

April 21, 1925.

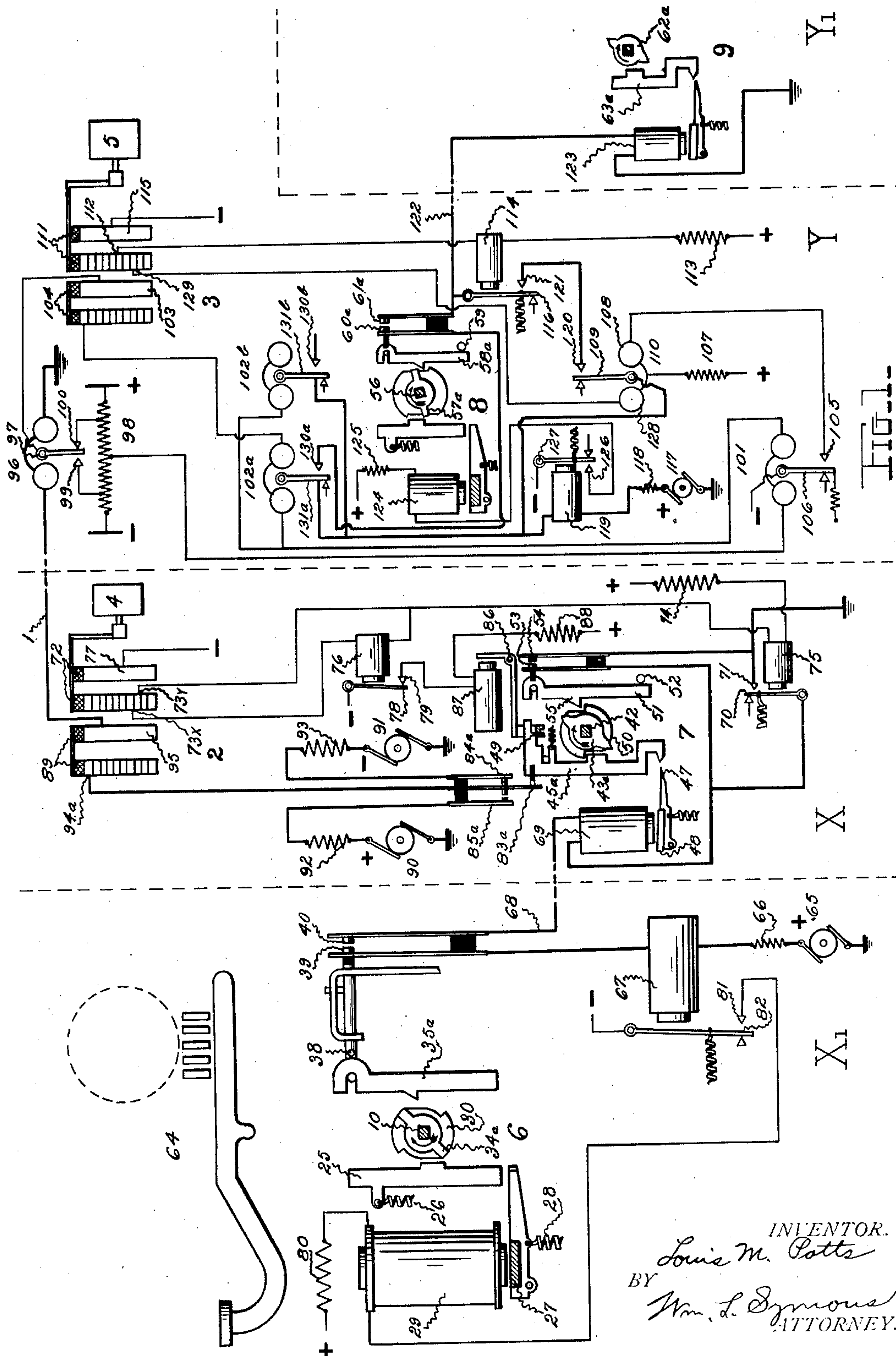
L. M. POTTS.

1,534,660

SYSTEM OF TELEGRAPHIC DISTRIBUTION

Filed March 20, 1920

3 Sheets-Sheet 1



April 21, 1925.

1,534,660

L. M. POTTS

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3 Sheets-Sheet 2

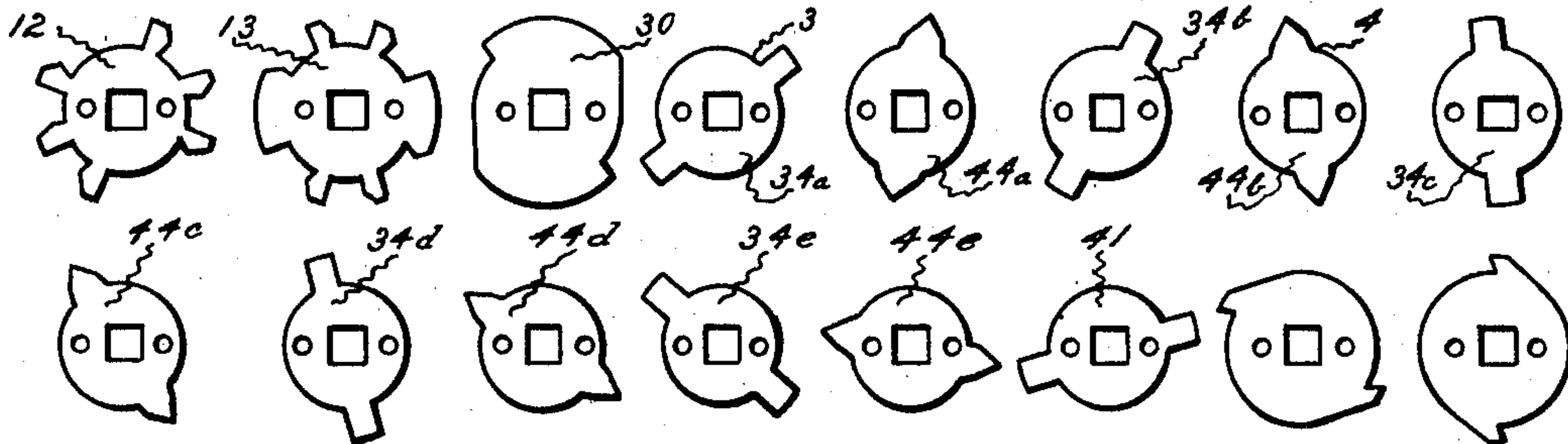


FIG. 2.

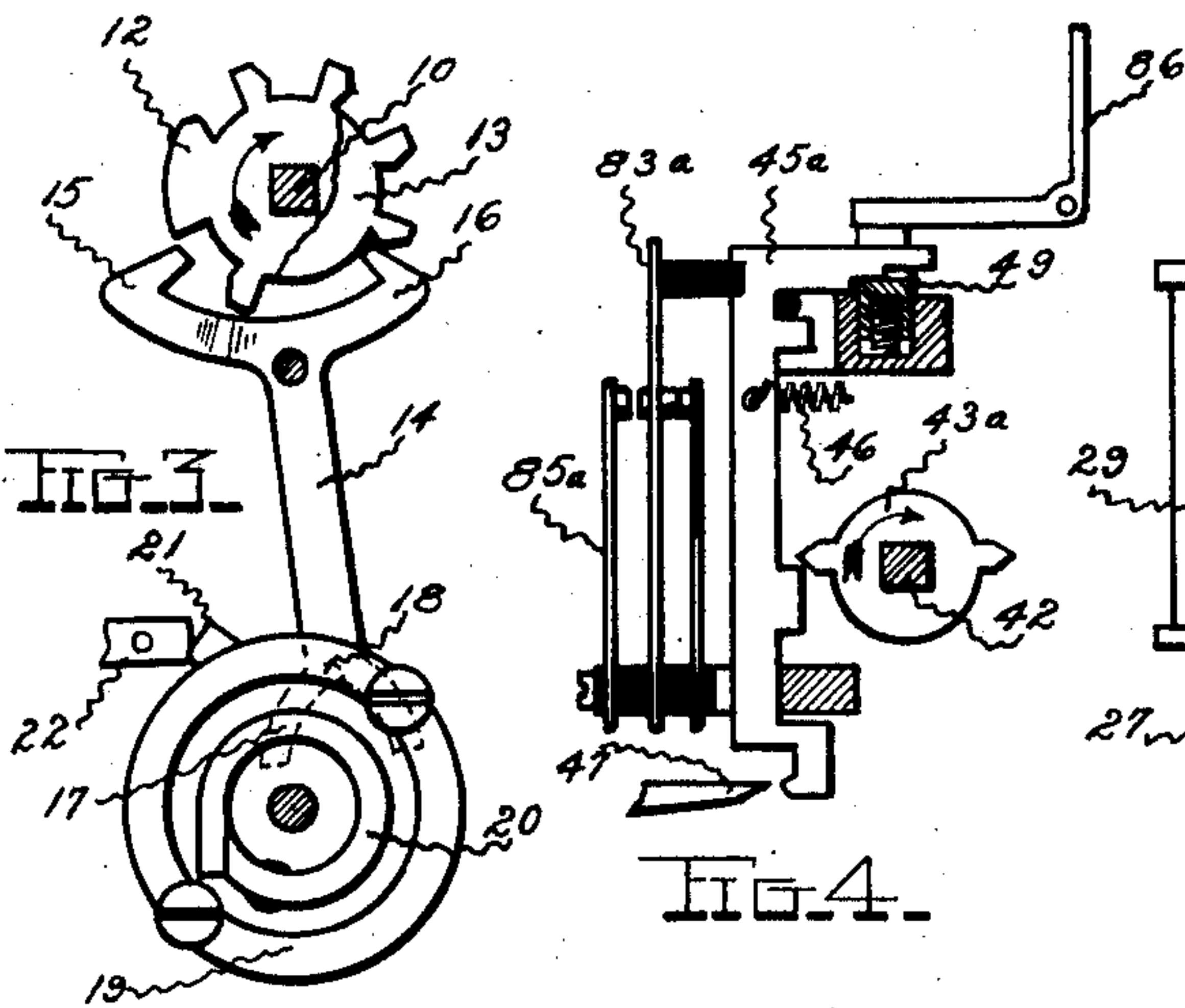


FIG. 3.

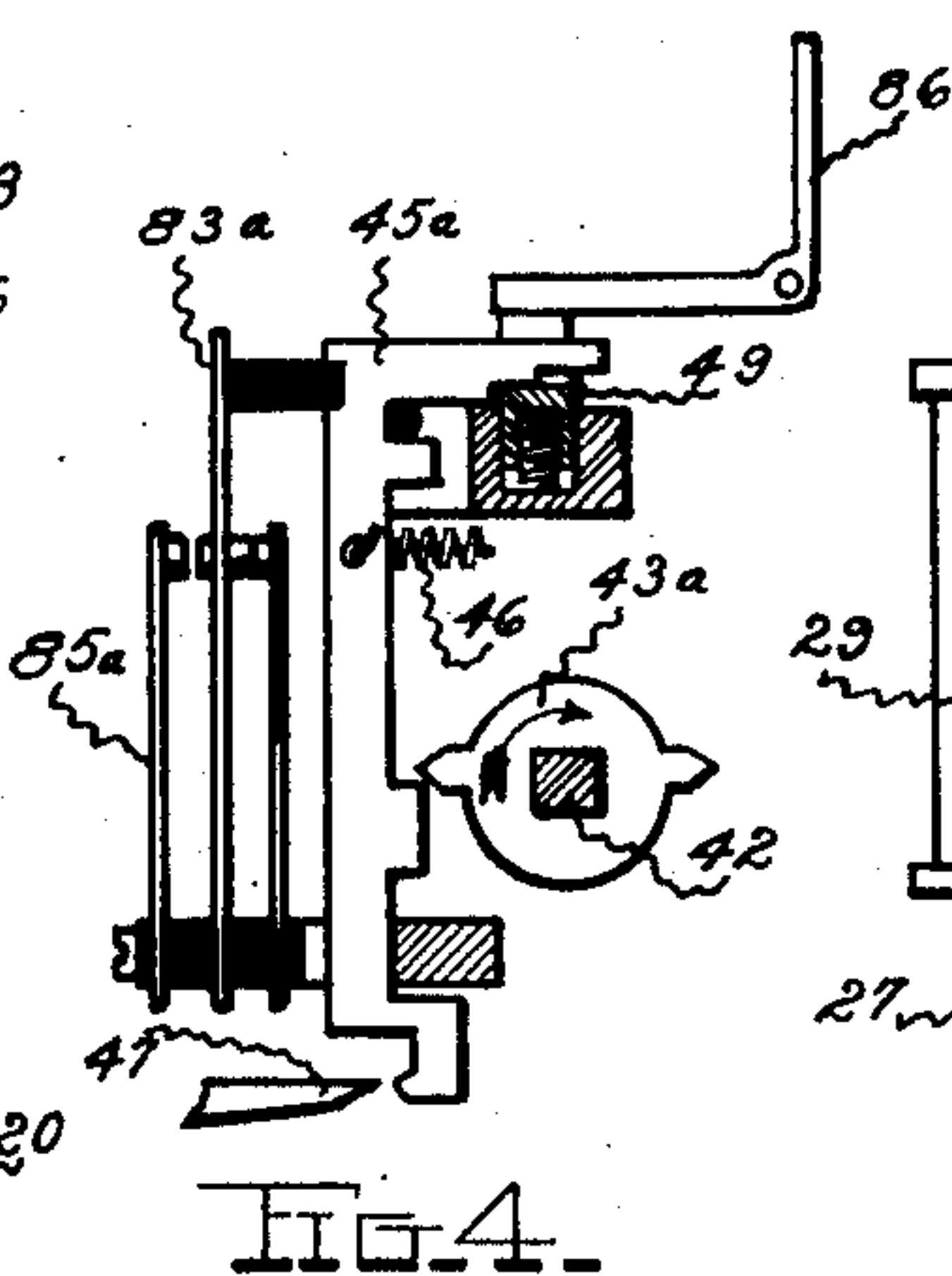


FIG. 4.

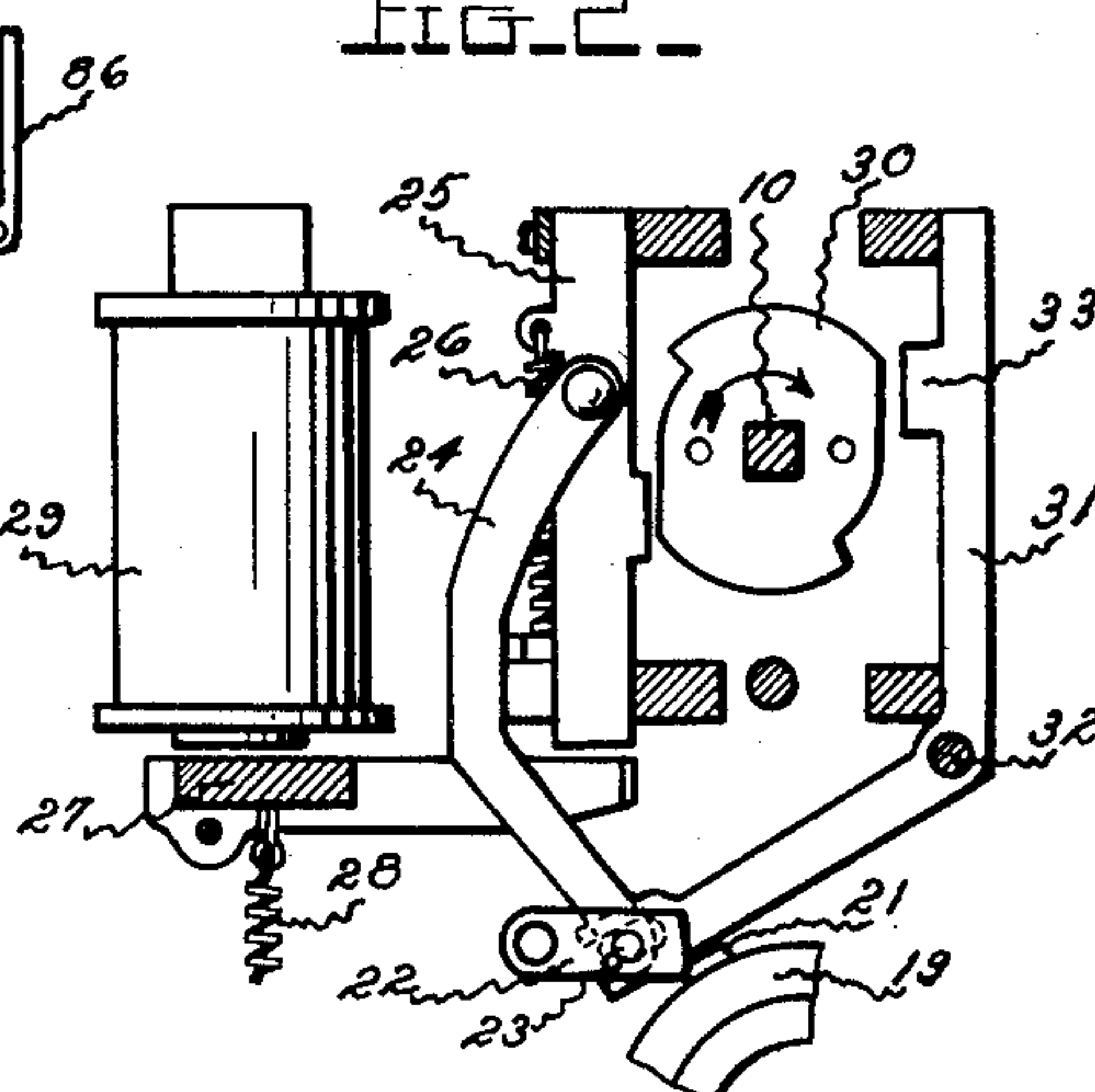


FIG. 5.

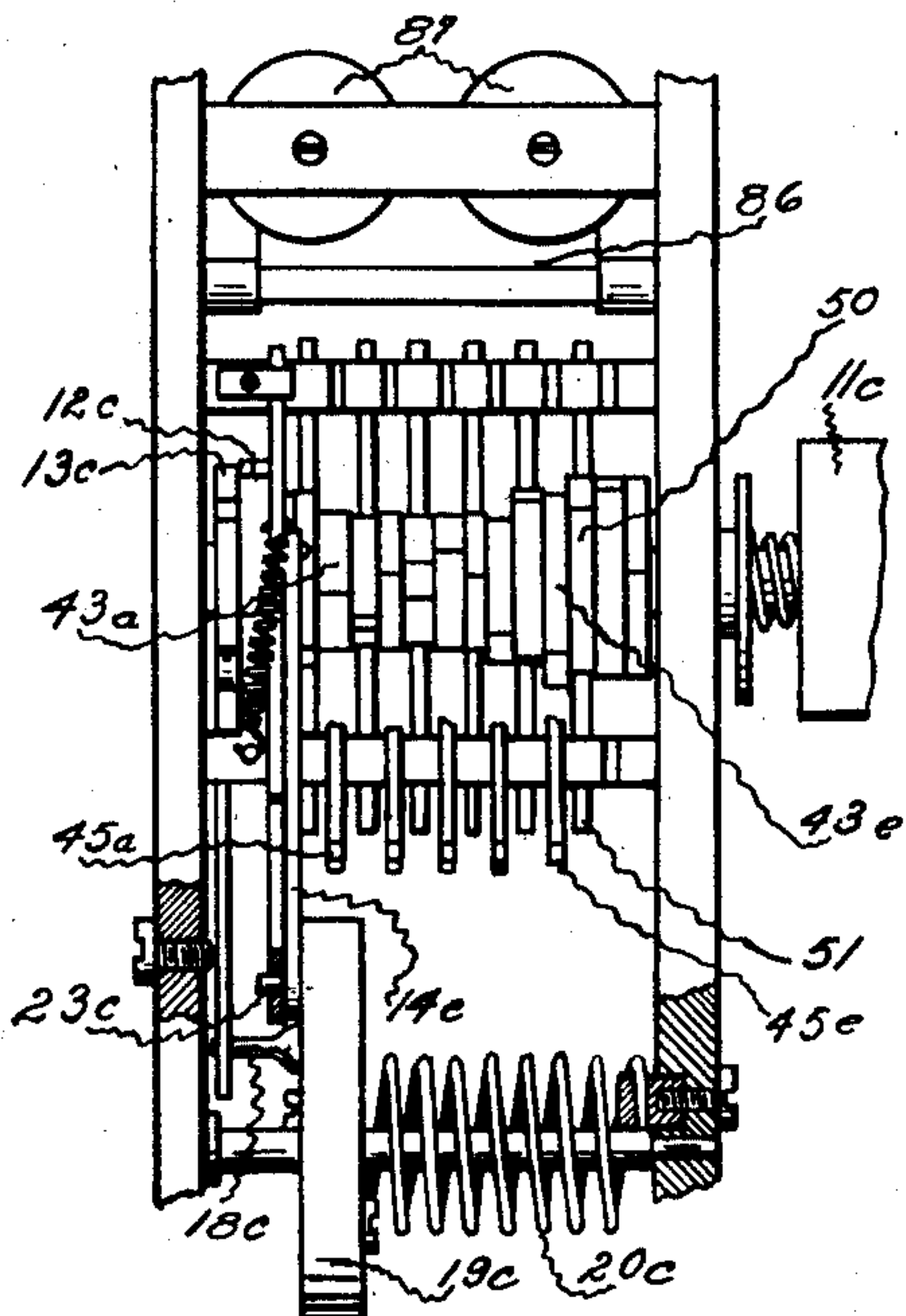


FIG. 6.

FIG. 7.

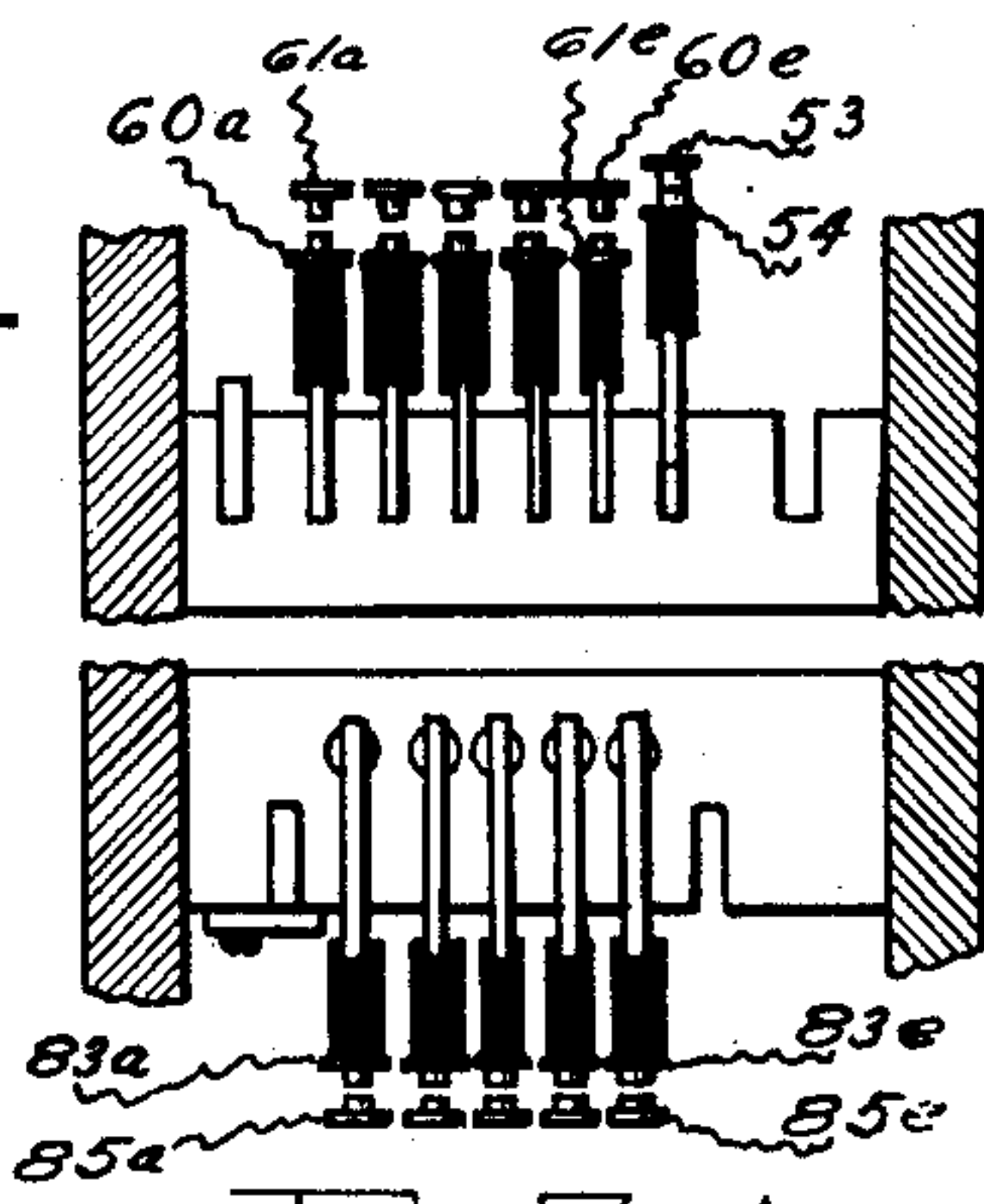


FIG. 7A.

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3 Sheets-Sheet 3

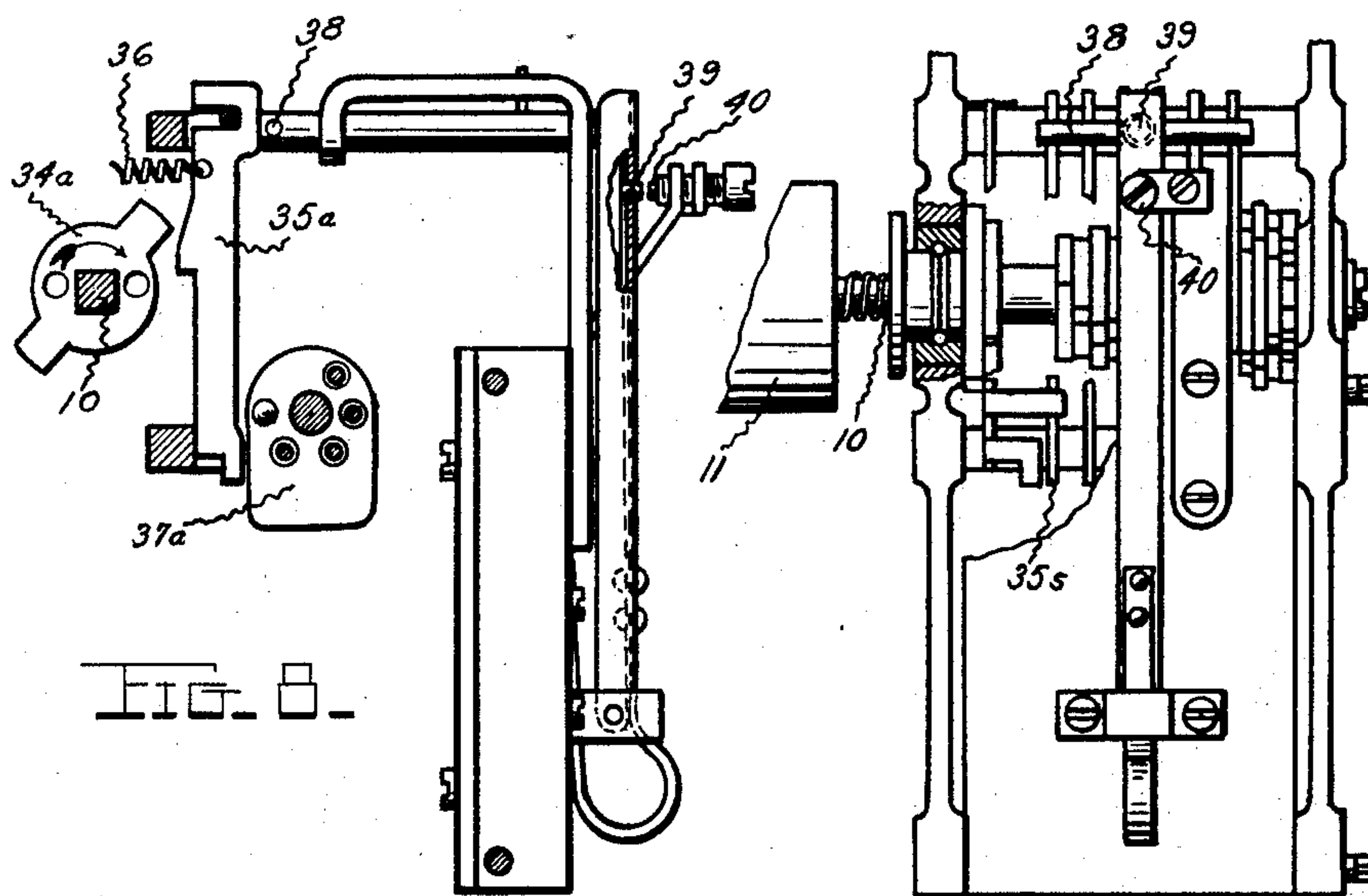


FIG. 9.

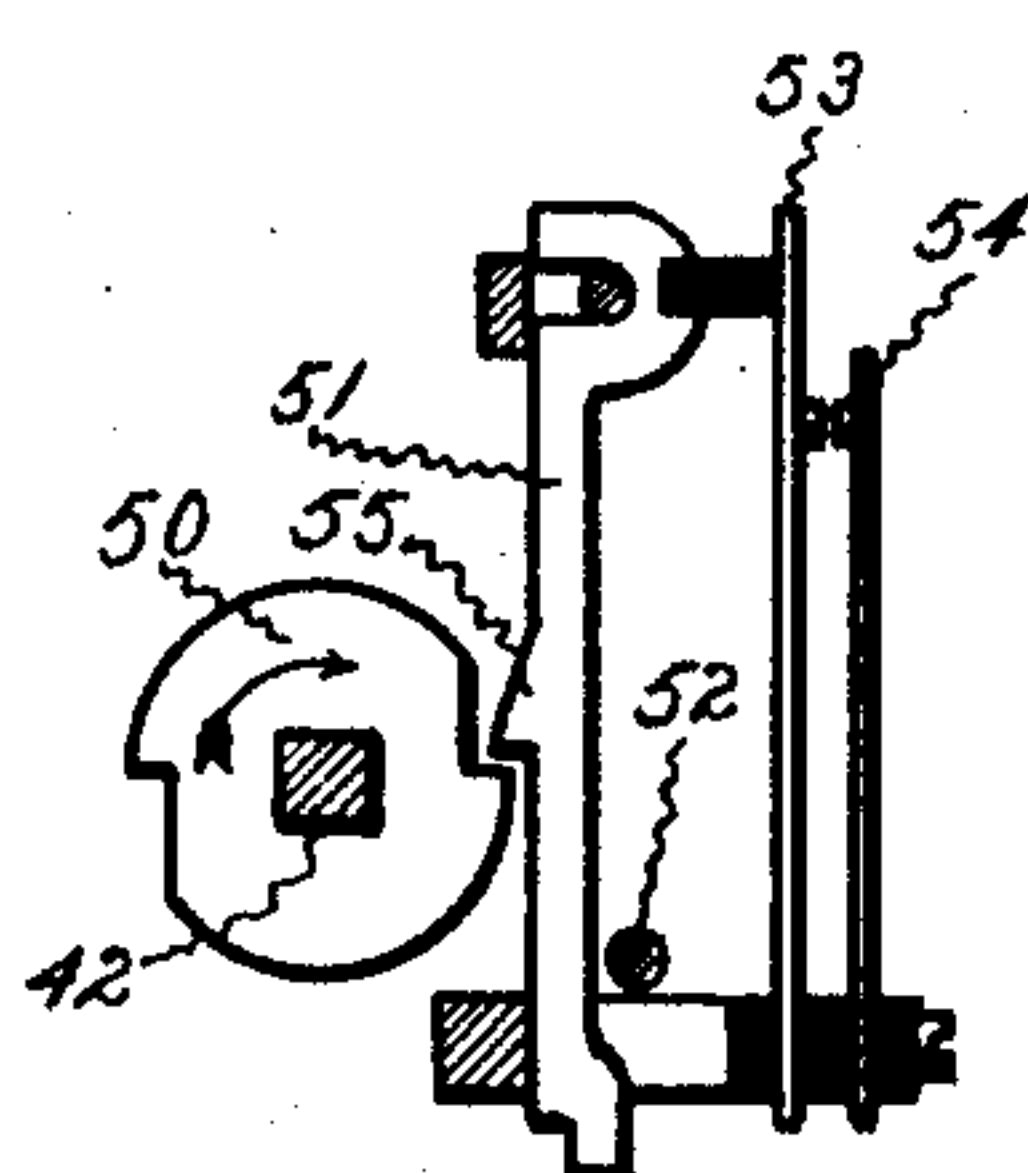


FIG. 10.

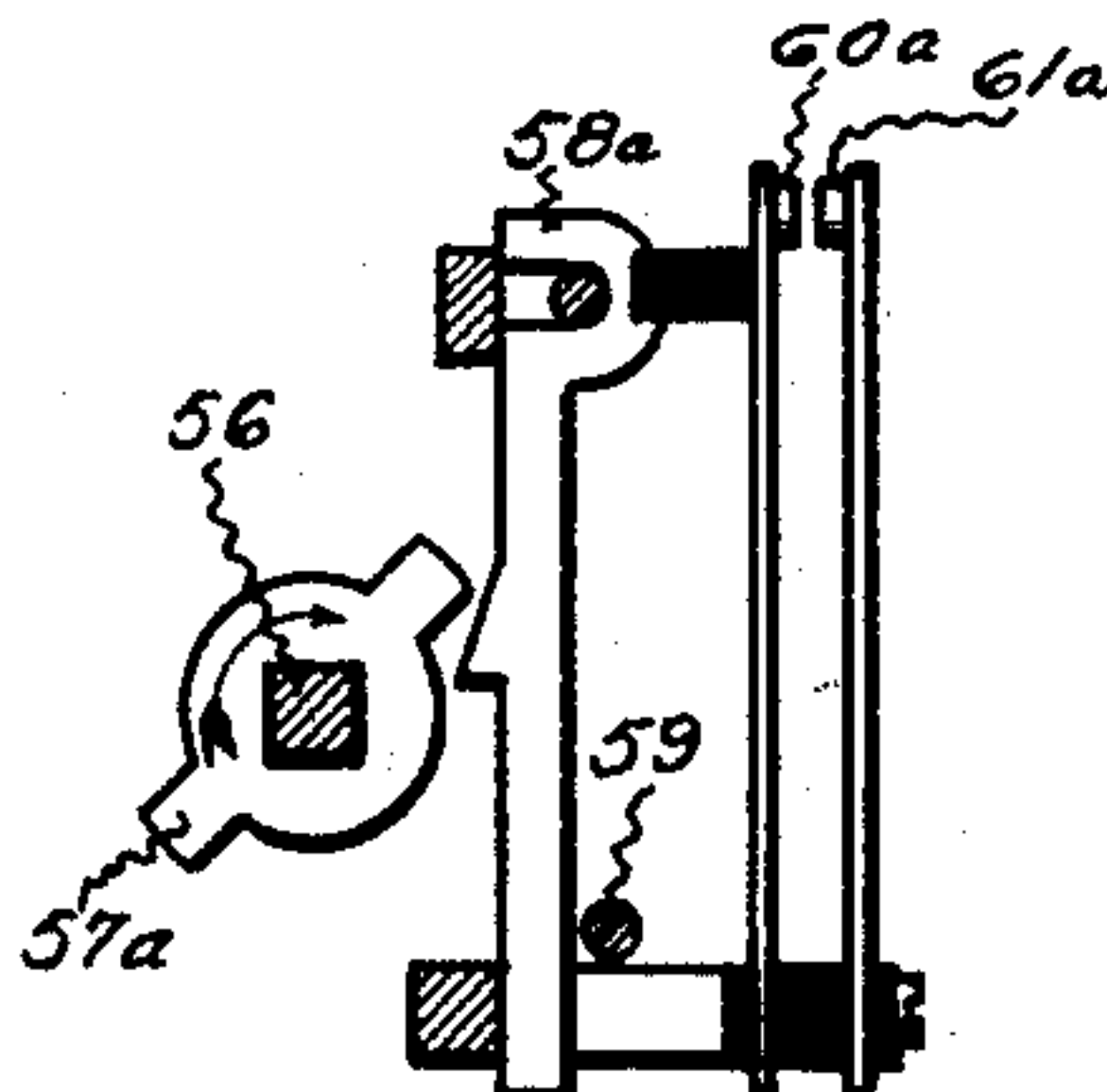


FIG. 11.



FIG. 12.

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UNITED STATES PATENT OFFICE.

LOUIS M. POTTS, OF BALTIMORE, MARYLAND, ASSIGNOR, BY MESNE ASSIGNMENTS, TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

SYSTEM OF TELEGRAPHIC DISTRIBUTION.

Application filed March 20, 1920. Serial No. 367,421.

To all whom it may concern:

Be it known that I, LOUIS M. POTTS, a citizen of the United States of America, residing at Baltimore, State of Maryland, have invented certain new and useful Improvements in Systems of Telegraphic Distribution, of which the following is a specification.

This invention relates to printing telegraph systems and more especially it has to do with the distribution of the impulses to the different channels of a multiplex system.

An object of the invention is to provide a system whereby a plurality of telegraph messages originating at separate stations may be transmitted to a main or central station over branch lines or extension circuits where such messages will be transmitted automatically over a main line.

Another object of the invention is the provision of a system which is efficient and reliable in operation.

Other objects will hereinafter appear.

The present invention is described in connection with a mechanical storage keyboard such as described in my Patent 1,419,409, issued June 13, 1922.

One embodiment of the invention is illustrated by the following drawings:—

Fig. 1 shows the electrical connections.

Fig. 2 shows the cams on the escapement shaft.

Fig. 3 shows the escapement and balance wheel.

Fig. 4 shows a receiving lever and contact.

Fig. 5 shows the start mechanism.

Fig. 6 is a fragmentary view looking at the receiving side of the machine at central X with some parts removed.

Fig. 7 is a fragmentary view looking down on the machine at central Y and shows the transmitting contacts.

Fig. 7^a is a fragmentary view looking down on the machine at central X and shows the receiving contacts.

Fig. 8 shows the transmitting contact mechanism at a substation.

Fig. 9 is a view of the machine at a substation looking at the transmitting side.

Fig. 10 shows the line closing contact at central.

Fig. 11 shows a transmitting contact at central.

Fig. 12 is a detail of a part of the armature.

Two main offices X and Y (see Fig. 1) are connected by a line which is operated in multiplex and has at each end distributing sunflower devices 2 and 3 which are run by driving devices 4 and 5 which include suitable timing and synchronizing devices adapted to continuously keep the trailer brushes at the two ends of the line in synchronism. At the branch office X, there is a transmitting device 6 which is started into operation at the beginning of each signal and sends a "start" impulse followed by the code impulses. At central X there is a similar device 7 which sets a series of contacts according to the signal received. The signals are in turn automatically transmitted over a channel of the multiplex and operate a series of relays at central Y where they are again automatically retransmitted by a selecting device 8, which is started into operation at the beginning of each signal, to branch office Y, where a suitable selecting device 9 receives the signals. Each of the selecting devices 6, 7, 8 and 9 is provided with a timing device. It is essential that the timing be so regulated that one cycle of each selector shall be performed in at least as short a time as is occupied by one revolution of sunflower devices 2 and 3, but may be any amount faster, as long as selecting devices 6 and 7, and selecting devices 8 and 9 are timed alike. The selecting devices 6 and 7 and 8 and 9 may differ in timing from one another, but would usually be alike for convenience.

Only so much of the mechanical part of the selecting devices 6, 7, 8 and 9 will be here described as is directly concerned with the invention as here claimed. A more complete description of the entire mechanism is given in my patent previously referred to. All of the selecting devices 6, 7, 8 and 9 are similar in construction with such variations as adapt them to sending or receiving. So much of the selecting device will first be de-

scribed as is required at a transmitting substation (see Fig. 6). A shaft 10 has mounted thereon a friction clutch 11, one member of which is in continuous motion, being
 5 driven by any suitable means, such as an electric motor, so that there is a tendency for shaft 10 to rotate (see Figs. 3 and 6). In Figure 6 the balance and escapement at central X is shown, but the same reference numerals with a sub C have been used so that
 10 the view shows the relation of the parts of the timing mechanism. There is mounted on shaft 10 two escapement wheels 12 and 13, which are engaged by an anchor 14 having
 15 pallets 15 and 16, which engage escapement wheels 12 and 13 respectively, anchor 14 also has a forked arm 17, which engages an impulse pin 18 on balance wheel 19. A coiled
 20 spring 20 has one end fast to balance wheel 19 and the other end fast to the frame of the machine, which gives the balance wheel some predetermined rate of vibration. Balance
 wheel 19 is locked in the position shown in Figure 3 by lug 21 engaging arm 22 (see
 25 Fig. 5). Arm 22 has a pin 23, which engages link 24, which in turn is pivotally attached to slide 25. Slide 25 is pressed downward by spring 26 thereby forcing arm 22 into engagement with lug 21 fast to balance
 30 wheel 19. The lower end of slide 25 is adapted to be engaged by the tip of armature 27. Armature 27 is adapted to be moved against the tension of spring 28 by the energization of magnet 29. When magnet 29 is
 35 energized armature 27 moves upward carrying with it slide 25, link 24, arm 22, and thereby releasing balance 19, and allowing balance 19, under tension of spring 20, to
 40 move to the left and thereby disengage pallet 16 from escapement wheel 13, and allowing shaft 10 to rotate until pallet 15 engages a tooth of escapement wheel 12. As balance 19 oscillates from side to side anchor 14 will
 45 be rocked and shaft 10 will be allowed to move step-by-step. As soon as shaft 10 starts in motion cam 30 engages bell crank 31, rocks it about pivot 32, and thereby holds arm 22 out of engagement with lug 21, until
 50 shaft 10 has rotated sufficiently far for the high part of cam 30 to be disengaged from the projection 33 on bell crank 31. By this means shaft 10 is allowed to make a half revolution in six steps before coming to rest. (See Figs. 2 and 6). Mounted on shaft 10
 55 is a series of five cams 34^a, 34^b, 34^c, 34^d and 34^e, which are spaced around the shaft in such a way that each one comes into operation successively during five consecutive
 60 steps of shaft 10. Cams 34^a to 34^e successively engage a series of five levers 35^a to 35^e, which are held to the left by springs 36 attached near the top thereof. The lower
 65 ends of levers 35^a to 35^e are adapted to be locked against motion to the right by a series of locks 37^a to 37^e (see Fig. 8), which

are controlled in any suitable manner, as for example, by a magazine keyboard as described in my patent mentioned above. Engaging the upper ends of levers 35^a to 35^e is
 70 a universal bar 38, which in turn engages a contact 39. As shaft 10 makes a half revolution the levers 35^a to 35^e move out at the bottom or top according to the way in which
 75 locks 37^a to 37^e are operated and contacts 39 and 40 are opened and closed in such a manner as to send a signal corresponding to the setting of the locks 37^a to 37^e. Mounted on
 80 shaft 10 is a sixth cam 41, which is adapted to engage lever 35^s in the stopping position of shaft 10, and thereby close contacts 39 and 40 and send a "start" impulse at the beginning of each signal, in case a signal is to
 85 be sent. The method of controlling the operation of lever 35^s is not here described as it forms no part of the invention and is fully described in my said above mentioned patent.

At central X shaft 42 has corresponding thereto a balance and escapement, a magnet and a starting mechanism exactly like that
 90 already described in connection with shaft 10 at substation X₁. Shaft 42 carries a series of cams 43^a to 43^e like cams 44^a to 44^e (see Fig. 2). Each cam 43^a to 43^e is staggered around the shaft 42 in steps similar
 95 to cams 44^a to 44^e. Each of the cams 43^a to 43^e engages a lever 45^a to 45^e, which is held to the right near the top by a spring 46 and as shaft 42 makes a half revolution levers 45^a to 45^e are moved out at the top or
 100 bottom according as the pointed tip 47 of armature 48 is up or down. If tip 47 is up when slide 45^a is engaged by cam 43^a slide 45^a is locked against motion at the bottom and moves outward at the top. When slide
 105 45^a is moved out at the top a spring pressed plunger 49 moves upward and locks it in this position.

Mounted on shaft 42 is a cam 50, associated with which is a lever 51, which is held
 110 against motion at the bottom by pin 52 and is adapted to operate contacts 53—54. In the normal stopping position of shaft 42 a projection 55 on lever 51 engages a notch in cam 50 and allows contacts 53—54 to remain
 115 open. However, as soon as shaft 42 starts to rotate lever 51 is moved to the right and contacts 53—54 are closed and remain closed until shaft 42 completes a half revolution. (Cam 50 may take the place on shaft 42 corresponding
 120 to the location of cam 41 on shaft 10). The function of these contacts will appear later.

At central Y shaft 56 has associated therewith a start mechanism and balance and
 125 escapement and a series of sending cams 57^a to 57^e exactly similar to the corresponding parts at substation X. The only difference between selecting devices 6 and 8 is that
 130 each of the levers 58^a to 58^e of selecting

device 8 is permanently prevented from moving to the right at the bottom by pin 59 and instead of each of the levers 58^a to 58^e operating a universal bar an individual circuit closer 60^a—61^a to 60^e—61^e is provided corresponding to each of the levers 58^a to 58^e.

At substation Y₁ selecting device 9 has a start mechanism, balance and escapement, a series of cams 69^a to 69^e, and a series of levers 63^a to 63^e exactly similar to those in selecting device 7. The series of levers 63^a to 63^e may form part of a recording mechanism such as is described in my Patent No. 1,229,202.

The electrical circuits and operation will now be described (refer to Fig. 1). At substation X₁, there is a keyboard and mechanical storage device 64 which controls the character of the signals sent by the selecting device 6. When a signal is to be sent contacts 39—40 close, and a "start" impulse is sent over a circuit traced as follows: positive pole generator 65, resistance 66, magnet 67, contact 39, contact 40, line 68, magnet 69, contact 70, contact 71, to ground and return to the other pole of generator 65. It is to be noted that this circuit can only be completed when trailers 72 are passing over segment 73^x which completes a circuit as follows: positive supply main, resistance 74, coil 75, coil 76, segment 73^x, trailers 72, ring 77, to negative supply main, thus energizing magnet 76 and closing contacts 78—79. Segment 73^y which immediately follows segment 73^x is connected directly to magnet coil 75 without passing through magnet coil 76, so that magnet coil 75 receives a longer impulse than magnet coil 76. This insures that contacts 70—71 shall remain closed until contacts 53—54 close and also insures that the depression of plungers 49 shall not interfere with the setting of the lever 45^a. If no signals are being sent and contacts 39—40 are open, the trailers 72, as they rotate, will close contacts 78—79 for a brief interval during each revolution. If transmission is started contacts 39—40 are closed, but the line will not close until the trailers 72 reach segment 73^x. When the line is so closed an impulse is sent on the line and magnets 67 and 69 are energized and each of the selecting devices 6 and 7 are started into operation. Magnet 29 is energized through a circuit traced as follows: positive supply main, resistance 80, magnet 29, contacts 81—82, to negative. When selecting device 6 is so started shaft 10 moves a half revolution and through the series of cams 34^a to 34^e, which are staggered around shaft 10, closes and opens contacts 39—40 in such a way as to send code signals according to the keys operated. There is one of the cams 34^a to 34^e for each element of the code, and a lever 35^a to 35^e correspond-

ing to each cam. All the levers 35^a to 35^e are adapted to operate contacts 39—40 through universal bar 38. By the arrangement just described the selecting devices 6 and 7 are started into operation at the beginning of each signal and always in the same relation to the sunflower device 2, while the character of the signals transmitted is controlled from the keyboard and storage device 64 at station X₁ the beginning of each signal is controlled by the sunflower device 2 at central X.

After the start impulse has been sent, magnet 69 at central X has been energized and selecting device 7 has been started into operation, a series of levers 45^a to 45^e are set in combinations according to the code signals sent from station X₁. There is one of the levers 45^a to 45^e corresponding to each of the elements of the code signal. When any signal is received which contains an element of the code corresponding to certain of the levers 45^a to 45^e, those levers are moved outward at the top and locked in that position by spring pressed plungers 49. When the complete signal has been sent the levers 45^a to 45^e will be set in a combination corresponding to the signal. Each of the levers 45^a to 45^e operates a corresponding contact tongue 83^a to 83^e, which in the normal or unset position of levers 45^a to 45^e rest against contact springs 84^a to 84^e. When a lever 45^a to 45^e is set or in a position corresponding to a signal containing a corresponding element of the code, contact tongues 83^a to 83^e make contact with contact springs 85^a to 85^e. After shaft 42 has completed a half revolution, i. e., at the end of a signal interval, tongues 83^a to 83^e will be engaging front or back contacts 84^a to 84^e or 85^a to 85^e in a combination corresponding to the signal sent. Whenever selecting device 7 is started into operation shaft 42 moves cam 50 which moves lever 51 and thereby closes contacts 53—54 and keeps them closed for a half revolution of shaft 42 or during the complete period for the reception of a single signal. Contacts 53—54 are connected in parallel with contacts 70—71. The latter contacts are closed momentarily, as previously described, at the beginning of each signal for a length of time sufficient to keep the line closed until contacts 53—54 can be closed, if a signal is being sent from substation X₁. In the case where no signals are being transmitted from substation X₁, contacts 70—71 close for a short interval at the beginning of each signal and contacts 53—54 do not close at all, so that for the remainder of a signal interval the line is open at central X.

All of the plungers 49 are engaged by a bell crank 86 which is adapted to be moved by magnet 87. Magnet 87 is energized by a circuit as follows: positive supply main,

resistance 88, magnet 87, contact 79, relay tongue 78, to negative. When trailer 72 passes over segment 73^x, tongue 78 operates, magnet 87 is energized, bell crank 86 moves and all the spring pressed plungers 49 are pressed downward and allow all the levers 45^a to 45^e to return to their normal position. It will be noted that the last mentioned operation takes place just after one signal has been transmitted and at the same time an impulse is transmitted which closes contacts 70—71 and thereby starts the selecting devices 6 and 7 into operation at the beginning of the next signal, as previously described.

As trailer brushes 89 rotate they will transmit positive and negative impulses in succession and in combinations according to the setting of levers 45^a to 45^e. The circuit may be traced as follows: ground, positive or negative terminal generator 90 or 91, resistance 92 or 93, contacts 85^a to 85^e or 84^a to 84^e, tongues 83^a to 83^e, segments 94^a to 94^e, trailers 89, collecting ring 95, line 1. coils of polarized relay 96, ground and return. The impulses transmitted over the above traced circuit will operate relay tongue 97 according to the impulses transmitted. A resistance 98 is connected from the positive to the negative supply terminal. Contacts 99 and 100 are tapped to resistance 98 at points in proximity to the positive and negative connections. The mid point of resistance 98 is connected to one coil terminal of polarized relay 101, the other terminal of which connects to one terminal of each of polarized relays 102^a to 102^e, one of which is provided for each element of the code. The other terminals of relays 102^a to 102^e connect to the corresponding segments of sunflower device 3. The collecting ring 103 connects to relay tongue 97. As trailers 104 rotate and tongue 97 vibrates from the incoming impulses positive or negative impulses will be transmitted successively through relays 102^a to 102^e and all of the impulses corresponding to the group of relays 102^a to 102^e will pass through polarized relay 101. Polarized relay 101 is adjusted so that it has a bias away from the connected contact 105, so that it will go forward when positive current is passing through the relay coils, but will immediately return when the current is stopped and will not go forward at all for negative impulses, that is, if in any given revolution of trailers 104 any one or more of the group of relays 102^a to 102^e receive a positive or setting impulse, relay tongue 106 will go forward and complete a circuit as follows: positive terminal, resistance 107, coil 108, contact 105, tongue 106, to negative, and will move tongue 109 of polarized relay 110 forward against its forward stop where it will remain.

Just after a signal has been transmitted over circuit 1 and trailer brush 104 has passed the last segment of the group on sunflower device 3, the group of relays 102^a to 102^e will be set in a combination corresponding to the signal sent and, if any of the relays 102^a to 102^e are set, relay tongue 109 will be forward and as trailer brushes 111 pass over segment 112 of sunflower device 3, a circuit will be completed as follows: positive supply main, resistance 113, coil 114, segment 112, trailer brushes 111, collecting ring 115, to negative. Coil 114 will be energized and tongue 116 thereof will move forward and complete a circuit as follows: positive pole of generator 117, resistance 118, magnet coil 119, tongue 109, contact 120, contact 121, relay tongue 116, line 122, magnet 123, to ground and return. The so-called "start" impulse is thus transmitted and magnets 123 and 124 are energized. Magnet 124 is energized by a circuit as follows: positive supply main, resistance 125, magnet 124, contact 126, tongue 127, to negative, tongue 127 being moved forward upon the energization of magnet 119. After the start impulse has been transmitted, an impulse is transmitted over a circuit as follows: positive supply main, resistance 107, coil 128 of relay 110, segment 129, trailer brushes 111, collecting ring 115, to negative. By this impulse tongue 109 of relay 110 is moved to its back stop ready for the reception of the next signal: Both of the magnets 123 and 124 being energized by the sending of the "start" impulse, selecting devices 8 and 9 are started into operation. Selecting device 8 moves one after the other a series of levers 58^a to 58^e, one corresponding to each of the elements of the code. Each of the levers 58^a to 58^e in turn controls a pair of contacts 60^a to 60^e and 61^a to 61^e, and these contacts are closed in an invariable sequence as selecting device 8 operates. Each of the contacts 60^a to 60^e is connected to the front contacts 130^a to 130^e of the corresponding polarized relays 102^a to 102^e. All the tongues 131^a to 131^e of the polarized relays 102^a to 102^e are connected through magnet 119 and resistance 118 to the positive pole of generator 117.

All of the contacts 61^a to 61^e connect to line 122 so that as selecting device 8 operates after being started, the contacts 60^a to 60^e and 61^a to 61^e in co-operation with the contacts 130^a to 130^e and 131^a to 131^e will transmit over line 122 code impulses identical in character with the code impulses originally transmitted over line 68 and a series of levers 63^a to 63^e, one corresponding to each of the elements of the code, will be set in combinations corresponding to the signals sent and may be recorded in any suitable manner, as for example, in printed characters as described in my United States

Patent No. 1,229,202. Selecting device 9 may be part of a recording mechanism similar to the one therein described.

What I claim is:

1. In a telegraph system, a sunflower device, means to operate said sunflower device uniformly, a series of relays, electrical connection between the coils of said relays and said sunflower device, a transmitting device started into operation at the beginning of each signal and automatically stopped at the end of each signal, said transmitting device including a series of transmitting contacts, said contacts being individually connected to the contacts of corresponding ones of said relays so that said relays control the character of the impulses transmitted by said transmitting contacts, a relay connected in a wire common to the circuit of all of said relays and responsive simultaneously with said relays upon the application of a current of a predetermined polarity for controlling the starting of said transmitting device.

2. In a telegraph system, a sunflower device, means to operate said sunflower device uniformly, a series of relays, electrical connection between the coils of said relays and said sunflower device, a transmitting device started into operation at the beginning of each signal and automatically stopped at the end of each signal, said transmitting device including a series of transmitting contacts, said contacts being individually connected to the contacts of corresponding ones of said relays so that said relays control the character of the impulses transmitted by said transmitting contacts, a relay responsive to impulses of one polarity only and connected in a wire common to the circuit of all of said relays, an auxiliary relay connected to the forward contact of said relays and responsive to one polarity only and operated thereby, a relay operated by the sunflower device once in each revolution and invariably in the same position in each revolution, a contact operated by said last mentioned relay and in series with the contact of the auxiliary relay so as to start the transmitting device into operation, whenever any relay of the series is operated.

3. In a telegraph system, a sunflower device, means to operate said sunflower device uniformly, a series of relays, electrical connection between the coils of said relays and said sunflower device, a transmitting device started into operation at the beginning of each signal and automatically stopped at the end of each signal, said transmitting device including a series of transmitting contacts, said contacts being individually connected to the contacts of corresponding ones of said relays so that said relays control the character of the impulses transmitted by said transmitting contacts, a relay respon-

sive to impulses of one polarity only and connected in a wire common to the circuit of all said relays, an auxiliary relay connected to the forward contact of said relays and responsive to one polarity only and operated thereby, a relay operated by the sunflower device once in each revolution and invariably in the same position in each revolution, a contact operated by said last mentioned relay and in series with the contact of the auxiliary relay so as to start the transmitting device into operation, whenever any relay of the series is operated, and means operated by the sunflower device to return the auxiliary relay to normal after the transmitting device has been started into operation.

4. In a telegraph system, a selecting device started into operation at the beginning of each signal and automatically stopped at the end of each signal, said selecting device comprising a circuit closer and a series of levers common to said circuit closer and adapted to operate said circuit closer in combinations according to the signal to be transmitted, a series of relays, connection between said relays and said circuit closer including multiplex synchronous sunflower devices, said connection being adapted to operate said relays successively and set them in combinations according to the signal transmitted by said circuit closer; a second selecting device started into operation at the beginning of each signal and automatically stopped at the end of each signal, said last mentioned selecting device comprising a series of levers, and a series of circuit closers one individual to each of said last mentioned levers, said circuit closers being individually connected to the contacts of corresponding ones of said series of relays, a magnet, means including said last mentioned selecting device to operate said series of contacts successively and thereby cause the armature of said magnet to repeat under the control of the contacts of said series of relays the operation of said first mentioned circuit closers.

5. In a telegraph system, a plurality of stations, a multiplex synchronous system connecting two of said stations, an extension circuit extending from one of said stations to a distant station, means for transmitting code combinations of message impulses over said multiplex system, and means including a series of contacts directly connected to said extension circuit, mechanically operated means for actuating said contacts to transfer directly to said extension circuit impulses from said multiplex system, and recording means at the distant station for recording such impulses.

6. In a telegraph system, a plurality of stations, a multiplex synchronous system connecting two of said stations, an extension-

sion circuit extending from one of said stations to a distant station, means for transmitting code combinations of message impulses over said multiplex system, a series
5 of relays operated in accordance with the transmission of message impulses over said multiplex system, mechanically operated means, and reciprocating contacts actuated by said mechanically operated means for
10 transferring to said extension circuit from said multiplex system impulses, the character of which is determined by the operation of said relays.

7. In a telegraph system, a plurality of
15 stations, a multiplex synchronous system connecting two of said stations, an extension circuit extending from one of said stations to a distant station, means for transmitting code combinations of message im-
20 pulses over the extension circuit, reciprocating contacts, means connected in said extension circuit and responsive to all impulses impressed thereon and acting mechanically
25 on said contacts to control their actuation, and means associated with said contacts for

transferring impulses from said extension circuit to said multiplex system in accordance with the operation of said reciprocating contacts.

8. In a telegraph system, a plurality of 30 stations, a multiplex synchronous system connecting two of said stations, an extension circuit extending from one of said stations to a distant station, means for transmitting code combinations of message impulses over 35 said multiplex system, means including a series of contacts for transferring the impulses from said multiplex system to said extension circuit, cam-operated means individual to each of said contacts, and means 40 controlled by impulses transmitted over said multiplex system for setting in operation said cam-operated means whereby said contacts are operated consecutively, and recording means at the distant station for record- 45 ing such impulses.

In testimony whereof I affix my signature.

LOUIS M. POTTS.