows: Supposing the segment of dis-
 tributer ring S^4 to which conductor 27 is
 connected (the segment numbered 9 in Fig. 130

1^a) to make contact with brush BR⁴, a circuit is thereby completed from ground at 28, magnet TM, conductor 27''''', (Figs. 1^b and 7) terminal *e*, conductor 27''''', (Figs. 1^a and 7), relay coil *r'*, conductor 27''', contacts Sy and Mo (normally closed as hereinafter described), conductor 27'', contact springs M¹ and M² (normally closed as hereinafter described), conductor 27', terminal *f*, conductor 27 (Figs. 1^b and 7), segment 9 of ring SR⁴, brush BR⁴, ring RG⁴, conductor 29, battery 30, to ground at 31; the armature 32 being thereby attracted and caused to engage and depress the lug 34 of any pin or pins 35 which may just previously have been in elevated position, thereby "clearing" the transmitter, freeing the pins 35 from the tape TS, and causing the lever 40—42 to advance the tape TS one step. As soon as the said segment 9 of ring S⁴ leaves the brush BR⁴, the circuit through magnet TM is broken and armature 32 is released, such of the pins 35 as may be beneath perforations of the tape TS in the new position of that tape, being permitted to rise, under the influence of their springs 39; and when such pins rise they carry upward with them the armature 32, also their corresponding key-levers 24, so shifting the contact tongues 23 of those levers into contact with the corresponding back stops 26; whereby a new set of contacts is "set up" in the transmitter, the particular contacts so set up corresponding to the particular row of perforations of tape TS then over the pins 35. When, during the rotation of brush BR³ over rings S³ and RG³, of distributor D¹, said brush DR³ contacts with that set of segments 1—5 inclusive of rings S³, corresponding to the transmitter T¹ under consideration, positive or negative current impulses will be transmitted through line L according as the contact tongues K¹—K⁵ inclusive, electrically connected to such segments 1—5 inclusive of ring S³, are in contact with their rear stops 25 or with their front stops 26. After brush BR³ has passed over such segments 1—5 inclusive of ring S³, brush BR⁴ makes contact with segment 9 of ring S⁴, and thereby magnet TM is again energized, its armature 32 is depressed, carrying down with it those pins 35 which previously had been elevated, thus clearing the transmitter and freeing the tape TS, which is again advanced one step by actuation of the star wheel 43 by lever 40—42, itself actuated by the descent of the armature 32.

It will be seen that the effect of the operation of the transmitter T¹ and of distributor D¹ is to send through the line L, a succession of five current impulses, some of which will, in general, be negative impulses, and others of which will, in general, be positive impulses, the particular relative arrangement of positive and negative impulses

in such series depending upon the particular character transmitted.

Referring now to Figs. 2—7 inclusive, showing the receiving printer and the circuits thereof, numeral 101 designates a rotatable type wheel, mounted upon a suitable type wheel shaft 101*a*, and 102 designates a so-called "starting magnet" controlling the rotation of the type wheel shaft and type wheel in a manner hereinafter described. 103 designates a paper-carrying carriage itself mounted to slide axially on a square-section guide rod 103*a* and comprising the usual rotatable paper-feed roll. For line spacing or paper feed, this rod 103*a*, and with it the paper-feed roll, are arranged to be rotated by the action of a magnet 104 and its armature 104*a*, the armature operating a suitable pawl-and-ratchet mechanism shown in Fig. 2^b. For drawing the paper carriage 103 to the left (as in letter spacing and spacing between words) a ratchet wheel 105 is provided, also a magnet 122 and armature 122*a*, and ratchet mechanism operated by said armature, for rotating ratchet wheel 105 step by step in a clockwise direction as viewed from above, (see Fig. 2^a). This ratchet wheel 105 is provided with a drum portion 105*a* upon which is wound a flexible cable 105*b* passing around a guide pulley 105*c* and thence connected to the paper roll carriage. At the right of the machine there is a spring-drum 115 connected by a flexible cable 115*a* to the paper roll carriage. The ratchet wheel 105 moves the paper roll carriage to the left against the tension of the spring of this drum 115; and at suitable times this spring drum 115 is permitted to draw the paper roll carriage back to the right as hereinafter described.

106 designates a carriage-return magnet arranged to operate a retaining pawl 106*a*. During the rotation of ratchet wheel 105 in a clockwise direction, for the step by step feeding of the paper roll carriage to the left, this pawl 106*a* operates to prevent backward rotation of the ratchet wheel 105; but when magnet 106 is energized, and pawl 106*a* is, in consequence, drawn out of engagement with ratchet wheel 105, the spring drum 115 is permitted to draw the paper roll carriage back to the right.

116 designates a so-called printing magnet, arranged to operate a plunger or hammer 116*a* the end of which is located opposite the face of the type wheel 101, such hammer being adapted to force the paper to be printed upon against that particular type face on type wheel 101 which is opposite the end of such plunger 116*a* at the time of energization of magnet 116. 117 designates an inking roller for the type wheel.

The particular construction of mechanism shown for feeding the paper roll 103 forward and backward and for causing the

paper carried thereby to be pressed, at intervals, against the type wheel 101, forms no portion of the present invention; and such mechanisms are well known; hence the particular mechanism shown is not thought to require detailed description here.

The mechanical selecting device, in the particular construction shown herein, comprises a plurality of notched disks 113, (five in the construction shown) one of which is shown in Fig. 5. These disks are arranged concentrically with the type wheel shaft 101a, and are each arranged to be rotated through a small angle whereby their peripheral notches are set up in different combinations with respect to stop bars 112 arranged around the peripheries of these selecting disks and each pivoted to a crown ring 112a, and having bell-crank portions extending radially inward toward the shaft 101b for a purpose hereinafter described. For each of these selecting disks 113 a corresponding magnet 113a (Figs. 3 and 5) is provided, the armature of which is connected by a lever 113b to the corresponding selecting disk 113; the construction being such that when any particular magnet 113a is energized the corresponding selecting disk 113 is rotated through a small angle, and when that magnet is deenergized, the usual retractile spring with which the armature of the magnet is provided returns that selecting disk to its first position. Stop pins 113c and 113d (Fig. 5), limit the motion of the disks.

It will be apparent that, with a proper arrangement of notches in the periphery of each of the disks 113, and with a proper range of movement (constant in all cases) for each disk 113, it is possible, by moving one or more of the disks 113 selectively, to produce a large number of slot-combinations, whereby, opposite one or another of the stop bars 112, the several disks 113 may be caused to present a series of aligned slots, permitting actuation of that particular stop bar; while no similar series of notches of all five disks, in line, will be opposite any of the other stop bars 112, and therefore the other stop bars will be prevented from operating. It will thus be seen that the several selecting disks 113 with their operating magnets 113a, and the stop bars 112, constitute a mechanical selecting device whereby one or another of the stop bars 112 may be selected for operation, at will. Each stop bar 112 is provided with a spring 112b (see Fig. 4) which tends to elevate the inner or radial portion of that stop when all of the selecting disks 113 together present a continuous vertical row of notches opposite the front or vertical portion of such stop bar.

The type wheel shaft 101a is provided with a projecting stop-arm 101b, arranged

to rotate with that shaft, and adapted to engage and be arrested by any stop bar 112 the inner end of which may have been raised by reason of the selection of that stop bar by the selecting disks 113. Such engagement arrests the type wheel with one of its type faces opposite the hammer or plunger 116a. For rotating the type wheel shaft 101a a spring 118 is provided on said shaft 101a, which spring is kept under substantially constant torque by intermeshing gears 118a and 118b, the latter driven by worm gearing 111 and 111a and a motor 110.

In order to release the stop arm 101b of the type wheel shaft 101a after the completion of each printing operation, and in order to depress that stop bar 112 which has been raised, two release magnets 107 and 108 are provided, having spring-retracted armature levers 107a and 108a with semi-circular extensions 107b and 108b located over the inner or radial portions of the stop bars 112. One or the other of these bars 107a and 108a, when they are pressed down by their springs, presses down any stop bar 112 which may have been elevated, and so releases the stop arm 101b and also frees the selecting disks from engagement by any one of the stop bars 112.

The type wheel 101 shown, though arranged to rotate with shaft 101a, is free for axial "shift" movement with respect to said shaft, and is provided with two circumferential rows of type faces, one or another of which rows will be opposite the end of the plunger or hammer 116a, according as the type wheel be in elevated or depressed position. For shifting this type wheel from lower position to upper, or back, a shift magnet 109 is provided the armature lever 109a of which is arranged to raise the type wheel when that magnet is energized, and to depress that type wheel when the magnet 109 is deenergized. The particular details of this shift mechanism form no portion of my invention, and such shift mechanisms are well known; hence description of the details of the shift mechanism shown is not thought to be required.

Certain of the so-called stop-bars, designated by numerals 112p—112z inclusive, are employed not for determining a particular character to be printed, but for controlling the circuits of the several auxiliary-function magnets, such as the line feed magnet 104, the letter space magnet 122, the carriage return magnet 106, and the shift magnet 109. Such auxiliary-function selecting bars or stop bars, are in construction substantially the same, and are arranged to be selected for operation in the same manner, by the disks 113, as the bars 112 which determine the particular characters to be printed; except that, if desired,

such auxiliary-function selecting bars need not be provided with means for engagement by the stop arm 101b, and hence are shown in Fig. 3, as shorter than the bars 112; and except that these bars 112p to 112z inclusive actuate electrical contacts, as illustrated in Fig. 7, in which figure the circuits whereby the contacts controlled by these auxiliary function selecting bars control their corresponding magnets, as well as the other circuits of the machine, and related circuits, are shown.

In Fig. 7 ML designates a main line relay, L the line circuit leading from the transmitting distributor D¹, (which is the distributor shown in Fig. 1^b) and D² is the receiving distributor of which only the rings and brushes required for receiving are shown, though in practice it is provided also with transmitting rings and brushes, and is substantially identical with distributor D¹ shown in Fig. 1^b. S¹ and RG¹ designate commutator rings employed for the control of the selecting relays, and BR¹ designates a corresponding brush adapted to connect electrically ring RG¹ with the several segments of the segmented ring S¹. S⁴ and RG⁴ are other commutator rings of the distributor D², and BR⁴ is a brush adapted to connect the several segments of the segmented ring S⁴, with the ring RG⁴. The commutator rings are shown "developed." R¹, R², R³, R⁴ and R⁵ are selecting relays, the magnet coils of each of which relays are connected electrically to one of the segments of the ring S¹ and are also connected electrically to a common return conductor 125 passing through normally closed contacts 133' and 134' of release magnet 108 and through conductor 125' to main current lead Y; one contact stop of relay ML being connected by conductor 127 to the opposite main current lead X. The main line relay ML may be understood to be a quick acting polarized relay, and its armature is connected by conductor 123 to distributor ring RG¹. It will be clear that, with the circuits arranged as shown, current impulses of one direction in line conductor L (positive pulses, for example) will cause relay ML to place current lead X in circuit with conductor 123, and so (if at such time brushes DR¹ are connecting ring RG¹ with one of the segments of the ring S¹ to which one of the five selecting relays R¹—R⁵ are connected) in circuit with one or another of selecting relays R¹—R⁵ inclusive, so energizing such one of the selecting relays; while current impulses in line wire L of the opposite direction will have no effect upon the selecting relays R¹—R⁵ inclusive.

Each of the selecting relays has a front contact connected to its magnet circuit, whereby when the corresponding armature of that selecting relay is attracted by clo-

sure of the magnet circuit of the relay as just described, another or holding circuit is completed through the magnet circuit of that relay, as follows: from current lead X through conductor 132 and the magnet coils of a release control relay 126 and one of the armatures and corresponding front contact stop of the particular selecting relay considered, and through the magnet coils of that relay to conductor 125 and thence through contacts 134' and 133' to current lead Y. It will thus be seen that upon the completion of a circuit from one of the segments of distributor ring S¹ through the magnet of the selecting relay corresponding to that segment, a holding circuit for that relay is completed which will hold such armature attracted until energization of the magnet 108, and consequent separation of contacts 133' and 134'. At the same time that such holding circuit is completed through the magnet of one of the selecting relays, another circuit is completed from current lead Y through conductor 131 and the back contact of relay 136 and the other armature of the particular selecting relay under consideration through a selecting magnet 113a corresponding to that particular selecting relay; and through conductor 131' to current lead X; each selecting magnet circuit being completed through the second armature of the corresponding selecting relay; such magnets 113a being the selecting magnets already referred to as shown in Fig. 2; and it will be clear that upon the energization of such selecting magnet 113a, its corresponding selecting disk 113 will be operated, as already described.

It will thus be apparent that according to the number and order of positive impulses contained in any one signal, transmitted through line conductor L, selecting disks 113 corresponding in number and in order to such positive impulses will be operated.

In Fig. 7 I have shown five only of the segments of ring S¹ connected to selecting relays R¹—R⁵ inclusive. In practice, other sets of five each of the segments of ring S¹ are connected similarly to other sets of selecting relays of other printers. For present purposes it has seemed sufficient, to show the circuits of one printer only; though in practice one distributor such as that of which the commutator ring S¹ forms a part, controls a number of printers.

After the last segment of ring S¹ to which a selecting relay of the set shown in Fig. 7 is connected electrically, has been passed by brush BR¹, brush BR⁴ connects current lead Y through ring RG⁴, a segment of ring S⁴, a conductor 129 and the front contact of release control relay 126, (the magnet of that relay having been energized and caused to attract its armature by the completion

of the previously traced holding circuits for the selecting relays) the armature of that relay and the magnet coils of a relay 130 to rear contact stop of a clear-out relay 127 and thence through the armature of relay 127 and conductor 135 to current lead X. The magnet of relay 130 (which relay may be termed the "release relay" since it controls the circuits of release magnets 107 and 108 already mentioned) is thereby energized, and its armatures attracted, thereby closing circuit from the current lead X through conductor 135 and the back contact of clear-out relay 127 and the magnet coil of relay 130 one of the armatures of relay 130 and magnets 107 and 108 to current lead Y. As previously explained, when magnets 107 and 108 are energized, the semi-circular armature extensions 107b and 108b of the armatures of these magnets are raised, thereby permitting that particular stop bar or selecting bar 112 which has been selected by the operation of the selecting disks 113, to enter the aligned row of notches of said disks 113 opposite it, and thereby to arrest stop arm 101b of the type wheel shaft when that stop arm comes opposite the elevated portion of such selected stop bar 112. The movement of release lever 108a separates contacts 133' and 134' (the effect of which will be shown later) and also causes the closing of contact between contacts 133 and 134, thereby closing a circuit from lead X through conductor 137 and the magnet coils of relay 136 and conductor 125' to lead Y. The magnet of relay 136 being thereby energized, a circuit is completed from lead X through conductor 135 and the armature of clear-out relay 127 and the rear contact of that relay, the armature 128 and corresponding front contact of relay 136, starting magnet 102, and through conductor 138 and contact stop 139 and contact spring 140 and conductor 141 to current lead Y. Thereby the starting magnet 102 is energized, and its armature detent 102a (Fig. 2) withdrawn from engagement with the ratchet wheel 101c on type wheel shaft 101b, thereby permitting spring 118 (Fig. 2) to start that shaft 101a, and with it the type wheel, in rotation; such rotation continuing until the stop arm 101b encounters the selected stop bar 112, as previously described.

The separation of contacts 133' and 134' consequent upon the energization of magnet 108, breaks the holding circuits of those selecting relays which have acted, permitting the armatures of those relays to return to normal; and for the same reason the armature of release control relay 126 returns to normal; but those selector disks 113 which have been actuated remain locked by the locking bar 112 selected, held down by levers 107a and 108a.

Stop arm 101b (shown in Fig. 7 near the

lower right hand corner of that figure) is in a circuit leading from current lead Y through the various stop bars or selecting bars 112 (of which one is shown diagrammatically in Fig. 7) and through such stop arm 101b (when such stop arm 101b is arrested by, and therefore is in contact with, one such stop bar 112) and thence through the printing magnet 116 and conductor 144, the main energizing coil of space-lock relay 145, and conductor 146 to the coil of clear-out relay 127, and thence to current lead X. Completion of this circuit by contact of stop arm 101b with one of the stop bars or selecting bars 112, besides energizing the printing magnet 116 and causing the hammer 116a (Fig. 2) to move forward, energizes the magnet of space-lock relay 145 and the magnet of clear-out relay 127.

Energizing the magnet of space-lock relay 145 attracts both armatures 149 and 150 of that relay. The attraction of armature 149 closes a holding circuit for the magnet of relay 145 from current lead Y through conductor 151, holding coil 152 of relay 145, armature 149 of that relay, conductor 153 and armature of spacing magnet 122 to current lead X. The attraction of the second armature 150 of space lock relay 145 closes circuit from current lead Y through conductor 154, the armature 150 and through the magnet coil of spacing magnet 122 to current lead X. Spacing magnet 122 therefore attracts its armature 122a (see also Fig. 2) causing the ratchet and pawl mechanism operated by that magnet to advance ratchet wheel 105 through the space of one tooth, so advancing the paper carriage 103 to the left through one letter space against the tension of spring drum 115. The holding coil 152 of the space lock relay 145 insures the operation of the letter spacing mechanism by the spacing magnet 122; for the armature of the relay 145 remains in attracted position until the armature 122a breaks contact with its coacting continuity preserving contact 122b, which it will not do until said armature 122a has moved a sufficient distance to insure the completion of the letter spacing operation. The breaking of contact between 122a and 122b breaks the circuit through the holding coil 152 of space lock relay 145, whereupon the two armatures of that relay are retracted and the magnet 122 deenergized (the circuit through the main coil of the magnet of relay 145 having previously been broken, as hereinafter described).

Clear-out relay 127, which attracted its armature when the magnet of the space lock relay was energized as previously described, thereby broke the circuit leading from current lead X through the back contact of that relay 127 and the magnet of release relay 130 and right hand armature of that relay 130

through release magnets 107 and 108 to current lead Y. The consequent deenergization of magnets 107 and 108 released, the locking bar 112 previously selected, and heretofore held down by lever 107a or 108a, and so permitted the selecting disks 113 which had been actuated to return to normal. The deenergization of magnet 108 also caused separation of contacts 133 and 134 with consequent deenergization of the magnet of start control relay 136 and therefore caused deenergization of the starting magnet 102.

If it is desired to move the paper carriage for letter spacing, without printing a character, a particular signal, consisting of a particular succession of positive and negative pulses, is transmitted, which causes the selection of a particular selecting bar 112v (Fig. 7) similar to the other selecting bars, except that there is no character on the type wheel corresponding to it; and this bar 112v, when selected, closes contact springs 157 and 158 (Fig. 7), thereby closing a circuit from current lead X through conductor 142, the magnet coil of clear-out relay 127 and conductor 146 and the main coil of space lock relay 145 and conductor 143, to contacts 134' and 133' of magnet 108 and thence to current lead Y. This particular selecting bar 112v is selected and operated in precisely the same manner as in any of the other selecting bars 112; which selection method has already been described and therefore need not be described again with respect to bar 112v. The energization of the magnet of space lock relay 145, which results from the selection and operation of this selecting bar 112v, effects the energization of the spacing magnet 122, and the subsequent restoration of the parts to their normal position, just as previously described with reference to the regular selecting bars 112. But owing to the fact that the clear-out relay 127 receives current immediately upon closing of the contact by selecting bar 112v, which follows immediately upon energization of magnet 108, and then immediately breaks the circuit (if any) for starting magnet 102, which circuit for the starting magnet 102 is closed, (if at all) by relay 136 only after magnet 108 has been energized, and since in the magnet circuit of relay 136 there is a retardation coil 136a, the starting magnet does not receive current in time to cause its armature to release the type wheel shaft 101a during letter spacing only, as described; in this respect the operation of letter spacing only differs from the operation of letter spacing which accompanies the printing of a character; for in the case of letter spacing accompanying the printing of a character, the space lock relay 145 is not energized, until after the stop arm 101b has contacted with the particular stop bar 112 selected, while the starting magnet 102 is energized

immediately following the energization of release magnets 107 and 108, and, necessarily, before contact is closed between the selected stop bar 112, and stop arm 101b; whereas in letter spacing only, contact is closed between 157 and 158 immediately following the energization of magnets 107 and 108, and therefore magnet 122 and the magnet of clear-out relay 127 are energized before magnet 102, so that relay 127 breaks the circuit of magnet 102 before that magnet has had an opportunity to operate its armature to release the type wheel.

Line spacing is accomplished similarly, by selecting a particular selecting bar 112w causing a contact spring 140 to close contact with contact spring 160 and thereby to complete a circuit from current lead Y through contact springs 140 and 160 to the line space magnet 104 and thence to current lead X. The energization of magnet 104 not only operates the line space mechanism, but also causes armature 104a to close circuit from current lead Y through armature 104a, and conductor 146, to the coils of clear-out relay 127, and to current lead X; the energization of the magnet of this clear-out relay restoring the parts to normal as previously explained.

As previously explained, the type wheel is provided with two circumferential rows of type faces, one above the other. The upper row of type faces is the row normally in use. When it is desired to raise the type wheel to bring the lower row of type faces into operative position, a particular signal is transmitted, which causes the selection of a particular selecting bar 112x which, when it operates, closes contact between contact springs 164 and 165 completing a circuit from current lead Y through other contact springs 167 and 168 to the shift magnet 109 and thence through contact springs 164 and 165 to the coils of clear-out relay 127 and thence to current lead X. The consequent energization of the magnet 109 shifts the type wheel (the details of the mechanism by which this magnet shifts the type wheel being unimportant for present purposes, since various mechanisms for that purpose are well known) and also the magnet 109 attracts an armature 109a.

This armature 109a, when attracted, closes circuit from current lead X through conductors 171 and 172 through the front contact and armature 109a of magnet 109 and the magnet coils of that magnet and through contact springs 168 and 167 to lead Y. Thereby the magnet 109 is held energized (and, consequently, the type wheel is held in elevated position) until a subsequent special release signal deenergizes magnet 109 as will next be described.

To deenergize magnet 109 and so to restore the type wheel to its lower position, a

special selecting bar 112_y is selected. This bar, when it operates, moves contact spring 167 out of contact with spring 168, thus breaking the connection through magnet 109 to lead Y, thereby deenergizing magnet 109 and so permitting the type wheel to drop. At the same time, selecting bar 112_y closes contact between contact spring 167 and another contact spring 173, whereby a circuit is completed from lead X through the coils of clear-out relay 127 and conductor 163 and through contact springs 173 and 167 to lead Y; the apparatus being thereby cleared for actuation by another signal transmitted through the line.

For carriage-return another selecting bar 112_z is selected by transmission through the line of an appropriate signal, and thereby contact is closed between contact springs 174 and 175; a circuit being thereby closed from lead X through the coils of clear-out relay 127 and conductor 176 and thence through contact springs 174 and 175 and magnet coils of carriage-return magnet 106 to lead Y. Energization of the magnet 106 causes its armature 106_a to release the ratchet wheel 105, and the spring drum 115 then returns the carriage to the right; and at the same time the attraction of the armature 106_a closes contact between contact points 178 and 179, completing a circuit from lead X through conductors 171 and 172 and contact springs 178' and 179' (which at the instant are in contact with one another) and through contact points 178 and 179 and the coils of magnet 106 to lead Y. While the clear-out relay 127 is operated immediately upon the closing of contact between 174 and 175, magnet 106 operates sufficiently quickly to attract its armature 106_a before the circuit through the coils of magnet 106 is broken through the return to normal position of selecting bar 112_z; and the closing of the holding circuit through the coils of magnet 106 retains the armature 106_a in attracted position, and therefore leaves the ratchet wheel 105 free to rotate backward until contact between 178' and 179' is broken. Contacts 178' and 179' are carriage contacts which are opened by a stud 105_d on the ratchet wheel 105 when the paper carriage 103 has returned clear to its right hand position; and when such contacts 178' and 179' are so opened by the carriage, magnet 106 is deenergized and the apparatus is ready for the reception of another signal.

In the diagram of the circuits of the printer, contained in Fig. 7, there are various features illustrated which are not essential to an understanding of the present invention; and therefore description of such features has been omitted.

Referring now to Fig. 1^a and to Figs. 8-11 inclusive, showing the auxiliary signaling or service signaling apparatus, 201 desig-

nates a rotatable shaft upon which are mounted circuit-controlling toothed wheels 202, 203 and 204, adapted to actuate contact devices hereinafter described, and upon which shaft is also mounted an escapement wheel 205. Shaft 201 is provided with a pinion 206 in mesh with a gear 207 mounted loosely on a shaft 208. Upon this shaft 208 is an operating lever 209 having a peripheral flange 210 in which are a plurality of holes into which the operator may insert his finger, or some suitable instrument, and then draw the operating lever 209 forward until such motion is arrested by the stationary stop 211. The operator then withdraws his finger, or the instrument by which he has so moved operating lever 209, permitting that lever to return under the influence of a spring 212, which spring has been wound by the previous motion forward of operating lever 209. Gear 207 has projecting from it a pin 213 carrying a pawl 214 engaging the teeth of a ratchet wheel 215 on shaft 208. When lever 209 is drawn forward, to wind spring 212, the pawl 214 ratchets over the teeth of ratchet wheel 215, but during the return motion of shaft 208 the pawl 214 is engaged by a tooth of the ratchet wheel 215, and caused to rotate backward, with shaft 208, carrying with it gear 207 and so imparting rotation to shaft 201 and the signal wheels 202, 203, and 204 on such shaft. However, shaft 201 can rotate only as permitted by the escapement lever 216, which engages the escapement wheel 205, this escapement lever 216 forming a part of the armature 217 of a magnet TM_a which is then substituted in circuit 27, as will be shown presently, for the magnet TM of the transmitter T¹ (Fig. 1^b). The conductor 27 (Figs. 1^b and 7) leading from one segment of the distributor ring S⁴ of distributor D¹ to the magnet TM of the transmitter T¹, before it reaches magnet TM passes to a terminal *f* of the auxiliary signaling apparatus and thence as conductor 27' to a contact spring M², normally in contact with another contact spring M¹ itself connected by conductor 27'' with a contact member M₀ normally in contact with a fixed contact member S_y; whence the circuit passes through conductor 27''' to coil *r*', of a relay R and thence through conductor 27'''' to terminal *e* and thence as conductor 27''''' to the magnet TM and thence to ground. As stated, normally, contact is closed between M¹ and M², so that in the normal operation of the transmitting apparatus shown in Fig. 1^b, the apparatus shown in Fig. 1^a plays no part so far as magnet TM is concerned. But when operating lever 209 (Fig. 1^a) is drawn forward as described, and arm SA carried by shaft 208 is moved away from contact spring M², thereby permitting such spring M² to break contact

with contact spring M^1 , and permitting spring M^2 to make contact with another contact spring M^3 , conductor 27' is connected by conductor 27a to the coils of magnet TMa and thence, by conductor 27b the circuit passes to terminal plate d to ground. One effect of pulling operating lever 209 forward, therefore, is to transfer the circuit of conductor 27 (Fig. 1^b) from magnet TM to magnet TMa (Fig. 1^a). Each time the brushes of distributor D^1 (Fig. 1^b) rotate contact is made through brush BR^4 by the ring RG^4 and segment 9 of ring S^4 , and thereby, once in each rotation of such brushes, magnet TMa (Fig. 1^a) is energized (when the circuit 27 has been so transferred to magnet TMa), and its armature 217 attracted, and then, as contact of brush BR^4 with segment 9 is broken, the armature 217 is retracted by its retractile spring 218; and for each such double movement of the armature 217 the escapement lever 216 permits escapement wheel 205 and shaft 201 to rotate through the space of one tooth of wheel 205 under the influence of spring 212. The extent of rotation of shaft 201 in this manner will depend upon how far the operating lever 209 of the auxiliary signal apparatus has been pulled forward; for it is not until that lever 209 has moved back clear to normal position that arm Sa engages contact spring M^2 and causes that spring to break contact with spring M^3 and to make contact with spring M^1 , thus transferring the circuit 27 from magnet TMa (Fig. 1^a) to magnet TM (Fig. 1^b).

The rotation of the shaft 201 in this manner rotates the signal wheels 202, 203 and 204, causing those wheels to operate their corresponding contact devices 202a, 203a and 204a, and thereby to transmit through the segments 1-5 inclusive of ring S^3 of distributor D^1 , signals to cause the appropriate operation of the selecting device of the receiving printer. In so doing, the contact devices of wheels 202, 203 and 204, operate just as if they were contacts of the transmitter T^1 ; that is to say, these contact devices of the auxiliary signaling apparatus transmit code signals which cause the selection of appropriate selector bars of the selecting device of the receiving printer; and to this end certain of the contact springs of contact devices 202a, 203a and 204a, are connected through certain of terminals $a, b, c, d, e, f, g, h, i, k$ and l , with appropriate contact members of the transmitter T^1 , so that the operation of the contact devices 202a, 203a and 204a has the same effect on the circuits as if corresponding contact combinations were set up in transmitter T^1 and the corresponding signals transmitted through the line circuit. The particular details of the connections of contact devices 202a, 203a

and 204a depend, of course, upon the particular code signals chosen for the selection of appropriate selecting bars of the receiving printer; and of course, any code signals within the capacity of the system might be allotted for the selection of the appropriate selecting bars of the receiving printer; hence it is not thought necessary to describe in detail the connections of the contact brushes of contact devices 202a, 203a and 204a, though the same are clearly shown in Fig. 1^a and in Fig. 7.

The first effect of the rotation of signal wheels 202, 203 and 204 is to cause the transmission of the signal which will cause the selection of the shift selecting bar 112x (Fig. 7) with consequent closing of contact between contact springs 164 and 165 and the energization of shift magnet 109 and the attraction of the armature 109a of that magnet, with consequent closing of a holding circuit through that magnet. The next effect of the rotation of the signal wheels 202, 203 and 204 is to cause the selection of a selecting bar 112p, whereby contact is closed between contact springs 219 and 220 with consequent energization of the magnet of relay 221, causing the ringing of a bell 222; and the further effect of the rotation of the signal wheels is to cause the selection of shift return selecting bar 112y and the consequent breaking of contact between contact springs 167 and 168 and closing of contact between contact springs 167 and 173, with consequent deenergization of the shift magnet 109 and the return of the parts to normal.

If the operating lever 209 of the auxiliary signal apparatus has been moved through more than one space, the operations of the contact devices 202a, 203a and 204a above described will be repeated, to the end that the bell 222 will be rung a number of times corresponding to the number of spaces through which the operating lever 209 has been moved.

P, in Fig. 1^b, designates a perforator by which the tape TS is perforated according to the messages to be transmitted. It is not necessary to illustrate or describe the construction of this perforator, as such perforators are well known. The tape TS passes first through this perforator, and therein is perforated according to the messages to be transmitted, and then passes in a loop to the transmitter T^1 . It is desired that the loop of tape intermediate the perforator and transmitter shall be maintained; and it is further desired that if, at any time, the length of this loop shall reach some predetermined minimum, then the transmitter shall be stopped automatically. To this end, a rod Le mounted to have a rocking motion, is located within the bight of the tape loop, and is arranged to be lifted, against the ten-

sion of a spring PS by the tape itself, when the tape loop reaches such predetermined minimum length. The lever Le' which carries this rod Le , is provided with contact Mo previously mentioned, normally in contact with the fixed contact piece Sy ; and as already shown, the conductor $27''-27'''$ passes through these contact points Mo and Sy to one coil r' of the relay R. This relay R has another coil r'' connected to the coil r' , the conductor $27''''$ leading from the "split" or point of junction of coils r' and r'' to terminal e , as already described; and there is a further conductor 233 leading from terminal f to contact point 224 of the relay, normally in contact with a contact point 225 of the relay, itself connected to coil r'' of the relay. The relay has an armature 226, normally out of contact with contact point 225, but which, when attracted by the magnet, causes contact 225 to break contact with contact stop 224.

Magnet coils r' and r'' are so wound as to neutralize each other when both are energized.

When rod Le is raised by the tape (or when it is raised manually, for this rod is also used as means for stopping the operation of the transmitter manually) the circuit $27''-27'''$ is broken, thereby deenergizing relay coil r' , the circuit path through conductor 223 and contact points 224 and 225 and coil r'' to conductor $27''''$ remaining intact, for the moment, and so causing armature 226 to be attracted, when, upon receipt of the next transmitter-operating impulse through magnet TM of transmitter T^1 (Fig. 1^b), coil r'' is energized through conductors 223 and $27''''$. The armature 226 of relay R then breaks this circuit $223-27''''$ between contact points 224 and 225, thereby breaking the circuit through magnet TM of the transmitter T^1 (Fig. 1^b) and so stopping that transmitter. Magnet coil r'' is held energized, and the armature 226 is held in attracted position, by current from the terminal c through conductor 227, non-inductive resistance 228 (which, in practice, is wound with the windings of the relay R) armature 226, and contact point 225, magnet winding r'' and conductor $27''''$ to terminal e . Thereby once rod Le has been raised, the magnet or relay R is held energized, and the transmitter T^1 is held inoperative, until, after the rod Le has been lowered, the circuit through coil r' of relay R is restored, coil r' then neutralizing coil r'' and permitting retraction of the armature 226.

A signal lamp La is connected by a conductor 229 (also leading from terminal c) with the armature 226 of relay R. This lamp is lighted when contact is made between armature 226 and contact pin 225, and remains lighted until rod Le is lowered.

It is desirable that when contact is broken between Mo and Sy , through the raising of rod Le , either by the action of the tape or by hand, the magnet TM shall be energized, so as to withdraw the pins 35 from the tape, and that such magnet shall remain energized while contact is being broken between Mo and Sy , so that another combination of contacts may not be set up in the transmitter, and the signal corresponding to such combination of contacts repeated indefinitely at the receiving end of the line while the transmitter is held arrested. To this end, when contact is broken between Mo and Sy , another circuit path is provided from the segment numbered 9 and ring S^4 of the distributor through conductor 27, terminal f and conductor 223, contacts 224 and 225 of relay R, coil r'' of that relay and conductor $27''''$ to terminal e and thence through transmitter magnet TM to ground. This circuit path continues for an instant only, but energizes coil r'' (coil r' being then deenergized) attracting armature 226 of the relay and so closing a circuit from the generator connected to terminal c , through conductor 229, relay armature 226, contact 225, relay coil r'' , conductor $27''''$ to terminal e and thence through conductor $27''''$ and transmitter magnet TM to ground at 28. The magnet TM is thereby held energized, and therefore all the pins 25 of the transmitter are held away from the tape; all of the contact tongues K^1-K^5 inclusive of the transmitter are thereby held in contact with their stops 25, so that during succeeding rotations of the distributor brush BR^3 , current impulses of one direction only will be transmitted through line wire L. Such current impulses of that direction do not cause any operation of the receiving printer; and therefore the receiving printer remains stationary until, through the lowering of rod Le , current is established again through coil r' of relay R, thereby neutralizing the action of coil r'' of that relay, permitting the armature 226 of the relay to retract, and so reestablishing normal conditions.

Rod Le , when raised, is held in the raised position, by a jockey spring 230, which spring, however, will yield, when that rod is lowered by hand.

For convenience in following the circuits, the rod Le and the contacts Mo and Sy are shown in Fig. 1^a; and these parts are also shown again in Fig. 1^b, in their proper location with the rod Le in the bight of the tape.

The particular relay R illustrated is one of well known type, and in this relay as actually constructed, the armature 226 is not itself a contact member, as indicated diagrammatically in Fig. 1^a, that armature instead actuating a spring contact member

226', causing that member 226' to contact with contact member 225, when the armature is attracted, and then to separate 225 from 224. The armature, it will be seen, moves horizontally.

The escapement 205—216, shown in perspective in Fig. 1^a and in detail in Figs. 10 and 11, is of well known double-dog type, the escapement lever 216 having two dogs 216^a and 216^b. When the armature 217 is retracted dog 216^a is in engagement with a tooth of ratchet wheel 205. When that armature is attracted dog 216^a moves laterally out of the path of that tooth of the escapement wheel, permitting such ratchet wheel tooth to drop into engagement with dog 216^b. When the armature 217 is retracted again, the next tooth of the escapement wheel engages dog 216^a.

The operation of the apparatus is as follows:

In the normal operation of the telegraph system, the tape TS is perforated, by means of the perforator P, according to the message to be transmitted, and the tape so perforated then passes into the transmitter T¹. The two distributors D¹ and D² may be assumed to be in operation, i. e., their brushes are traveling over the surfaces of the commutator rings of these distributors, and are rotating in synchronism, such synchronism being maintained by any suitable means, such for example as that set forth in the Yorke-Benjamin application Serial No. 654, above mentioned. Each time the segment numbered 9 of ring RG⁴ of distributor D¹ makes contact with its brush BR⁴, magnet TM of transmitter T¹ is energized momentarily, thus pulling down any of the feeler pins 35 which may have been elevated and at the same time causing the star wheel 43 to advance the tape TS one space. As soon as brush BR⁴ has left segment 9 of ring S⁴, the magnet TM is again deenergized, and such of the feeler pins 35 as may then be underneath perforations of the tape TS are permitted to rise through those perforations, thereby setting up a series of contacts in the transmitter; and when brush BR³ of distributor D¹ next passes over the segments 1—5 inclusive of ring S³, corresponding to the contacts thus set up in the transmitter, current pulses are transmitted through the line L which operate the main line relay ML (Fig. 7). Since at such time the brush BR¹ of distributor D² is passing over the segments numbered 1—5 inclusive of ring S¹ of that distributor, a corresponding combination of the selecting relays R¹—R⁵ inclusive connected to that distributor D² are actuated, and thereby the corresponding selecting disks 113 of the receiving printer are actuated, whereby one or another of the selecting bars or stop bars 112 (or, possibly, one of the contact actuating bars 112^v—112^z) is selected

and depressed upon the immediately following energization of magnets 107 and 108. If it is one of the stop bars 112 which has been so selected, the type wheel will be arrested at the proper point, and then, through the energization of the printing magnet 116, the corresponding character will be imprinted upon the sheet of paper carried by the paper carriage 103. Should one of the contact operation bars 112^v—112^z be actuated, then, instead of a character being printed on the paper, the contacts operated by that bar 112^v—112^z will be actuated, and according as one or another of the bars 112^v—112^z is selected and actuated, the paper carriage will be spaced to the left, or the line feed mechanism will be operated, or the carriage will be returned, or the type wheel will be shifted, or returned.

If, during this normal operation, the stop bar Le of the automatic stop apparatus be raised, either through the bight of the tape TS growing too short, or because lever Le has been raised by hand, then the branch 27''—27''' of the circuit 27 leading to the transmitter magnet TM will be broken between contacts Mo and Sy, thereby deenergizing coil r' of relay R and permitting coil r'' of that relay to attract the armature 226, thereby closing a circuit from ground through the generator connected to terminal c (Fig. 7) conductor 229, lamp La and resistance 228 (in multiple), armature 226, contact 225, coil r'', conductor 27'''' and terminal e, conductor 27''''' and magnet TM to ground at 28, thereby holding the transmitter magnet TM energized so long as stop rod Le remains in its elevated position. The energization of this magnet TM stops the transmitter, because while that magnet TM is energized, all of the feeler fingers 35 of the transmitter are held out of engagement with the tape, and so no signal-combinations are set up for transmission to the receiving printer. When stop rod Le is lowered, the circuit through the coil r' of relay R is re-established, whereby the magnet of relay R is deenergized through neutralization of the action of relay r'' by the action of relay r', and the operation of the transmitter proceeds.

It will be noted that since, when stop rod Le is raised, the circuit holding magnet TM of the transmitter energized, is not established until after a current pulse has been transmitted through coil r'' of relay R from the segment number 9 of ring S⁴ of distributor D¹, the magnet TM cannot be energized, and the feeler pins 35 drawn down, while a signal already set up in the contacts of a transmitter is being transmitted. While of course the time interval occupied by the passage of brush BR³ over segments numbered 1—5 inclusive of the ring S³ of distributor D¹ is very short, yet except for

the action of the relay R it might happen, sometimes, that the magnet TM would be energized through rise of stop rod Le at the instant while the brush BR³ is passing over those segments 1-5 inclusive; and in such case mutilation of the signal might occur. The action of the relay R, as above described, makes such mutilation of signals impossible. The action of that relay R also absolutely prevents magnet TM being de-energized, and a signal combination set up in the transmitter, until that rod Le is lowered again.

Supposing now that the transmitting operator desires to send to the receiving end of the line one of the signals which the service-signal transmitting device shown in Fig. 1^a is adapted to send. The transmitting operator then places his finger in the appropriate hole or operating lever 209 and draws that operating lever over until motion of that lever is arrested by the stop 211. The operator then releases lever 209. The first effect of pulling the lever 209 over as described, is to break contact between contact springs M¹ and M², and to make contact between springs M² and M³, thereby transferring the circuit 27 from the main transmitter magnet TM to the service-signal transmitter, magnet TM_a. After the operator has released lever 209, when brush BR⁴ next encounters segment numbered 9 of ring S⁴ of distributor D¹, a current pulse is sent through the circuit 27 and magnet TM_a, thereby attracting armature 217; and permitting escapement wheel 205 to rotate through the space of half a tooth under the influence of springs 212; and upon the immediately following deenergization of this circuit 27, through passage of brush BR⁴ off segment 9, the armature 217 is retracted, permitting the escapement wheel 205 to rotate through another space of half a tooth. On the next succeeding rotation of brush BR⁴, magnet TM_a is again energized and deenergized in the same manner, the escapement wheel 205 rotating through another tooth space, and so on; and such rotation of the escapement wheel 205 causes the signal wheels 202, 203 and 204 to operate their transmitting contacts, thereby sending through ring S³ of distributor D the corresponding signal; which signal has the same effect upon the selecting apparatus of the receiving printer as if the same signal had been sent through transmitter T¹. The first effect of the signal so sent by the service signal apparatus shown in Fig. 1^a, causes selection of selecting bar 112_x, with consequent energization of magnet 109 and the locking up of the armature 109_a of that magnet, thereby completing a circuit to contact spring 219. The next effect of the operation of the service-signal apparatus shown in Fig. 1^a is to cause the selection of select-

ing bar 112_p, whereby contact is closed between springs 219 and 220, thereby energizing the magnet of relay 221, and so completing a circuit through bell 222. The next effect of the operation of the service-signal apparatus shown in Fig. 1^a is to cause the selection of selecting bar 112_y, whereby the holding circuit of magnet 109 is broken, with consequent deenergization of the magnet of relay 221 and restoration of the parts to normal.

If operating lever 209 of the service-signal apparatus has been moved through a space of more than one tooth, the signal wheels continue to rotate, and the above mentioned series of operations, *i. e.*, the selection first of selecting bar 112_x, then the selection of bar 112_v, and then the selection of bar 112_y, is repeated, causing the bell 222 to be rung again, and the bell is rung a number of times corresponding to the number of spaces through which operating lever 209 of the service-signal apparatus has been moved.

When the service signal operating lever 209 has returned to normal position, contact is broken between springs M² and M³, and contact is closed between springs M² and M¹; and thereby the circuit 27 is transferred from magnet TM_a to the magnet TM of that main transmitter, that transmitter T¹ then beginning operation as before.

It will be seen that when contact is broken between M¹ and M², due to the operation of the service-signal apparatus, magnet TM_a is not energized until the distributor brush BR⁴ encounters segment 9 of ring S⁴. At the same instant that magnet TM_a is so energized relay coil *r*' is energized (while relay coil *r*' is not energized, the circuit through coil *r*' having been broken between contacts M¹ and M²); therefore, the armature 226 of relay R being attracted, a circuit is completed from the generator connected to terminal *c* through coil *r*' of relay R, conductors 27'''' and 27'''' and magnet TM of the main transmitter, thereby energizing that magnet and holding it energized until, when contact is again closed between springs M¹ and M², upon the return of the service-signal transmitter to normal condition, relay coil *r*' is neutralized by relay coil *r*'. By this means the operation of the main transmitter, while the auxiliary or service signal transmitter is operated is prevented.

What I claim is:

1. A printing telegraph system comprising in combination a line conductor, automatic transmitting means therefor, a receiving printer, and auxiliary signal receiving means and auxiliary transmitting means arranged to operate the auxiliary signal receiving means through the receiving printer.

2. A printing telegraph system comprising in combination a line conductor, main

automatic transmitting means therefor, a receiving printer, and auxiliary signal receiving means for said line conductor and auxiliary signal transmitting means arranged to operate said auxiliary signal receiving means and comprising means whereby such auxiliary signal transmitting means, when operated, is connected to said line circuit and functionally disconnects the main transmitter from such line conductor.

3. A printing telegraph system comprising in combination a line conductor, main automatic transmitting means therefor, a receiving printer, and auxiliary signal receiving means for said line conductor, and auxiliary signal transmitting means arranged to operate said auxiliary signal receiving means and comprising contact means, and operating means therefor, arranged when operated to cause said contact means to transmit one or another of a plurality of predetermined code signals.

4. A printing telegraph system comprising in combination a line conductor, main automatic transmitting means therefor, a receiving printer, and auxiliary signal receiving means for said line conductor, and auxiliary signal transmitting means arranged to operate said auxiliary signal receiving means and comprising contact means, and operating means therefor, arranged when operated to cause said contact means to transmit one or another of a plurality of predetermined code signals, and arranged also to functionally disconnect the main transmitter from such line circuit prior to the transmission of such code signals.

5. A telegraph system comprising in combination a line conductor, synchronously operated distributors therefor, automatic transmitting means arranged to transmit code signals through said distributors and the line conductor, main receiving means and auxiliary receiving means both arranged to receive signals through one of said distributors, and auxiliary transmitting means arranged to operate the auxiliary signal receiving means through said distributors and the line conductor.

6. A telegraph system comprising in combination a line conductor, synchronously operated distributors therefor, automatic transmitting means arranged to transmit code signals through said distributors and the line conductor, main receiving means and auxiliary receiving means both arranged to receive signals through one of said distributors, and auxiliary transmitting means arranged to operate the auxiliary signal receiving means through said distributors and the line conductor, and comprising means whereby such auxiliary signal transmitting means, when operated, functionally disconnects the main transmitter from such line conductor.

7. A printing telegraph system comprising in combination a line conductor, main automatic transmitting means therefor, a receiving printer, and auxiliary signal receiving means for said line conductor, and auxiliary signal transmitting means comprising contact means and operating means therefor, itself comprising a movable member having a predetermined code-signal formed thereon and arranged to operate such contact means according to such code signal.

8. A printing telegraph system comprising in combination a line conductor, main automatic transmitting means therefor, a receiving printer, and auxiliary signal receiving means for said line conductor, and auxiliary signal transmitting means comprising contact means and operating means therefor, itself comprising a movable member having a predetermined code-signal formed thereon and arranged to operate such contact means according to such code signal one or more times according to the way such auxiliary signal transmitting means is operated.

9. A printing telegraph system comprising in combination a line conductor, main automatic transmitting means therefor, a receiving printer, and auxiliary signal receiving means for said line conductor, and auxiliary signal transmitting means comprising contact means and operating means therefor, itself comprising a movable member having a predetermined code-signal formed thereon and arranged to operate such contact means according to such code signal, said auxiliary signal transmitting means further comprising means whereby the main transmitter is functionally disconnected from the line conductor when such auxiliary signal transmitting means is operated.

10. A telegraph system comprising in combination a line conductor, automatic transmitting means arranged to transmit code signals through that line conductor, main signal receiving means and auxiliary signal receiving means, the main signal receiving means comprising selecting means arranged to be operated by code signals transmitted over that conductor, such selecting means comprising a plurality of circuit-operating selecting members, a circuit for said auxiliary receiving means controlled by one of said selecting members, means, comprising locking means, also controlling that circuit and controlled by a second of said selecting members, means controlling said locking means and controlled by a third of said selecting members, and auxiliary signal transmitting means arranged when operated to transmit code signals to cause, first, the operation of the second of said selecting members, then the first of said selecting

members, and then the third of said selecting members.

11. A telegraph system comprising in combination a line conductor, automatic transmitting means arranged to transmit code signals through that line conductor, main signal receiving means and auxiliary signal receiving means, the main signal receiving means comprising selecting means arranged to be operated by code signals transmitted over that conductor, such selecting means comprising a plurality of circuit-operating selecting members, a circuit for said auxiliary receiving means controlled by one of said selecting members, means, comprising locking means, also controlling that circuit and controlled by a second of said selecting members, means controlling said locking means and controlled by a third of said selecting members, and auxiliary signaling transmitting means arranged when operated to transmit code signals to cause, first, the operation of the second of said selecting members, then the first of said selecting members, and then the third of said selecting members, said auxiliary signal transmitting means further arranged, when operated, to functionally disconnect the main transmitter from the line conductor.

12. A telegraph system comprising in combination a line conductor, synchronously operated distributors therefor, main automatic transmitting means arranged to transmit code signals through said distributors and the line conductor and comprising a controlling magnet, a controlling circuit for said magnet, the distributor associated with such transmitting means having a contact controlling such magnet circuit, and auxiliary signal transmitting means comprising a controlling magnet and signal transmitting means controlled by that magnet, and contact means arranged, when said auxiliary signal transmitting means is operated, to substitute the magnet of said auxiliary transmitting means for the magnet of said main signal transmitting means in the said magnet circuit controlled by the distributor.

13. A telegraph system comprising in combination a line conductor, synchronously operated distributors therefor, main automatic transmitting means arranged to transmit code signals through said distributors and the line conductor and comprising a controlling magnet, a controlling circuit for said magnet, the distributor associated with such transmitting means having a contact controlling such magnet circuit, and auxiliary signal transmitting means comprising a rotary operating member spring actuated in one direction and arranged to be actuated otherwise in the other direction against its spring, signal transmitting means arranged to be operated by said operating member when driven by its spring, means,

comprising an escapement and an operating magnet therefor, controlling the operation of such signal transmitting means, the magnet of said escapement being controlled by the distributor which also controls the said main transmitting means.

14. A telegraph system comprising in combination a line conductor, synchronously operated distributors therefor, main automatic transmitting means arranged to transmit code signals through said distributors and the line conductor and comprising a controlling magnet, a controlling circuit for said magnet, the distributor associated with such transmitting means having a contact controlling such magnet circuit, and auxiliary signal transmitting means comprising a rotary operating member spring actuated in one direction and arranged to be actuated otherwise in the other direction against its spring, signal transmitting means arranged to be operated by said operating member when driven by its spring, means, comprising an escapement and an operating magnet therefor, controlling the operation of such signal transmitting means, said auxiliary signal transmitting means further comprising contact means arranged when said auxiliary signal transmitting means is operated, to substitute the said escapement means in the magnet circuit controlled by the distributor.

15. A telegraph system comprising a main transmitter having a magnet controlling its operation, which magnet, when energized, prevents the transmission of signals by said transmitter, a circuit for said magnet and means for sending current impulses through said circuit periodically to alternately energize and deenergize said magnet, an auxiliary transmitter having a contact which is opened when said auxiliary transmitter is operated and remains open until said auxiliary transmitter returns to normal condition, the said magnet circuit of the main transmitter having two branches, one of which passes through the said contact of the auxiliary transmitter, and means for energizing the said transmitter magnet through the other branch of the said circuit and holding such magnet energized until the said contact of the auxiliary transmitter is closed.

16. A telegraph system comprising a main transmitter having a magnet controlling its operation, which magnet, when energized, prevents the transmission of signals by said transmitter, an auxiliary transmitter having a contact which is opened when said auxiliary transmitter is operated and remains open until said auxiliary transmitter returns to normal condition, and means operated by the operation of such contact and arranged to close a circuit through the said transmitter magnet, when said contact

is opened, and to hold such circuit through the transmitter magnet closed, until the said contact is again closed.

17. A telegraph system comprising a main transmitter having a magnet controlling its operation, which magnet, when energized, prevents the transmission of signals by said transmitter, a circuit for said magnet and means for sending current impulses through said circuit periodically to alternately energize and deenergize said magnet, an auxiliary transmitter having a contact which is opened when said auxiliary transmitter is operated and remains open until said auxiliary transmitter returns to normal condition, the said magnet circuit of the main transmitter having two branches, a relay having opposing magnet coils one for one branch of such circuit, the other for the other branch of such circuit, one branch of said circuit passing also through the said contact of the auxiliary transmitter, said relay having a contact arranged to hold closed the other branch of said circuit, during the time that the first mentioned branch of that circuit is broken by the auxiliary transmitter contact, such relay contact arranged to hold its branch circuit closed, independent of the means for sending current impulses through the magnet circuit periodically, whereby said main transmitting magnet is held energized so long as the auxiliary transmitter contact holds open the circuit through the corresponding relay coil.

18. A signaling system comprising a current controller adapted to selectively provide different current combinations, mechanism for interrupting the normal operation of said controller and providing a characteristic current combination, and a member for selecting a desired current combination and initiating the operation of said mechanism.

19. A signaling system comprising a selectively operated current controller, means co-operating therewith to produce a selective succession of current impulses, mechanism co-operating with said means and interrupting the normal operation of said controller to substitute a characteristic combination of impulses, and a member for selectively affecting and initiating the operation of said mechanism.

20. A signaling system comprising a current controller adapted to selectively provide current combinations, cams and circuit connections for interrupting the normal op-

eration of said controller and selectively providing a plurality of characteristic current combinations, an electro-magnet for causing the actuation of said cams, and a manually actuated control member for initiating the operation of said electromagnet and selecting the combinations of impulses formed.

21. In a signaling system, the combination of a current controller adapted to selectively effect various current combinations, an intermittently operating actuating electromagnet therefor, a plurality of cams co-operating with said controller to affect the normal operation thereof and to provide characteristic current combinations dependent upon the extent of their rotation, an electromagnetically actuated device for rotating said cams, and a manually actuated control member and co-operating circuit connections for determining the extent of rotation of said cams, arresting the intermittent operation of said electromagnet and initiating the operation of said device.

22. A signaling mechanism comprising a cam shaft, a plurality of cams thereon, a plurality of switches controlled by said cams for providing a sequence of current impulse combinations, a spring for rotating said shaft, a manually actuated control member for winding said spring, an escapement for controlling the unwinding of said spring, an electromagnet therefor, and an operating circuit for the electromagnet controlled by said member.

23. A telegraph system comprising a main transmitter having a magnet controlling its operation, which magnet when energized, prevents the transmission of signals by said transmitter, an auxiliary transmitter having a contact which is opened when said auxiliary transmitter is operated and remains open until said auxiliary transmitter returns to normal condition, and means operated by the operation of such contact and arranged to close a circuit through the said transmitter magnet, when said contact is opened, and to hold such circuit through the transmitter magnet closed, until the said contact is again closed.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WALTER A. HOUGHTALING.

Witnesses:

H. M. MARBLE,

PAUL H. FRANK.