No. 742,374. PATENTED OCT. 27, 1903.

W. W. ALEXANDER.

CIRCUIT CONTROLLER FOR SURGICO-DENTAL ENGINES.

APPLICATION FILED DEC. 24, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

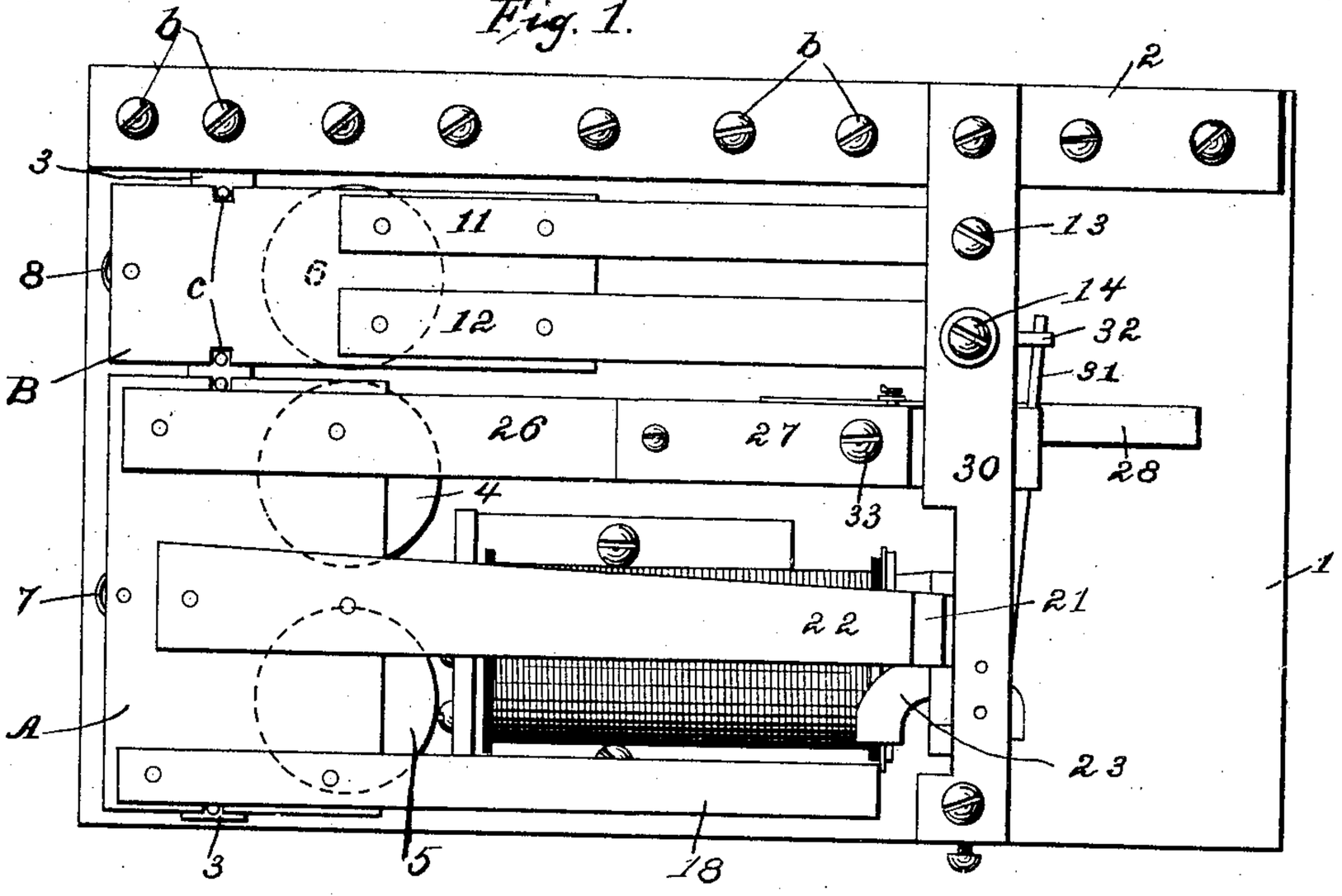
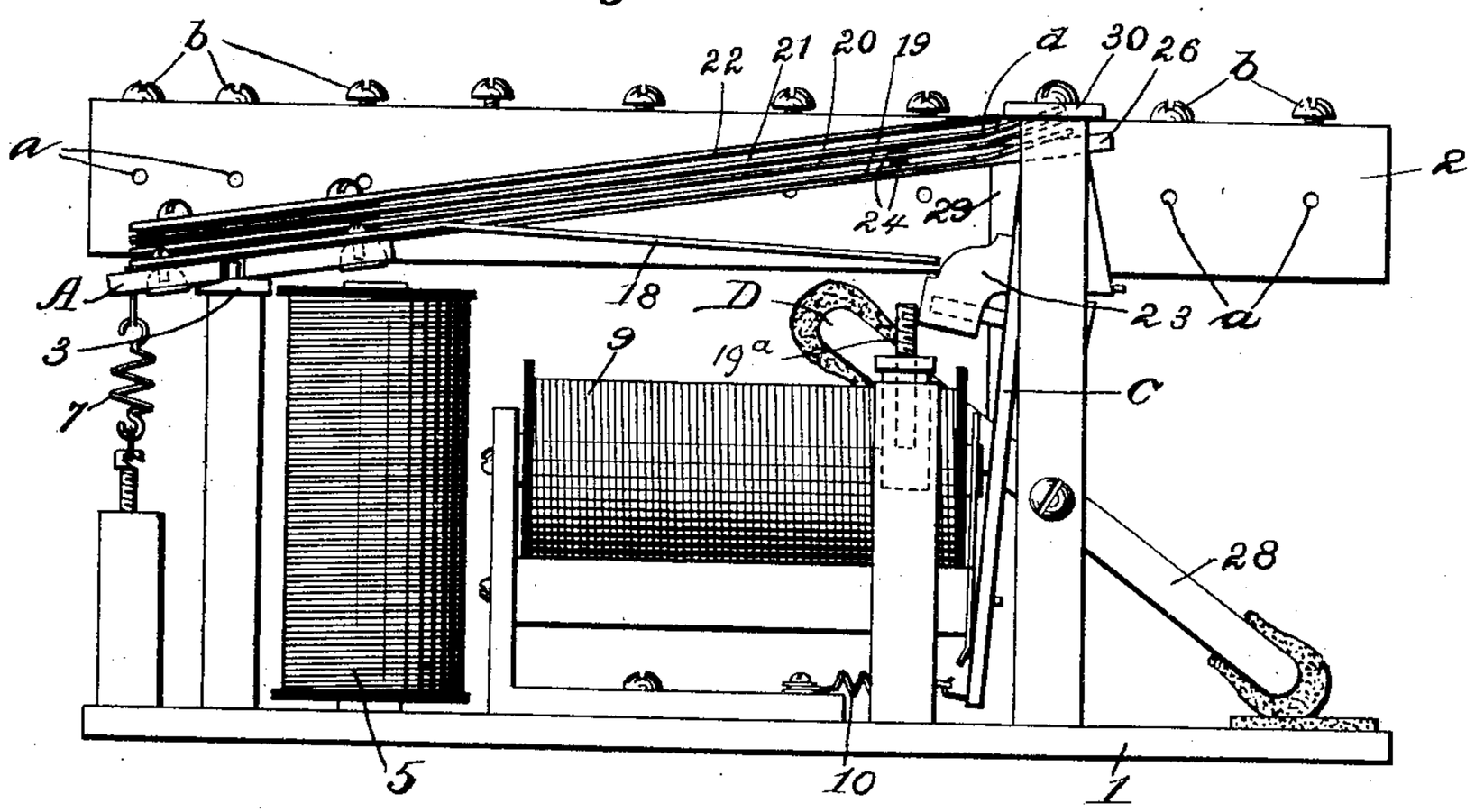


Fig. 2.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 3.

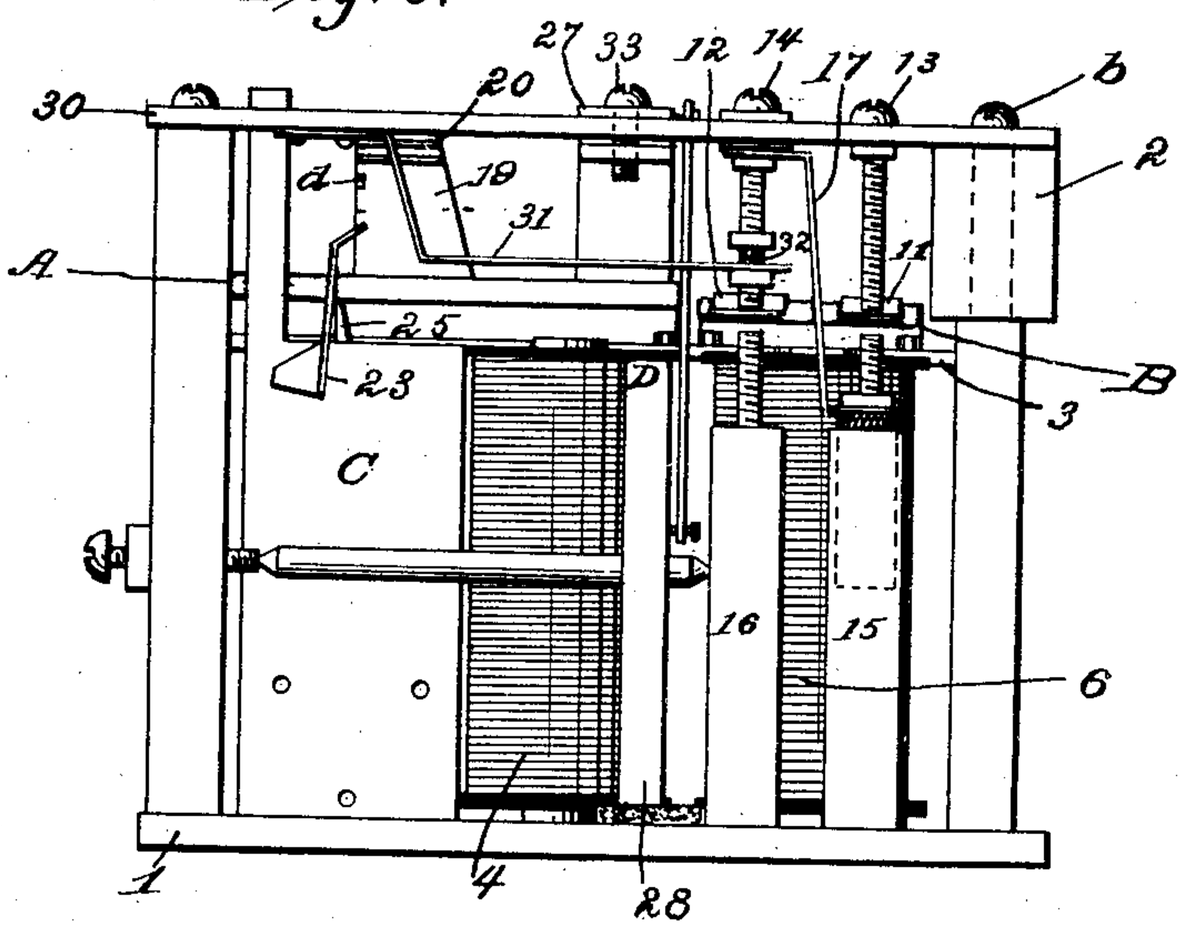
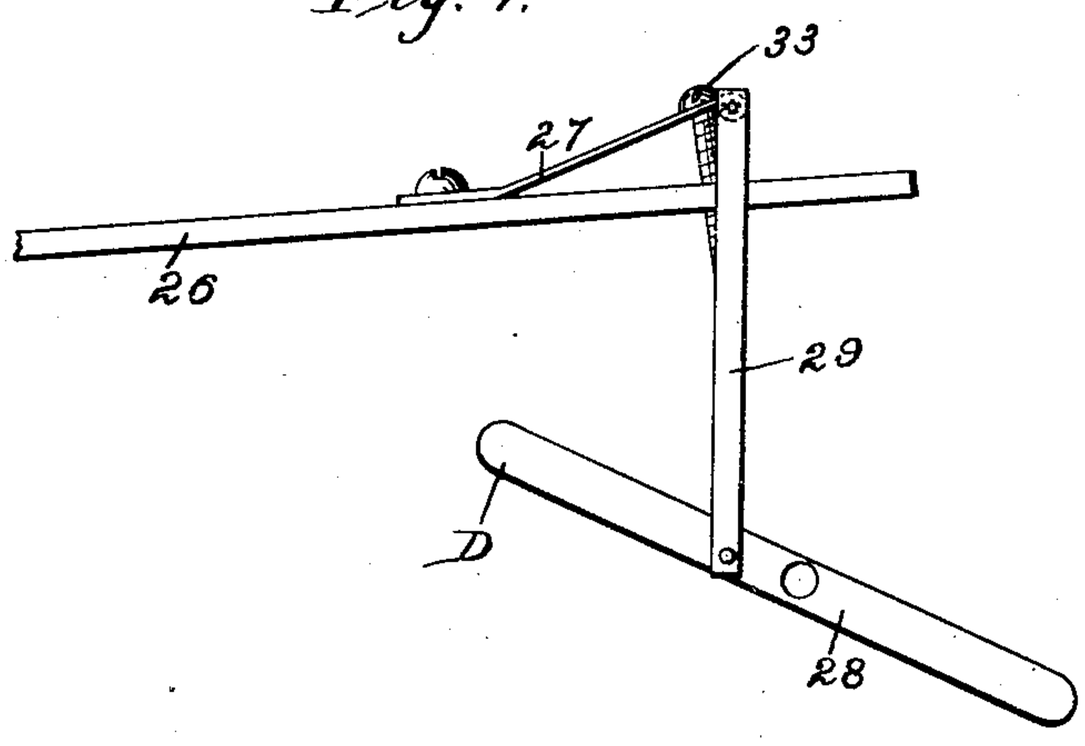


Fig. 4.



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 5.

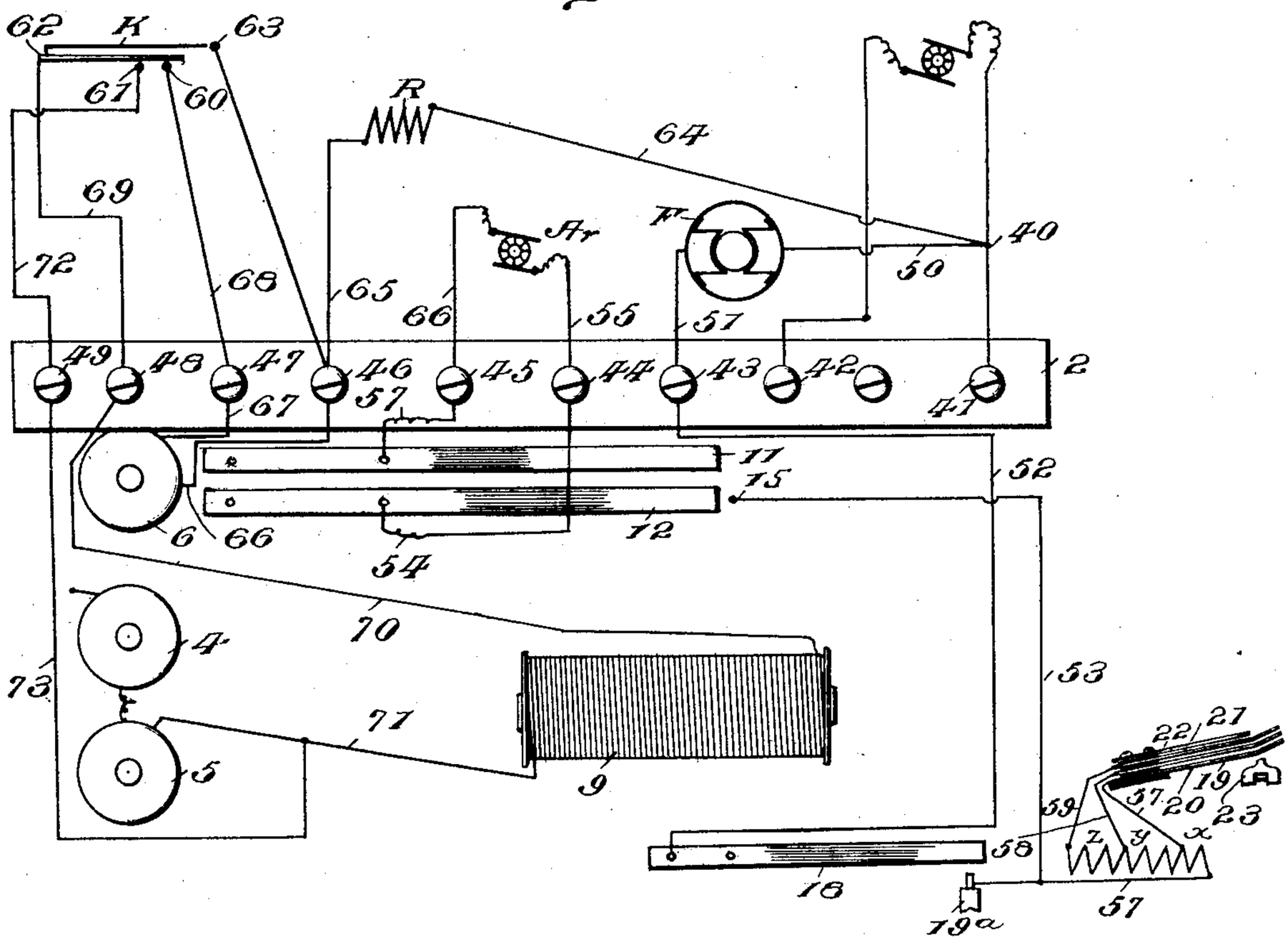
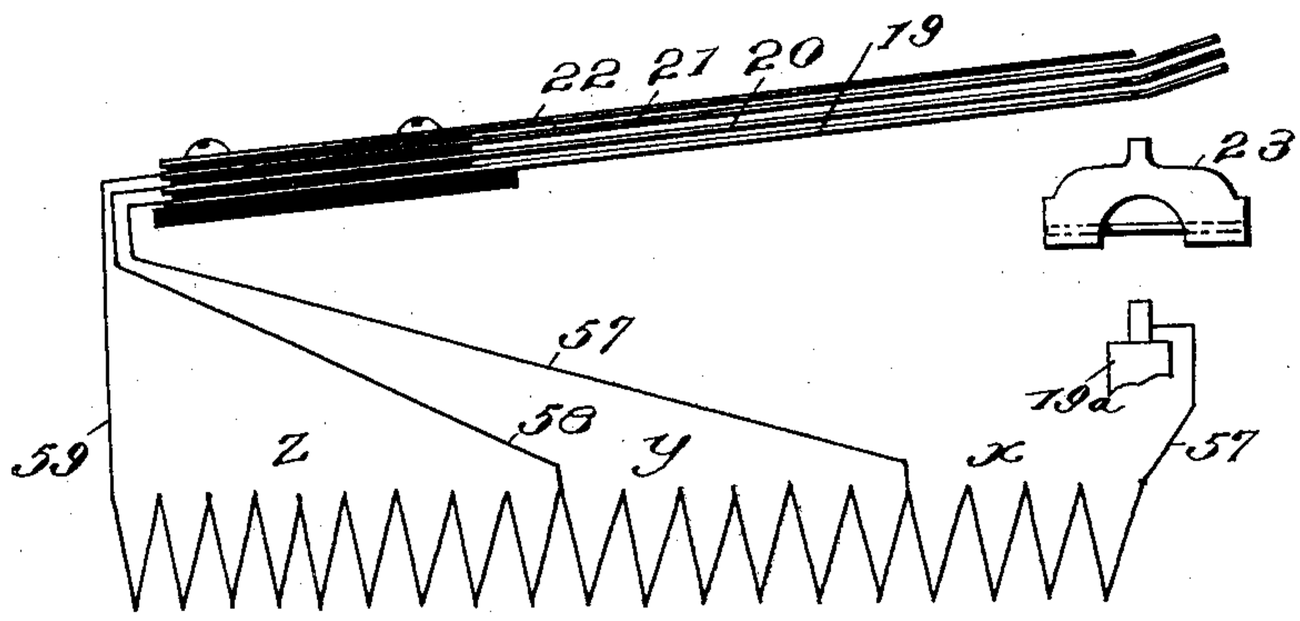


Fig. 6.



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No. 742,374. Patented October 27, 1903.

UNITED STATES PATENT OFFICE.

WILLIAM W. ALEXANDER, OF KANSAS CITY, MISSOURI, ASSIGNOR TO L. A. RHEOSTAT COMPANY, OF KANSAS CITY, MISSOURI.

CIRCUIT-CONTROLLER FOR SURGICO-DENTAL ENGINES.

SPECIFICATION forming part of Letters Patent No. 742,374, dated October 27, 1903.

Application filed December 24, 1902. Serial No. 136,464. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. ALEXANDER, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Circuit-Controllers for Surgico-Dental Engines, of which the following is a specification.

This invention relates to electric controllers for surgico-dental engines and the like, and is designed to place the starting, stopping, changing of speed, and reversing of a motor under the control of three switches or circuit-closing keys, which latter may be embodied in one instrument or may comprise separate members.

The nature, characteristic features, and scope of the invention will be more clearly understood from the following detailed description, taken in connection with the accompanying drawings, forming a part hereof, wherein—

Figure 1 is a top plan view of an electric controller embodying features of my invention. Figs. 2 and 3 are respectively side and front elevational views of the same, and Fig. 4 is a detail. Fig. 5 is a diagram view illustrating the electric circuits of the controller. Fig. 6 is a portion of the device in side view. Fig. 7 is a top view of the escaping-pawl.

In the drawings like reference characters denote like parts throughout the several views.

1 designates a suitable support or base, which may comprise a plate of soft iron.

2 designates a block of insulating material which imparts rigidity and strength and also affords a convenient means of connecting the circuits, as will be readily understood from the drawings. For the latter purpose openings *a* are provided to receive the wires, which may be secured to place by adjusting the screws *b*.

A and B designate two generally horizontally-disposed armatures, which are mounted and arranged to rock with little or no friction upon a beveled plate 3. The connection between said armatures and plate is a pin-and-slot connection, as illustrated at *c* in Fig. 1. Said armatures A B are arranged above and coöperate with the electromagnets 4 and 5 and 6, respectively, and are normally held away from the pole-pieces of the magnets by retractile springs 7 and 8, respectively.

C is a vertically-ranging armature normally solicited away from the pole of magnet 9 by a retractile spring 10.

Mounted upon but insulated from the armature B are a pair of strips 11 and 12 of conducting material, which in practice form part of the circuit of the armature of the motor to be operated. Conductors 11 and 12 are arranged to make contact under normal conditions with screws 13 and 14 and to make contact with posts 15 and 16 when electromagnet 6 is energized. Screw 14 and the contact-point of post 15 are electrically insulated from surrounding parts and are electrically connected by the conductor 17. Screw 13 and post 16 are in common with the frame, which latter is intended to be connected with one terminal of the dynamo or other source of electrical power used to operate the motor. Screw 14 and post 15 are designed to be connected indirectly with the opposite terminal. It will thus be apparent to those skilled in the art that armature B acts simply as a pole-changer and determines the direction of the current through the conducting-strips 11 and 12, and consequently its direction in the armature of the motor to be controlled in the one direction or the other, according as armature B is in its normal position or down upon the pole-piece of electromagnet 6. Hence it will be seen that opening or closing the circuit through the electromagnet 6 will reverse the motor.

Mounted insulatedly upon the armature A is a conducting-strip 18, arranged to make contact with the insulated contact 19^a when armature 9 collides with the pole-pieces of magnets 4 and 5. The conducting-strip 18 and the insulated contact 19^a are designed to be connected in series with the source of power and the motor to be operated upon, and it will be observed that armature A becomes a switch capable of opening and closing the circuit from the source of power through the motor by means of the charge and discharge of magnets 4 and 5. It will further be observed that the switch or key which controls the circuit through magnets

4 and 5 also controls the starting and stopping of the motor to be operated upon; but armature A has another function, which will now be described.

19, 20, 21, and 22 are strips of spring conducting material, such as brass, mounted upon the armature A and insulated from said armature and also from each other. 19, 20, and 21 are given an upward inclination at their outer extremities and are notched at one side.

23 is an escaping-pawl member pivotally mounted upon the armature C in such a way that when armature A is pulled down upon the poles of magnets 4 and 5 the springs 19, 20, 21, and 22, which normally stand slightly separated, are bent upward and pressed or bunched together by colliding with the point of the spring-pawl 23, and are thus put in common with one another and with the frame of the machine. Springs 19 and 21 are provided with projecting lugs 24, which prevent the three conducting-springs 19, 20, and 21 from coming together at the notched portion *d*. If now while these springs are bunched upon the pawl 23 electromagnet 9 be charged, armature C will be pulled backward and the point of the escaping-pawl 23 will by slipping between strips 19 and 20 permit spring 19 by reason of its notched edge portion *d* to fall past the pawl, and thus break its contact with the frame. If magnet 9 be now discharged and recharged, armature C will move forward and back and conducting-spring member 20 will pass below the escaping-pawl 23. Another discharge and recharge of magnet 9 and conductor 21 will pass below. I have selected three of these conducting-springs as being a convenient number; but it will be understood that the number may be increased or diminished without altering their action or construction. If at any time magnets 4 and 5 be discharged, the conducting-springs 19, 20, 21, and 22 will return to their normal positions, pushing the pawl 23 to the side as they move upward. Immediately they have passed pawl 23 will by gravitation resume its normal position against the stop 25. The conducting-springs 19, 20, and 21 are intended to be electrically connected at their rear ends with an appropriately-graduated resistance and may be regarded as analogous to the several contact-points of a common resistance-box, while pawl 23 may be regarded as the analogy of the switch-lever of the same, the distinction being that in the present instance the contacts sweep over the lever, which is practically stationary, instead of the lever sweeping over the contacts, as in the ordinary resistance-box. The successive breaking of contacts between springs 19, 20, and 21 and pawl 23 (strip or member 22 has no notched edge, and consequently remains upon the pawl 23 after the others have passed, regardless of the movements of said pawl) may be made to cut resistance either in or out, according as the speed of the motor is to be controlled by throwing a branch across the resistance, or by placing resistance in series with the armature or field of the motor alone, or with the two combined, or by any other method where the speed of a motor is controlled by cutting in or out a graduated resistance.

For some kinds of work it is desirable to have the electric engine stop instantly the current is cut off. I have made provision for this, as follows: Mounted upon armature A is a bar 26, provided with an inclined spring member 27 29. 29 is a connecting-rod affixed to the spring 27 and serving to connect the bar 26 with a pivotal bar 28, whereby the latter is made to oscillate when the armature A is moved. The connecting-rod 29 is loosely connected to bars 26 and 28 to allow for a slight lost motion. Assuming now that armature A is down upon its magnet, we will break the circuit in magnets 4 and 5. Retractile spring 7 instantly begins to return armature A upward (away from the pole) and continues to move it until all the independent motion (which is very little) between parts 26, 27, and 28 is taken up, after which bar 28 must be moved and the inertia of this mass of metal has to be overcome, and consequently the upward movement from this point is somewhat retarded. This slight retardation is the basis of the instantaneous stopping of the motor, as will now be explained. On the under side of the cross-bar 30 is an L-shaped piece of spring metal 31, which normally lies in contact with a projection 32 of the insulated screw 14. Now when it is remembered that the screw 14 (or its mate 15) is intended to be connected with one terminal of the armature of the motor and that the frame, and consequently the spring 31, with the other terminal it will be seen that when contact is made between 31 and 32 the armature of the motor is short-circuited. When the circuit is closed through the motor and its source of power via conducting-strip 18 and insulated post 19ª by the charging of magnets 4 and 5, this short circuit on the motor's armature is broken by the pressing of bar 26 upon the spring 31, and of course continues broken while the engine is running; but the instant magnets 4 and 5 are discharged armature A starts upward, carrying bar 26 with it, and the short-circuit is again put on the armature of the motor. This has occurred instantly, because the last motion between parts 26, 28, and 29 has permitted bar 26 to move far enough to put on this short circuit before the inertia of bar 28 was encountered. Now contact between conducting-spring 18 and insulated post 19 is so adjusted that this circuit is maintained here until bar 26 has reached a position considerably higher than that required to put the short circuit on at 32. Consequently the motor field will remain closed and the motor-armature short-circuited during the time that the inertia of the bar 28 retards the upward movement of the armature A and its superimposed parts. Thus for a

brief time the motor is converted into a generator, and by this means the momentum of its armature is overcome, and it is instantly stopped. It is intended that the ends of the bar 28 should be provided with a felt or similar cushion, and by means of screw 33 the length of the bar 29, that end D of bar 28, strikes upon its pad or cushion at the proper time to keep the armature A from coming in contact with the poles of magnets 4 and 5, and thereby the action of the machine is rendered practically noiseless. Hence it will be seen that I have combined in one instrument means for starting, stopping, reversing, and regulating the speed of electric engines.

In connection with the electric circuits shown in Fig. 5 I have represented a dynamo as the source of power from which the current is led by a suitable conductor to binding-screw 41. (For the sake of clearness I have represented the connections that in practice come at 41 as being at 40.) The other side of the dynamo, which I designate the "negative," is connected to the pawl by means of a wire and the screw 42 and the post which supports one end of the insulating-block 2. At 41 (40 in the drawings) the current divides. One branch goes to supply the motor to be operated and the other to operate the various parts of the controller itself. It will be readily understood that a separate source of power (as a battery) might be used to operate the controller without making any material changes in the construction or working of the apparatus. From the binding-screw 41 the current passes by conductor 50 to the field F of the motor to be operated, and thence by conductor 51 to the binding-screw 43, from the screw 43, by a suitable conductor 52 to the brass circuit-closing strip 18, thence to contact-point 19^a, where it divides. One branch goes by way of conductor 53 to insulated post 15, Fig. 3, by conductor 17 to insulated screw 14, by brass strip 12, and conductors 54 and 55, Fig. 5, and binding-screw 44 to the armature A^r of the motor to be operated, through the armature A^r, and by way of conductor 56, screw 45, to conductor 57, to strip 11, thence to screw 13, Fig. 3, which is electrically connected with the frame, or, in other words, returns it to the negative pole of the dynamo. Returning to 19^a the other branch goes by a suitable conductor to the resistance-coil x y z and from thence by way of one or the other of conductors 57, 58, and 59 to one of the brass springs 19, 20, and 21 to the escaping-pawl 23, which is electrically connected with the frame. In following this circuit it will be seen that strip 18 and contact-point 19^a serve to open or to close the motor-circuit and that the resistance x y z is a branch across the motor's armature, thus serving to regulate the motor's speed, giving a minimum speed with the resistance x alone cut in, a greater one with x and y both in, still greater with x, y, and z, and yet still greater when this branch across the armature is broken, as it is after the three springs 19, 20, and 21 have all passed the escaping-pawl 23. Fig. 6 is a detail that serves to make clearer the connections of springs 19, 20, and 21 with the variable resistance x, y, and z.

I shall now describe the circuits of the controller itself, and for this purpose shall represent the circuits as controlled by a multiple circuit-closing key, such as that described in my Letters Patent No. 734,793. This multiple circuit-closing key K has two contact-points 60 and 61, which underlie an arched spring member 62 in such a way that contact must always be made between 62 and 60 before that between 62 and 61 can be made. Moreover, the contact between 62 and 61 may be made or broken at will without breaking that between 60 and 62. 63 is a third contact, which may be electrically connected with 62 by turning a lever entirely independent of either 60 or 61. Starting at one source of power (binding-screw 41) the current passes through a suitable resistance R. This resistance may or may not be necessary, according to the potential used and the winding of the magnets 4, 5, 6, and 9, by way of conductor 64, thence along conductor 65 to binding-screw 46, thence, if contact 62 to 63 be open, as we shall suppose it is, by conductor 66 to magnet 6, and then by conductor 68 to contact 60, thence, supposing contact between 60 and 62 is established, by way of spring member 62 and conductor 69 to binding-screw 48, thence along conductor 70 to electromagnet 9, thence on conductor 71 (supposing contact 61 to 62 to be open) to magnets 4 and 5, thence to the frame or negative. Returning to contact 60, we will suppose that contact 61 to 62 is closed. Then the current instead of going through magnets 9, 5, and 4 by way of conductors 69, 70, and 71 will take a shorter path along conductor 72 and 73 to the frame, thus skipping magnet 9. It will thus be seen that while magnets 4 and 5 are kept charged by closing contact 60 to 62 magnet 9 may be charged or discharged at will by making or breaking contact 61 to 62. Returning to binding-screw 46, it will be readily seen that if contact 63 to 60 be closed the current will pass directly through 62 to 60 or 61, whichever path be available, instead of going indirectly through magnet 6. It will now be apparent that the contact 63 gives control of the motor's direction of rotation by altering the position of strips 11 and 12 through the agency of the electromagnet 6, and that contact 60 provides for bringing the armature A down upon the poles of magnets 4 and 5, and that contact 61 provides means for releasing the spring members 19, 20, and 21 through the agency of the magnet 9, which three motions and their combinations suffice to give complete control over the motor to be operated.

Having described the nature and objects of the invention, I claim—

1. Apparatus of the class described, comprising a frame, a pole-changer, a main cir-

cuit-closer, a series of insulated spring-bars carried thereby, an armature and its complemental electromagnet, and a pawl pivotally mounted on said armature and acting to electrically connect said spring-bars with a suitably-graduated resistance, substantially as described.

2. Apparatus of the class described, comprising a frame, a pole-changer having a pin-and-slot connection therewith, a combined circuit-closer and resistance-controller, and a cushioning device for rendering said parts noiseless in operation, substantially as described.

3. Apparatus of the class described, comprising a frame, pole-changer, a main circuit-closer, and a series of spring-bars coöperating therewith for cutting in or out more or less resistance, substantially as described.

4. Apparatus of the class described, comprising a frame, a pole-changer, a main circuit-closer, a series of spring-bars carried thereby, and means coöperating therewith for cutting in or out more or less resistance, substantially as described.

5. Apparatus of the class described, comprising a frame, a pole-changer, a main circuit-closer, a series of spring-bars carried thereby, and means for tripping said spring-bars for cutting in or out more or less resistance, substantially as described.

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

WILLIAM W. ALEXANDER.

Witnesses:
M. C. GILLHAM,
JAMES G. SMITH.