D. MURRAY.

PRINTING TELEGRAPH SYSTEM.

APPLICATION FILED APR. 16, 1913.

1,114,905.

Patented Oct. 27, 1914.

8 SHEETS—SHEET 1.

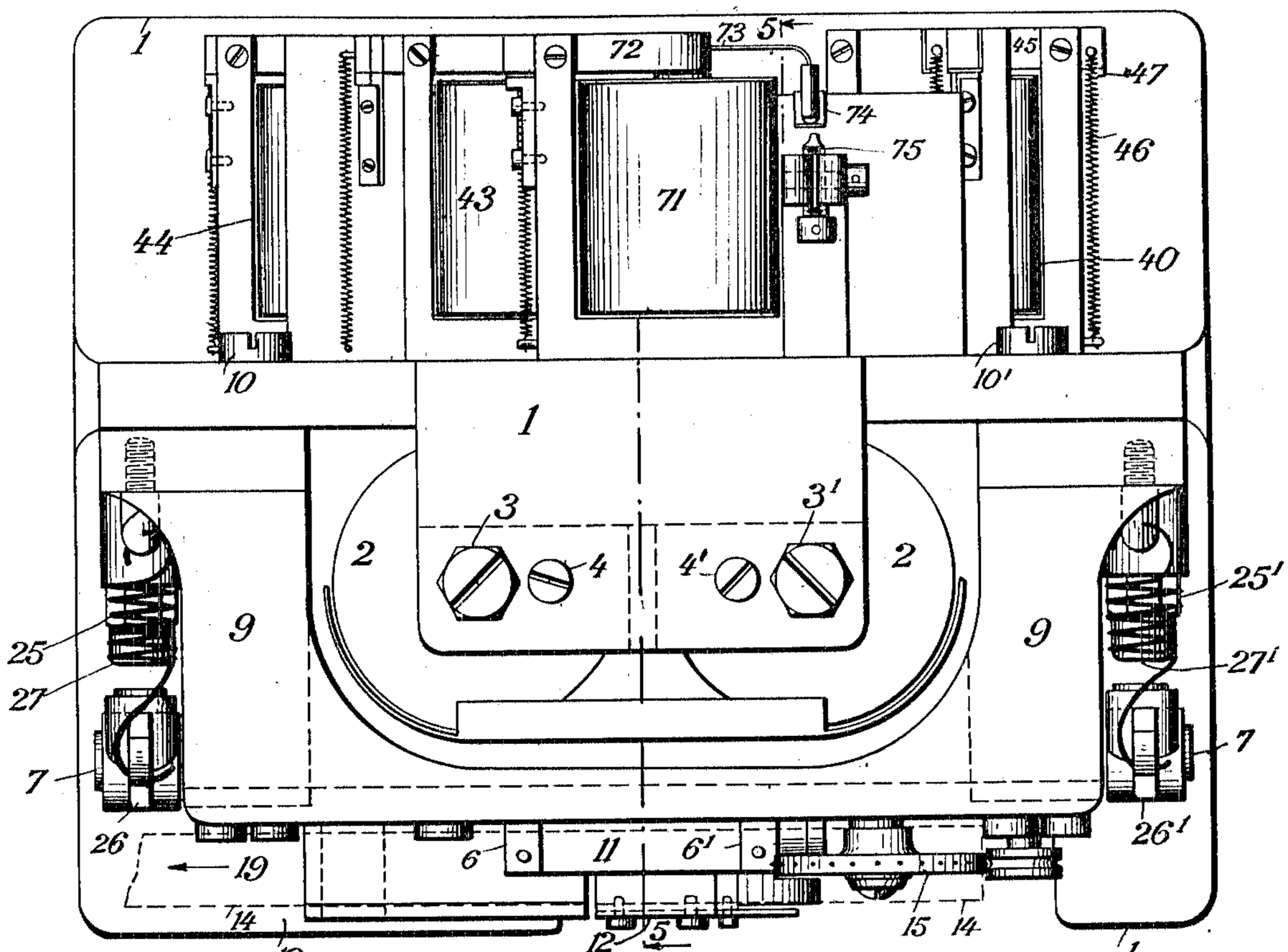

Fig. 1.

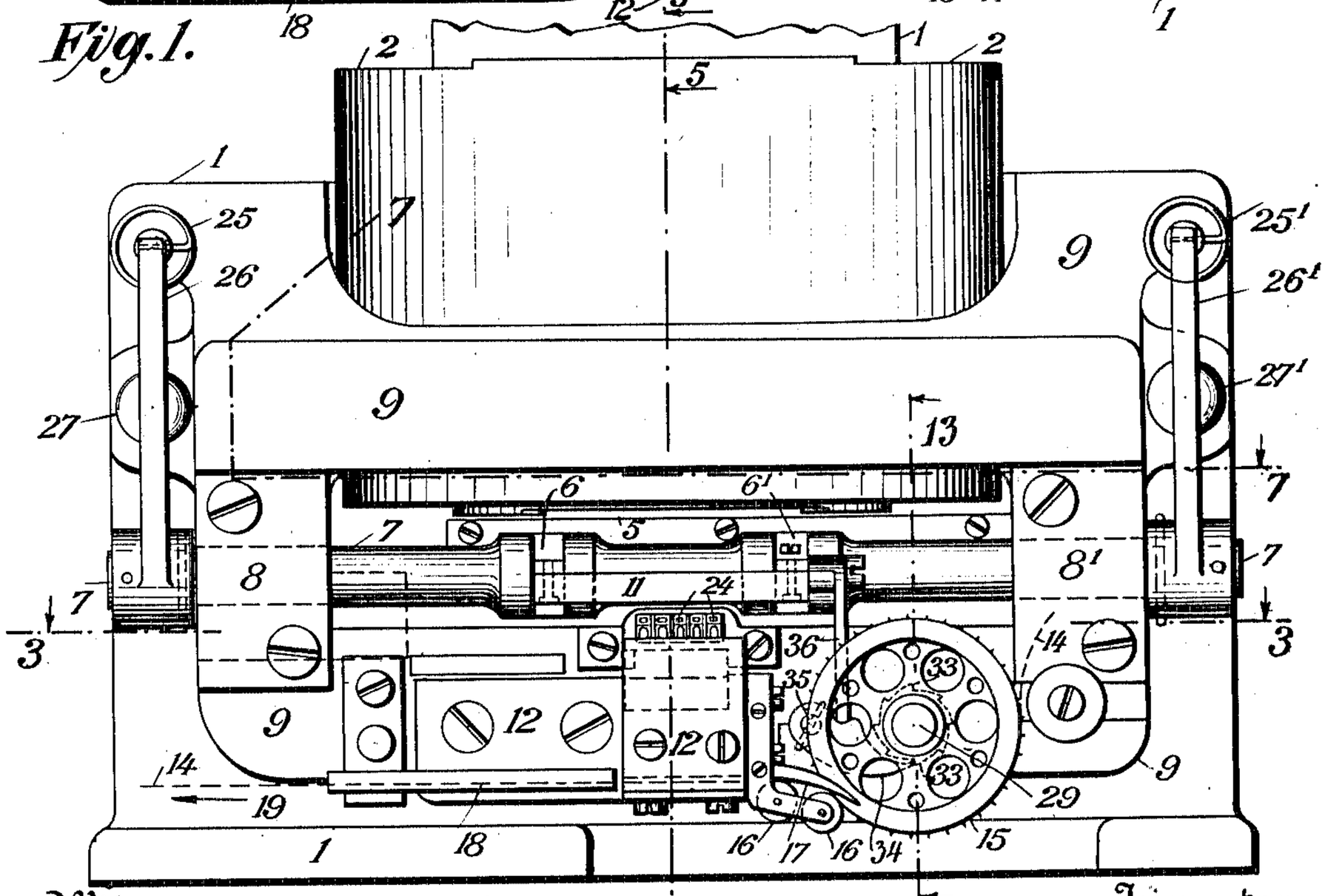

Fig. 2.

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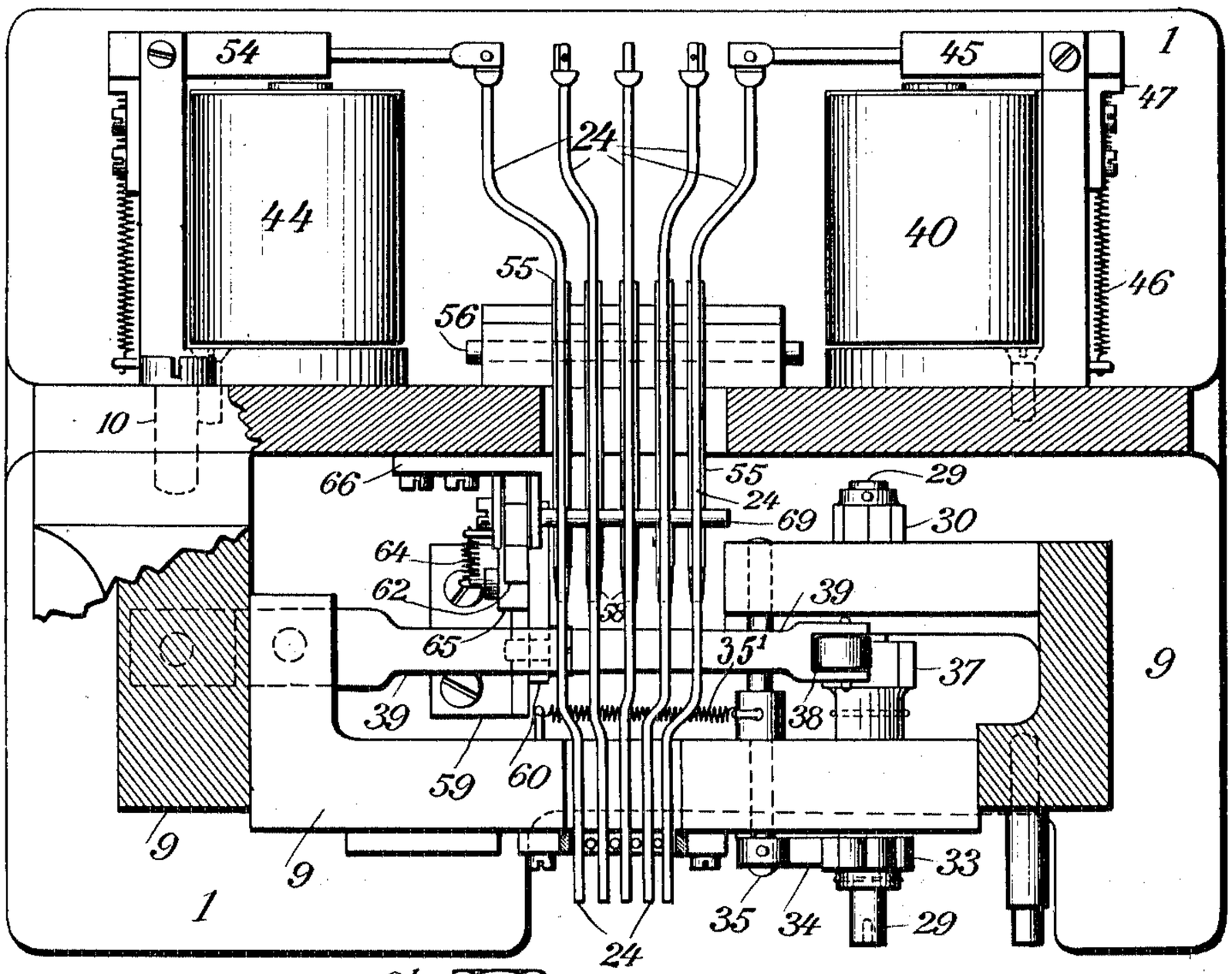
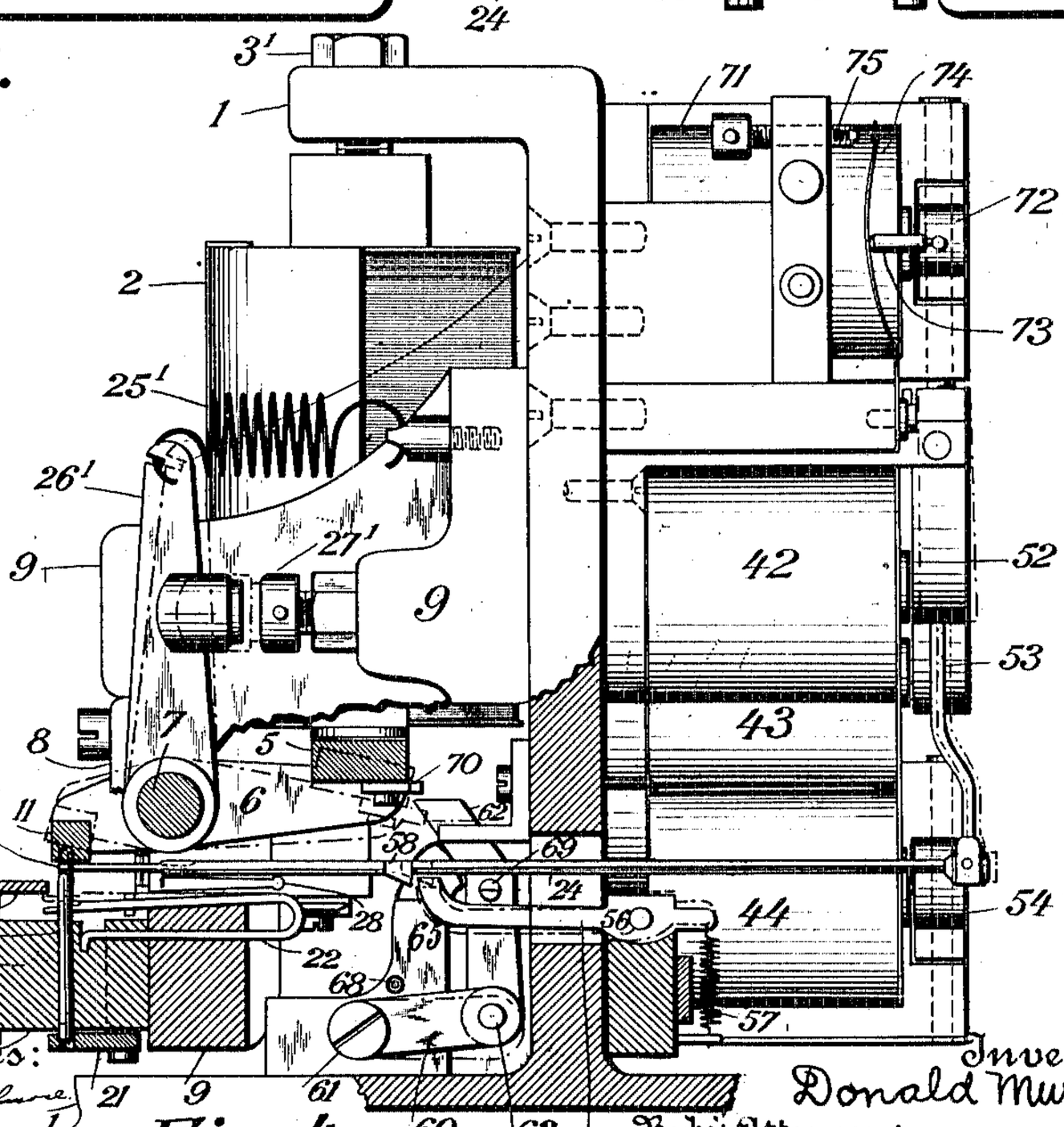


Fig. 3.



Witnesses:

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Fig. 4.

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8 SHEETS—SHEET 3.

Fig. 5.

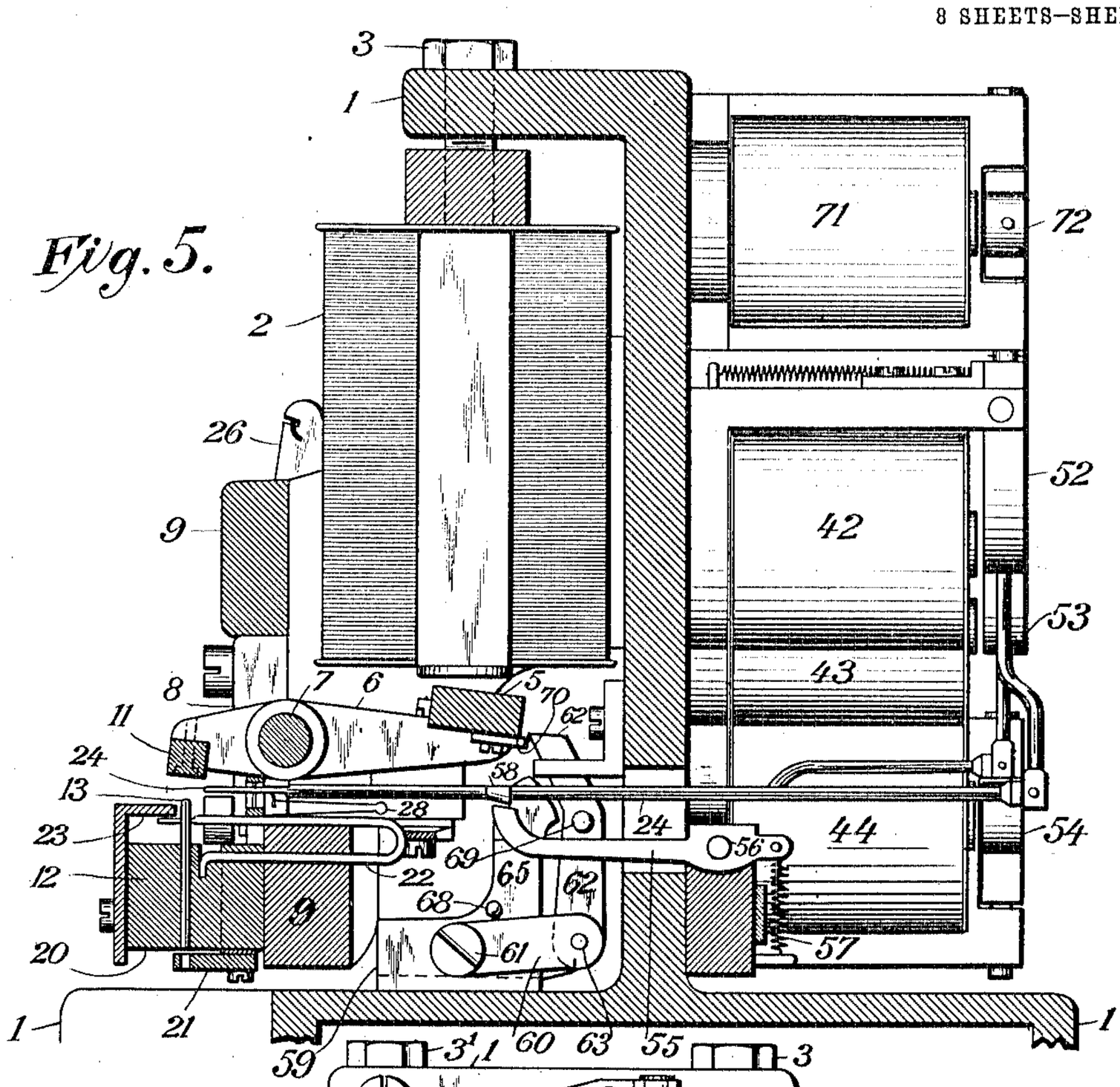

Fig. 6.

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8 SHEETS—SHEET 4.

Fig. 7.

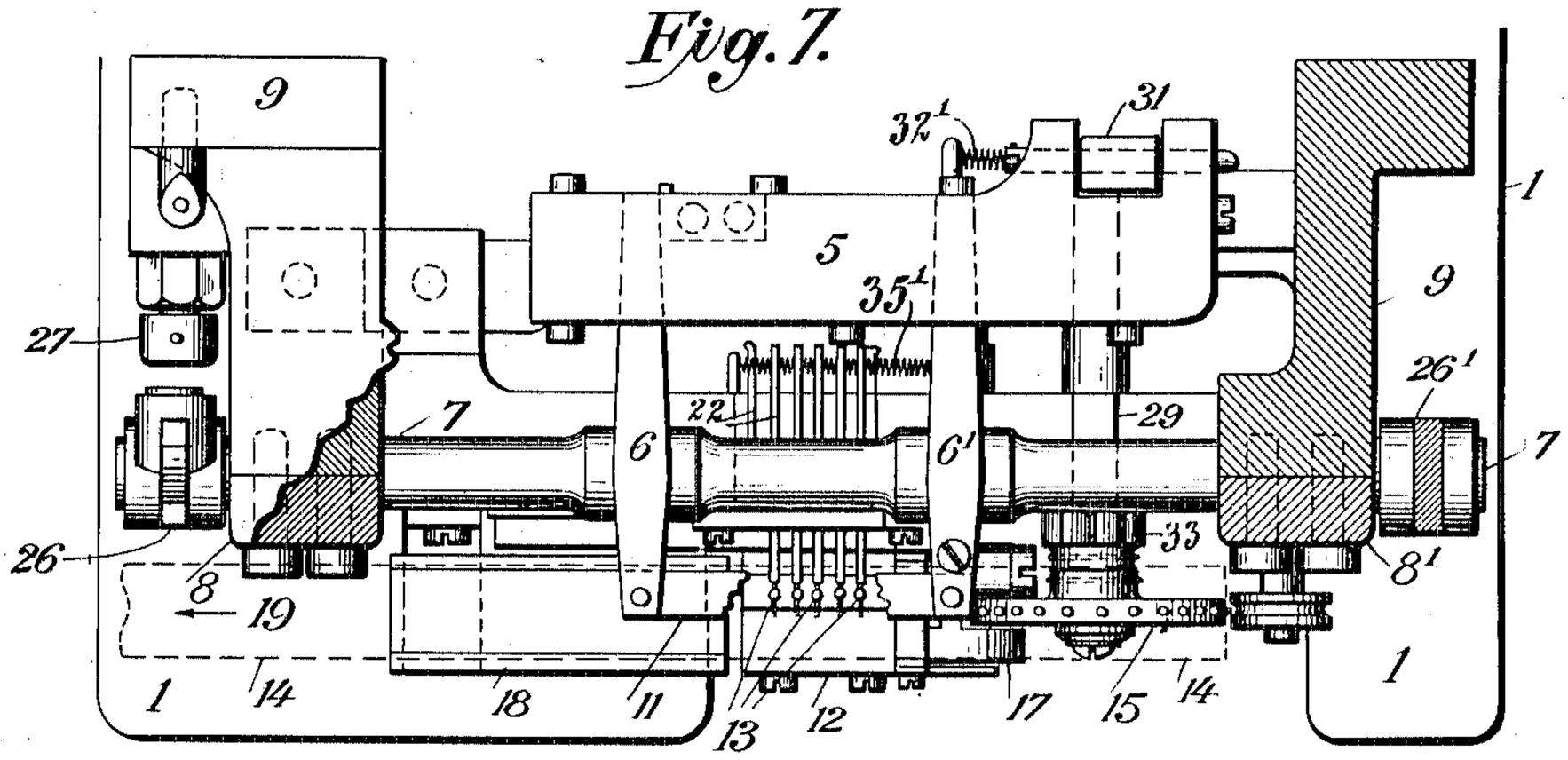


Fig. 13.

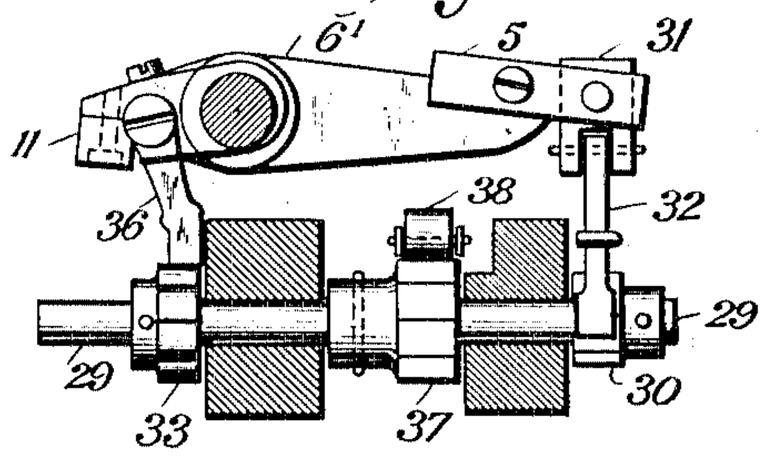


Fig. 10.

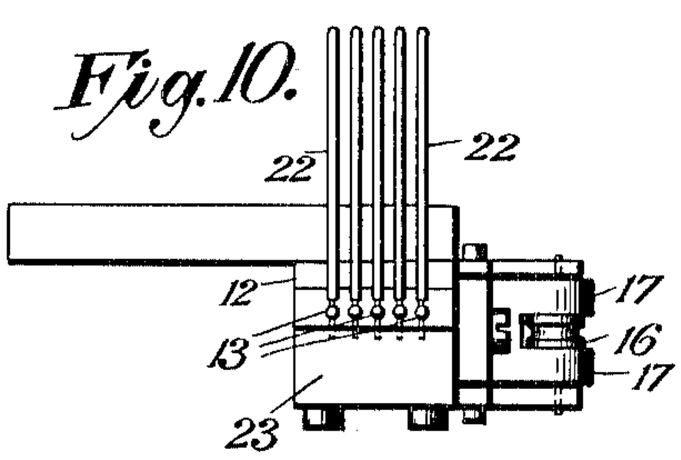


Fig. 12.

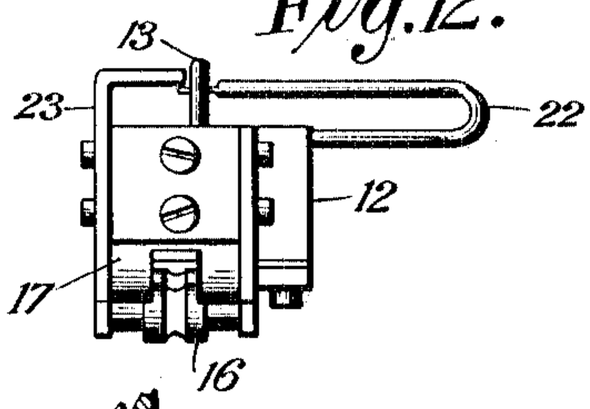


Fig. 11.

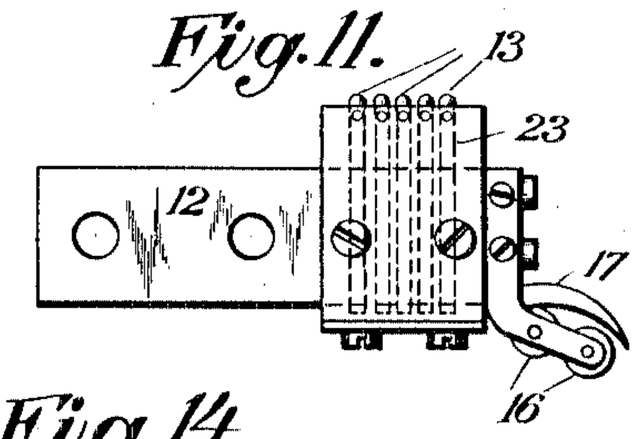
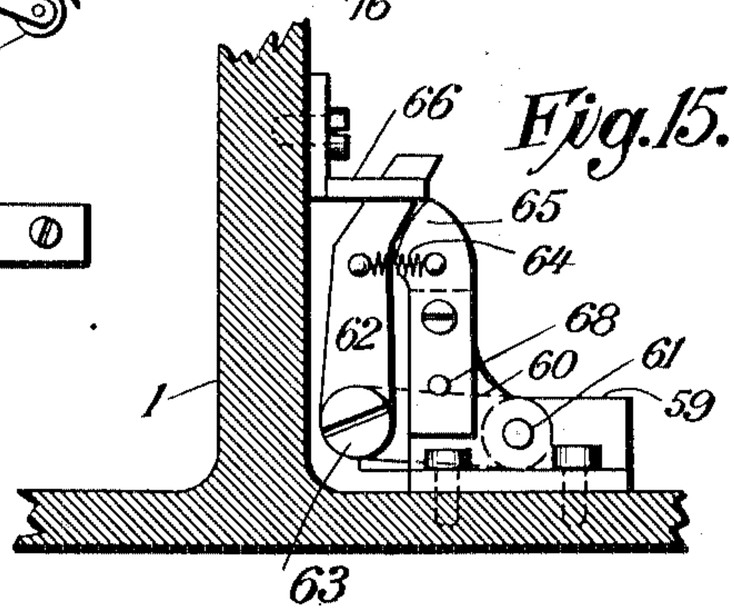


Fig. 14.

Fig. 15.



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1,114,905.

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8 SHEETS—SHEET 5.

Fig. 8.

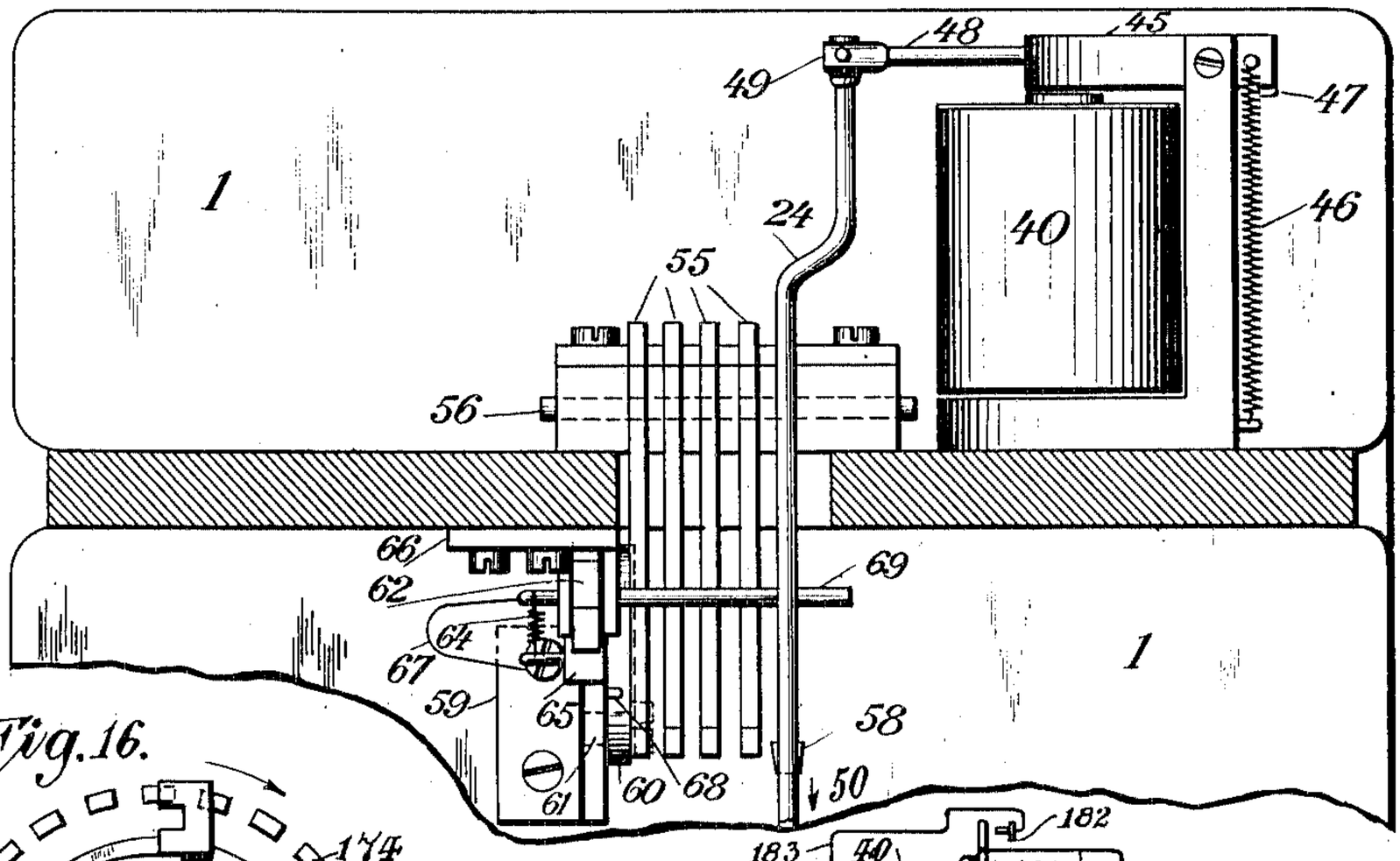

Fig. 16.

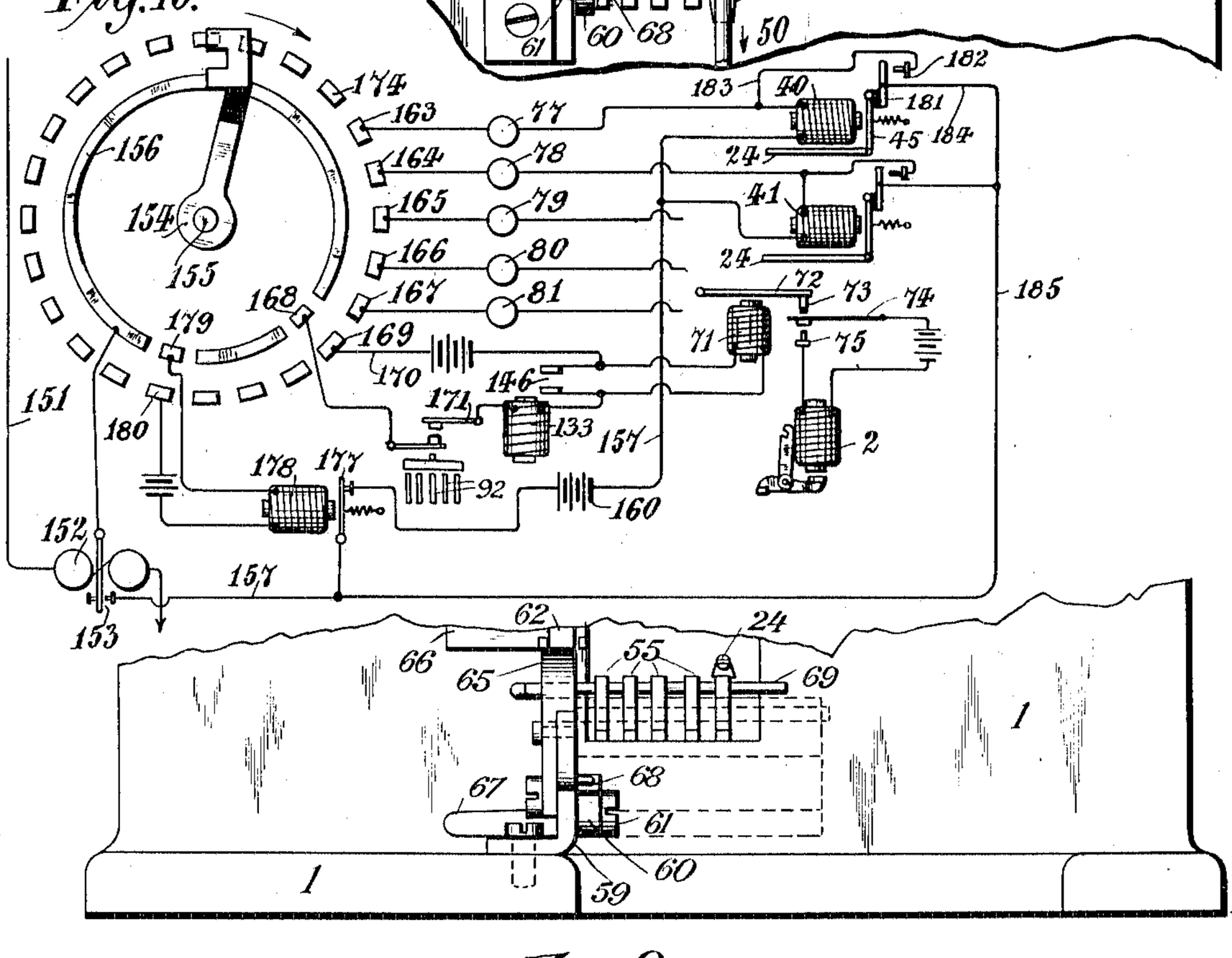

Fig. 9.

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8 SHEETS—SHEET 6.

Fig. 17.

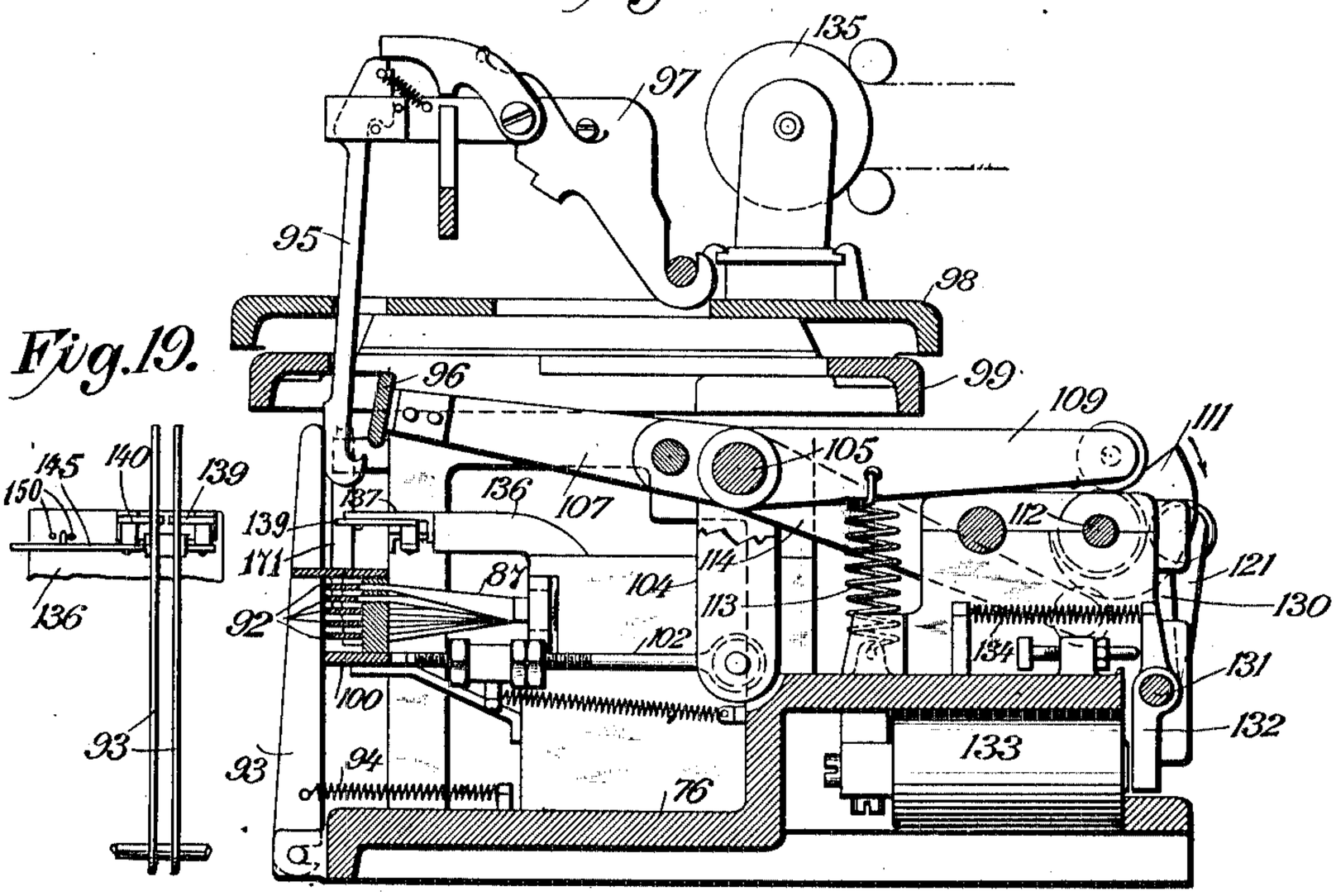

Fig. 19.

Fig. 18.

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APPLICATION FILED APR. 16, 1913.

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8 SHEETS—SHEET 7.

Fig. 21.

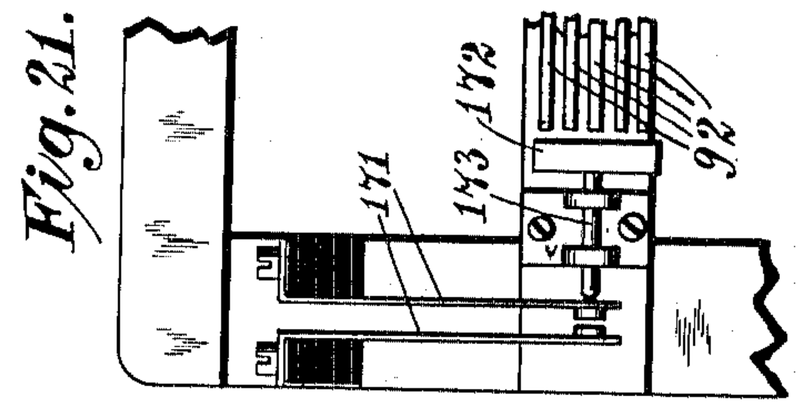
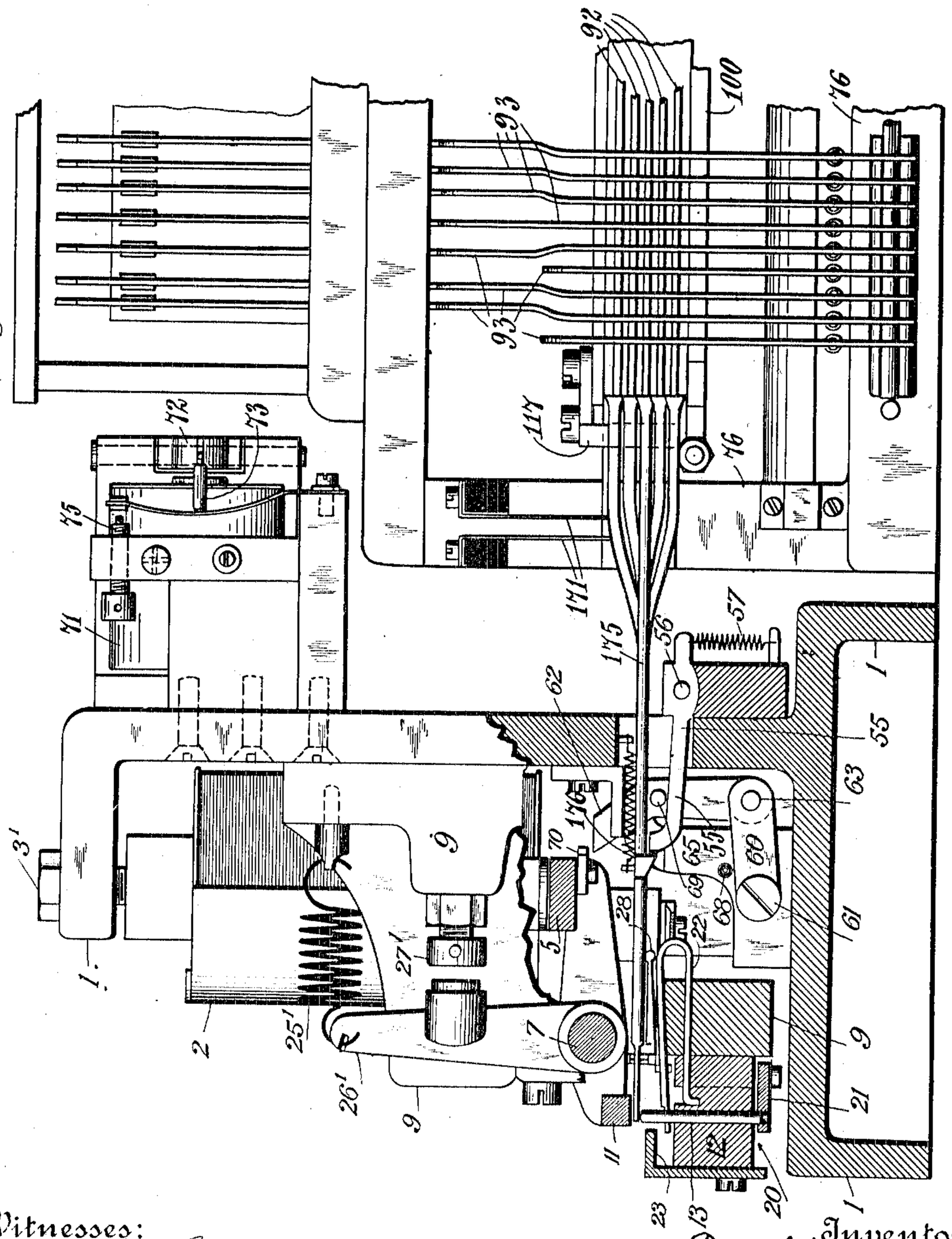


Fig. 20.



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APPLICATION FILED APR. 16, 1913.

1,114,905.

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8 SHEETS—SHEET 8.

Fig. 24.

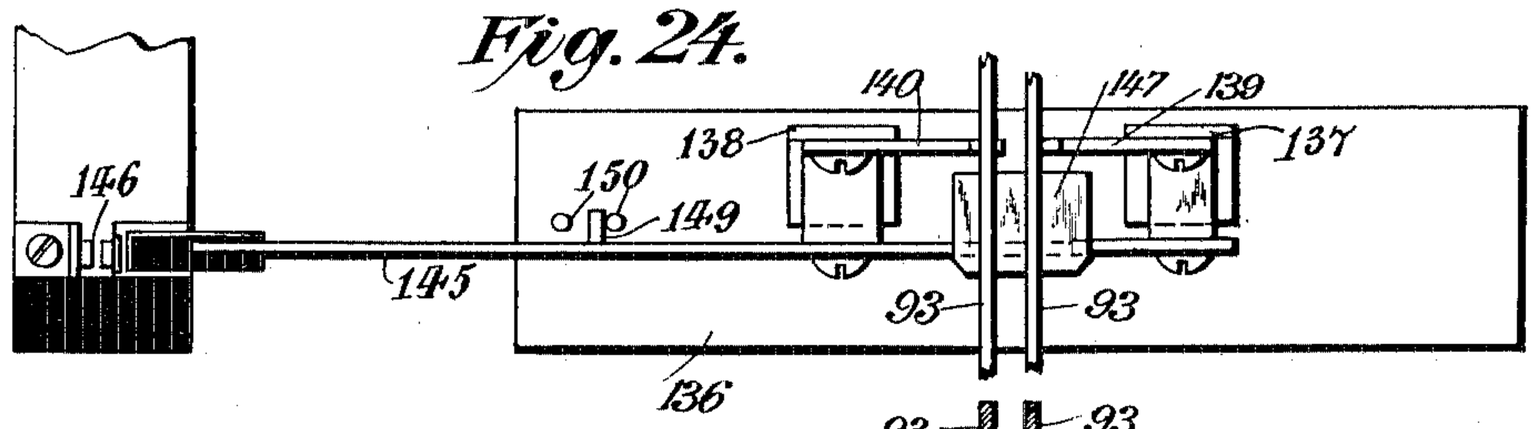


Fig. 25.

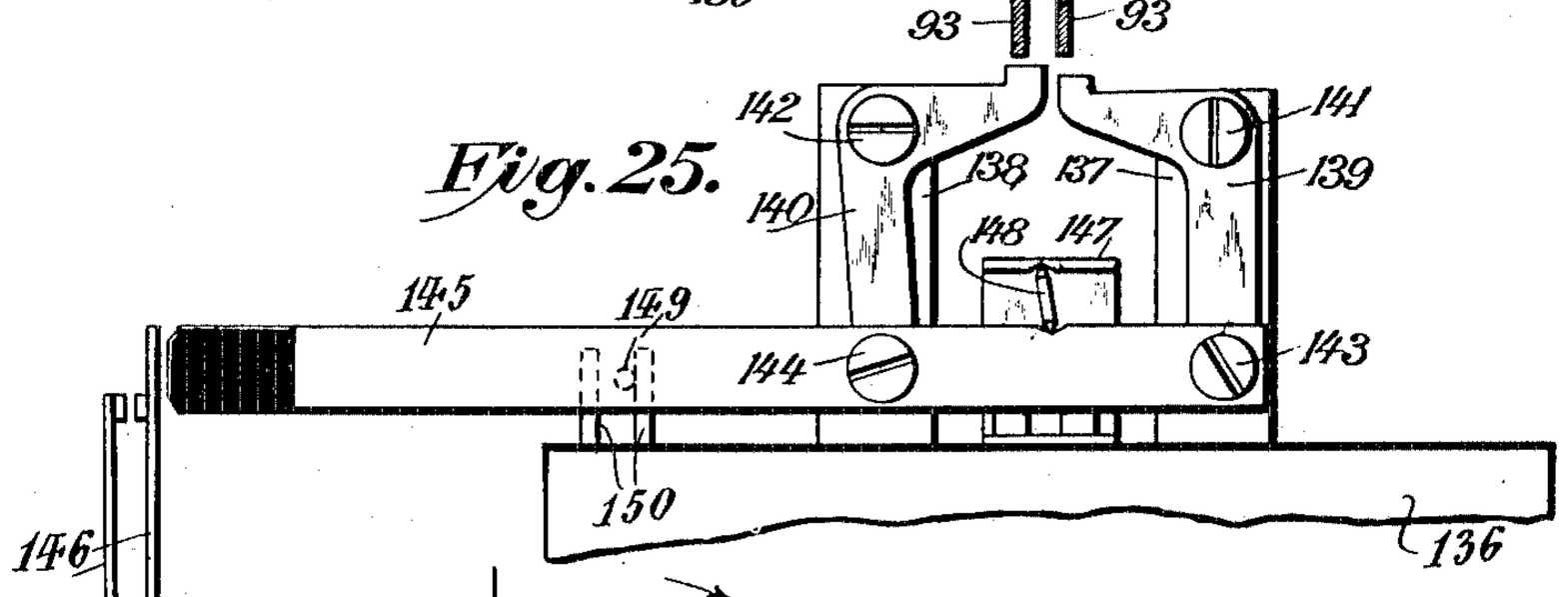


Fig. 22.

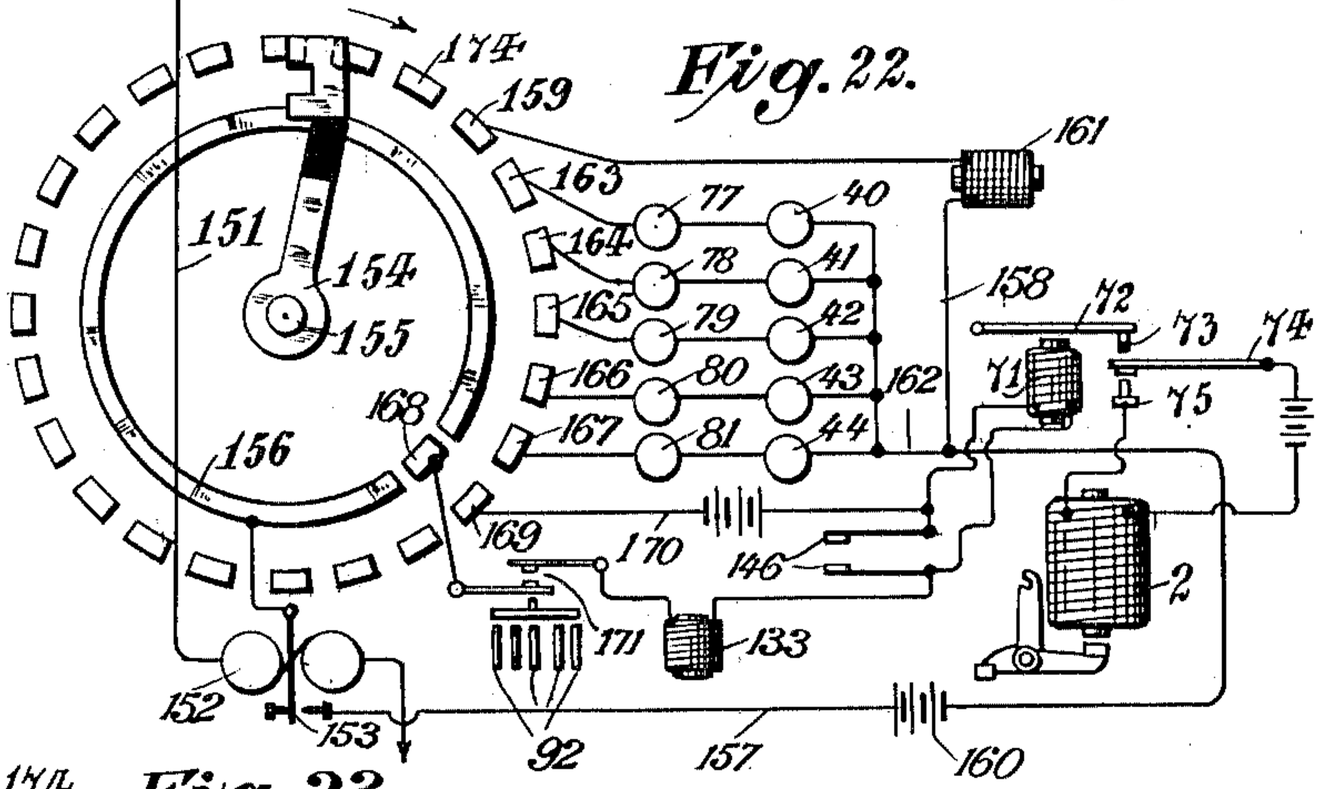
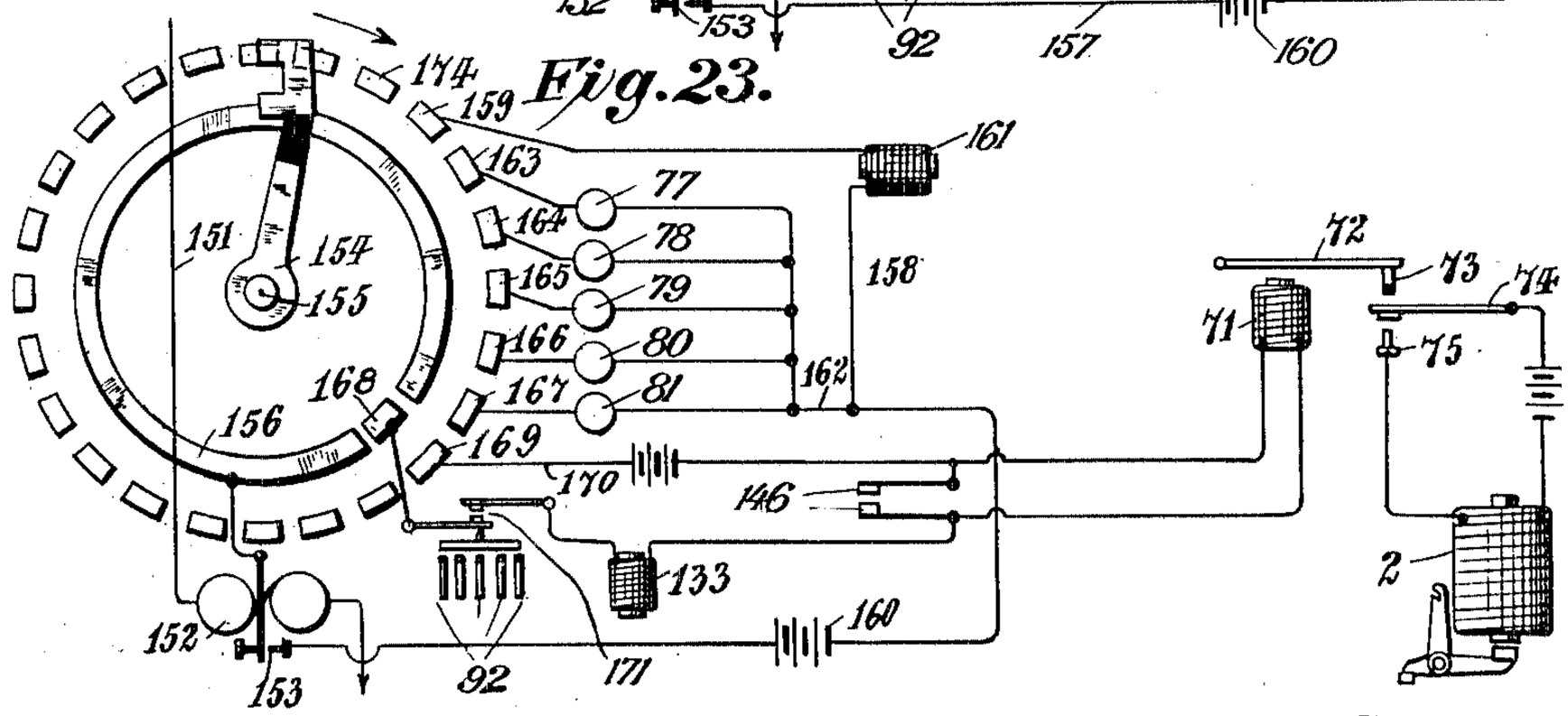


Fig. 23.



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UNITED STATES PATENT OFFICE.

DONALD MURRAY, OF LONDON, ENGLAND, ASSIGNOR TO THE WESTERN UNION TELEGRAPH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PRINTING-TELEGRAPH SYSTEM.

1,114,905. Specification of Letters Patent. Patented Oct. 27, 1914.

Application filed April 16, 1913. Serial No. 761,465.

To all whom it may concern:

Be it known that I, DONALD MURRAY, a subject of the King of Great Britain, and residing at 3 Lombard Court, in the county of London, England, have invented certain new and useful Improvements in Printing-Telegraph Systems, of which the following is a specification, reference being had to the accompanying drawings, which form a part hereof.

This invention relates primarily to improvements in printing telegraph systems.

It is more particularly adapted for use in a multiplex system, although its utility is not limited to such a system.

One object of the invention is to combine in convenient and practical form and arrangement, at a receiving station, two reproducers, such as a printer and perforator, so that while one reproducer, as the printer, is reproducing one record or printed record of the message being transmitted from the sending station, the other reproducer, as the perforator, may be reproducing another or perforated record of the same message, preferably in a tape which is separate from the message blank upon which the printer operates. This tape, after receiving its record, which preferably consists of groups of holes corresponding to the letters of the printed message, may then be used for automatic retransmission of the message to another city.

Another object of the invention is to provide an arrangement whereby the operation of one reproducer alone or in conjunction with the other reproducer may be controlled from the sending station. In this way both reproducers may be worked in conjunction with each other or one may be worked alone, at the will of the sending operator. Thus, the message may be reproduced at the receiving station in printed form alone or it may be reproduced in printed form and also, in whole or in part, in perforated form for retransmission to a third station. In the preferred arrangement, this is accomplished by the provisions of a switching device at the receiving station which is controlled by the main line connecting the stations and through the selecting magnets of the printer.

Another object of the invention is to improve certain features of the perforator.

The invention consists of the various features and combinations thereof hereinafter pointed out.

The features of the invention are shown in their preferred forms in the accompanying drawings, which constitute a part of this specification, and in which like reference numerals designate corresponding parts throughout.

Referring to said drawings, Figure 1 is a plan view of the receiving perforator. Fig. 2 is a front elevation of the same. Fig. 3 is a horizontal section along the line 3—3 of Fig. 2. Fig. 4 is a side elevation partly in section and broken away to show certain locking mechanism. Fig. 5 is a sectional elevation along the line 5—5—5 of Figs. 1 and 2. Fig. 6 is a back elevation of the receiving perforator. Fig. 7 is a horizontal section of the perforating mechanism on the line 7—7 of Fig. 2. Fig. 8 is a horizontal section on the line 3—3 of Fig. 2, like Fig. 3, but with various parts omitted to show more clearly the action of the locking and releasing mechanism. Fig. 9 is a front elevation of the same mechanism as that shown in Fig. 8. Fig. 10 is a plan view of the punch-block. Fig. 11 is a front elevation of the punch-block. Fig. 12 is a side elevation of the punch-block. Fig. 13 is a vertical section of the tape-feeding mechanism on the line 13—13 of Fig. 2. Fig. 14 is a rear view of the same tape-feeding mechanism. Fig. 15 is a side elevation of the releasing mechanism shown also in Figs. 8 and 9. Fig. 16 is a diagram showing a modified arrangement for electrically locking the selectors of the perforator in operating position. Fig. 17 is a sectional elevation on line 17—17 of Fig. 18 and showing a printer, parts being omitted, adapted for use in the general system of the invention. Fig. 18 is a plan view of the printer, the typewriter mechanism being omitted. Fig. 19 is a detached detail showing in front elevation a special switching device mounted in the printer. Fig. 20 is a front elevation of part of the printer and a sectional elevation of the perforator showing the two mechanically combined, as a modification. Fig. 21 is a front elevation of a switch, in detail, as indicated in the printer of Fig. 20. Fig. 22 is a diagram of the circuits at the receiving station for operating the printer and perforator. Fig. 23 is a similar view to Fig. 22 but showing a modification. Fig. 24 is a front elevation of a special switching device indicated in Figs. 22 and 23 and also in Fig. 19. Fig. 25 is a plan view from below of this same device.

Reference will now be made to the parts as shown in the drawings and first to the perforator shown in Figs. 1 to 15 inclusive. This machine acts as one of the reproducers at the receiving station and consists of three main portions best seen in Fig. 4. These are as follows: First, on the left hand side of Fig. 4 there is a mechanism for perforating holes in the paper tape and for feeding the tape forward. Second, on the right hand side of Fig. 4 there is a group of five magnets for forming a temporary mechanical record of each letter signal transmitted. Third, in the middle of Fig. 4 near the base in the broken away portion there is a locking device for retaining and storing up the mechanical record of the letter signals just referred to until they have been recorded as perforations in the paper tape. Starting first with the tape perforating mechanism, 1 is the metal frame of the machine. 9 is a metal bridge-piece forming part of the frame and attached to frame 1 by two screws 10, 10′. 2 is a large magnet supplying the power for perforating the holes in the paper tape. This magnet is attached to frame 1 in a hanging position by two bolts 3, 3′, and it is adjusted by two set-screws 4, 4′. The magnet attracts the armature 5, which is rigidly attached to two levers 6, 6′ (Figs. 5 and 7). These two levers 6, 6′, are in their turn rigidly attached to a shaft 7 which is free to rock in bearings 8, 8′, in the bridge piece 9. At their other ends the levers 6, 6′, carry a cross-bar 11 (Figs. 2, 4, 5 and 7). This cross-bar 11 is a hammer constituting part of an actuator which forces the punches 13 through the paper tape under certain conditions. The punch-block 12 carrying the punches 13, is most clearly seen in Figs. 4 and 5.

In Figs. 10, 11 and 12, the punch-block and punches are shown as separate details. The punch-block and associated parts as shown in Fig. 10 can be seen in place in Fig. 7; as shown in Fig. 11 in place in Fig. 2. Fig. 12 corresponds to the sectional views in Figs. 4 and 5. The paper tape shown in dotted outline at 14 (Figs. 1, 2 and 7) passes down around the star-wheel 15 (Fig. 2), between two guide rollers 16 and the stripper 17, through the punch-block 12, along the guide-plate 18 and out of the machine in the direction shown by the arrow 19. This machine, as shown, is arranged for perforating tape in the preferred manner, namely, with a single line of holes lengthwise of the tape.

Referring to Figs 4 and 5, the tape passes horizontally through the punch-block 12 in the groove 20. 21 is the die-plate into which the punches 13 enter and between which and the punches the paper tape passes. After perforating the paper the punches are retracted by the loop springs 22 which have their lower ends fixed in the punch-block and their upper ends passing through holes in the punches and under the stop-plate 23. The stop-plate 23 thus limits the retraction of the punches. There are five punches in a row, as may be seen in Figs. 7, 10 and 11. These punches, one or more at a time, produce various permutations of five holes and spaces in the paper tape. In order to select the various permutations of punches required to represent the various letters, selectors, preferably in the form of small interposing rods 24 are employed. These interposing rods are controlled by the five setting magnets, as will be explained presently. The interposing rods are held up by a light spring 28 common to all the rods, Figs. 4 and 5. When these interposing rods are thrust, one or more at a time, between the corresponding punches and the hammer bar 11, Fig. 5, they enable the hammer bar 11 to force the corresponding punches through the paper tape into the die-plate 21. The stroke of the hammer bar 11 is adjusted so that it cannot reach the punches if an interposing rod does not come between them. In Fig. 5 the armature 5 and the hammer 11 are in their normal retracted position, held there by springs 25, 25′, attached to the frame of the machine and to two levers 26, 26′, Figs. 1, 2 and 4. These two levers are pinned to the shaft 7, and normally they are held retracted against the adjustable stops 27, 27′. In Fig. 5 the armature 5, hammer 11, levers 6, 6′, and the levers 26, 26′, all of which may be considered as constituting the actuator for the recording devices or punches, are in the normal position of rest. In Fig. 4 the magnet 2 has attracted its armature 5 and the hammer 11 has forced one of the punches into the die-plate, an interposing rod intervening. It will be noted that the interposing rods or selectors are normally stationary and move only from one fixed position to another fixed position. When the electromagnet 2 becomes demagnetized, the armature 5 and the other parts connected with it go back to the position of rest shown in Fig. 5 and in dotted outline in Fig. 4 as the result of the tension of the springs 25, 25′. In going back, the paper tape is fed forward one letter-space by the mechanism now to be described.

The mechanism for feeding the paper tape forward, after it is perforated with a group of holes representing a letter, is best seen in Figs. 7, 13 and 14. At the end of a small spindle 29 a star-wheel 15 is located. It is shown in Fig. 7. In Fig. 13 the star-wheel has been omitted. The teeth of the star-wheel are adapted to engage with a row of central feed holes perforated beforehand in the paper tape. Referring to Fig. 13, at the opposite end of the spindle 29 to the star-

wheel 15, there is a small ratchet wheel 30. Attached to the armature 5 by a universal joint 31 there is a pawl 32, having a spring 32′. When the armature 5 is attracted by the punching magnet 2, the pawl 32 is pulled back from the ratchet 30. When the armature 5 is released the springs 25, 25′, Figs. 2 and 4, pull the armature back forcibly and cause the pawl 32, Figs. 13 and 14, to strike the ratchet 30 and move it forward one tooth. The ratchet being pinned to the spindle 29, the spindle, and with it the star-wheel 15, revolves to an equal extent, thereby feeding forward the paper tape one letter space. There are two special devices to prevent over-feeding of the tape and to secure it in definite position. One of these is a ratchet 33 pinned to a shaft 29 and having its teeth facing in the opposite direction to the teeth of the ratchet 30. In Fig. 2, the ratchet 33 is shown in dotted outline. There is also a locking pawl 34, pivoted on spindle 35 and having a spring 35′, which engages with the ratchet 33. A thrust-bar 36 pivoted on the armature lever 6′ is designed to thrust the pawl 34 out of engagement with the ratchet 33, when the armature is attracted by the magnet. When the armature is released the pawl 34 begins to move in toward the ratchet 33, but not before the star-wheel 15 has been moved forward one letter space by the pawl 32, Fig. 13. Pawl 34 then engages with the ratchet 33, and so prevents any further movement or over feed of the star-wheel 15. In order to position the star-wheel quite definitely, there is a third ratchet 37, Figs. 3 and 13, pinned to the spindle 29. A jockey roller 38 carried by a spring 39, which is fixed on bridge piece 9, engages with the teeth of ratchet 37 and holds it, and therefore the star-wheel, in one of several definite positions while the punching takes place.

There remains to be described the method of controlling the five selectors or interposing rods 24. These interposing rods 24 are connected to five setting magnets 40, 41, 42, 43 and 44, Fig. 6. The method of connection is shown more clearly in Fig. 8. 45 is the armature pulled back by a spring 46 against a stop 47. There is a similar arrangement of the armatures 51, 52, 53 and 54 of the other four setting magnets. Projecting from the armature 45, there is a rod 48 to which the interposing rod 24 is connected by a hinge joint 49. When the magnet 40 is energized the rod 24 is thrust forward about $\frac{1}{8}$ of an inch in the direction of the arrow 50. Referring to Figs. 4 and 5 it will be seen that this action of the several armatures brings one or more of the interposing rods between one or more of the punches 13 and the hammer 11 already described. Any one or more of the five interposing rods can therefore be thrust forward over one or more of the punches by one or more of the five setting magnets 40 to 44; but as these magnets only receive momentary impulses through them, it is necessary to provide a locking device to retain the settings of the interposing rods until the paper tape has been punched, the locking mechanism being released immediately afterward. This is achieved by the mechanism shown in Figs. 3, 4, 5, 6, 8, 9 and 15. Referring to Figs. 4 and 5, there is a series of five pawls 55, pivoted at 56, normally held up by five springs 57. Attached to each of the five interposing rods 24 there is a tooth 58. When one of the setting magnets 40 to 44 thrusts forward an interposing rod 24 a corresponding pawl holds the interposing rod in the forward position by catching behind the tooth 58. It is held in this position until the tape has been perforated by the magnet attracting the armature 5.

The method of releasing the locked interposing rods after a letter signal has been perforated in the paper tape is shown in Figs. 3, 4, 5, 8, 9 and 15. Referring first to Fig. 15, a small angle-plate 59 screwed to the base of the machine carries a lever 60 pivoted at 61. Pivoted at 63 on the other end of this lever there is a vertical push piece or pawl 62 of hardened steel. This pawl is held by a spring 64 against a hardened steel inclined-plane piece 65, which is screwed fast to the angle-plate 59. 66 is a slotted bracket to steady the push piece or pawl 62. The wire spring 67 keeps the pawl 62 in the upward position against the stop 68 (Figs. 8 and 9), on piece 65.

Returning now to Fig. 5, at the back of the armature there is fixed a small steel plate 70. The tip of the pawl 62 rests against the edge of this plate. When the armature is attracted, plate 70 rises with the armature past the tip of the pawl 62, which is then moved forward by its spring 64 into the position shown in Fig. 4, resting against the inclined plane piece 65. When the armature is released and falls back under the tension of the springs 25, 25′, the plate 70 strikes the top of the pawl 62. Pawl 62 being pivoted at 63 on the free end of the lever 60, which is pivoted at 61, is depressed by the plate 70. Projecting laterally from the pawl 62 there is a horizontal rod 69 (see also Figs. 3, 8 and 9). The pawl 62 as it is pushed down carries with it the rod 69, which then presses down the five locking pawls 55, one or more at a time, until they are free from the teeth 58 of the interposing rods 24. The interposing rods then being released are retracted by the armature springs 46 of the setting magnets (Fig. 8). As the armature 5 descends, however, it forces the pawl 62 more and more against the inclined plane piece 65 (Fig. 15). The result is that the pawl is gradually pushed

back until finally it escapes from the plate 70 and jumps up into its old position as shown in Fig. 5 under the pressure of the spring 67, Fig. 8. Everything is then in normal position ready for the setting and perforating of the next letter signal, when the train of operations already described is repeated.

In order that the machine may be controlled with very little current the operating magnet 71 of the perforator acts as a relay to open and close a local circuit in which the punching magnet is inclined. The armature 72 of this magnet 71 has a projecting rod 73 with an insulated end which presses against the spring contact 74. When the magnet 71 is energized the rod 73 presses the spring 74 into contact with 75. This completes the local circuit through the punching magnet 2 which is then operated. The other reproducer, in conjunction with which the perforator is designed to operate, is shown in the form of a printer in Figs. 17 to 18. This printer is similar in construction to that shown and described in United States Letters Patent No. 1,021,942, granted to me April 2, 1912. Referring now to this printer 76 is the base and frame of the selecting and printing mechanism of the printer. Secured to this frame are five selecting magnets 77, 78, 79, 80 and 81 having spring retracted armatures 82, 83, 84, 85 and 86 carrying pawls 87, 88, 89, 90 and 91. These pawls control five differentially slotted combs 92, arranged in a stack at the froht of the frame 76, and having lengthwise motion of about $\frac{1}{16}$ of an inch when released from their pawls. Directly forward of the combs and pivoted to the base is a series of crossbars or selectors 93 which are drawn toward the combs by springs 94. When one or more of the selecting magnets is energized by a current of the letter signal group, the relative position of the combs is altered to select one of the crossbars 93 which thereupon moves into the coinciding slots of the combs to throw the corresponding hook 95 of the series of such hooks rearward and into the path of the descending striker bar 96. Hooks 95 hang in alinement with crossbars 93 and are connected at their upper ends with the key levers 97 of a typewriter or other printing mechanism which need not be fully shown. The base 98 of the typewriter is fixed to a plate 99 which in turn rests upon and is fixed to the frame 76 of the printer. Crossbars 93 are normally held away from the combs by a supporting bar 100 carried on rods 101, 102 which are moved forward toward the crossbars by connecting arms 103, 104 rigidly secured to the rock shaft 105. The striker bar 96 is carried by arms 106, 107 and 108 provided with collars which are loose on shaft 105 to permit the striker bar to oscillate up and down. The striker bar is moved up and down by lever 109 rigidly secured to the collar 110 of arm 107, lever 109 being moved upward by a cam 111 carried on the rotatable cam shaft 112. A spring 113 connected to the base and to arm 109 pulls said arm downward and against its cam 111 and acts to return striker bar 96 to its upper position when such action is permitted by the offset in cam 111. Shaft 105 is rocked to move the supporting bar 100 forward against the crossbars by means of lever 114 which is rigidly secured to shaft 105 and is moved downward by cam 115 on the cam shaft. Springs 116 connected to the rearwardly extending ends of supporting bar 100 and to the main frame act to retract the supporting bar when such movement is permitted by cam 115. After the combs have been shifted in response to the selecting magnets, they are returned to normal position by a lever 117 to which movement is imparted by rod 118 connected with rocking frame 119 which is operated by rod 120 connected with an upright lever 121 pivoted on the main frame. This lever is moved rearward by cam 122 on cam shaft 112. A spring, not shown, secured to the base and to said lever 121, acts to pull the lever forward and to restore lever 117 to normal position when permitted by cam 122. 123 is a continuously driven pulley shaft which may be driven from an electric or other suitable motor. It carries a gear 124 meshing with a gear 125 which is loose on cam shaft 112 and carries one member of a coupling 126, the other member of which is mounted on the cam shaft so as to turn with, but slide thereon. Spring 127 tends to close the coupling and when the coupling is closed, the cam shaft is driven from the pulley shaft 123. This coupling is closed during only one rotation thereof, owing to the action of a stationary cam 128, which is met by follower pin 129 fixed on the sliding member of the coupling, thereby opening the coupling and causing said pin to be caught and held by a detent 130 which thus prevents further rotation of the cam shaft and holds the coupling open. This detent is fixed on shaft 131 on which is fixed armature 132. This armature is operated by the operating magnet 133 of the printer. When the spring 134 of the armature retracts it, detent 130 is held in engagement with the follower pin 129.

In the operation of the parts thus far described, when one of the crossbars or selectors 93 moves rearward after having been selected by one or more of the selecting magnets, acting through the combs, this selected crossbar moves the corresponding hook 95 rearward into the path of striker bar 96. Operating magnet 133 is then energized to close coupling 126 and cam shaft 112 makes

one rotation. Striker bar 96 then descends and pulls the selected hook 95 downward to print the selected letter or character on the blank which passes over the platen 135 of the typewriter. Immediately after the striker bar has engaged the selected hook 95, supporting bar 100 moves forward to restore the selected crossbar to normal position. The combs are then restored to normal position by lever 117 ready to be set again in another letter permutation. When the cam shaft has completed its one rotation, all the parts have been restored to normal position, coupling 126 is open and cam shaft 112 stops. The printer is then ready for another operation.

In order that the printer may be made to operate alone or in conjunction with the perforator, the printer is provided with a special switching device controlled from the sending station over the main line. This switching device is shown in Figs. 17 and 18 mounted in place in the printer. It is also shown in detail in Fig. 19 and in enlarged detail in Figs. 24 and 25. Carried by the frame of the printer is a support 136 carrying brackets 137 and 138 which project toward the crossbars 93 above the combs. On these brackets bell crank levers 139 and 140 are pivoted on pins 141 and 142, respectively. The rear ends of these bell crank levers are pivoted, respectively, by means of pins 143 and 144 to a rod 145 having its outer end made of insulating material and arranged to operate the contact springs 146 carried by the frame of the printer. The outer ends of bell crank levers 139 and 140 project in close proximity to the crossbars 93 so that when a special one of these crossbars is permitted to move rearward, after having been selected by the combs, it actuates bell crank lever 140, thereby moving rod 145 to close contact springs 146. When another special crossbar 93 is selected, it actuates bell crank lever 139 to return the rod to normal position and open the contact springs. In order that the rod may remain in either position to which it has been moved, a spring angle plate 147 is provided which bears against the upper end of a jockey pin 148 whose lower end bears against rod 145. The pin is held in place by notches formed in the spring and rod to receive the ends of the pin. Thus, the rod is held positively in either position to which it may have been moved. The movement of the rod is limited by means of a lug 149 fixed on the rod and two pins 150 which are fixed on support 136 and between which the lug works. By means of this switching device it will thus be seen that when one or more of the setting magnets of the printer is energized by a special signal transmitted over the main line, contact springs 146 are closed to throw the perforator into operation so that it may work in conjunction with the printer. Conversely the perforator may be thrown out of action to permit the printer to work alone by a reverse operation of the switching device.

The circuits at the receiving station for operating the printer and perforator are shown in Fig. 22 and also in modified form in Fig. 23. Referring first to Fig. 22, 151 is the main telegraph line which extends from the sending station through the main line relay 152 at the receiving station to earth. The main line signals open and close contacts 153 of the main line relay. 154 is a constantly rotating contact arm of a multiplex distributer, such as that of the Baudot type. It rotates on spindle 155 and carries at its outer end a contact brush designed to sweep over the stationary contacts of the distributer. Contacts 153 are connected on one side to a stationary segmental contact 156 and on the other side by wire 157 and wire 158 to contact block 159. Generator 160 is connected in wire 157 and magnet 161 is connected in wire 158. Connecting with wire 157 is a wire 162 from which extend multiple branches connecting with contacts 163, 164, 165, 166 and 167. These multiple branches include the selecting magnets 77, 78, 79, 80, and 81 of the printer and selecting magnets 40, 41, 42, 43 and 44 of the perforator. Connecting with contact blocks 168 and 169 of the distributer is a local operating circuit 170 which includes operating magnet 133 of the printer and operating magnet 71 of the perforator. Magnet 71 is the operating magnet of the perforator but it is desirable not to employ it directly to do the heavy work of actuating the punches 13. Magnet 71 is, therefore, arranged to actuate the punches, or operate the perforator, through a separate local circuit which it controls and which includes the large punch magnet 2. This is indicated in Fig. 22, wherein armature of magnet 71 carries a rod 73 which moves spring contact 74 against contact 75 to close the local circuit through punch magnet 2, when magnet 71 is energized. When magnet 71 is deënergized spring contact 74 separates from contact 75 to deënergize magnet 2. These contacts, as thus operated and arranged, have been already described and are shown in Fig. 4. Connected in operating circuit 170, and in a shunt around magnet 71, is a switch 146. Also connected in local circuit 170 is a normally open switch 171 arranged to be closed by the action of each one of the combs 92 of the printer. This switch is shown in detail in Fig. 21, and is indicated in position in Figs. 17 and 18. When one or more combs have been shifted by their selecting magnets, block 172, carrying pin 173, is pushed forward to close the switch. As soon as the comb or combs have been restored to normal position the switch opens

automatically. By means of this switch the operating circuit 170 may be closed only during such times as main line relay 152 is being operated to receive a message. If it were not for this switch, operating magnets 71 and 133 would be energized, assuming switch 146 to be closed, every time contact arm 154 passed over contacts 168 and 169 and cause the armatures of these magnets and magnet 2 to chatter when main line relay 152 is quiescent. Contact arm 154 rotates in synchronism with the arm of a similar distributer at the sending station. Consequently, when contact arm 154 is on contact block 174 thereby connecting it with contact segment 156, the contact arm at the sending station is in the same position. Contact 174 and the corresponding contact at the sending station are the positive or correcting contacts at both stations. Hence, when the contact arm at the sending station is on the contact block corresponding to contact 174, a positive impulse is sent over the telegraph line 151 to relay 152, thereby closing contacts 153. But there is no local circuit formed because the contact block 174 is not connected to anything. Actually, however, contact arm 154 is arranged to run slightly faster than the corresponding arm at the sending station. The result is that while the positive impulse is still on the line, contact arm 154 tends to reach contact block 159 so as to complete a local circuit from contacts 153, through wire 157, generator 160, wire 158, magnet 161, contact 159, contact arm 154, segment 156 to contacts 153. Magnet 161 is thus energized so as to operate suitable governing mechanism which retards contact arm 154. The synchronism being maintained in this way, any signal being transmitted from the sending station will cause a local circuit to be closed at the receiving station through the corresponding contact blocks 163, 164, 165, 166 and 167, the current flowing from generator 160, through wire 157 to wire 162, and thence through one or more of the multiple branches to the selecting magnets therein connected, through the corresponding blocks, contact arm 154, contact 156, contacts 153, and wire 157 back to generator. In this way one or more of these pairs of printer and perforator selecting magnets is energized. The action of the printer selecting magnets 77 to 81, inclusive, has been described in the foregoing in connection with the printer shown in Figs. 17 and 18. The action of the perforator selecting magnets 40 to 44, inclusive, has been described in the foregoing in connection with the perforator shown in Figs. 1 to 15, inclusive.

After contact arm 154 has passed over the contacts connected with the selecting magnets, it then passes over and connects contacts 168 and 169. Contact 171 having been already closed by the action of the combs 92, which have just been operated by the selecting magnets, local circuit 170 is closed to energize operating magnets 133 and 71 of the printer and perforator, respectively, to both print and perforate the character just selected by the selecting magnets. If the sending operator desires that the message transmitted, or any part thereof be merely printed and not perforated, he transmits a special signal over the main line which causes one or more of the selecting magnets of the printer to be energized and thereby cause switch 146 to be closed by the action of one of the crossbars 93, as described in the foregoing. As has already been described, this switch remains closed until it is opened as the result of a subsequent signal transmitted over the main line. Hence, when the local circuit 170 is closed, operating magnet 133 is energized but operating magnet 71 remains unenergized because current through this magnet is shunted through switch 146. The receiving perforator will, therefore, be idle. When, thereafter, it is desired to reproduce a message in both printed and perforated form, the proper signal is transmitted and switch 146 is opened so that the perforator again works in conjunction with the printer.

If desired, the printer and perforator may be connected for conjoint operation by arranging the combs of the printer to mechanically actuate the selector rods of the perforator. This modification is shown in Fig. 20. As thus connected for operation, only one set of selecting magnets will be required, the selecting magnets of the perforator being dispensed with. This is indicated in Fig. 20 and also in the diagram of circuits appropriate thereto shown in Fig. 23.

Referring now to Figs. 20 and 23, the mechanism of the perforator is the same as that shown in Figs. 1 to 15 inclusive with the following exceptions. The selecting magnets of the perforator are dispensed with and in place of the selector rods 24 selector rods 175 are substituted which are in all respects similar to the selector rods 24, except that the latter are lengthened at their rear ends and arranged for actuation in one direction by the combs of the printer, and for actuation in the opposite direction by springs 176. The view of the perforator shown in Fig. 20 corresponds with that of Fig. 4. As shown in Fig. 20, the selector rods 175 are extended so as to have their ends supported in close proximity to the ends of the combs 92. As thus arranged, when the combs of the printer are moved lengthwise by their setting magnets, the corresponding selector rods 175 are moved to make the corresponding selection of the punches to be actuated, the corresponding selection for the printer mechanism being set up at the same time

through the combs and the crossbars or selectors 93 of the printer. After the selector rods 175 have been thus moved by the combs, the combs are free to be returned to their normal position, as before, by lever 117 and crossbars 93 may be returned to their normal position by supporting bar 100. The selector rods 175, however, remain in their set position, being there held by pawls 55 until these are released in the manner heretofore described. When so released, selector rods 175 are returned to normal position by springs 176 which are connected at one end to the rods and at the other end to the frame of the machine.

In the diagram of the circuits appropriate to the modifications shown in Fig. 20, the circuits and connections are identical with those shown in Fig. 22 except that the perforator selecting magnets 40 to 44, inclusive, are omitted, the printer selecting magnets accomplishing their work as well as their own in the manner described. When switch 146 in Fig. 23 is closed by the movement of the proper crossbar 93, shown in Fig. 20, operating magnet 71 of the perforator is cut out in the same way as has been described with reference to Fig. 22. If it is desired that the receiving mechanism shall record the transmitted signals in perforation only, the printing mechanism may be dispensed with and the printer selecting magnets 77 to 81, inclusive, omitted from the circuits shown in Fig. 22. The receiving mechanism will then act as a receiving perforator only. It is also obvious that the switching device may be greatly modified without departing from the essentials of this feature of the invention.

While it is preferred to employ mechanical means for locking and releasing the selector rods, such as the means heretofore described for this purpose, it is possible to employ electrical means to accomplish this result. Such an arrangement is shown in Fig. 16. As thus shown, only two of the perforator selecting magnets are indicated for the sake of clearness, namely, magnets 40 and 41, and governing magnet 161 is omitted. Wire 157 leads from contacts 153 of main line relay 152 to the multiple branches of the selecting magnets, as in Fig. 22, but in Fig. 16 it includes a circuit controller 177 operated by magnet 178 connected in a local circuit with contacts 179 and 180 of the distributer. Armature 45 of magnet 40 carries on its pivoted end a projecting contact 181 which coöperates with front contact 182 which is connected by wire 183 with the multiple branch of magnets 40 and 77 at a point between the magnets. Contact 181 is connected by branch wire 184 to common return wire 185 which connects with wire 157 at a point between circuit controller 177 and contacts 153. Contacts 181 and 182 are normally open. The operation is as follows: When contacts 153 are closed current from generator 160 flows as before through wire 157, selecting magnets 40 and 77, distributer contacts, etc., and back to generator 160, but returns through circuit controller 177. When magnet 40 is thus energized it moves forward its selector rod 24, as before, but its armature now closes contacts 181 and 182 so that magnet 40 remains energized through a holding circuit which may be traced from generator 160 through wire 157, magnet 40, wire 183, contacts 182 and 181, wires 184 and 185, circuit controller 177 and switch 171 back to generator 160. Thus selector rod 24 of magnet 40 remains in its set position by the action of the magnet itself. Magnet 40 is deenergized to allow its selector rod to return to normal position as soon as distributer arm 154 reaches contact blocks 179 and 180, whereupon the local circuit of magnet 178 closes momentarily to break the holding circuit of magnet 40 just traced. The parts are all then restored to normal position. Magnet 41 and the other selecting magnets of the perforator are similarly connected and arranged to electrically lock and release their selector rods 24. It will be noted that magnet 178 constitutes means common to all the selectors for releasing the selectors. The same is true of the push piece 62 and its rod 69, (Fig. 4).

Various modifications in the construction, arrangement and operation of the parts other than those herein specifically indicated may be made by those familiar with the art without departing from the scope of the invention, as herein set forth.

What I claim is:

1. The combination with recording devices adapted to be actuated singly and in combination and an actuator therefor; of normally stationary selectors adapted to move from one fixed position to another fixed position to select the particular recording device or devices to be actuated and temporarily retain such selection; means for so moving the selectors; means for retaining the selectors in set position; and means for restoring the selectors to normal position.

2. The combination with recording devices adapted to be actuated singly and in combination and an actuator therefor; of selectors adapted to be set to select the particular recording device or devices to be actuated and temporarily retain such selection; setting means for the selectors; means separate from said setting means and disconnected from the recording devices for retaining the selectors in set position; and means for restoring the selectors to normal position.

3. The combination with recording devices adapted to be actuated singly and in

combination and an actuator therefor; of selectors adapted to be set to select the particular recording device or devices to be actuated and temporarily retain such selection; means for setting the selectors; and means operated by the actuator for restoring the selectors to normal position.

4. The combination with recording devices adapted to be actuated singly and in combination and an actuator therefor; of selectors adapted to be set to select the particular recording device or devices to be actuated and temporarily retain such selection, said selectors being adapted to be moved into and out of interposition between the recording devices and the actuator; setting means for the selectors; means separate from said setting means for retaining the selectors in set position; and means for restoring the selectors to normal position.

5. The combination with recording devices and an actuator therefor; of selectors adapted to be set to select the particular recording device or devices to be actuated; selecting magnets to move the selectors to one position; springs to move the selectors to their other position; pawls to retain the selectors in the position to which they have been moved by their magnets; and means to release the pawls.

6. The combination with recording devices and an actuator therefor; of selectors adapted to be set to select the particular recording device or devices to be actuated, said selectors being adapted to be moved into and out of interposition between the recording devices and the actuator; selecting magnets to move the selectors to one position; springs to move the selectors to their other position; means to retain the selectors in the position to which they have been moved by their magnets; and means common to all the selectors to release the same.

7. The combination with recording devices and an actuator therefor; of selectors adapted to be set to select the particular recording device or devices to be actuated; selecting magnets to move the selectors to one position; springs to move the selectors to their other position; pawls to retain the selectors in the position to which they have been moved by their magnets; and means common to all the pawls to release the pawls, said means comprising a spring retracted push piece operated by the actuator and carrying a rod to engage the pawls and having means to move it into and out of the path of the actuator.

8. The combination with recording devices adapted to be actuated singly and in combination and an actuator therefor; of selectors adapted to be set to select the particular recording device or devices to be actuated and temporarily retain such selection, said selectors being adapted to be moved into and out of interposition between the recording devices and the actuator; means operated by the actuator for restoring the selectors to normal position; and selecting magnets to control the setting of the selectors.

9. The combination with recording devices adapted to be actuated singly and in combination and an actuator therefor; of blank feed mechanism operated by the actuator; selectors adapted to be set to select the particular recording device or devices to be actuated and temporarily retain such selection; setting means for the selectors; means separate from said setting means for retaining the selectors in set position; and means for restoring the selectors to normal position.

10. The combination with recording devices adapted to be actuated singly and in combination and an actuator therefor; of blank feed mechanism including a rotary blank carrier, a shaft therefor having a ratchet wheel and pawl operated by the actuator; selectors adapted to be set to select the particular recording device or devices to be actuated and temporarily retain such selection; setting means for the selectors; means separate from said setting means for retaining the selectors in set position; and means for restoring the selectors to normal position.

11. In a receiving perforator for a printing telegraph, the combination with a series of punches adapted to be actuated singly and in combination, an actuator therefor and a magnet for operating the actuator; of selector rods adapted to be set to select the particular punch or punches to be actuated, said selector rods being adapted to be moved into and out of interposition between the punches and the actuator; selecting magnets controlled from the sending station and controlling the setting of the selector rods; retaining pawls for the selector rods; and means to release the pawls after the punches have been operated.

12. In a receiving tape perforator for a printing telegraph, the combination with a series of punches adapted to be actuated singly and in combination, an actuator therefor and a magnet for operating the actuator; of selector rods adapted to be set to select the particular punch or punches to be actuated, said selector rods being adapted to be moved into and out of interposition between the punches and the actuator; selecting magnets controlled from the sending station and controlling the setting of the selector rods; retaining pawls for the selector rods; means to release the pawls after the punches have been operated; and mecha-

nism for feeding the tape forward one step and then locking it after the punches have operated.

13. In a telegraph system for automatically reproducing at a receiving station messages sent from a sending station, the combination of two receiving reproducers operable by the same signaling impulses and means controlled from the sending station for rendering one of said reproducers alone receptive to the said signaling impulses or both simultaneously receptive to the same signaling impulses.

14. In a telegraph system for automatically reproducing at a receiving station messages sent from a sending station, the combination of two receiving reproducers and a switch located at the receiving station and operated by one of said reproducers, said switch being controlled from the sending station for rendering one of said reproducers operable alone or in conjunction with the other reproducer.

15. In a printing telegraph system, the combination of a receiving printer and perforator adapted to be operated from a sending station, and means controlled from the sending station for rendering the printer operable alone or in conjunction with the perforator.

16. In a printing telegraph system, the combination of a receiving printer and perforator having a main line for operating them simultaneously from a sending station, and means controllable by the main line for rendering the printer operable alone or in conjunction with the perforator.

17. In a printing telegraph system, the combination with a receiving printer and perforator, each having an operating magnet; of a main line for operating the printer and perforator from a sending station; and a switching device at the receiving station controllable by the main line to cut out the perforator magnet or connect it for simultaneous operation with the printer magnet.

18. In a printing telegraph system, the combination with a receiving printer and perforator having selecting magnets to determine the characters to be reproduced and each having an operating magnet; of a main line for operating the printer and perforator from a sending station; and a switching device at the receiving station controllable by the main line through said selecting magnets to cut out the perforator magnet or connect it for simultaneous operation with the printer magnet.

19. In a telegraph system for automatically reproducing at a receiving station messages sent from the sending station, the combination with two receiving reproducers having selecting magnets to determine the characters to be reproduced; of a main line for operating the reproducers from the sending station; and a switching device at the receiving station controllable by the main line through said selecting magnets to render one of the reproducers operable alone or in conjunction with the other.

20. In a printing telegraph system, the combination with a distributer and local circuit connections therefor having a generator and multiple branches, the distributer having a common contact connected with one side of the local generator and a series of contacts connected through the multiple branches with the other side of the generator; of two selectively operated reproducers having selecting magnets in said multiple branches; operating magnets, one for each reproducer; and a local circuit for simultaneously operating said operating magnets.

21. In a telegraph system for automatically reproducing at a receiving station messages sent from a sending station, the combination with a distributer and local circuit connections therefor; of two selectively operated reproducers having selecting magnets in said circuit connections; a local operating circuit for said reproducers; a main line controlling said local circuit and circuit connections; and a switching device controlled by the main line for rendering one of said reproducers operable alone or in conjunction with the other.

22. In a printing telegraph system, the combination with a distributer and local circuit connections therefor having a generator and multiple branches, the distributer having a common contact connected with one side of the local generator and a series of contacts connected through multiple branches with the other side of the generator; of two selectively operated reproducers having selecting magnets in said multiple branches; operating magnets, one for each reproducer; a local circuit for said operating magnets; a main line controlling said local circuit and circuit connections; and a switching device controlled by the main line and adapted to cut one of said operating magnets in or out of its local circuit.

23. In a printing telegraph system, the combination with a receiving distributer and local circuit connections therefor; of two selectively operated reproducers having selecting magnets in said circuit connections and having selecting mechanism controlled by the selecting magnets; a local operating circuit for said reproducers; and a switching device actuated by said selecting mechanism for cutting in or out one of said reproducers.

24. In a printing telegraph system, the combination with a distributer and local circuit connections therefor; of a printer

and perforator selectively operated and having selecting magnets in said circuit connections; operating magnets for the printer and perforator; a local circuit for said operating magnets; a main line controlling said local circuit and circuit connections; and a switching device controlled by the main line and adapted to control the operation of the perforator.

25. In a telegraph system for automatically reproducing at a receiving station messages sent from a sending station, the combination with a receiving distributer and local circuit connections therefor; of two receiving reproducers having selecting magnets in said local circuit connections and selecting mechanism; and a local operating circuit for said reproducers connecting with the distributer and controlled by said selecting mechanism.

26. In a telegraph system for automatically reproducing at a receiving station messages sent from a sending station, the combination with a receiving distributer and local circuit connections therefor; of two receiving reproducers having selecting magnets in said local circuit connections and selecting mechanism; a local operating circuit for said reproducers connecting with the distributer and controlled by said selecting mechanism; a main line; and a switching device controlled by the main line through certain elements of the selecting mechanism for rendering one of said reproducers operable alone or in conjunction with the other.

27. In a telegraph system for automatically reproducing at a receiving station messages sent from a sending station, the combination with a receiving distributer and local circuit connections therefor; of a receiving reproducer having selecting magnets in said local circuit connections and selecting mechanism; and a local operating circuit for said reproducer connecting with the distributer and controlled by said selecting mechanism.

28. In a telegraph system for automatically reproducing at a receiving station messages sent from a sending station, the combination of two selectively operated reproducers each having its own group of selectors adapted to be set to select the particular characters to be reproduced, in combination with selecting mechanism arranged to set both groups of selectors.

29. In a telegraph system for automatically reproducing at a receiving station messages sent from a sending station, the combination of two selectively operated reproducers each having its own group of selectors adapted to be set to select the particular characters to be reproduced, in combination with selecting combs arranged to mechanically shift one group of selectors and simultaneously control the other group of selectors; and selecting magnets to operate the combs.

30. In a printing telegraph system, the combination of a receiving printer and perforator each having its own group of selectors adapted to be set to select the particular characters to be reproduced, in combination with selecting mechanism arranged to mechanically shift the perforator selectors and simultaneously control the printer selectors; means to retain the perforator selectors in set position independent of the movement of the selecting mechanism; and magnets controlling said selecting mechanism.

31. In a printing telegraph system, the combination of a receiving printer and perforator each having its own group of selectors adapted to be set to select the particular characters to be reproduced, in combination with selecting mechanism arranged to mechanically shift the perforator selectors and simultaneously control the printer selectors, said perforator selectors comprising longitudinally movable rods and said selecting mechanism comprising longitudinally movable combs in alinement with and arranged to push said rods into operating position; means to retain the perforator selectors in set position independent of the movement of the selecting mechanism; and magnets to control said selecting mechanism.

32. In a printing telegraph system, the combination of a receiving printer and perforator each having its own group of selectors adapted to be set to select the particular characters to be reproduced, in combination with selecting mechanism arranged to mechanically shift the perforator selectors and simultaneously control the printer selectors, said perforator selectors comprising longitudinally movable rods and said selecting mechanism comprising longitudinally movable combs in alinement with and arranged to push said rods into operating position; means to retain the perforator selectors in set position independent of the movement of the selecting mechanism; means for rendering the printer operable alone or in conjunction with the perforator; and magnets to control said selecting mechanism.

This specification signed and witnessed this 28 day of March, 1913.

DONALD MURRAY.

Signed in the presence of—

H. D. JAMESON,

O. J. WORTH.

Correction in Letters Patent No. 1,114,905.

It is hereby certified that in Letters Patent No. 1,114,905, granted October 27, 1914, upon the application of Donald Murray, of London, England, for an improvement in "Printing-Telegraph Systems," an error appears in the printed specification requiring correction as follows: Page 4, line 13, for the word "inclined" read *included;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 24th day of November, A. D., 1914.

[SEAL.]

R. F. WHITEHEAD,

Acting Commissioner of Patents.