No. 811,950. PATENTED FEB. 6, 1906.

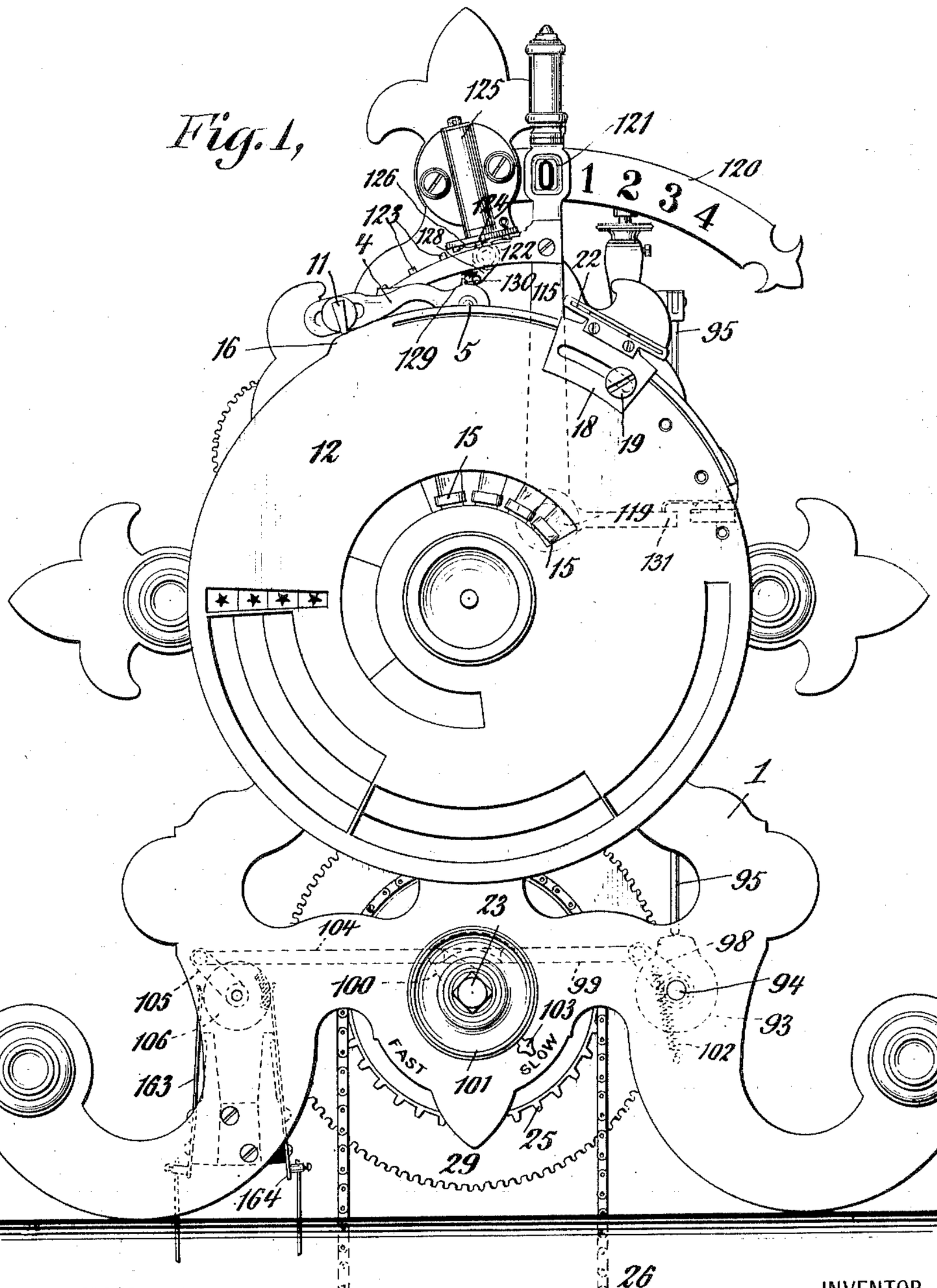
C. F. PEARCE.

DIAL TRANSMITTER.

APPLICATION FILED SEPT. 9, 1905.

9 SHEETS—SHEET 1.

Fig. 1,



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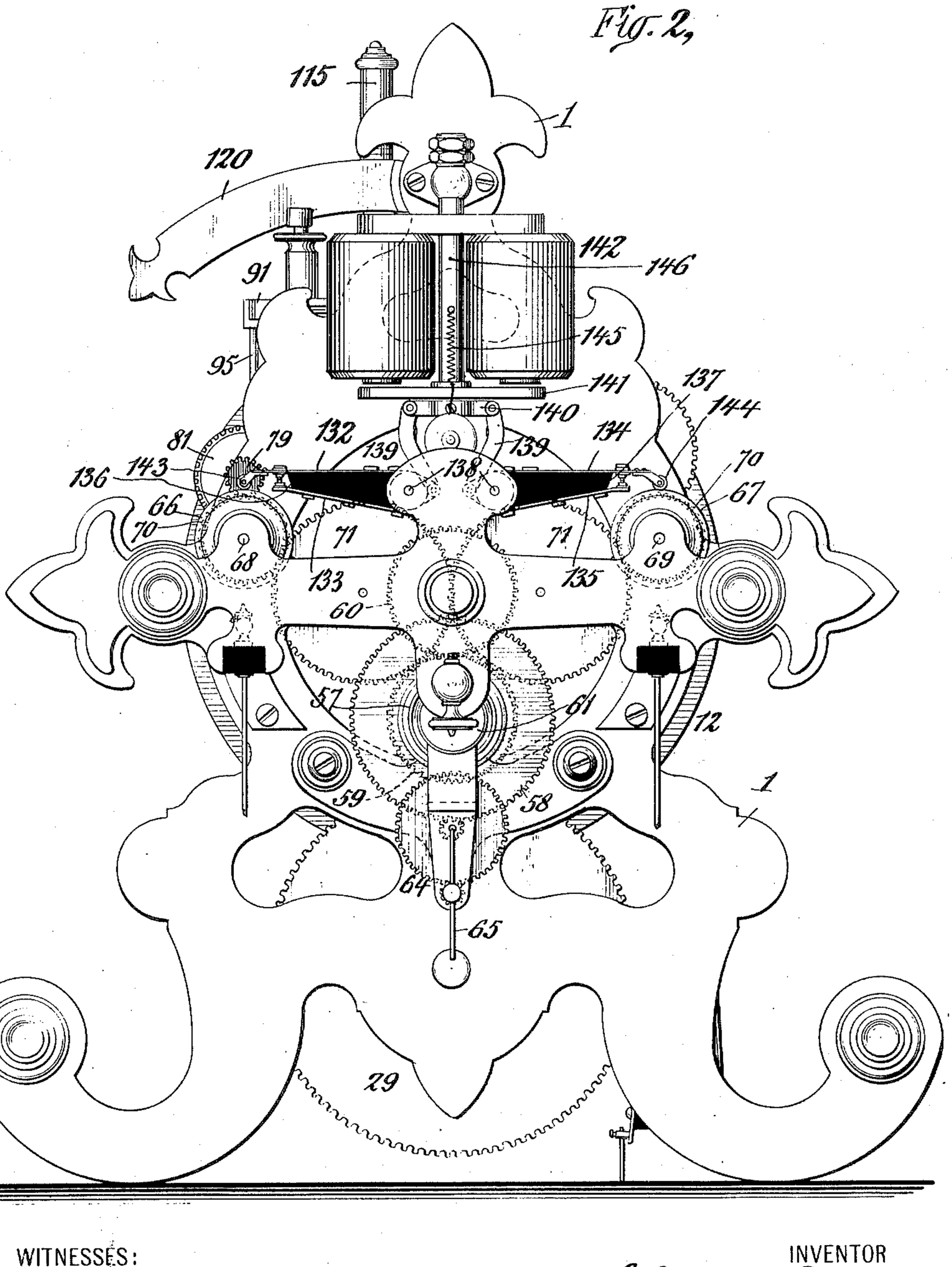
9 SHEETS—SHEET 2.

Fig. 2.



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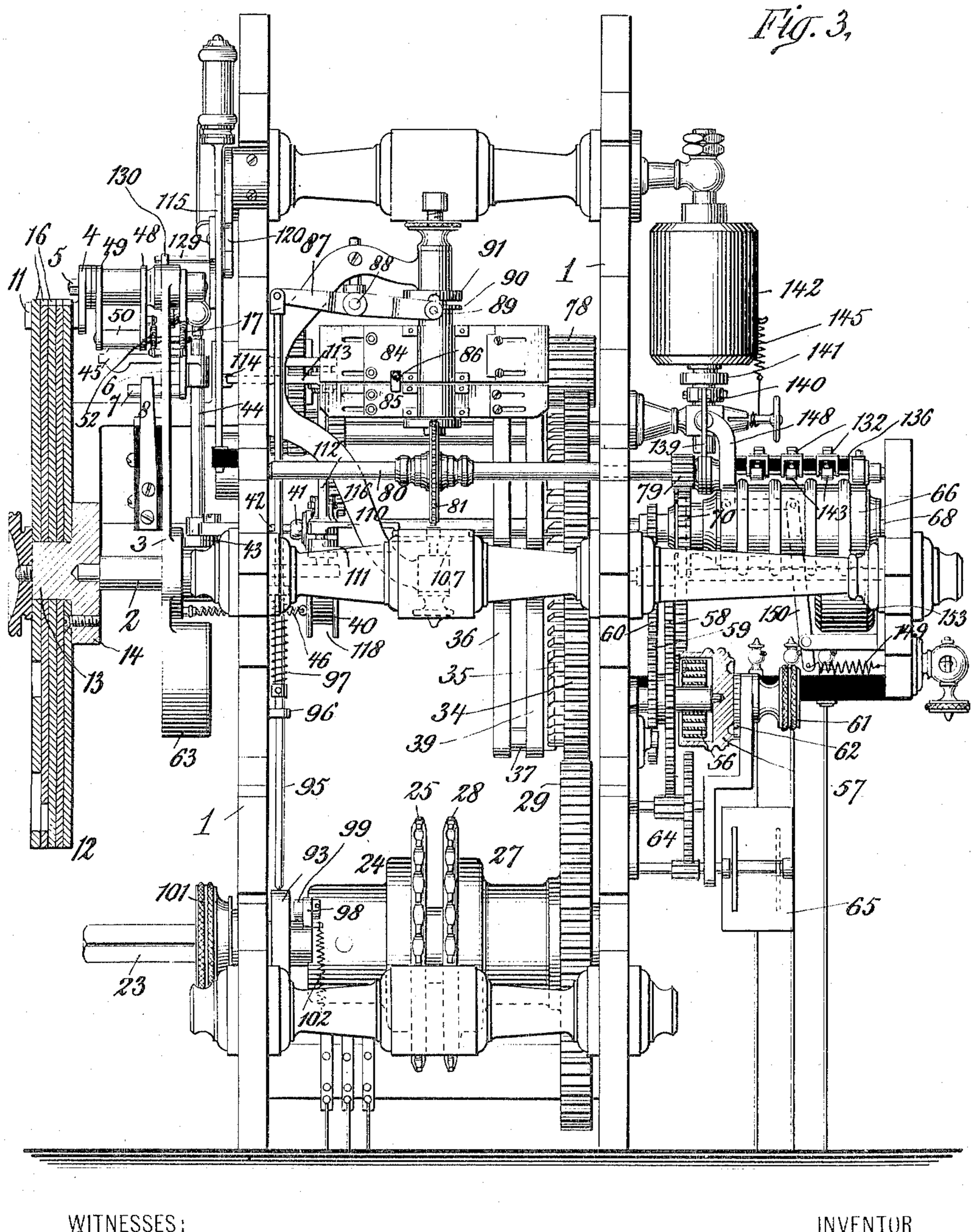
9 SHEETS—SHEET 3.

Fig. 3.



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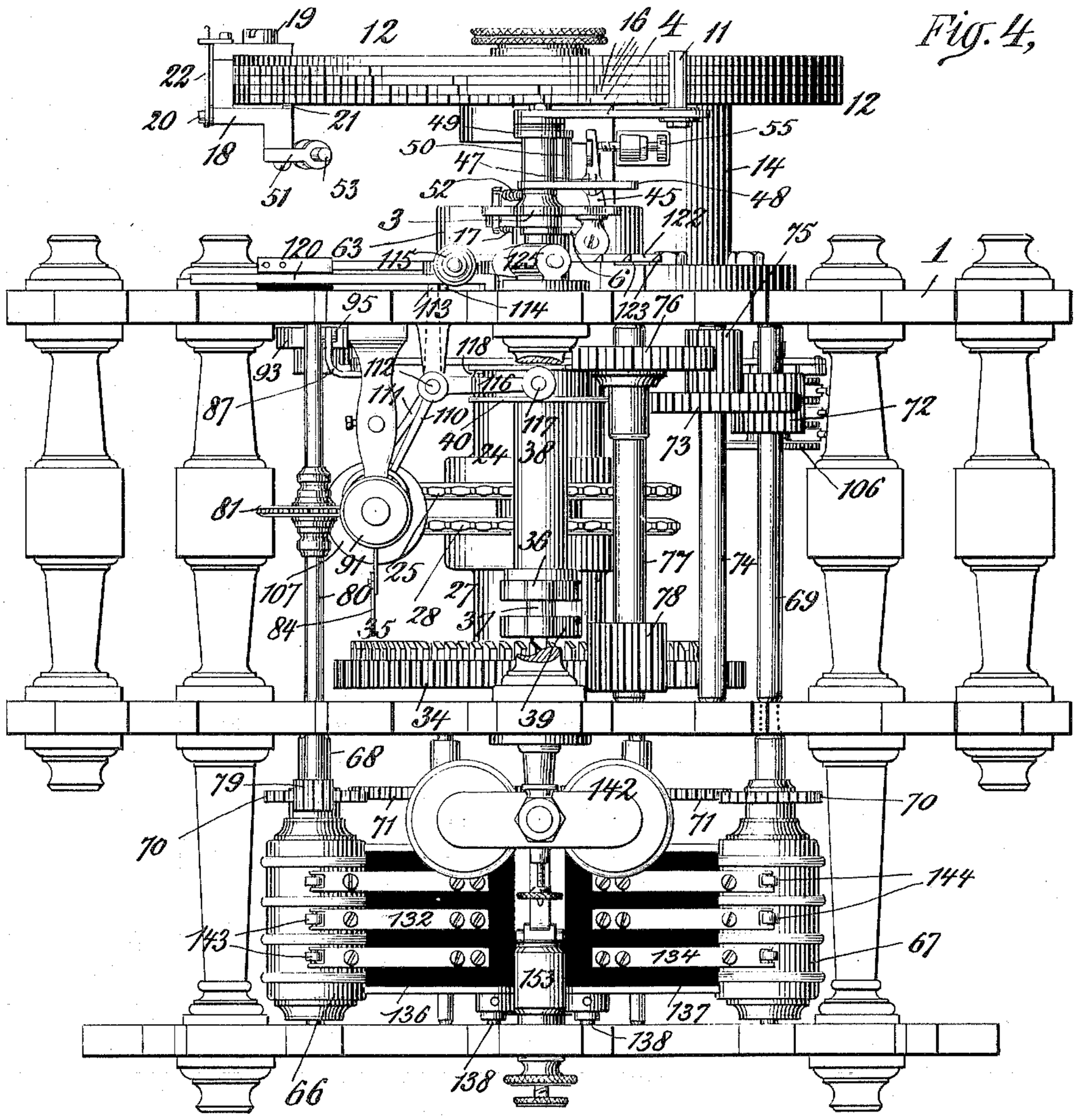
9 SHEETS—SHEET 4.

Fig. 4.



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9 SHEETS—SHEET 5.

Fig. 5.

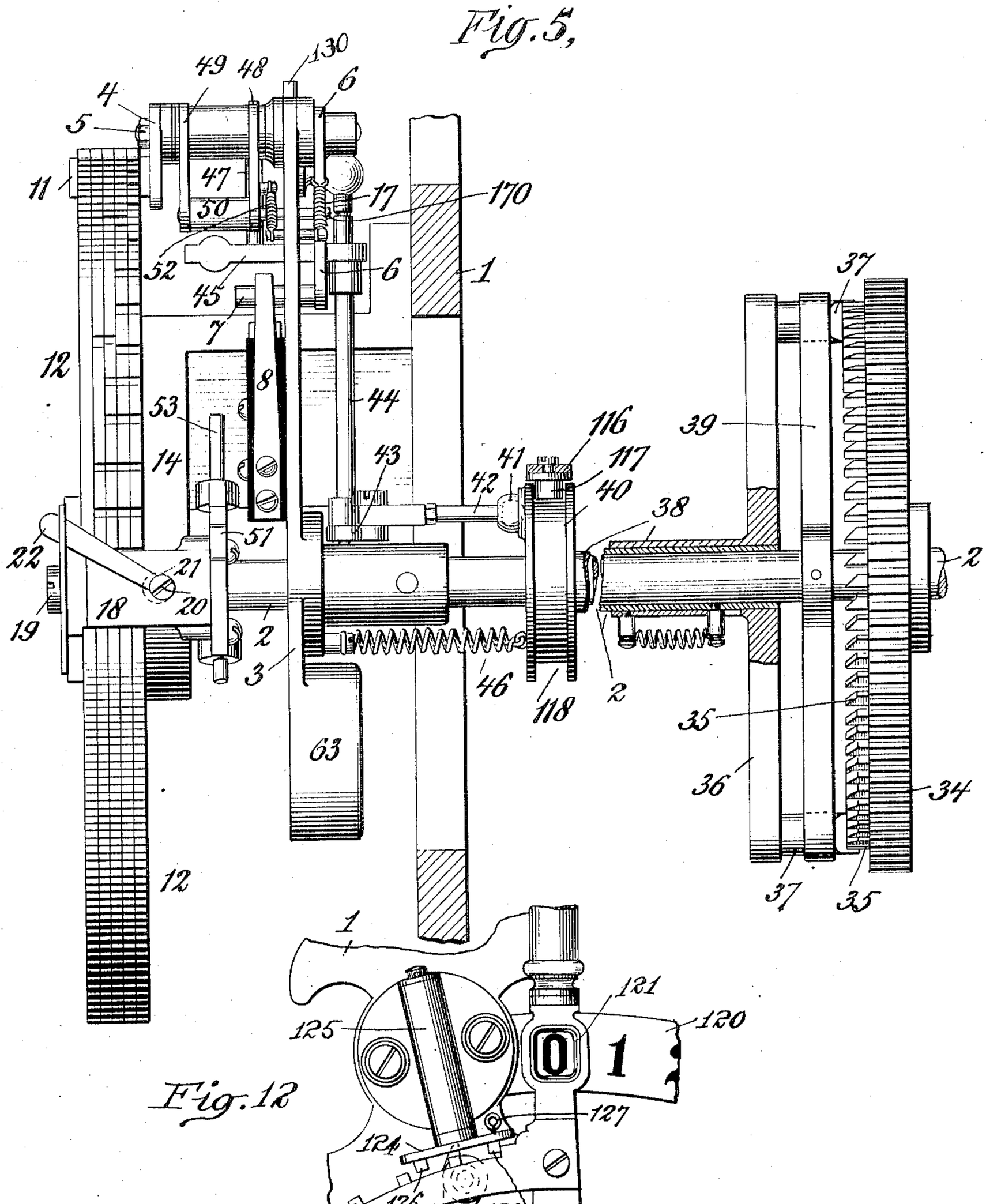

Fig. 12.

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9 SHEETS—SHEET 6.

Fig. 6.

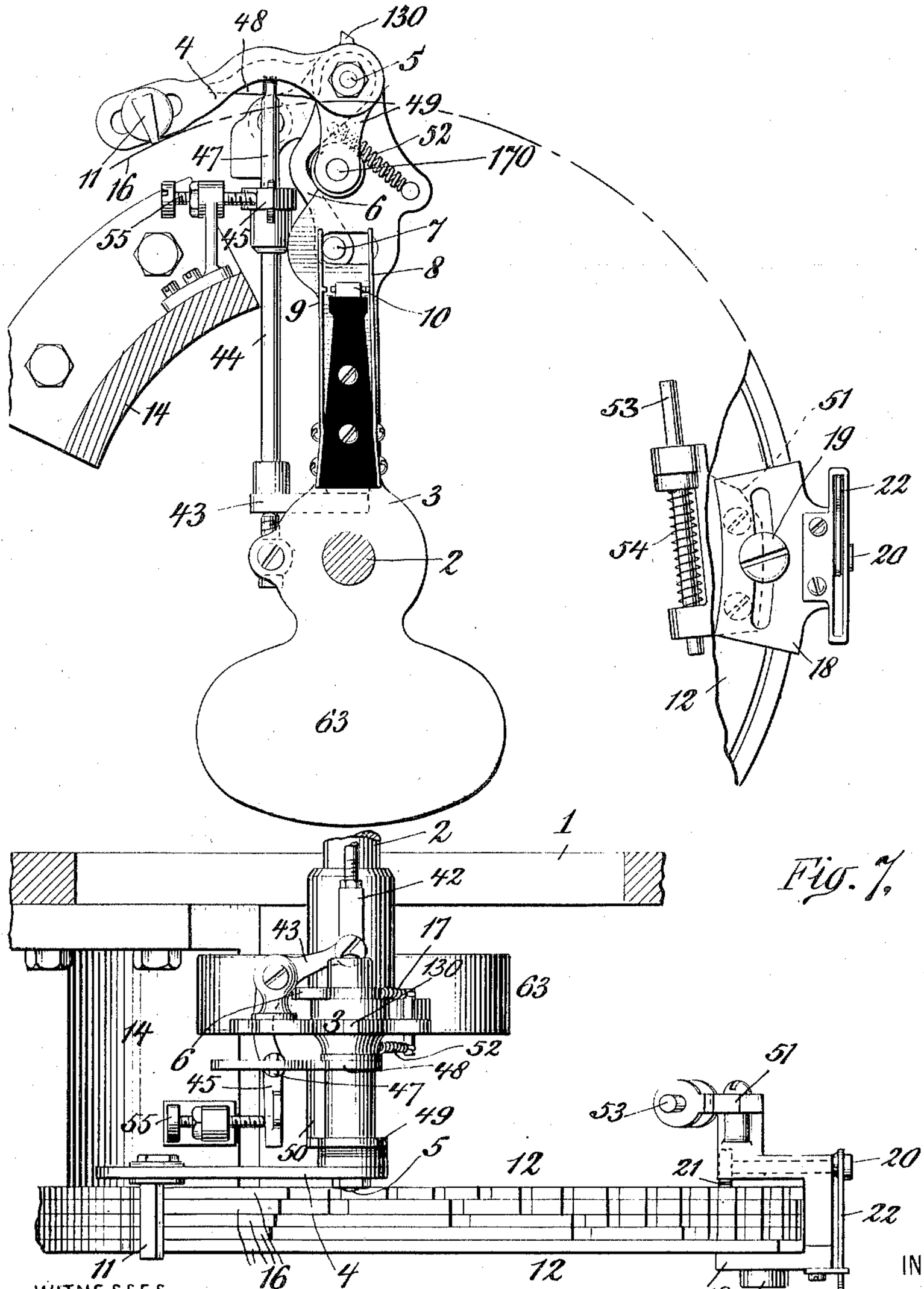

Fig. 7.

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9 SHEETS—SHEET 7.

Fig. 8,

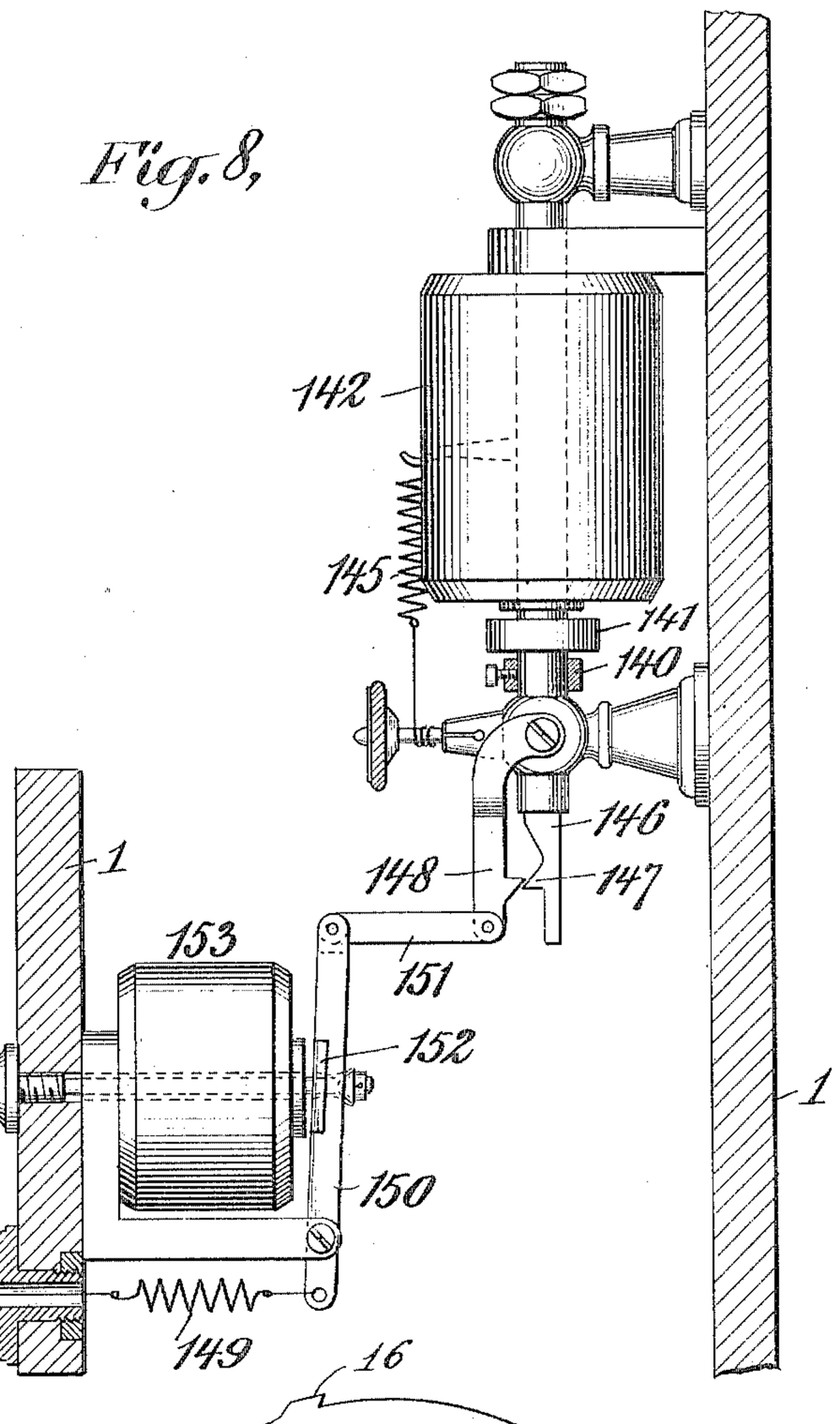
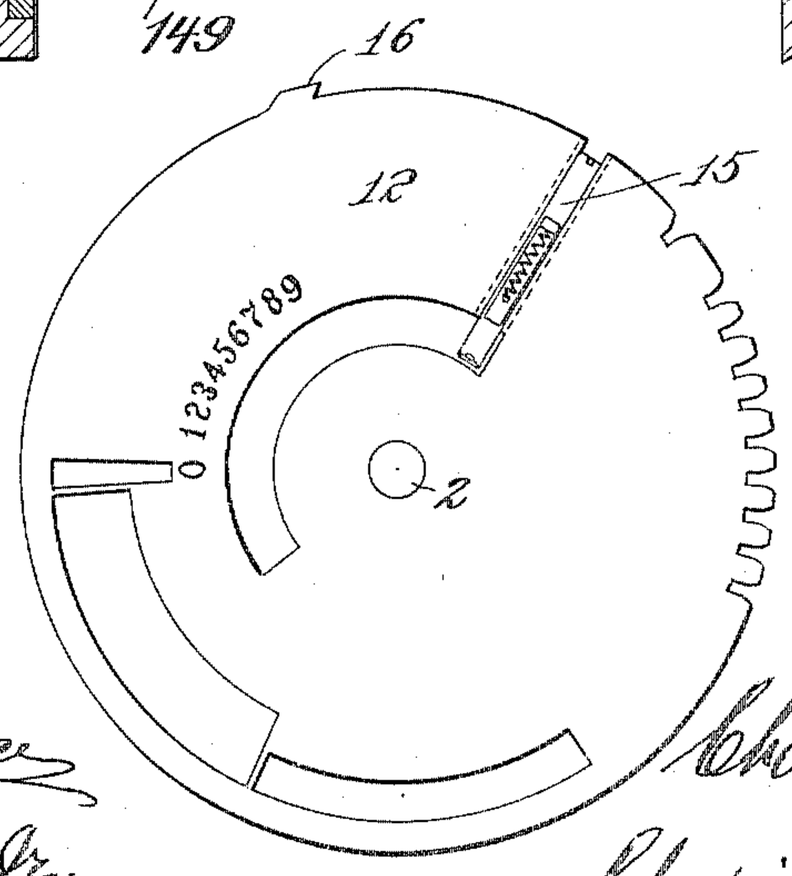


Fig. 9,



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9 SHEETS—SHEET 8.

Fig. 10,

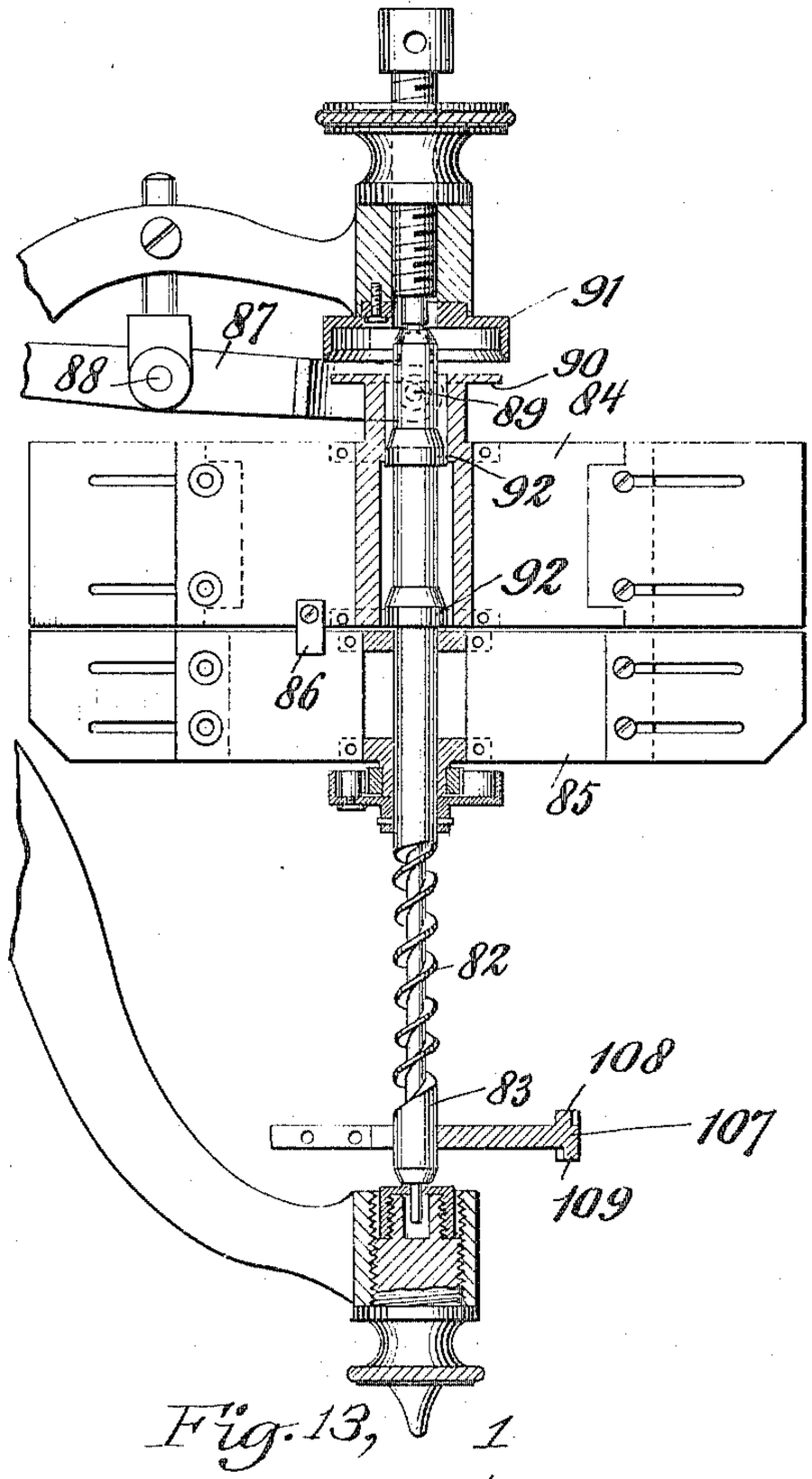


Fig. 11,

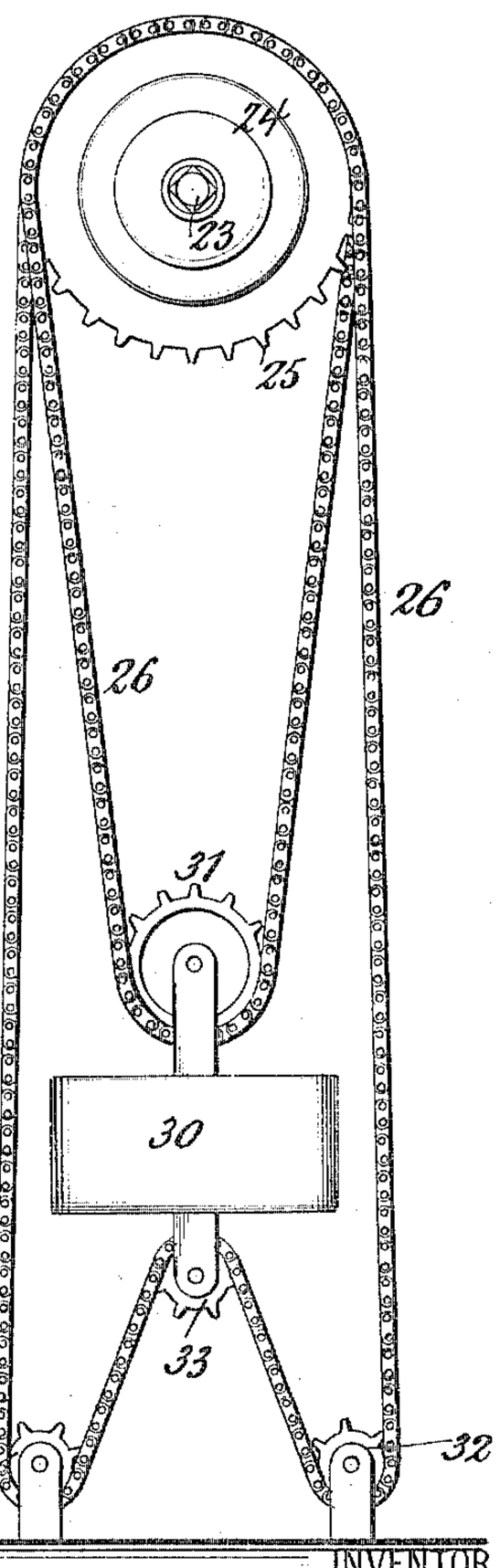
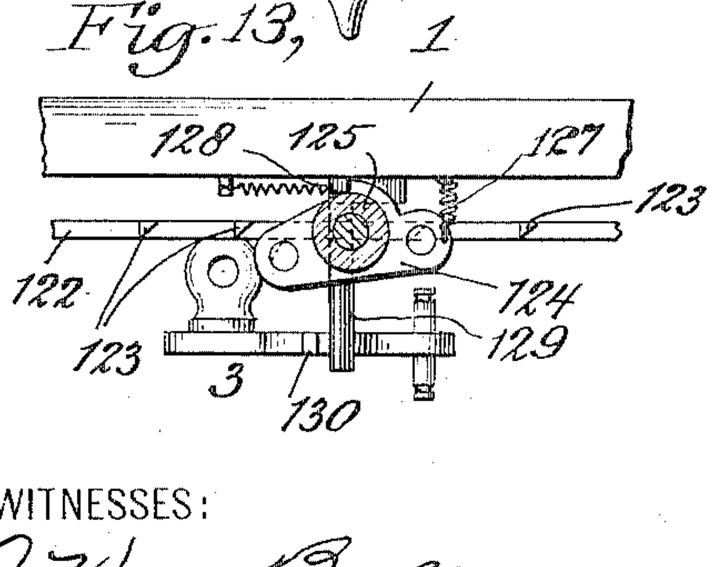


Fig. 13,



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9 SHEETS—SHEET 9.

Fig. 14,

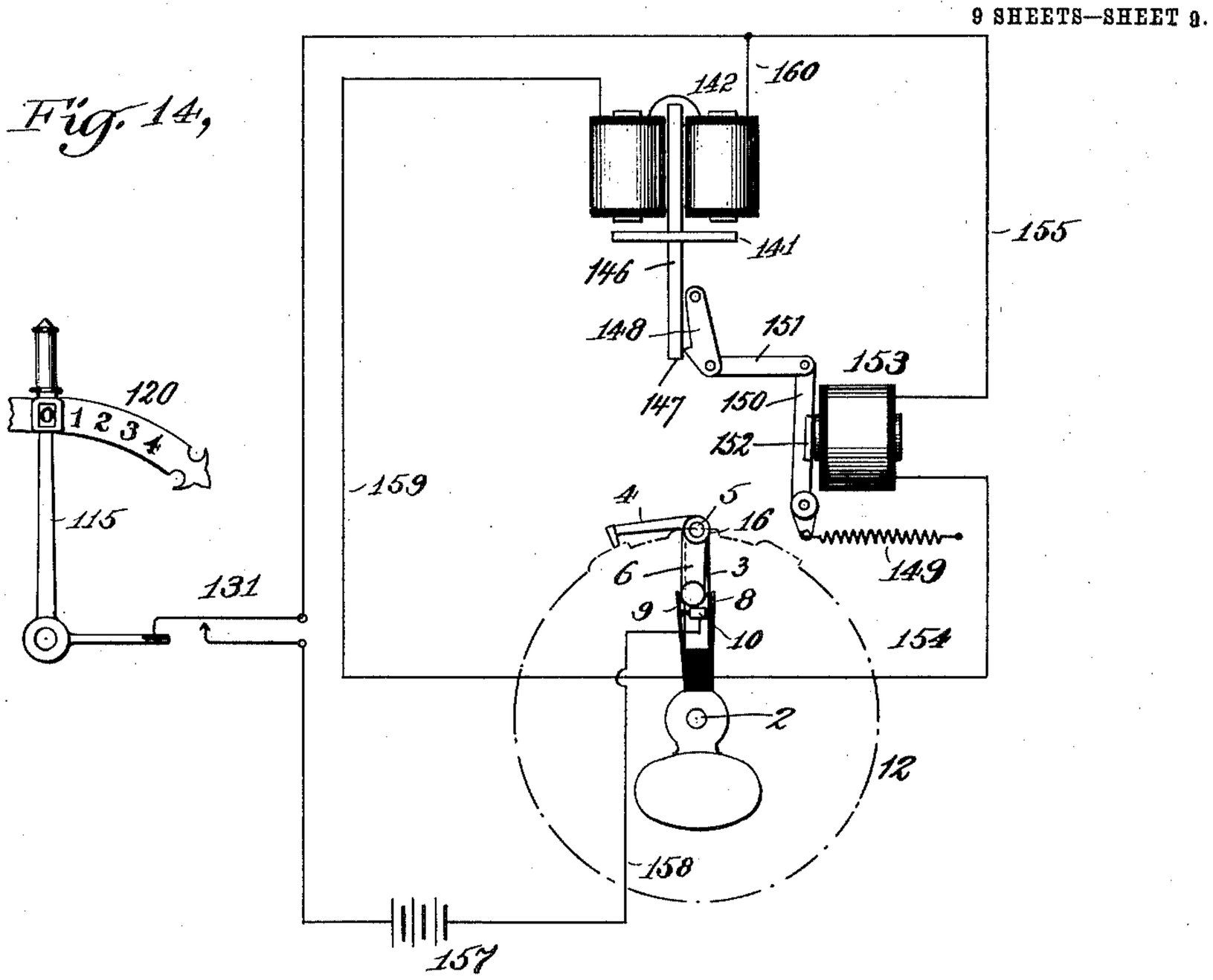
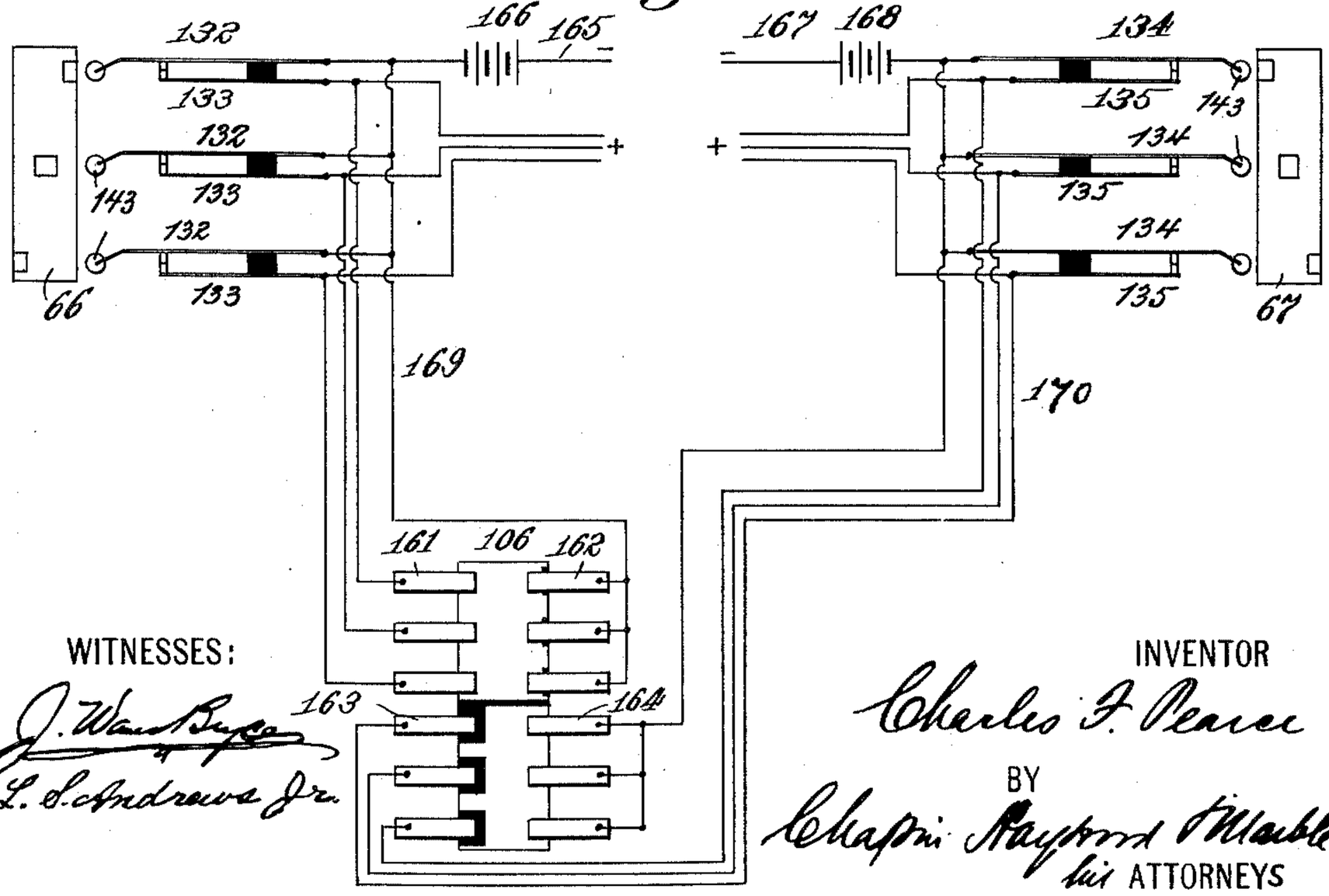


Fig. 15,



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UNITED STATES PATENT OFFICE.

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DIAL-TRANSMITTER.

No. 811,950. Specification of Letters Patent. Patented Feb. 6, 1906.

Application filed September 9, 1905. Serial No. 277,714.

To all whom it may concern:

Be it known that I, CHARLES F. PEARCE, a citizen of the United States of America, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Dial-Transmitters, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to dial-transmitters such as are employed as a central-station instrument for fire-alarm signal systems. Two such instruments are illustrated in United States Patents No. 482,877, of September 20, 1892, and No. 526,356, of September 18, 1894; and my present invention consists in certain improvements in the form of instruments illustrated in such patents.

My improvements consist, first, in novel means for varying the speed of operation of the controlling-arm of the device, in combination with a switch for selecting the circuits to be controlled; second, in an improved clamping means for holding the dials rigid in the positions in which they have been set during the operation of the machine; third, in a novel form of actuating device in which energy is stored at each operation of the machine for the purpose of positively releasing the clutch at the end of the forward movement of the controlling-arm and for imparting an initial impulse to start the controlling-arm on its backward movement; fourth, in certain improved means for controlling the speed of movement of the controlling-arm, including a time-train and adjustable return-spring; fifth, in certain improved arrangement and construction of the power mechanism for driving the machine; sixth, in an improved means for operating the circuit make-and-break device whereby under certain conditions the contact-springs are lifted clear of their actuating means and locked in such position until again released for another operation, and, lastly, in certain novel details of construction and combination of parts as will hereinafter be more fully pointed out.

In providing two speeds in combination with a switch for selecting the circuits to be controlled I contemplate employing circuits including audible signals to be operated in engine-houses and also circuits including signals to be operated in towers. The latter involve the employment of much heavier signal-bells and need to be operated much slower, so that by my improvement I may set the machine first to operate engine-house bells at the ordinary rate of speed and then to operate tower-bells at a much lower rate of speed. In the present form of my invention the act of changing the machine from one speed to another also changes the selecting-switch, so as to select the circuits corresponding to the speed at which the machine is set.

In machines of this description dials are adjusted to predetermined positions in order to determine the signals sent prior to the operation of the machine to send the signals. It is of course quite essential that the dials be held rigidly in their proper relative positions, and locking-dogs between the dials are ordinarily employed for this purpose. I still employ such locking-dogs, but I provide a clamp also, so as to lock all the dials together in whatever position they may have been set, entirely independently of the said dials—this for the reason that if the dials are not set quite far enough for the dogs to properly engage there is danger that they may move, and while absolutely accurate setting is not essential for a correct signal being sent it is essential that the dials shall not move during the operation of the machine, because then any error would be largely amplified. The controlling-arm, which travels backward and forward with relation to the disks to control the circuit making and breaking, operates at the end of its forward movement to withdraw a clutch, thereby releasing itself from the driving mechanism, so that it may return to an initial position under spring tension. I have provided an actuating device comprising a spring-pressed plunger or equivalent means in which power is stored during the forward movement of the controlling-arm for positively operating the clutch-release directly same is tripped by the arrival of the said controlling-arm at a predetermined point. The employment of this actuating device also saves the necessity of the extreme accuracy formerly necessary in the adjustment of the tripping means with relation to the clutch-release detent, compensates for any wear that may take place, and, while relieving the parts of any delicacy, insures their positive operation at the exact moment desired.

Further objects of my invention are generally to simplify the mechanism, to improve

the operation of the device whereby every movement is made positive and unfailing, to save the working parts from undue wear, and to control the circuit-operating means in a simple and efficient manner.

In order that my invention may be fully understood, I will now describe, with reference to the accompanying drawings, an embodiment thereof and will then point out the novel features in claims.

In the drawings, Figure 1 is a view in front elevation of a machine embodying my invention. Fig. 2 is a rear elevation of the same. Fig. 3 is a side elevation of the same with certain portions shown in vertical section. Fig. 4 is a top view. Fig. 5 is a detail view, partly in side elevation and partly in section, of certain parts including the dials, the controlling-arm and correlated parts, and the clutch mechanism. Fig. 6 is a detail view, in front elevation, of certain parts including the controlling-arm and the spring-pressed plunger for operating the clutch-release, the major portion of the disks and the brackets supporting them being broken away. Fig. 7 is a top view of the parts shown in Fig. 6, including the greater portion of the disks and their supporting-bracket. Fig. 8 is a view, in side elevation, of the electromagnetic means for controlling the circuit-breaking device. Fig. 9 is a detail view, on a smaller scale, of one of the dials removed from the machine. Fig. 10 is a detail view, in partial side elevation and partial central section, of the fly-fan mechanism, by operation of which two different speeds are effected. Fig. 11 is a detail view of the weight-drive for the clock-train. Fig. 12 is a fragmentary view on the same sheet with Fig. 5, illustrating in front elevation the escapement mechanism for the starting-lever. Fig. 13 is a fragmentary view of the same in horizontal section. Figs. 14 and 15 are diagrammatic views illustrating certain electric circuits.

Referring to the apparatus illustrated in the drawings by reference characters, 1 designates the frame of the machine, in which is loosely journaled a central shaft 2. Rigidly secured to this central shaft is the controlling-arm 3. This controlling-arm (shown in detail in Fig. 6) carries a trailer 4, pivoted thereto at 5. The trailer 4 comprises one arm of a bell-crank lever, the other arm of which is designated by the reference character 6 and is provided with a pin 7 at its outer end, said pin passing through a slot in the arm 3 and projecting between two contact-springs 8 and 9. The contact-springs 8 and 9 when relaxed contact with an intermediate contact-point 10, the movement of the arm 6 in one direction or the other lifting one or the other of the springs 8 and 9 away from such contact. The trailer 4 carries a projecting member 11 near its outer end, which serves as a follower, the said member adapted to rest upon the periphery of the dials 12. The dials 12 are mounted upon a hub 13, projecting forward from a bracket 14, secured to the main frame of the machine. The rear or No. 1 dial is rigidly secured to the said bracket and is hence held thereon against rotation. The remainder of the dials are loosely mounted upon the bracket and may be rotated as desired. These dials are quite similar to those shown in Patent No. 526,356, above referred to, the front four dials being each provided with a locking-dog 15 for locking it to the dial at the rear thereof. Each of the dials is provided with a peripheral projection 16, upon which the follower 11 upon the trailer 4 is adapted to rest, the projection upon the front dial extending for quite a distance around the periphery thereof, as shown in Fig. 1, while the projections on the other dials are quite short, as shown in Fig. 9. When the follower is resting upon one (or more) of these projections, the arm 6 is so rocked as to open contact between the contact-spring 9 and the intermediate contact-point 10 and permit contact to be made between the contact-spring 8 and the intermediate point 10, while if the dials be in such a position as to permit the follower 11 to drop onto the main portion of the peripheries thereof and the arm 6 hence to rock in the opposite direction contact will be made between the contact-points 9 and 10 and broken between the contact-points 8 and 10. A spring 17 tends to move the trailer 4 and arm 6 in the latter position, the projections 16 upon the dials acting as cams to rock the said parts against the spring resistance. On setting the machine prior to sending out signals the dials are first moved to their proper positions, the projecting portions of the dials being thus advanced to the proper positions to successively engage the follower 11 of the trailer 4. They are set progressively, the No. 2 dial or the dial immediately in front of the stationary dial (which has been here termed the "No. 1 dial") is moved around the required distance, carrying with it the dials in front of it. The No. 3 dial is next set, and so on until finally all of them, including the No. 5 or outside dial, have been properly positioned. The dogs 15 are intended to hold the dials in the positions to which they have been set with respect to each other; but I have provided an auxiliary locking device for clamping all the dials together, so that they may remain absolutely locked against movement until the said clamping device is operated to release them. This clamping device comprises a stationary member 18, adjustably secured upon the front of the outermost dial, as by means of a screw 19, the said member overhanging the periphery of all the dials and passing to the rear of the No. 1 or stationary dial. A spindle 20 is mounted in the rear portion of the stationary member, being pro-

vided at its inner end with a cam 21 and at its outer end with an operating-lever 22. When the operating-lever is thrown in one direction, the cam is released from engagement with the rearmost dial, and the dials are free to move: but when the operating-handle is thrown in the other direction the cam engages the rear of the stationary dial, clamping the dials between itself and the front portion of the stationary member 18, and thus locking all of the dials together.

The controlling-arm 3, which is rotated with respect to the dials in the operation of the machine, is rotated in one direction by means comprising a weight, a drum, gearing connecting same with the central shaft 2, a clutch between the said gearing and the said shaft, and a clock-train, including fly-fan mechanism for regulating the speed of the movement of the parts, and in the other direction spring means in which energy is stored during the movement of the arm in one direction, a clock-train, and a fly-fan. A winding-spindle 23 is journaled in the frame 1 near the base of the machine, said winding-spindle carrying a drum 24, having sprocket-teeth 25, upon which is hung a driving-chain 26. A second drum 27 is loosely mounted upon the winding-spindle 23, said drum 27 having sprocket-teeth 28 and carrying also a spur-gear 29. The driving-chain passes over the sprocket-teeth 28 and then over the sprocket-teeth 29, and a weight 30 is suspended from the loop of the chain, which is allowed to hang between the two said sprocket-wheels by means of an idler-wheel 31, as clearly shown in Fig. 11. For convenience the chain is made in endless form, the remainder of the chain passing beneath idler-wheels 32, pivoted to a stationary support, and over an idler-wheel 33, carried by the weight. The weight is wound up by turning the spindle 23 and the sprocket-wheel 25 in a direction to lift the weight (the drum 27 and sprocket 28 being stationary at the time or at least having only such a small movement as it might have during the operation of the machine.) During the normal operation of the machine the sprocket-wheel 25 is stationary, while the sprocket 28 revolves slowly, the weight slowly falling. It will be noticed that in such an arrangement the chain is always kept substantially taut and there are no free or loose ends of chain. During the time the upper loop shortens as the weight is being wound up the lower loop lengthens, and as the upper loop lengthens in the operation of the machine the lower loop shortens. The spur-gear 29 is arranged in mesh with another spur-gear 34, said spur-gear mounted loosely upon the central shaft 2. This spur-gear has laterally-projecting teeth 35 and constitutes one member of a clutch, the other member of which includes a yoke 36, having teeth 37 for engaging the teeth 35, the yoke 36 secured to a sleeve 38, mounted concentrically with the central shaft 2. The teeth 37 pass loosely through a guide 39, secured to rotate with the shaft 2. By this means the clutch member, including the yoke 36 and teeth 37, is compelled to rotate with the shaft, but is permitted longitudinal movement thereon sufficient to move the teeth 37 into and out of engagement with the teeth 35. The sleeve is here shown as made in two parts, spring connected, whereby the parts may be permitted to yield upon first engagement, should it be necessary, as is well known in this form of coupling-clutch. The precise form or construction of this clutch is, however, entirely immaterial, and other forms of clutch may be employed, if desired. Secured to the sleeve 38 is a collar 40, to the side of which is connected, by means of a universal joint 41, a link 42. The other end of the link is pivoted to an arm 43, secured to the lower end of a spindle 44. The spindle 44 is journaled in suitable bearings carried by the arm 3, and at its upper end the said spindle is provided with an operating-arm 45. The parts are so related that rocking of the spindle 44, due to a movement backward or forward of the operating-arm 45, will move the sleeve 38 and parts carried thereby backward and forward upon the spindle 2. A spring 46 operates normally to move the sleeve in a direction to withdraw the clutch members from engagement with each other, the tension of the spring being overcome by means engaging the operating-lever in a manner to be presently described. The operating-arm 45 is provided with a vertical pin 47 uprising therefrom, the upper end of which is adapted to be engaged by a locking-detent 48, said detent provided with a notch for receiving the end of the said pin, as shown more clearly in Fig. 6 of the drawings. The locking-detent 48 is loosely mounted upon the spindle 5, which forms the pivot for the trailer 4 and arm 6. It is entirely unconnected therewith, however, but is connected with an operating-arm 49 of its own. The operating-arm is provided at its lower end with an antifriction-roller 50, which is arranged in the travel of movement of the arm 3 (by which it is carried) to engage a cam-surface 51, arranged for convenience upon the rear of the clamp member 20, and with a rearwardly-projecting pin 170, which passes to the rear of the arm 3 and at certain times engages the arm 6 to rock the trailer 4 upon its support. A spring 52 serves to normally rock the detent 48 and arm 49 in a position for the detent 48 to engage the end of the vertical pin 47. The clamp member 20 also carries a plunger 53, spring-actuated by means of a spring 54. The end of the spring-plunger is arranged in the path of movement of the operating-arm 45 to engage same when the arm 3 is rotating in one direction, and an adjustable screw-

stop 55, mounted in the stationary bracket 14, is arranged in the path of movement of the said arm to engage same when the arm is moving in the other direction. The weight and gearing operate to drive the arm 3 in one direction when the clutch above referred to is in engagement, such movement being against the resistance of a helical spring 56. This spring has one end secured to a normally stationary barrel 57 and is fastened at its other end to the hub of a spur-gear 58. The spur-gear has rigidly secured to it a pinion 59, in mesh with another pinion 60, keyed or pinned to the central shaft 2. The tension of the spring 56 may be regulated at will by adjusting the barrel 57, a knob 61 being provided for this purpose and a ratchet and pawl 62 being provided for holding the barrel in the position to which it is adjusted.

It will be understood from the foregoing that when the clutch-teeth 35 37 are in engagement with each other and the movement of the parts otherwise unimpeded the arm 3 will turn around in a clockwise direction. It will continue to so turn until near the end of its final movement the antifriction-roller 50 upon the arm 49 engages the cam 51 to lift the detent 48 from engagement with the pin 47 upon the operating-arm 45. In its final movement it will thus free the vertical pin 47, releasing the operating-arm 45, spindle 44, and arm 43 and so permitting the spring 46 to withdraw the sleeve 38 and clutch member carried thereby from engagement with the other clutch member, whereby the arm and parts carried thereby will be freed from the drive mechanism and will be free to return to a normal position under the influence of the spring 56. It will also be noticed that the arrangement of parts is such that prior to the engagement of the antifriction-wheel 50 with the cam 51 the plunger 52 will have been engaged by the operating-arm 45, the spring 53 being compressed in the final movement of the arm, whereby the withdrawal of the clutch and the initial return movement of the arm will be made positive and caused to take place at exactly the predetermined point. It may be here noted that means is provided for preventing further movement of the weight-motor and gearing connected therewith at such times as the clutch is disconnected, such means to be presently described. Upon the return of the arm and correlated parts to a normal position the arm 45 will be engaged by the stop 55, thereby again rocking the spindle 45 upon its support, causing the clutch members to again engage each other and resetting the locking-detent 48 into engagement with the vertical pin 47. The arm now will start to move forward again under the influence of the motor unless otherwise prevented. The arm 3 is preferably counterbalanced by means of a weight 63, so that the parts will rotate freely in either direction, substantially unopposed by gravity. In order to prevent the arm from returning to normal position under the influence of the spring 56 too rapidly, I have provided a clock-train 64, connecting with the spur-gear 58, said clock-train driving a fly-fan 65.

The weight-motor is designed not only to rotate the controlling-arm 3, but also to rotate two cams 66 67, arranged at the rear of the machine and comprising part of circuit making and breaking devices. The cams 66 and 67 are mounted upon shafts 68 and 69, respectively, each being provided with pinions 70, connected together through idler-gears 71. The shaft 69, carrying the pinions 70 and cam 67, extends through the machine and is provided at its other end with a driving-pinion 72. Said driving-pinion is arranged in mesh with a spur-gear 73, mounted upon a shaft 74 and upon which is also mounted a pinion 75. The pinion 75 is engaged by a spur-gear 76 upon a shaft 77, upon which is also secured a pinion 78, in turn meshing with the spur-gear 34. It will follow, then, that whenever the spur-gear is rotated the cams 66 and 67 will also be rotated. The clock-train above described is continued through to a retarding mechanism comprising fly-fans in the following manner: The pinion 70 upon the shaft 68, which carries the cam 66, is in mesh with another pinion 79 upon a shaft 80. The shaft 80 carries a drive-wheel 81, in driving connection with a worm 82 upon a vertical fly-fan spindle 83. This fly-fan spindle is journaled in suitable bearings upon the main frame of the machine and carries fly-fans 84 and 85. These fans act as a retarding device to limit the speed of movement of the clock-train, and hence the speed of movement of the controlling-arm (in one direction) and of the cams 66 and 67 aforesaid. As above stated, there are two fans 84 and 85, the fan 85 being arranged in positive engagement with the spindle 83, (in one direction,) while the fly-fan 84 is loosely mounted thereon. The fan 84, however, has a depending lug 86 in the path of movement of the fan 85, so that under normal conditions the two fans will rotate together, forming, in effect, a single fan, which will act to retard the mechanism to a predetermined degree. I have provided means, however, whereby the fan 84 may be lifted up and held stationary while the fan 85 is revolved, whereby less resistance will be applied to the movement of the train of gearing and less retardation will take place. By this means two different speeds of movement are provided for at the will of the operator. The means for lifting the fan 84 comprises a lever 87, pivoted at 88 and provided with pins 89, which are adapted to bear against the under side of a flange or shoulder 90, formed as a part of or secured to the fan 84. Upon rocking the lever 87

upon its support the fan may be lifted up, so that the depending lug 86 is out of the path of movement of the fan 85, and hence there will be no driving relation between the fans 84 and 85. In order to hold the fan 84 steady at such times, I have provided a housing 91 for receiving the flange 90, the upper face of the flange being adapted to be pressed against the inner face of the housing, whereby the said fan will be held steady against vibration or rotation and, further, will be centered, so as to hold it away from frictional engagement with the spindle. The spindle has enlarged bearing portions 92, and the hub of the fan 84 is suitably recessed and cut away, so that when the fan is in its upper position, in which it is to be held stationary, there will be greater clearance between the spindle and the fan than when the fan is in its lowermost and rotative position. The upper edges of the projecting portions 92 are preferably tapered or conical in form, and the lower edge of the housing 91 may conveniently be beveled in order to properly guide the fan in its movement.

The lever 87 is operated by means of a cam 93, mounted upon a stud 94, a rod 95 being pivotally connected to the lever 87 and bearing upon the cam 93. The rod is suitably guided in bearings 96, and a spring 97 tends to keep the rod in engagement with the cam-face. Secured to the cam 93 is an arm 98, which is connected, by means of a link 99, with another arm 100, mounted concentrically with the spindle 23, but loosely thereon. A knob 101 upon the exterior of the machine is connected with the said arm, and by turning the knob in one direction or the other the cam 93 may be operated to raise or lower the rod 95, and hence to operate the lever 87 and to throw the fan 84 into and out of operative position. A spring 102 is connected at one end of the frame and at the other end to the arm 98 for the purpose of maintaining the cam in either of its two positions. The link 99 connecting same with the knob 101, the knob will also be maintained in its adjusted position. A pointer 103 may be conveniently employed to indicate the position of the parts, the said indicator pointing to the word "Slow" when the fans are connected and to the word "Fast" when the fan 84 is thrown out of operation. A second link 104 connects the arms 98 and 100 with an arm 105, to which is secured a rotary switch member 106. The rotary switch member is arranged in its movement to switch from one circuit or set of circuits to another, whereby the operation of selecting the circuits is synchronized with the operation of the speed-controlling device.

The fan-spindle 83 has secured thereto a disk 107, upon the upper and under side of which are projections 108 109, and detents 110 111, mounted upon a vertical spindle 112, are arranged to engage, respectively, with the said upper and lower projections. The detent 111 is rigidly secured to the spindle near its lower end, the said spindle near its upper end being provided with an arm 113, which passes through the front frame 1 and lies in the path of a projection 114 on the rear of a starting-arm 115. The starting-arm 115 is arranged in its movement to rock the arm 113, so as to swing the detent 111 into and out of the path of the lower projection 109 of the disk 107. The other detent 110 is loosely mounted upon the vertical spindle 112 and constitutes one arm of a bell-crank lever, the other arm 116 of which extends over the collar 40 upon the sleeve 38 and is provided with a stud 117, which engages a circumferential groove 118 in the said collar 40. When the collar 40 is shifted longitudinally upon the shank 2 in the throwing in and out of the main clutch, the detent 110 is operated to swing into and out of the path of movement of the upper projection 108 of the disk 107.

The starting arm or lever 115 is pivoted to the frame at 119, being permitted a limited movement backward and forward upon said pivotal connection. A quadrant-arm 120, secured to the frame 1, has numerals "0" "1" "2," &c., thereon, the lever having an opening 121, arranged to register with the said numbers, whereby the quadrant acts to indicate the position to which the lever is set. The lever 115 is provided with a laterally-extending arm 122, whose outer surface is arranged upon an arc struck from the pivotal axis of the lever 115 as a center and is provided with peripheral teeth or notches 123 of the form employed in the escape-wheels of escapements. An escape-lever 124 is pivotally mounted in a bearing 125, secured to the frame 1, the escape-lever having projections or pallets 126, adapted to engage with the teeth 123. The escape-lever is spring-actuated in one direction by means of a spring 127 and is arranged to be moved in the other direction against the tension of the spring 127 by means of a lever 128, said lever having a pin 129, arranged in the path of a projection 130 upon the controlling-arm 3. When the machine is in its initial position, the starting-lever 115 is in its normal rest position and in which it is shown in Fig. 1 with the window or opening 121 thereof in register with the numeral "0" upon the quadrant 120. In this position the projection 114 upon the rear of the starting-lever will be in engagement with the arm 116 of the detent 10, holding the detent 111 in such a position as to be in the path of movement of the projection 109 of the disk 107. At this time, however, the controlling-arm 3 will be in its normal position with the operating-arm 45 carried thereby in engagement with the stop 55, and, as before explained, the main clutch, including the teeth 35 upon the member 34 and the

teeth 37 upon the member 36, will be in engagement. The parts then will be all ready to rotate under the influence of the weight 30, but will be held against rotation by the detent 111. To start the machine, then, it will be only necessary to move the starting-lever 115 to the right one or more units of distance, each unit of distance being represented by one of the numerals upon the quadrant 120 and by the distance between two of the escape-teeth 123. If the lever be moved a single unit, the controlling-arm will travel forward until it is released by the tripping of the locating-detent 48, which will permit the spring 46 and plunger 53 to rotate the spindle 44, thereby throwing in the detent 110, so that the same may be caused to engage the stop or projection 108 upon the dial 107 of the fly-fan spindle 83, thus stopping the fly-fan and with it the gear-train. At the same time the main clutch will be drawn out of engagement, and the arm 3 will be free to return to its normal position under the control of the spring 56, as above explained. The controlling-arm in returning to normal will operate the escapement, the projection 130 thereof engaging the lever 128 for this purpose, thereby permitttng the starting arm or lever 115 to return to normal under the influence of its spring. When the controlling-arm 3 comes to its final position, the operating-arm 45 being engaged by the screw-stop 55, the spindle 44 will be rocked upon its support, causing the reëngagement of the clutch and the throwing out of the detent 110; but in the meantime the return of the starting-arm 115 to normal will have thrown the detent 111 into engagement with the lower projection 109 of the disk 107 upon the fly-fan spindle 83, whereby the gear-train will be locked against movement until the starting-lever is again moved. If the starting-lever had been set over to "2," "3," or "4"—that is to say, a greater number of units than one—it would have dropped back by operation of the escapement only one noteh at each reciprocation of the controlling-arm and would not throw in its detent 111 until it finally moved back to zero. Thus when the starting-arm is thrown over a greater distance than one unit the controlling-arm will be moved forward again each time it returns to normal position, until finally the starting-arm drops back to zero. By properly setting the starting-arm the machine may be made to repeat any desired number of times up to its capacity. The starting arm or lever 115 further controls a switch 131, by which circuit is broken when the said starting-arm is in its zero position and closed only when the arm is set at some position away from the normal.

I will now proceed to describe the circuit making and breaking devices, which are arranged, for convenience, at the rear of the machine and in which the cams 66 and 67 aforesaid are included. Reference may be had more particularly to Figs. 2, 3, 4, and 8, in which the construction and arrangement of parts are clearly illustrated.

Two sets of contact-springs (designated by the reference characters 132 and 133 and 134 and 135) are suitably secured to insulating-blocks 136 and 137. These insulating-blocks are pivotally mounted at 138 138 upon the frame 1 and are connected, by means of links 139, with a cross-head 140, secured to the armature 141 of an electromagnet 142. Reciprocation of the armature 141 with respect to its magnet 142 will have the effect of rocking the insulating-blocks 136 and 137 upon their supports, as will be well understood. The upper contact-springs 132 and 134 are provided at their outer ends with cam-followers 143 and 144, which are adapted to engage with the cams 66 and 67 when the contact-springs are in one position. When the said contact-springs are rocked upon their supports by the armature 141 moving away from the said electromagnet, the cam-followers 143 will be lifted clear of the cams and will not be affected thereby; but when the armature 141 is attracted toward its electromagnet 142 the cam-followers will be forced down to a position to be engaged by said cams. The cams are provided with suitable projections for lifting the cam-followers upon the upper springs 132 134, thereby breaking the contact between the upper and lower sets of springs. A retractile spring 145 acts to retract the armature 141 from its magnet 142 when the same is deënergized. The armature 141 is mounted upon a stem 146, the lower end of which has a tooth or projection 147, and a latch 148 (see particularly Fig. 8) is arranged to engage the said tooth or projection 147 to hold the armature firmly up in its attracted position, so that it will not be apt to move away by reason of any shock, vibration, or the like. A spring 149, operating through a lever 150 and a link 151, tends to hold the latch in position. The lever 150 carries an armature 152, which coacts with an electromagnet 153. When the electromagnet 153 is energized, it will attract the armature 152, thereby withdrawing the latch 148 from the path of the tooth or projection 147. Viewing the parts, then, as shown in Fig. 7, a momentary energization of the electromagnet 142 will attract its armature to lift the stem 146 and projection 147 thereon on top of the latch 148, where it will be held, even though the current should fail through the said electromagnet. After the electromagnet 142 has been deënergized a momentary energization of the electromagnet 153 will have the effect of releasing the latch 148 from beneath the teeth 147 and allowing the armature 141 and stem 146 and parts connected thereto to return to their lowermost position. The electromagnets 153

and 142 may be conveniently connected with the contact-springs 8 and 9, with the switch 131 of the starting-lever 15, and with battery in the manner shown by the diagram Fig. 14. In this figure a wire 154 is shown as leading from the contact-spring 8 to the electromagnet 153, and from the electromagnet 153 a wire 155 leads to one point of the switch 131. The other point of the switch connects with the wire 156 to a generator 157, a wire 158 leading from the other side of the generator to the intermediate contact-point 10. Another wire 159 leads from the contact-spring 9 to one side of the electromagnet 142, and another wire 160 leads from the other side of the electromagnet 142, connecting with the wire 155 to return to the switch 131. By tracing out the foregoing circuits it will be clear that when the switch 131 is closed by reason of the starting arm or lever 115 being thrown away from its zero position either the electromagnet 153 or the electromagnet 142 will be energized by the closing of circuit between either the contact-spring 8 or the contact-spring 9 with the intermediate contact-point 10. The contact-springs 8 and 9 are, it will be remembered, controlled by the trailer 4 and its arm 6. When the trailer 4 is on a projection 16 of any of the dials 12, the contact-spring 9 will be forced away from the contact-point 10, while the contact-spring 8 will be permitted to engage with said intermediate contact-point 10. Under such conditions the unlatching-magnet 153 will be energized, while the electromagnet 142 will be inert. The result of this will be to lift the contact-springs 132 and 131 and the followers 143 and 144, carried thereby, away from the cams 66 and 67, whereby contact will not be broken thereby between the springs 132 134 and the springs 133 135. When, on the other hand, the trailer 4 has been allowed to drop, having passed away from any of the projections 16, the position of the contact-springs 8 and 9 will be reversed, the spring 8 being forced out of contact with the intermediate contact-point 10, and the spring 9 being permitted to contact therewith. This will break circuit through the magnet 153, releasing the latch 148 and allowing same to move under the influence of its spring 149, while the magnet 142 will be energized to lift its armature 141, permitting the latch to engage and hold it in its lifted position, thereby forcing the cam-followers 143 into engagement with the cams 66 and 67. Rotation of the cams 66 and 67 will now operate to open and close circuit between the sets of springs 132 134 and 133 135. It will be understood that in setting the device the peripheral projections 16 thereof will be disposed progressively around the circular path of the trailer, with intervening spaces between them, so that as the arm 3, which carries the trailer 4, moves from its initial position to the limit of its movement (such limit, it will be remembered, being controlled by the position of the outermost dial) the trailer will fall and rise successively, causing the circuit-breaking devices, including the springs 132 133 134 135, to be successively thrown into and out of operative position with respect to their operating-cams. The cams 66 and 67 have a certain definite speed rotation with respect to the movement of the trailer-arm and trailer, so that the distance between successive peripheral projections 16 will control the number of circuit-breaking operations, while the length of the projections themselves or the distance the trailer travels over the projections will control the pauses between said circuit-breaking operations. By this means a plurality of predetermined successive signals, with a certain pause between each one of them, may be sent in accordance with the position in which the dials are set.

The circuit making and breaking devices, including the contact-springs 132 133 134 135, may be employed to control any desired signal-circuit. In Fig. 15 I have shown signal-circuits which may be so controlled; but I desire to be by no means limited to such specific arrangement. In this view, I have represented the parts diagrammatically, the cams 66 and 67 being illustrated as turned at right angles to a plurality of contact-springs 132 133 and 134 135, arranged above each other. I have also shown the rotary switch member 106 with brushes 161, 162, 163, and 164 in engagement therewith. The sets of springs 132 133 and 134 135 are arranged to control a plurality of line-circuits, the set of springs 132 133 controlling circuits having a common return 165 to a generator 166 and the sets of springs 134 135 controlling circuits having a common return 167 to a generator 168. The circuits controlled by the two said sets of contact-springs are preferably normally closed circuits and are here so shown, the circuits being normally closed through the said contact-springs. Branch wires 169 and 170 connect with the said line-circuits and with the brushes of the rotary switch 106, the wires 169 connecting with the brushes 161 and 162 of the said switch and the wires 167 connecting with the brushes 163 and 164. In the diagram herein the brushes 161 162 are shown as upon a live part of the rotary switch member 106, the said wires 169 thus forming a continuous closed circuit for the line-circuits of the generator 166, so that path will be provided for the current even when the contact-springs 132 and 133 are separated. The brushes 163 164, on the contrary, are shown as in position engaging the one with the dead or insulated portion of the rotary switch 106, whereby a connection through the branch wires is cut out, so that the cam 67 in its operation will separate the sets of springs 134, 135, to break circuit through the lines oper-

ated by the generator 168. By reversing the position of the rotary switch member 106 the brushes 161 and 162 may be insulated from each other, while the brushes 163 164 will be electrically connected. Thus signals may be sent along the circuits of the generators 166 or 168 at will and will be so sent in accordance with the position of the rotary switch member 106. It will be remembered that in setting the rotary switch member from one position to the other the retarding device is also adjusted, so that the speed at which the signals are sent is regulated in accordance with the circuits controlled. One set of circuits, then, may be arranged to control tower-signals and the other engine-house signals, and the tower or engine-house signals will be sent according to the position of the knob 101 and indicating-pointer 103.

To make clear the entire operation of the machine, we will assume that it is desired to send out the signal "236" over the engine-house circuits—that is, at a rapid rate, repeating this signal three times. To accomplish this, the first thing necessary is to set the No. 2 dial—that is, the second dial from the rear—around a distance of two units, (carrying the other dials—that is, the No. 3, 4, and 5 dials—with it,) then to set the No. 3 dial around three more units, (carrying the fourth and fifth dials with it,) then to set the No. 4 dial round six more units, (carrying the fifth dial with it.) The front or fifth dial, it will be remembered, carries the cam 51 and plunger 53, which control the limit of movement of the arm, and carries also the clamping device 18. After the dials have been thus set they should be positively locked in the position in which they are set by operation of the clamping-lever 22. The knob 101 should now be turned round so that the pointer 103 will indicate "fast." The effect of this will be to properly set the switch member 106 to select the circuits over which it is desired to send the signals—let us say, for example, the circuits controlled by the generator 168—the brushes 163 and 164 being in such case disconnected electrically, while the brushes 161 and 162 are electrically connected, and to properly position the cam 93, whereby the rod 95 will fall, rocking the lever 87 from the position in which it is shown in the drawings, (see Fig. 10,) lifting the fan 84 away from engagement with the fan 85, so that it will be held stationary and clear of the said fan 85 and spindle 83. The machine is now set ready for operation, and to start it it will be only necessary to throw over the starting-lever, which in order to adjust the machine for repeating three times should be set over to a point where the window 121 of the said starting arm or lever is opposite the numeral 3 upon the quadrant 120. Immediately the starting-lever was moved from its initial position the detent 111 was moved out of the path of the projection 109 of the dial 107 upon the fly-fan spindle 83. This released, the clock-train and the weight 30, acting upon same, causes the controlling-arm 3 to begin to revolve, carrying the trailer 4 with it. The initial movement of the arm 115 also closed the switch 131. In its initial position the trailer 4 rested upon a projection 16 upon the rearmost dial, and as this dial is a stationary one the trailer will not drop until the arm has commenced to move. In its upward position the trailer maintains the contact-spring 9 out of contact with intermediate contact-point 10 and permits the contact-switch 8 to come in contact with the intermediate contact-point 10, whereby the magnet 153 is energized and the magnet 142 inert. In such position, as above explained, the circuit making and breaking device at the rear of the machine is inoperative, and although the cams 66 and 67 began to rotate immediately the clock-train started, because they are in gear with the said clock-train, no signals are sent. After the arm 3 and trailer 4 have moved a short distance the trailer will fall over the end of the projection 16 upon the rearmost dial and the position of the contact-springs 8 and 9 will be reversed. The magnet 153 will now be deënergized and the magnet 142 energized, causing the circuit making and breaking devices to become operative and to remain operative for two units of time, (equal to two revolutions of the cams, whereby two successive signals will be sent over the line,) until the arm 3 in its movement lifts the trailer 4 onto the peripheral projection 16 of the No. 2 dial. The circuit making and breaking devices will now remain inert for a period equal to the length of the said peripheral projection, thereby causing a pause in the sending out of signals until the trailer drops over the end of the said projection, when three more signals will be sent, corresponding to the three units of time between the peripheral projection upon the second and third dials and until the trailer is lifted onto the said projection on the third dial. Another pause will now take place until the trailer drops into the space between the projections upon the third and fourth dials, when six successive signals will be sent to complete the sending of the signals "236," above referred to, the trailer then rising upon the lateral projection 16 of the fourth dial. The fifth dial being in register with the fourth dial, the trailer will also be upon the projection 16 of the said fifth or outermost dial. The projection 16 of the outermost dial is longer than any of the other projections in order that there may be a longer pause between the sending of the successive signals, the duration of the pause depending upon the position of the member 18, carrying the cam 51, which said member is made adjustable for the purpose of varying the duration of this pause as may be desired.

When the trailer has traveled nearly the length of the exposed portion of the projection 16 upon the outermost dial, the operating-arm 45 upon the spindle 44 will come in contact with the plunger 53, the continued movement of the arm compressing the spring 54. Still further movement of the said controlling-arm will bring the roller 50 upon the arm 49 upon the cam 51, rocking the said cam 49 upon its support and finally lifting the locking-detent 48 from engagement with the pin 47 upon the arm 45. At the same time the rearwardly-projecting pin 170 of the arm 49 will engage the arm 6 of the trailer to lift the said trailer clear of the peripheral dial projections 16. The spindle 44 will be positively rocked by the spring action of the plunger 53 and by the action of the spring 46, thereby positively withdrawing the main clutch-teeth 37 from engagement with the clutch-teeth 35, disconnecting the said arm from its driving mechanism and at the same time swinging the detent 110 into the path of the fly-fan mechanism, thereby locking up the clock-train to prevent further movement thereof. The arm 3 will be returned to its initial position by means of the spring 56, in which energy has been stored during the forward movement of the arm, the speed of the rearward movement being properly checked by means of the clock-train and fly-fan 65. During such movement the trailer 4 will be held up by the pin 170. The arm will now return to normal position, in its final movement resetting the spindle 44 by engagement of the operating-arm 45 with the stud 55, causing the pin 47 to engage the notch in the locking-detent 48 to hold it in its position, reëngaging the main clutch and releasing the clock-train. In the final return movement of the said arm the escapement mechanism of the starting-lever 115 will also have been operated, thereby allowing the said starting-arm to drop back one notch. The same cycle of operations will now be gone through again, because immediately the clutch was engaged and the clock-train released the weight tends to move the arm 3 forward again, and the arm will so move forward, again sending out the signal "236," the arm 3 being again finally restored to its initial position and while being so restored dropping the starting-lever back another notch. After the controlling-arm has been moved forward again and for the third time and is again returned to its normal position it will drop the starting-arm 115 back to its first position, and in this position the detent 111, controlled by said arm 115, will be moved to a position to stop the clock-train, so that even though the detent 110, controlled by the controlling-lever, be moved clear of the said clock-train the mechanism will be stopped by the said detent 111 until the starting-lever is again moved away from its initial rest position. The clamp-operating lever 22 may now be released and the dials set back to their normal positions, or they may be left in their previous positions until it is desired to again reset the machine for sending out another signal.

What I claim is—

1. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of a retarding device for regulating the speed of such rotation, said retarding device including two fly-fans mounted upon one spindle and arranged normally to rotate together, and means for disconnecting one of said fans from rotative relation with the other said fan.

2. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of a retarding device for regulating the speed of such rotation, said retarding device comprising two fly-fans arranged to rotate synchronously, and means for disconnecting one of said fans, and for holding it positively against rotation at such times, while the other fan is permitted to rotate freely.

3. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of a retarding device for regulating the speed of such rotation, said retarding device comprising a clock-train and two fly-fans arranged to rotate in unison, a circuit-selecting switch, and hand operating means therefor, a cam, also operated by said hand operating means, and means controlled by said cam for disconnecting one of the said fly-fans.

4. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of speed-retarding means for controlling the speed of such rotation, including a gear-train and two fly-fans, said fans comprising a main and a supplemental fan arranged to normally engage each other, means for disengaging the supplemental fan from engagement with the other fan, a circuit-selecting switch, and means for operating the said circuit-selecting switch at the time the said supplemental fly-fan is caused to engage or disengage the other said fan.

5. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of a retarding device for regulating the speed of such rotation, said retarding device comprising two normally connected fly-fans and means for freeing one of said fans from engagement with the other.

6. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of a retarding device for regulating the speed of such rotation, said retarding device comprising a clock-train, a spindle in gear therewith,

a fly-fan in driving relation upon said spindle, another fly-fan loosely surrounding said spindle, but provided with a portion adapted to engage a part in driving relation with said spindle, whereby the two said fans may rotate together, and means for lifting said fan out of such driving relation, and for holding said fan entirely clear of said spindle, and parts rotating therewith.

7. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of a retarding device, including a clock-train, a spindle in gear therewith, a fan in driving relation upon said spindle, another fan loosely mounted upon said spindle, said fan provided with a flange, a lever engaging said flange for lifting said fan into and out of driving relation with the first said fan, and a housing for receiving said flange.

8. In a dial-transmitter, the combination with a plurality of dials adapted to be rotarily adjusted, one with respect to the other, of a clamp for simultaneously locking all of the said dials together.

9. In a dial-transmitter, the combination with a plurality of dials adapted to be rotarily adjusted, one with respect to the other, individual locking means between the said dials, and an independent clamp for clamping all of the said dials together in their adjusted positions.

10. In a dial-transmitter, the combination with a plurality of dials adapted to be rotarily adjusted, one with respect to the other, of a clamp for locking the said dials together, comprising a bracket secured to one dial and overhanging the others, a cam arranged in its operation to clamp the dials between itself and the said bracket, and an operating-lever for said cam.

11. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of driving means for effecting such rotation, a clutch for said driving means, clutch-releasing mechanism, tripping means therefor, and an actuating device in which energy is stored during the aforesaid rotation to be imparted to the clutch-releasing mechanism when the same is tripped.

12. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of driving means for effecting such rotation, a clutch for said driving means, clutch-releasing mechanism, tripping means therefor, and a spring-plunger arranged to engage the clutch-releasing mechanism during the aforesaid rotation, and a little prior to the operation of the tripping mechanism.

13. In a dial-transmitter, the combination with dials and a controlling-arm, of driving means for rotating the controlling-arm, a clutch for said driving means, clutch-operating mechanism, tripping means including a locking-detent engaging a part of said clutch-releasing mechanism, a spring-pressed plunger for engaging said clutch-operating mechanism during the movement of the arm, and a projection for operating said tripping means upon a further movement of said arm.

14. In a dial-transmitter, the combination with dials, a controlling-arm, and driving means for rotating the one with respect to the other in one direction, of spring-pressed means for returning the parts to normal position, means for adjusting the tension thereof, and a retarding device for regulating the speed of such return movement.

15. In a dial-transmitter, the combination of a dial, a controlling-arm, and means for rotating the one with respect to the other, the said means comprising a gear-train, and a weight-motor, the weight-motor composed of two chain-wheels, one connected to the gear-train and the other to winding means, an endless chain arranged over said chain-wheels with a loop between them, a weight suspended from said loop, idler-wheels secured to a stationary support around which the other end of the chain is passed, and an idler-pulley upon the said weight for supporting the opposite loop of said chain, substantially as set forth.

16. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of circuit make and break devices operated during the said rotation, and means operated by the relative rotation of said parts for mechanically throwing the circuit make and break devices into and out of operative relation.

17. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of line-circuit make and break devices controlled thereby, and means for throwing the said circuit make and break devices into and out of operative relation, said means including an electromagnet and a local-circuit breaker.

18. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of line-circuit make and break devices controlled thereby, means for mechanically throwing the circuit make and break devices into and out of operative relation, and locking means for holding them in their position in operative relation, when so adjusted.

19. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of line-circuit make and break devices controlled thereby, means electrically controlled for mechanically throwing the circuit make and break devices into and out of operative relation, and electrically-controlled locking

means for holding them in their position in operative relation when so adjusted.

20. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of cams connected for rotation therewith, contact-springs arranged to be operated by said cams, and means for moving said contact-springs into and out of operative relation with said cams.

21. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of cams connected for rotation therewith, contact-springs arranged to be operated by said cams, and electrically-controlled means for moving said contact-springs into and out of operative relation with said cams.

22. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of cams connected for rotation therewith, contact-springs arranged to be operated by said cams, means for moving said contact-springs into and out of operative relation with said cams, and locking means for holding them in their position in operative relation when so moved.

23. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of cams connected for rotation therewith, contact-springs arranged to be operated by said cams, means for moving said contact-springs into and out of operative relation with said cams, and electrically-controlled locking means for holding them in their position in operative relation when so moved.

24. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of cams connected for rotation therewith, contact-springs arranged to be operated by said cams, means including an electromagnet for moving said contact-springs into and out of operative relation with said cams, and a local-circuit breaker for said electromagnet.

25. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of cams connected for rotation therewith, contact-springs arranged to be operated by said cams, means including an electromagnet for moving said contact-springs into and out of operative relation with said cams, and an electromagnet locking and releasing device therefor.

26. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of cams connected for rotation therewith, pivoted contact-springs arranged to be operated by said cams, an electromagnet, an armature therefor connected to said contact-springs, and a local-circuit breaker for said electromagnet.

27. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of cams connected for rotation therewith, pivoted contact-springs arranged to be operated by said cams, an electromagnet, an armature therefor connected to said contact-springs, a latch for holding said armature in its attracted position, and electromagnetic means for releasing said latch.

28. In a dial-transmitter, the combination with dials, a controlling-arm, and means for rotating the one with respect to the other, of cams connected for rotation therewith, pivoted contact-springs arranged to be operated by said cams, an electromagnet, an armature therefor connected to said contact-springs, a latch for holding said armature in its attracted position, electromagnetic means for releasing said latch, and a local circuit make and break device for alternately making and breaking circuit through the said electromagnetic means.

In witness whereof I have hereunto set my hand this 6th day of September, 1905.

CHARLES F. PEARCE.

Witnesses:
D. HOWARD HAYWOOD,
LYMAN S. ANDREWS, Jr.