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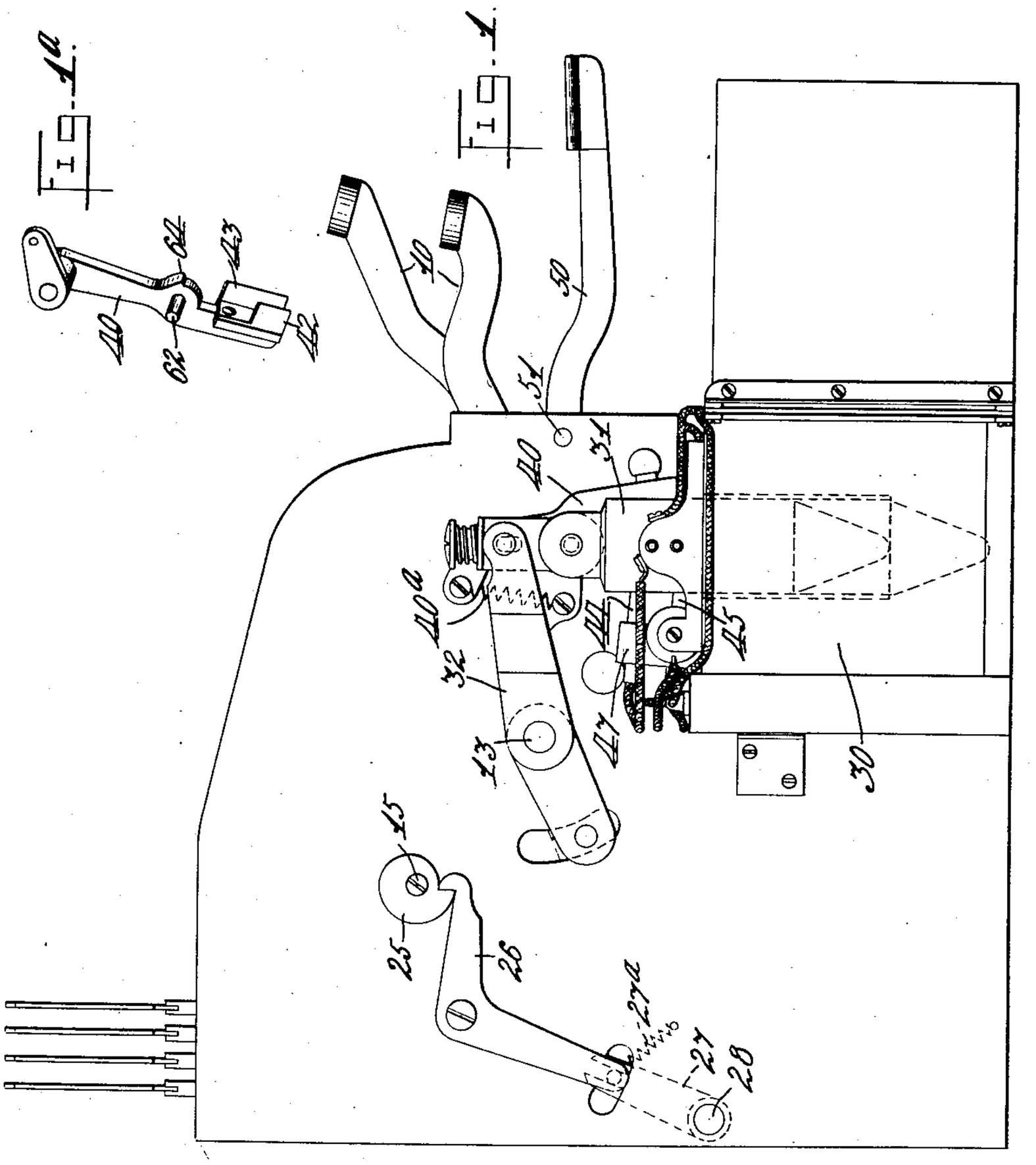
ELECTRIC DRIVING DEVICE FOR REGISTERING MACHINES.

APPLICATION FILED JULY 15, 1905. RENEWED OCT. 20, 1908.

959,548.

Patented May 31, 1910.

5 SHEETS—SHEET 1.



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5 SHEETS—SHEET 2.

Fig. 2a.

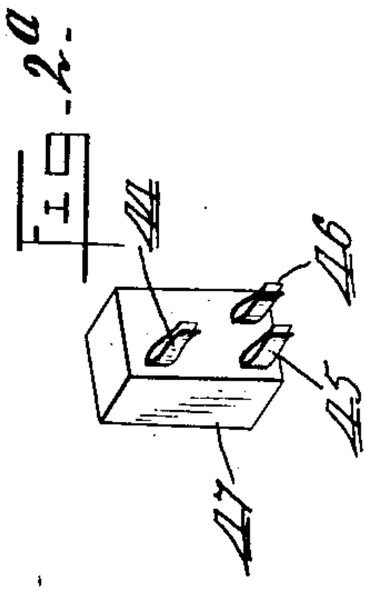
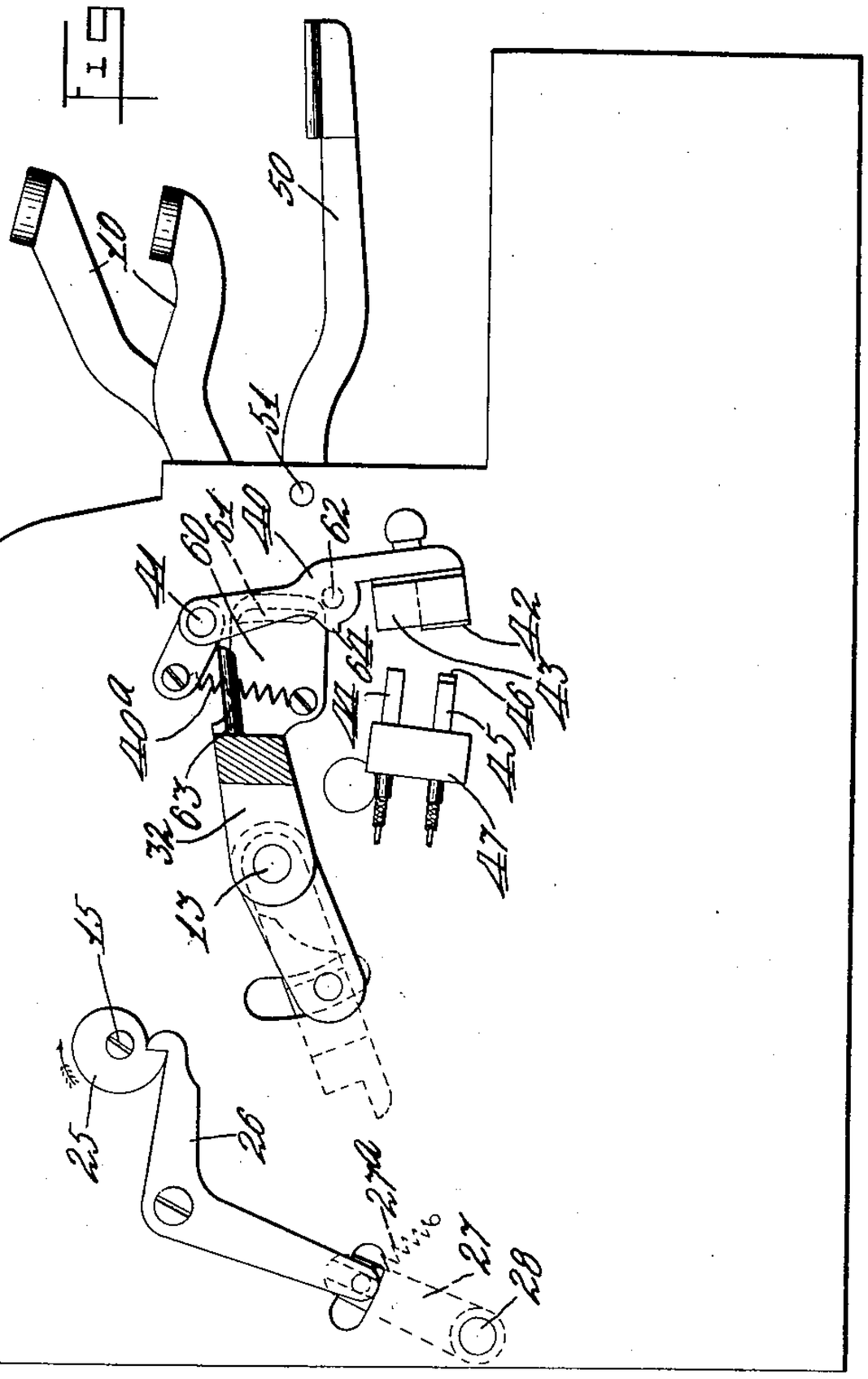


Fig. 2.



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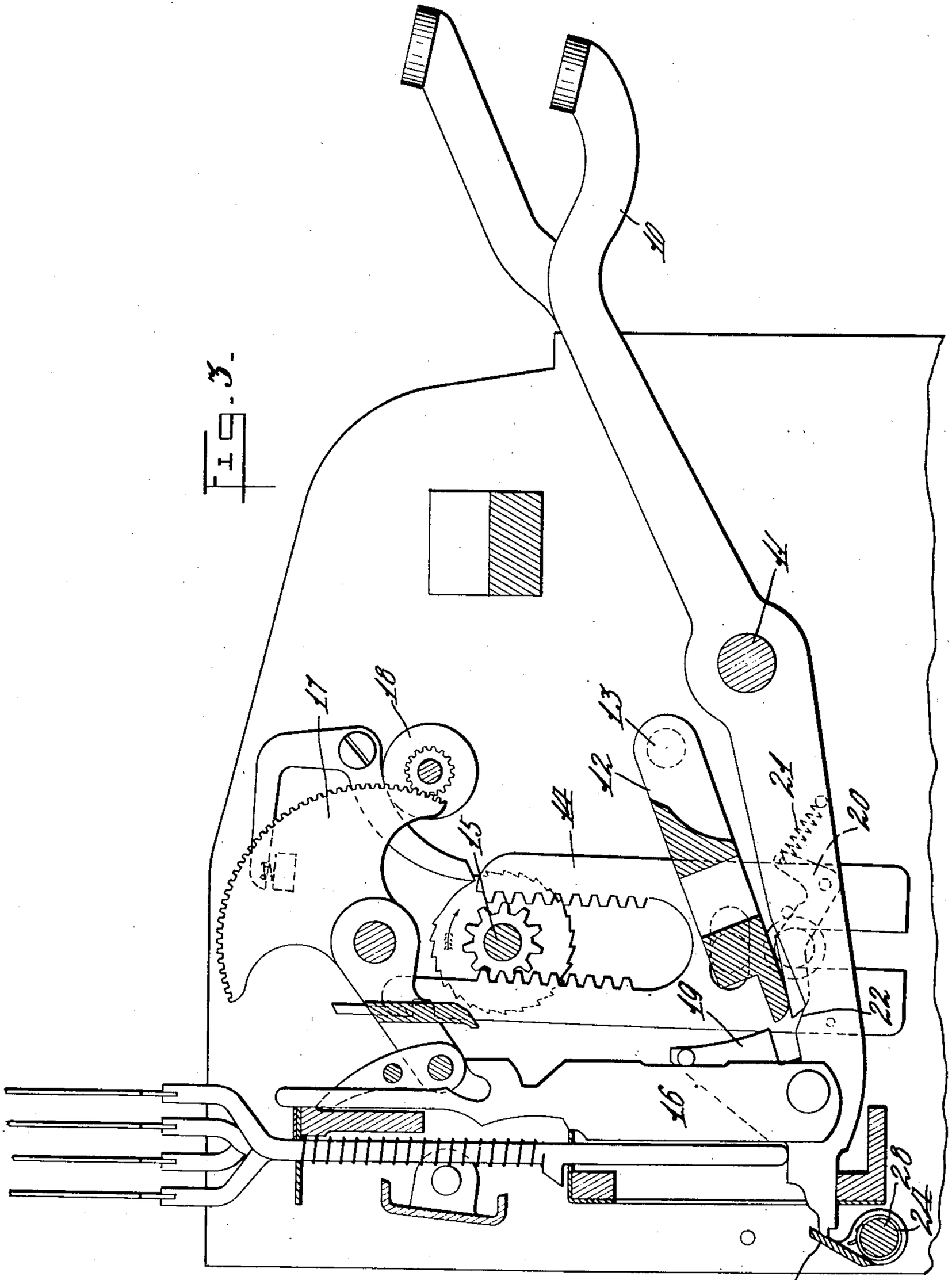
5 SHEETS—SHEET 3.

Fig. 3.



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5 SHEETS—SHEET 4.

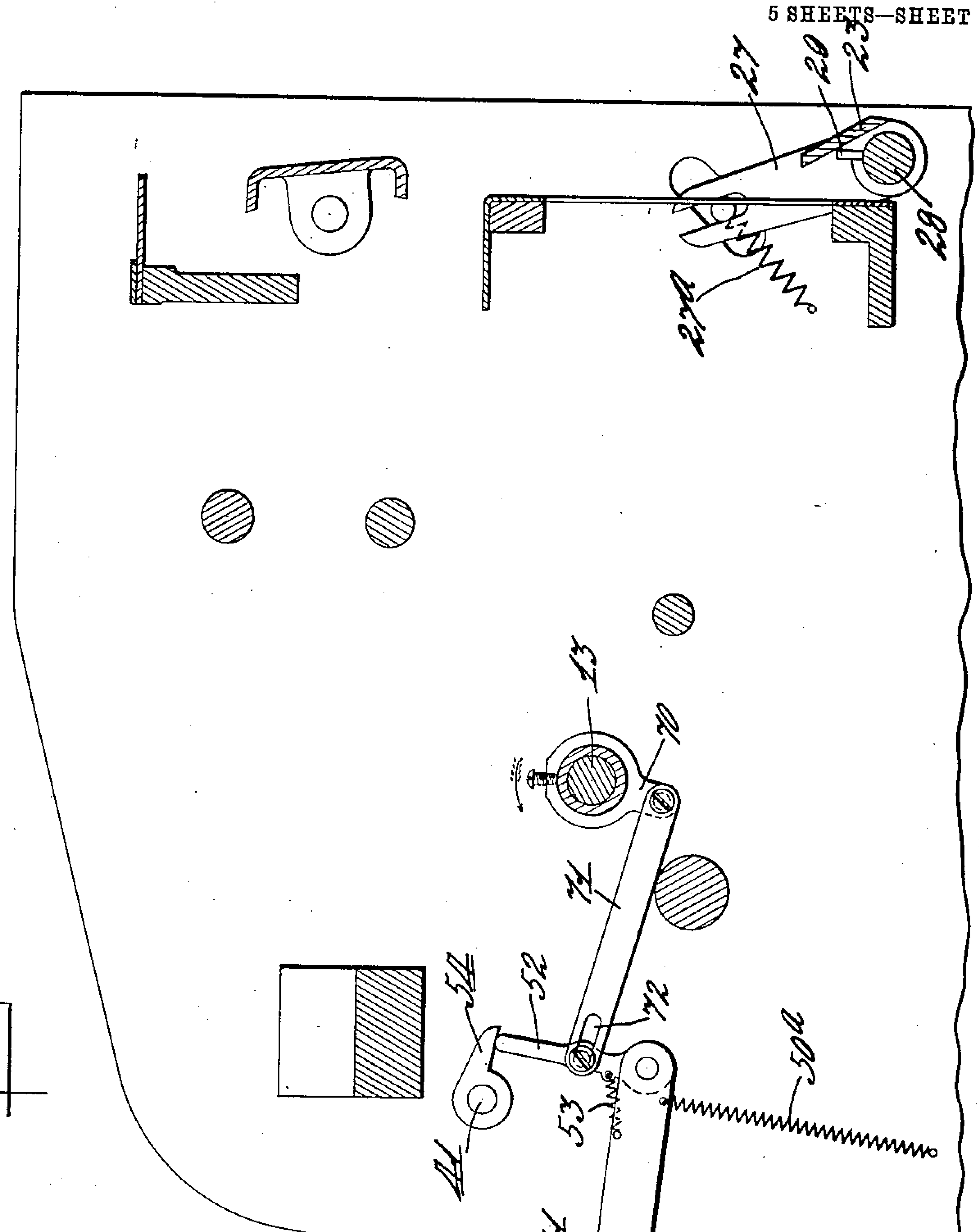

Fig. 4.

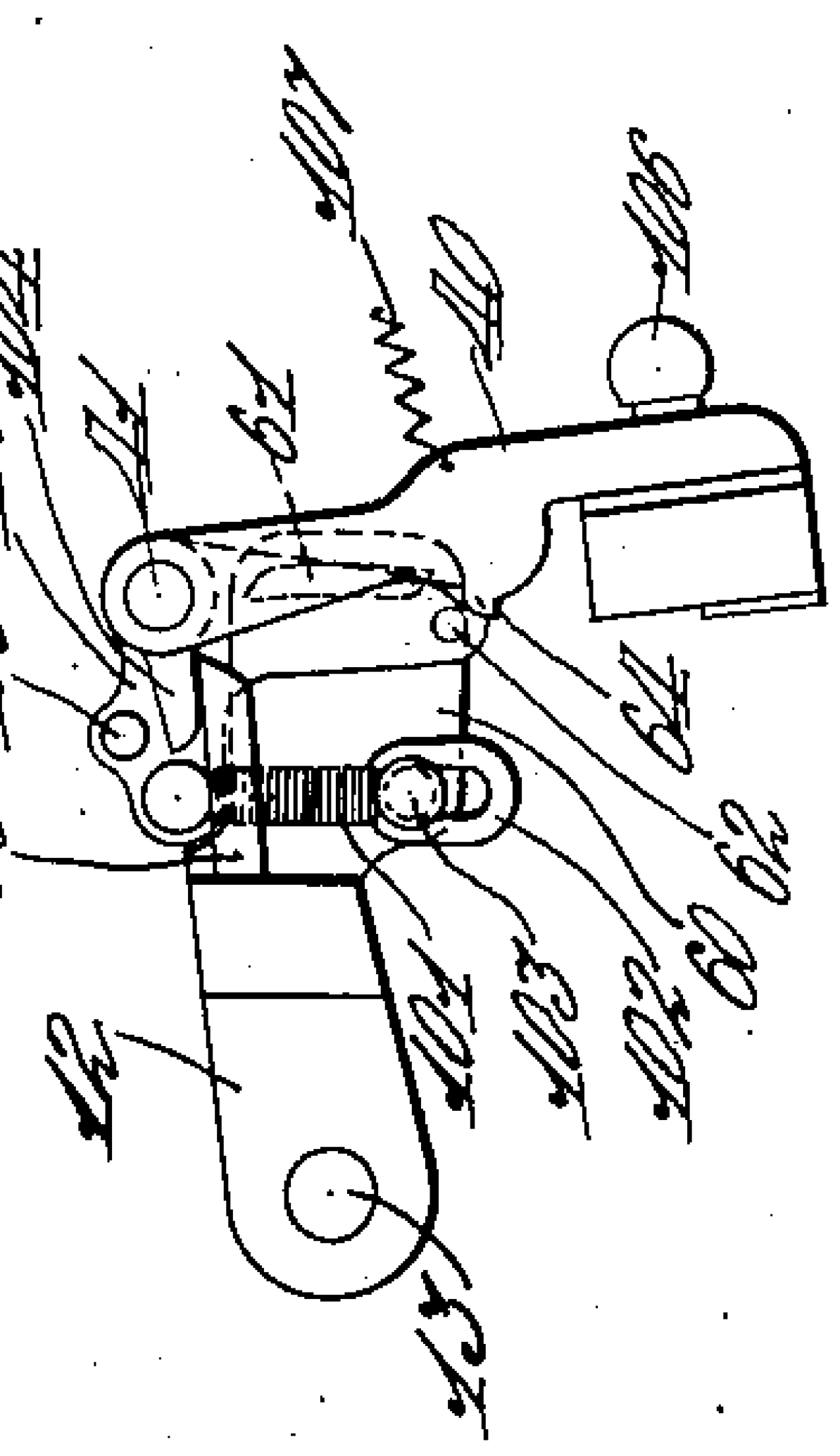

Fig. 6.

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5 SHEETS—SHEET 5.

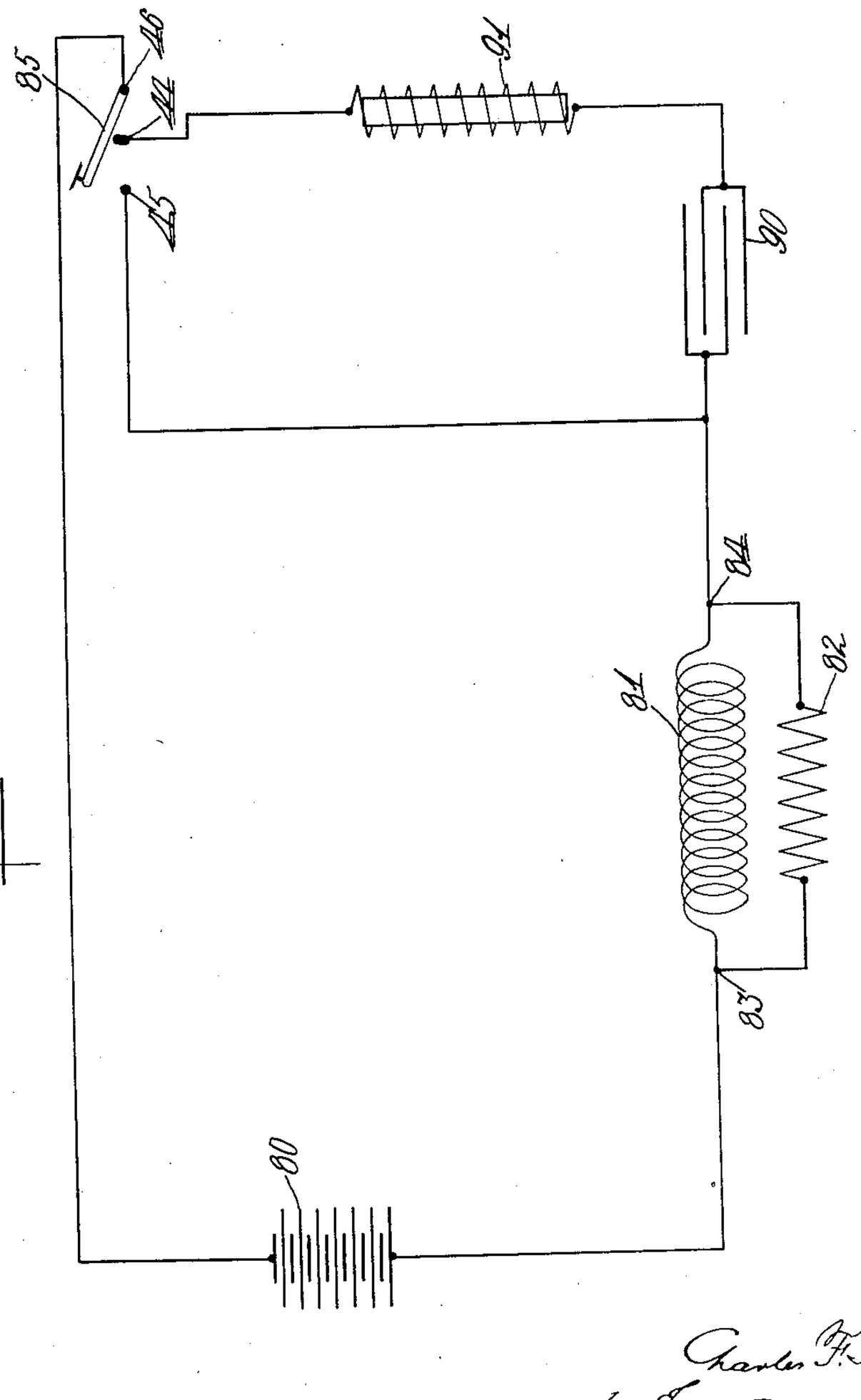

Fig. 5.

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UNITED STATES PATENT OFFICE.

CHARLES F. KETTERING, OF DAYTON, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE NATIONAL CASH REGISTER COMPANY, OF DAYTON, OHIO, A CORPORATION OF OHIO, (INCORPORATED IN 1906.)

ELECTRIC DRIVING DEVICE FOR REGISTERING-MACHINES.

959,548. Specification of Letters Patent. **Patented May 31, 1910.**

Application filed July 15, 1905, Serial No. 269,811. Renewed October 20, 1908. Serial No. 458,672.

To all whom it may concern:

Be it known that I, CHARLES F. KETTERING, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Electric Driving Devices for Registering-Machines, of which I declare the following to be a full, clear, and exact description.

This invention relates to improvements in electric driving devices for registering machines such as cash registers, adding machines, and other analogous mechanisms, and has for its principal object to provide an improved arrangement of circuits in connection with the form of electric driving means employed, and also includes certain other improvements relating to the operation of the switch key for closing the main circuit and in the construction of the ordinary keys of the machine, these latter improvements relating to devices for preventing a repeated operation of the motor by the holding of the switch key depressed, and also as regards the ordinary keys of the machine, permitting an initial movement thereof preparatory to the actuation of the driven member of the machine, which driven member then completes the operation of such keys as have been initially operated. As above stated, however, the primary object of these inventions is to provide an improved arrangement of circuits in connection with the electric driving device for the machine. In machines of this character, such as cash registers, where the register is put through a great number of operations each day it is of course desirable to have some form of electric driving device which will decrease the manual labor connected with the numerous successive operations, but these machines depend largely for their commercial utility upon their durability and freedom from the liability of getting out of order, and where electric driving devices are used, great trouble is experienced in the maintenance of the switch electrodes or terminals in proper condition, for with the power necessary to drive machines of this character, constant sparking to any considerable extent at the electrodes would soon cause the same to become coated and pitted and would soon destroy the efficiency of same, and it is with a view to minimizing as much as possible this undue sparking at the switch terminals that the present improvements are devised.

With these and incidental objects in view, the invention consists in certain novel features of construction and combinations of parts, the essential elements of which are set forth in appended claims and a preferred form of embodiment of which is hereinafter specifically described with reference to the drawings which accompany and form part of this specification.

Of said drawings: Figure 1 represents an end elevation of a cash register to which the present electric driving device is applied; Fig. 1ª represents a detail perspective view of the switch; Fig. 2 represents an end elevation of the cash register with the solenoid motor removed and the extending connection between the cash register and the motor sectionalized; Fig. 2ª represents a detail perspective view of the switch block carrying the three switch terminals; Fig. 3 represents a vertical cross-section through the cash register; Fig. 4 represents a detail sectional view of certain of the parts connected with the switch key, many of the other parts of the cash register being removed for the sake of clearness; and Fig. 5 represents a diagrammatic view of the arrangement of the electrical circuits. Fig. 6 represents a modified form of the switch opening mechanism.

These improvements are shown as applied to a type of cash register which is now well-known in the art and of which it is not necessary to give a detailed description as to its general construction and arrangement of parts. This register is of the type described in Letters Patent of the United States issued to Thomas Carney, No. 497,860 dated May 23, 1893 and No. 748,260 dated Dec. 29, 1903, and reference may be had to these patents for a more detailed description of the cash register. It is sufficient to say in brief that this cash register comprises a series of keys 10 (see Fig. 3) pivoted upon a transverse shaft 11 and coöperating with a key coupler 12 fast upon a transverse shaft 13. The oscillatory movements of this key coupler serve to raise and lower a double rack 14 which transmits a complete revolution to the main operating shaft 15. Lifter bars 16 are attached at the extremity of each

key and serve to operate registering segments 17 differentially to register the proper amounts upon the counter 18. The rearward end of each key is formed with a nose 19 arranged to be engaged by the key coupler 12 so that the key may be lifted with the key coupler and coupled thereto. In the present instance the key coupler 12 is arranged to be oscillated or driven by means of an electric motor in the shape of a magnetic solenoid having a driving core attached to said key coupler as will be presently described; and for the purpose of operating the machine the amount keys 10 are arranged to be given an initial movement to position them to be picked up by the key coupler and thereby operated to be given their complete movements. To effect this, each key has pivoted upon its side a restoring pawl 20, the rearward end of which rests against the underside of the key coupler, and the pawl is held in such position by means of a spring 21. Each key is also cut away as at 22 so as to permit an initial operation of the key to bring this cut-away portion up against the underside of the key coupler, the pawl 20 thereby being turned against the tension of the spring 21. To latch the key in this position a back-rod 23 is provided which extends transversely at the rear of a single bank of keys (there being a separate rod 23 for each bank of keys). The rod 23 is spring-pressed by a spring 24 so that when the rear end of any key is given this initial movement the back-rod 23 will snap forward in under said key and retain the key in depressed position. In order to release this back-rod from engagement with the keys to permit the same to return to normal position at the end of operation of the key coupler, a cam 25 is provided (see Figs. 1 and 2) which is fast upon one end of the aforesaid main operating shaft 15 and operates the bell crank lever 26 which has a slot and pin connection with an arm 27 extending upwardly from the shaft 28 upon which all of the back-rods 23 are mounted so that upon the operation of the machine and the rotation of the shaft 15 in the direction shown by the arrows, the bell crank lever 26 will be operated near the end of the operation of the machine to rock the shaft 28. The shaft 28 is provided with a series of pins 29 (see Fig. 4) one for each back-rod 23 for each bank of keys so that upon the rocking of the shaft 28 in this manner, the pins 29 will rock their respective back-rods 23 rearward and permit the keys to return completely to normal position at the end of the operation of the machine, which return is accomplished by the pressure of the key coupler 12 upon the aforesaid restoring pawls 20. A spring 27[a] normally draws the arm 27 forward.

Having thus described the operation of the keys in connection with the key coupler, the connections between the key coupler and the driving motor will now be described. This motor 30 (see Fig. 1) is in the shape of a magnetic solenoid comprising a solenoid coil which when an electric current is passing therethrough operates magnetically the solenoid core 31 to which is attached an arm 32 fast to the extending trunnion 13 of the key coupler oscillated in the ordinary manner, and of course such oscillation of the key coupler will pick up and operate such of the cash register keys as have been initially operated to position the same to be engaged by the key coupler in the manner above described.

Of course any suitable form of electric energy such as a battery may be utilized to energize the solenoid coil of the motor 30, and a particular form of switch is devised for completing the main circuit through the solenoid coil and for establishing such other circuits as will now be described. This switch comprises a swinging arm 40 (see Figs. 2 and 1[a]) mounted upon a rock shaft 41 and carrying at its lower extremity two contact making knives 42 and 43, it being observed on Fig. 1[a] that these two knives are comprised of one piece of conducting material but that the knife 42 is shorter in extent than 43, and from Fig. 2 it will be seen that the knife 42 projects rearward a slight extent beyond knife 43. These knives coöperate with corresponding stationary spring-strip terminals 44, 45 and 46 (see Figs. 2 and 2[a]), which terminals are seated in a stationary and insulated switch block 47 and are electrically connected by suitable conducting wires to establish certain circuits as will be hereinafter more fully described. When the switch arm 40 swings on its rock shaft 41, the knives 42 and 43 are carried into engagement between their corresponding spring-strips, the elongated knife 43 making engagement with both of the terminals 44 and 45 and the protruding knife 42 making engagement with the terminal 46. The purpose of the protrusion of this knife 42 is so that it will make contact with the terminal 46 just prior to the making of the contact of the knife 43 with the upper terminal 44, and then as will be seen in Fig. 2 the terminal 45 is somewhat shorter than the terminal 44 so that the making of the contact of the knife 43 with the terminal 45 will occur just subsequently to the aforesaid making of the contact of the same knife 43 with the upper terminal 44. Thus from this arrangement of knives and terminals it will be apparent that upon the swinging rearward of the switch arm 40 the contact of the terminals will be made in the follow-

ing order: first with terminal 46, then with terminal 44, then with terminal 45, and as these various terminals are connected by separate wires to circuits which will be later described, this effects the establishment of the current in these circuits in a particular manner and with a certain result to be set forth later. The actual swinging rearward of the switch arm 40 for the purpose of making these contacts is accomplished by means of a key 50 (see Fig. 4) pivoted at 51 upon the side frame of the machine and carrying at its rearward end an actuating arm 52 controlled by a spring 53, which arm 52 engages the nose 54 of a projection fast upon the aforesaid shaft 41 which carries the switch arm 40. When the key 50 is depressed the actuating arm 52 bears against the nose 54 and rocks the shaft 41 to carry the switch arm 40 rearward to make the contact in the manner just described, this swinging rearward of the switch arm 40 being against the tension of the restoring spring 40[a] (see Fig. 2). The contact having been made in this manner and the circuits established through the driving motor, this motor is now energized and the solenoid core 31 drawn downward to oscillate the key coupler in the manner described.

For the purpose of retaining the switch arm 40 in contact making position during the upward movement of the key coupler, that is: during one direction of its oscillatory movement, there is made fast to the key coupler a forwardly extending arm 60 carrying a flange 61 which coöperates with a pin 62 fast upon the side of the switch arm 40. Thus when the switch arm is swung rearward to make the contacts and the key coupler is oscillated, the arm 60 moves downward and the flange 61 moves in front of the pin 62 and holds the switch arm securely locked in contact making position; but when the arm 60 reaches the limit of its downward movement, the flange at this point is discontinued so as to permit the free return of the switch arm 40 to normal forward position under its spring tension, the switch key 50 having been released immediately by hand or having its effectiveness disabled by mechanism to be presently described. However since this spring tension of the spring 40[a] might not be sufficient to insure the switch 40 being returned to normal non-contact making position, a pin 63 is provided which projects forwardly from the key coupler and upon the completion of this part of the oscillatory movement of the key coupler (*i. e.*: when the pin 63 is carried downward) this pin 63 strikes a projecting nose 64 on the rearward side of the switch arm 40 and positively forces the switch arm out of contact making position so that its spring is then free to draw the arm to normal non-contact making position.

The switch key disabling device above referred to comprises the mechanism shown in Fig. 4. Fast to the key coupler shaft 13 is a collar 70 to which is attached a link 71 which is slotted at 72 at its forward end to engage a pin on the side of the aforesaid actuating arm 52, so that upon the oscillation of the shaft 13 in the direction shown by the arrow, the link 71 is drawn rearward and the arm 52 thereby also drawn rearward against the tension of its spring 53 so that the upper end of the arm 52 is withdrawn from contact with the nose 54 and the shaft 41 may be freely rocked back to normal position by reason of the return of the switch arm to normal position, and if the key 50 were held in depressed position the arm 52 would simply strike against the rearward end of the nose 54 and the key would be disabled as to its effectiveness upon the switch and it would be necessary to return the key 50 to normal upper position before the arm 52 would again engage underneath the nose 54 to permit a repetition of the switch operating movement. A spring 50[a] normally returns the outer end of the switch key 50 to normal upper position.

The electrical connections and arrangements of circuits will now be described by the aid of diagrammatic Fig. 5. The battery 80 comprises the main source of electric energy for operating the driving motor or magnet. The inductive element or coil 81 represents the solenoid coil of the driving magnet. Shunted around this inductive coil 81 is a non-inductive resistance 82, this shunt circuit being between the points 83 and 84. The switch key 85 corresponds to the aforesaid switch arm 40. This switch key 85 coöperates with the terminal points 45, 44 and 46 which are the same terminal points as already described as mounted upon the switch block 47, (see Fig. 2[a].) As set forth above the construction of this switch is such that the contact is made first through the terminals 46 and 44 and then through the terminals 44 and 45, and for representing this effect clearly, the contact terminal 44 in diagrammatic Fig. 5 is shown slightly widened so that the switch key 85 would make contact between terminals 46 and 44 just prior to the making of the contact between terminals 44 and 45. For convenience in designating these two make and break points, the make and break point between the terminals 46 and 44 will be designated as a secondary make and break point and the make and break point between the terminals 44 and 45 will be designated as a primary make and break point. In Fig. 5 the switch key 85 is shown connected at one end to the terminal 46 and this would correspond to the partially operated position of the switch arm 40 in the actual construction shown in Fig. 2 in which partially op-

erated position the switch arm 40 is swung rearwardly sufficiently to bring its knife blade 42 into engagement with the terminal 46, and the machine could remain in this condition normally, as no current would then be flowing since no circuits are then established, but it is preferred to have the contact normally broken between the switch and the first terminal 46, although for convenience the switch key 85 is shown normally connected to the terminal 46. Shunted between the terminals 44 and 45 of the primary make and break point is a circuit containing a condenser 90 and an inductive resistance 91. The action of these circuits upon the operation of the switch key 85 will now be described.

When the switch key is moved partially so as to make the contact at the secondary make and break point (namely: between the terminals 46 and 44) the condenser 90 and inductive resistance 91 are put in series with the battery and the inductive coil 81, and the condenser is charged to the voltage of the battery. As soon as the key 85 is depressed farther to its extreme position making contact also at the primary make and break point between the terminals 44 and 45, the battery circuit is now completely made through the inductive coil 81 and the condenser is immediately short-circuited across the terminals 44 and 45. This sudden short-circuiting of the condenser would of course normally tend to cause a decided sparking between the terminals 44 and 45 but the presence of the inductive resistance 91 in series with the condenser prevents any implusive and excessive rush of current, so that the circuit is completely made between the terminals 44 and 45 before the condenser has had opportunity to cause the abnormal sparking to take place, and contact now being made between these two terminals, the condenser is immediately discharged to a condition of zero potential without any deleterious effect due to such abnormal sparking. The current is now flowing normally through the battery and the terminals 46 and 45 and through the inductive coil 81 of the operating magnet and of course this energizing of the inductive coil 81 causes the operation of the machine in the manner described. Now upon the succeeding opening of the switch key 85 by the automatic operation of the machine, the following results take place. Assuming that the key 85 has been moved upward to its intermediate position whereby it has just broken the contact between the terminals 44 and 45, but the contact between the terminals 44 and 46 still remains, it will be seen that the main current through the inductive coil 81 is broken and this breaking of the circuit through the inductive coil 81 causing the sudden cessation of the maintenance of the lines of magnetic force through said inductive coil, thereby in effect makes the inductive coil 81 a seat or generator of its own electro-motive force, which electro-motive force added to that of the battery, would, by such sudden rise, cause a marked sparking effect between the terminals 45 and 44. The presence however of the condenser 90 in the circuit at this point however, (since the contact remains made through the terminals 44 and 46) causes this excessive electro-motive force to dissipate itself by surging back and forth in this condenser circuit instead of dissipating itself by means of sparking, and before any undue sparking could take place the switch key 85 may be completely returned to upper position thereby withdrawing the contact making knife far enough to effectually remove the possibility of any spark taking place because of the distance apart between the contact making devices. If, however, this high electro-motive force were suddenly thrown upon the condenser in this manner, it would require a condenser of expensive and careful construction to prevent the possibility of puncturing, and to remove this possibility and to permit the use of a condenser of less capacity, the shunt circuit of non-inductive resistance 82 around the inductive coil 81 is used. The effect of this latter shunt circuit is that when this inductive coil becomes its own generator of an electro-motive force in the manner above described, this shunt circuit constitutes an eddy-circuit around which this current, due to such electro-motive force, may flow, and in this manner some of this excessive electro-motive force is dissipated without the sudden throwing of the entire amount of this electro-motive force upon the condenser 90. The effect of undue sparking between the terminals 45 and 44 upon this opening movement of the switch key 85 having thus been reduced, the key 85 now returns to normal position breaking the circuit between the terminals 44 and 46; and this leaves the condenser charged, of course, since it has just been connected in series while the contact was made between the terminals 44 and 46, but this breaking of the contact between the points 44 and 46 causes no sparking at these terminals and the residual charge of the condenser gradually is dissipated by leakage or remains for the renewal of the charge upon the next closing of the switch key 85.

It is to be understood that if desired the terminals 44 and 46 could be consolidated so that there would be only one make and break point, and in such case in the open position of the key 85, the condenser 90 would always be in series with the battery and the advantageous results above described as to preventing undue sparking at the terminal 45 upon the making and breaking of the cur-

rent would nevertheless still be present; but in such case if the condenser 90 for some reason became punctured this would effect a complete short circuit and thereby would cause the continued flow of the current through the operating inductive coil 81, so that by this double switch mechanism the condenser circuit is only made just preparatory to the making of the circuit through the main inductive coil in the manner just described. Further, it is to be understood that the non-inductive resistance 82 might be replaced by any non-inductive element such as a condenser, and the invention is broad enough to cover the use of any non-inductive element in this manner.

The driving motor in the present instance is in the shape of a magnetic solenoid, the solenoid coil of which is represented by the inductive coil 81 of Fig. 5 but it will be obvious that this same arrangement of circuits might be used for other forms of motor driving devices where a single inductive coil or element is used incidentally to the construction of the power-producing device, that is: in the use of such an inductive coil or element in a magnetic clutch for coupling up an operating motor to a driven member of the machine, or in the use of such an inductive coil in the ordinary form of motor in use directly as a driving mechanism for the machine; and in the claims where the term "inductive element" is used in this connection, it is to be understood that the invention is not confined to the mere use of the inductive coil for an operating magnet solenoid, but comprises the use of an inductive coil or element in any other form of device for producing power or for use in connection with driving motors intended to operate or drive machines in this or analogous manner.

In Fig. 2 it will be seen that the spring 40^a which is used to throw the switch 40 forward upon the opening of the switch, is attached to the key coupler plate 60 so that the spring 40^a is put under tension as the key coupler goes downward and thus effects a substantial increase in the tension of the spring so as to make the spring more effective at the time the switch is free to be moved forward so as thereby to open the switch with as quick and snapping movement as possible.

In Fig. 6 a modified form of switch device is shown. The switch 40 is mounted on the shaft 41 and swung rearward to engage the contact knives in the manner already described in connection with Figs. 2 and 4, but in this modified form, the switch-opening device comprises a bell crank lever 100 pivoted loosely upon the said shaft 41, the rearwardly extending arm of this bell crank lever having connected thereto a spring 101 carrying at its lower end an elongated ring 102 which is slotted to engage the headed pin 103 carried upon the forwardly extending key coupler plate 60. This plate 60 carries the usual flange 61 for engaging the pin 62 which is carried upon the downwardly extending arm of the bell crank lever 100. A short arm 104 projects rearwardly from the pivotal end of the switch 40 to coöperate with a pin 105 on the bell crank lever 100. The operation of these parts is as follows: When the key 50 is depressed in the manner previously described and the shaft 41 is thereby rocked to carry the switch arm 40 into engagement with the contact knives, the friction of the knives grips the switch to hold the same in contact making position, and then of course as soon as the circuit is made, the key coupler plate 60 immediately descends, and the pin 103 reaches the lower end of the slot in the ring 102 and then puts the spring under tension so that at the limit of the downward movement of the key coupler plate 60 the spring 101 is stretched to its fullest extent and tends to pull downward the rearward arm of the bell crank lever 100, and by reason of the engagement of the pin 62 with the flange 61, the bell crank lever cannot swing in this manner until the key coupler plate has got to the limit of its downward stroke, at which point the flange 61 terminates and the bell crank lever is free to swing under the tension of the spring 101, and this causes the pin 105 to strike the switch arm 104 and with a quick movement kick the switch 40 forward into non-contact making position. Then when the key coupler plate 60 is returned to normal upper position the spring 101 is slack and exerts no force on the switch 40, but the switch is held forward against its stop pin 106 by means of a very light spring 107 which has simply but slight enough tension to overcome the weight of the switch arm and prevent same from dropping rearward into contact with the knives. Thus it will be seen that in this modified form of switch mechanism, the switch arm 40 is not maintained in contact making position by means of the flange 61 as in the other form of mechanism above described, and is practically free to be moved into or out of contact with the knives at any time, but the spring kicking or switch opening means is put under tension during the operative movement of the key coupler and is restrained under such tension until the proper time when it is released and permitted to strike the switch and thereby forcing the same into open position. As in the first form of switch opening device above described, this modified form of device may also embody the pin 63 carried by the key coupler and arranged to strike the nose 64 on the rearward side of the switch arm 40 so as positively to force the switch arm out of contact making position when the key

coupler 60 has reached its downward extremity of movement.

While the forms of mechanisms here shown and described are admirably adapted to fulfil the objects primarily stated, it is to be understood that it is not intended to be confined to the forms herein disclosed, for they are susceptible of embodiment in various forms, all coming within the scope of the claims which follow.

Having thus described the invention what is claimed as new is as follows:

1. In an electric driving device, the combination with a source of electric energy included in a circuit with an inductive element; of a switch for making and breaking said circuit; and a shunt circuit between the terminals of said switch, said shunt circuit including a condenser and an inductive resistance.

2. In an electric driving device, the combination with a source of electric energy included in a circuit with an inductive element, of a switch for making said circuit; means operated through the medium of said inductive element for automatically operating said switch to break said circuit; and a shunt circuit between the terminals of said switch, said shunt circuit including a condenser and an inductive resistance.

3. In an electric driving device, the combination with a source of electric energy included in circuit with an inductive element, of a switch for making and breaking said circuit; a shunt circuit around said inductive element and including therein a non-inductive element; and a second shunt circuit between the terminals of said switch, said second shunt circuit including a condenser and an inductive resistance.

4. In an electric driving device, the combination with a source of electric energy included in a circuit with an inductive element, of a switch for making and breaking said circuit; a shunt circuit around said inductive element and including a non-inductive resistance; and a second shunt circuit between the terminals of said switch, said second shunt circuit including a condenser and an inductive resistance.

5. In an electric driving device for registering machines, the combination with a driving member of the registering machine, of an operating solenoid comprising a solenoid coil and a solenoid core attached to said driving member; a circuit including said solenoid coil; a switch for making and breaking said circuit; a shunt circuit around said solenoid coil and including a non-inductive element; and a second shunt circuit between the terminals of said switch and including a condenser and an inductive resistance in series.

6. In an electric driving device, the combination with a source of electric energy included in a circuit with an inductive element, of a double switch in said circuit, comprising primary and secondary make and break points with provisions whereby the operation of the switch closes the secondary make and break point prior to the primary and opens the primary prior to the secondary; and a shunt circuit between the terminals of the primary make and break point, said shunt circuit including a condenser.

7. In an electric driving device, the combination with a source of electric energy included in a circuit with an inductive element, of a double switch in said circuit, comprising primary and secondary make and break points with provisions whereby the operation of the switch closes the secondary make and break point prior to the primary and opens the primary prior to the secondary; and a shunt circuit between the terminals of the primary make and break point, said shunt circuit including a condenser and an inductive resistance in series.

8. In an electric driving device, the combination with a source of electric energy included in circuit with an inductive element, of a double switch in said circuit comprising primary and secondary make and break points with provision whereby the operation of the switch closes the secondary make and break point prior to the primary and opens the primary prior to the secondary; a shunt circuit around said inductive element, said shunt circuit including a non-inductive element; and a second shunt circuit between the terminals of the primary make and break point, said latter shunt circuit including a condenser and an inductive resistance.

9. In an electric driving device for registering machines, the combination with a driving motor and a circuit therefor, of an oscillatory driven member of the registering machine; a switch for controlling the motor circuit; manipulative means for operating the switch to carry the same into contact making position; means connected with said oscillatory member for holding the switch in contact making position; and means also connected with said oscillatory member for positively forcing said switch into non-contact making position.

10. In an electric driving device for registering machines, the combination with a driving motor and a circuit therefor, of an oscillatory driven member of the registering machine; a switch for controlling the motor circuit; manipulative means for operating the switch to carry the same into contact making position; means connected with said oscillatory member for holding the switch in contact making position during one direction of the movement of said oscillatory member, said means being constructed to

permit the free return of said switch at the end of such movement; and means also connected with said oscillatory member for positively forcing said switch into non-contact making position at the end of such movement in one direction.

11. In an electric driving device for registering machines, the combination with a driving motor and a circuit therefor, of an oscillatory driven member of the registering machine; a switch for controlling the motor circuit; manipulative means for operating the switch to carry the same into contact making position; a series of transaction determining keys for said registering machine, each of said keys having provisions permitting an initial movement thereof to position the same to be coupled to said oscillatory member; an oscillating back-rod positioned to engage the rear ends of said keys to hold them in such initial position; and means also operated by said motor for rocking said back-rod to permit the keys to return to normal position.

12. In an electric driving device for registering machines, the combination with a reciprocating electric motor and a circuit including the same, of a key coupler connected to said motor; a circuit including said motor; a switch and key connected therewith for closing said circuit; a series of amount keys for the registering machine coöperating with the key coupler and each being formed with cut-away portions to permit an initial movement of the key to carry the same into position to be engaged by the key coupler; spring pawls mounted on said keys and engaging said key coupler to complete the restoration of the keys to normal position; a spring-pressed back-rod situated in the rear of said keys and engaging the ends thereof to hold the same in initially operated position; and connections between said key coupler and said back-rod for rocking the latter at the completion of operation of the machine so as to permit operated keys to return completely to normal position.

13. In a driving device for registering machines, the combination with a driving motor and circuit therefor, of an oscillatory driven member connected with said motor; a switch for closing the circuit through said motor; a key for operating said switch to close said circuit; a spring retained actuating arm connected with said key and engaging said switch to close the switch by the operation of said key; and a slotted link connected with said oscillatory member and said arm for withdrawing the arm from contact with the switch upon the operation of the motor whereby to disable the effectiveness of said key upon said switch.

14. In an electric driving device for registering machines, the combination with a driving motor and a circuit therefor, of a driven member operated by said motor; a switch for closing said circuit; and a spring connection between said switch and said driven member whereby the movement of the driven member puts the spring under tension to open the switch.

15. In an electric driving device for registering machines, the combination with a driving motor and a circuit therefor, of a driven member operated by said motor; a switch for said circuit; a spring operated switch opening device rendered effective by the movement of the driven member; and a second switch opening device positively operated by said driven member for forcing said switch out of position to complete the motor circuit.

16. In an electric driving device for registering machines, the combination with a driving motor and a circuit therefor, of a driven member operated by said motor; a switch for said circuit; a switch opening device normally inactive and independent of said switch; means for causing said switch opening device to become active upon the movement of said driven member; and means for restraining the effectiveness of said switch opening device upon said switch until the driven member has reached a predetermined point in its movement.

17. In an electric driving device for registering machines, the combination with a driving motor and a circuit therefor, of a driven member operated by said motor; a switch for said circuit; a switch opening device having a spring connection with said driven member which spring is put under tension by the movement of the driven member; and means for restraining the switch opening device under its spring tension until the driven member has reached a predetermined point in its movement.

18. In an electric driving device for registering machines, the combination with a driving electric motor, and a circuit for said motor including a switch, of a member driven by said motor, a spring connecting said member to said switch, and a projection on said member positioned to obstruct said switch during the movement of said member.

19. In an electric driving device for registering machines, the combination with a driving electric motor, and a circuit for said motor including a switch, of means for manually operating said switch, a member driven by said motor, and a projection on said member positioned to obstruct said switch during movement of said member.

20. In an electric driving device, the combination with a source of electric energy included in a circuit with an inductive element, of a double snap switch in said circuit, comprising primary and secondary make and break points with provisions whereby

the operation of the switch closes the secondary make and break point prior to the primary and opens the primary prior to the secondary; and a shunt circuit between the terminals of the primary make and break point, said shunt circuit including a condenser.

21. In an electric driving device, the combination with a source of electric energy included in a circuit with an inductive element, of a double snap switch in said circuit, comprising primary and secondary make and break points with provisions whereby the operation of the switch closes the secondary make and break point prior to the primary and opens the primary prior to the secondary; and a shunt circuit between the terminals of the primary make and break point, said shunt circuit including a condenser and an inductive resistance in series.

22. In an electric driving device, the combination with an electric motor, of a circuit for same and including a switch, a spring for moving said switch to break said circuit, and means operated by the motor for positively forcing said switch out of position completing the circuit.

23. In an electric driving device, the combination with an electric motor, of a circuit for same including a circuit controlling device, a spring for moving said controlling device to break the circuit, and means positively operated by the operation of the machine, to move said controlling device to break the circuit if the spring fails to act.

24. In an electric driving device, the combination with an electric motor and a registering mechanism driven thereby, of a circuit for said motor including a switch; a spring operated switch opening device rendered effective by the movement of the driven member but restrained from operation until the driven member has reached a predetermined point in its movement, and a second switch opening device positively operated by said driven member for forcing said switch out of position to complete the motor circuit.

In testimony whereof I affix my signature in the presence of two witnesses.

CHARLES F. KETTERING.

Witnesses:

WM. O. HENDERSON,

C. B. FOSTER.,

Correction in Letters Patent No. 959,548.

It is hereby certified that in Letters Patent No. 959,548, granted May 31, 1910, upon the application of Charles F. Kettering, of Dayton, Ohio, for an improvement in "Electric Driving Devices for Registering-Machines," an error appears in the printed specification requiring correction as follows: Page 2, line 75, the words "oscillated in the ordinary man-" should be stricken out and the words *so that when the solenoid is* inserted instead; 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 26th day of July, A. D., 1910.

[SEAL.]

F. A. TENNANT,

Acting Commissioner of Patents.