(No Model.) 3 Sheets—Sheet 1.

C. D. WARNER.

ELECTRIC TOWER CLOCK.

No. 518,337. Patented Apr. 17, 1894.

Fig. 1

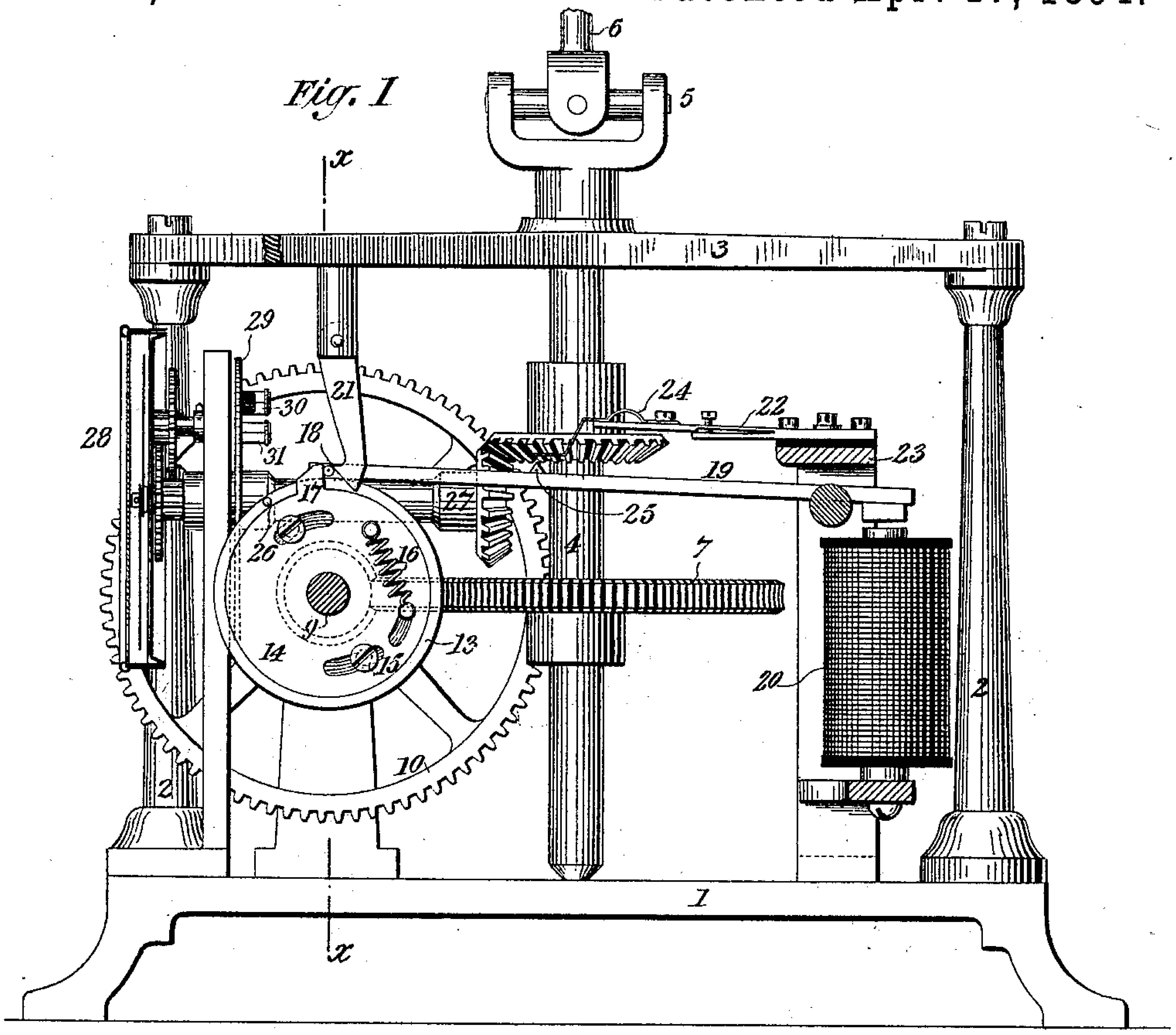

Fig. 2

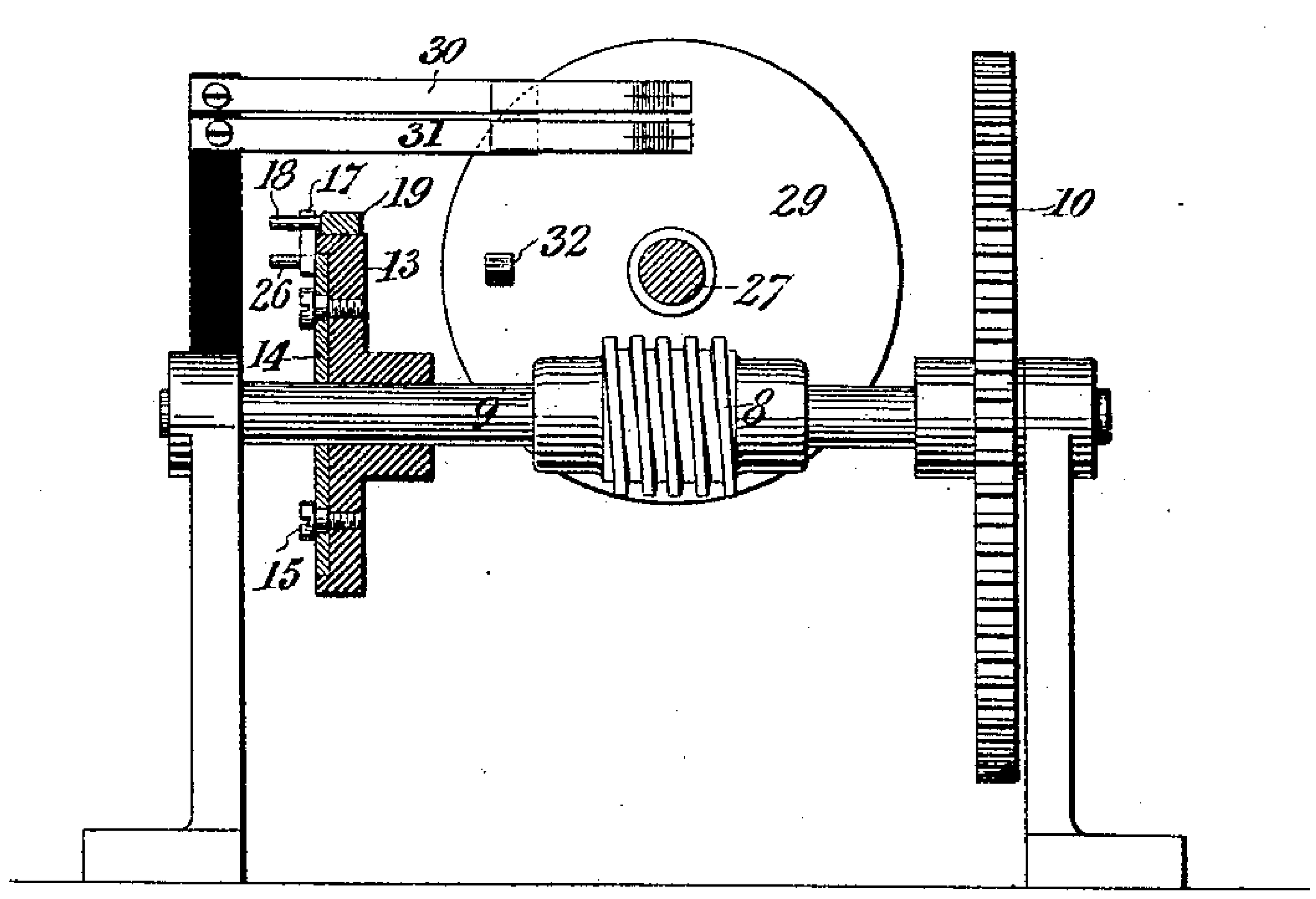

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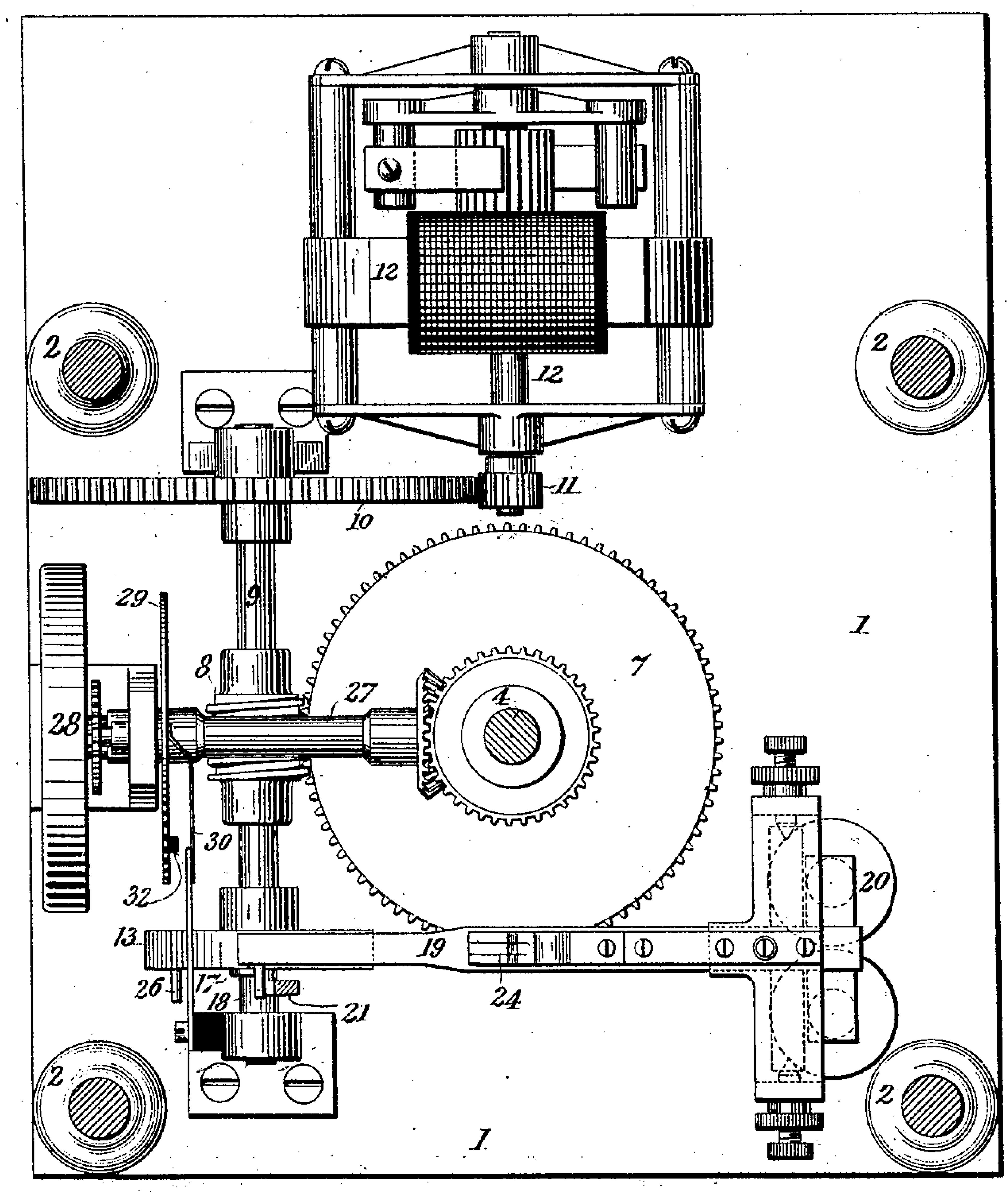
Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

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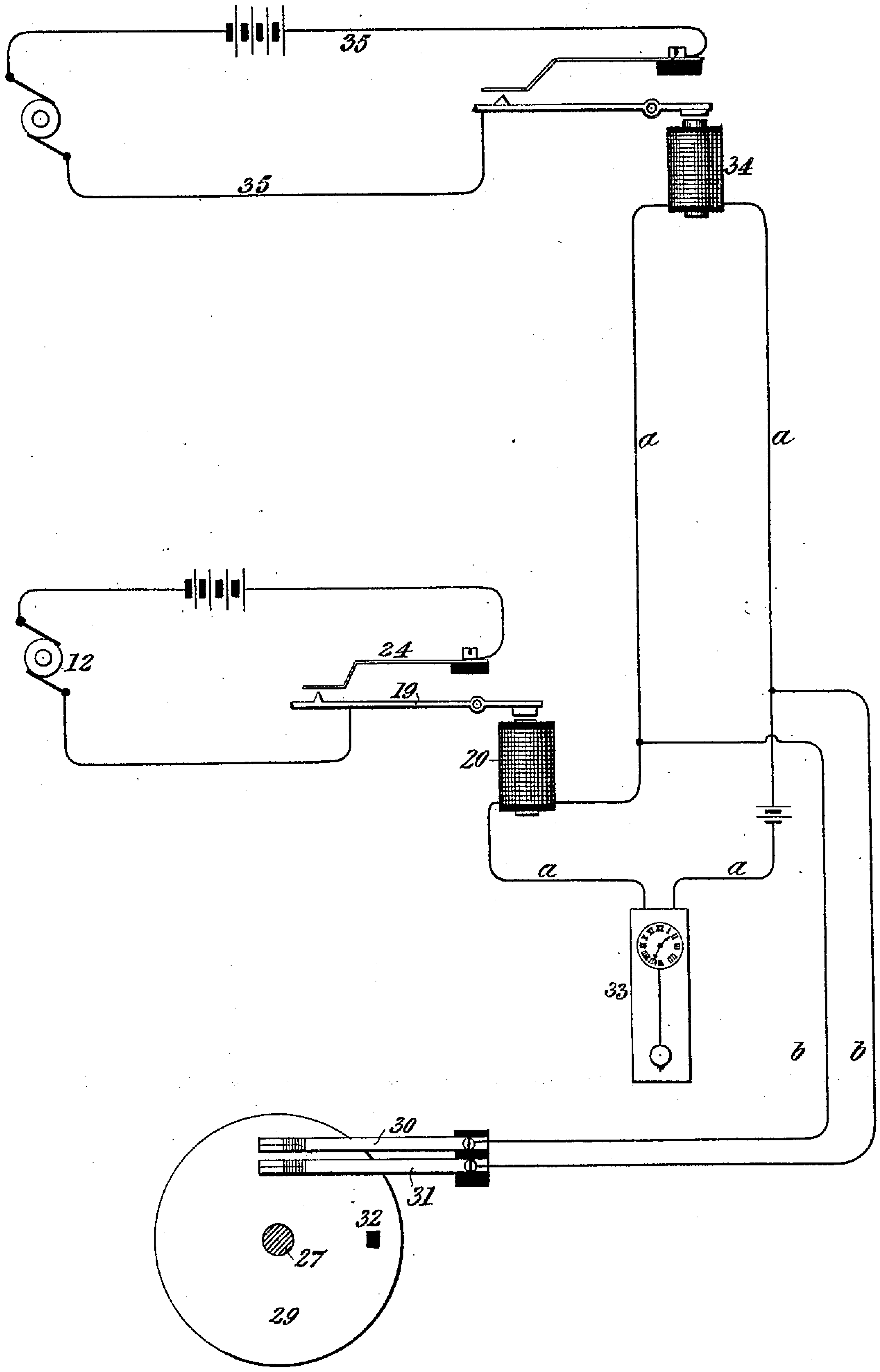
Fig. 4



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UNITED STATES PATENT OFFICE.

CHARLES D. WARNER, OF ANSONIA, CONNECTICUT.

ELECTRIC TOWER-CLOCK.

SPECIFICATION forming part of Letters Patent No. 518,337, dated April 17, 1894.

Application filed April 6, 1893. Serial No. 469,262. (No model.)

To all whom it may concern:

Be it known that I, CHARLES D. WARNER, a citizen of the United States, residing at Ansonia, county of New Haven, and State of Connecticut, have invented a certain new and useful Improvement in Tower-Clocks, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the same.

This invention relates to electric mechanism for operating the hands of a clock of large dimensions, such as a tower-clock.

Preliminarily to describing this invention, I desire to explain some of the conditions that obtain in tower clock mechanism and the proper operation of the same, which conditions define such mechanism in essential and governing respects from common clocks that are protected or located in-doors.

First, the hands of a tower or similar clock must be of great size (compared with those of clocks of indoor location), for the purpose of being seen as far as possible, and for the purpose of withstanding the action of wind, snow and rain. For a like reason, the shafts supporting and actuating the hands must be similarly heavy and strong. It will be seen, therefore, that the friction and inertia of the hands and of their supporting and actuating mechanism connecting them with the time-train, are influential in the matter of regularly and properly operating the clock. The hands are necessarily exposed to wind and storm, and the resistance they exert to being moved is practically continuously varying; their movement may be opposed by strong wind pressure, or they may be weighted with or frictionally retarded by rain, snow or ice. The power, therefore, necessary at any particular time to move the hands, is indeterminate, whereas, it is highly desirable, especially if electric apparatus driven by batteries be employed to move the hands, to only consume such power as at a given time is sufficient to do the work then required.

I am aware that various electric apparatus has been employed to actuate the hands of common, master, or secondary, in-door clocks, such as a magnet and an armature lever, or a motor arranged and operating at regular intervals to wind up a spring which drives the hands of the clock; but in all such cases, the work to be done is practically of a predeterminate amount, and hence the conditions of economical and continuous interval-working is easily established and maintained. Experience has shown, however, that no such apparatus is suitable for properly and economically working the hands of a tower clock. In the case of a common electro-magnet actuating a lever armature, when used for such purpose, excessive battery power would be required to insure operation of the hands when most resisted, and to overcome by the quick action of such magnet the inertia of the parts to be moved, and thus there would be a great waste of battery power at other times. In case of a motor for winding a driving spring, or of a plain magnet being similarly used, there would be need of maintaining a large excess of spring power, so that the utmost force needed to move the hands at any time should be available therefor, and therefore the battery would waste in doing work at other times against such reserve spring force. The size and waste and irregular working of the battery has been found to be, under these conditions, such as to practically prohibit the use of such electric driving mechanism for tower or similar clocks. On the other hand, it is highly desirable to work the hands of a tower clock by electric power applied at proper intervals through the instrumentality of a master or primary clock or regulator; for, by the successful employment of such a system, the large expense of the pendulum, power weight, and other mechanism of the common form of tower clocks, as well as that of adapting the tower or building to such a clock, is avoided.

The object of the invention is to produce an electric apparatus for driving tower-clock hands which shall be constructed and adapted to properly and economically operate the hands, being at the same time free of the objections named above.

The invention consists of an electric-motor adapted to be operatively connected to the hands of a tower or similar clock, and which is so arranged and controlled that, under suitable working condition, it will drive the hands of the clock by its acquired momentum after it has ceased to be electrically energized.

The invention also consists of automatic devices for elastically retarding and for operating and controlling the motor, and also of devices for operating and controlling a striking-mechanism circuit through the hands-operating mechanism.

In the drawings, Figure 1 is an elevation view of the mechanism of a tower clock embodying my invention; that is, this is the mechanism to be located in or near the part of the tower where are the clock dials and the shafting extending to and operating the hands of the dials. Fig. 2 is a vertical section on plane x, x, looking toward the left-hand. Fig. 3 is a plan view of the mechanism of Fig. 1, the upper plate of the framework being sectioned away. Fig. 4 is a diagrammatic view of the electric circuits, which will be further explained hereinafter.

1 represents the mechanism, and 2 pillars connecting the base and upper plate frame 3.

4 is a vertical shaft journaled in the base and plate frame, and connected by coupling 5 and vertical shaft 6 with the common system of shafts that extend to and operate the hands at the dials. This shaft 4 bears the gear 7 which meshes with worm 8 on horizontal shaft 9, which in turn and through gear 10 and pinion 11 is operatively connected with the armature or other rotating part of the electric motor 12. It will now be plain, that upon connecting the motor with a suitable battery or other source of electric power, the armature thereof will be rotated and transmit motion to the hands of the dials to advance them. The gearing between the motor and the driving shaft 4 is preferably of such arrangement that the reduction of speed is considerable; that is, for a given angular movement of the driving shaft, say that corresponding to the minute hand moving a minute space, the armature of the motor will rotate many times, and the work to be done by it will be effected in a corresponding length of time. The connections are such, however, that the greatest probable work to be done at any time, by a given motor and battery, will not require a longer time than the interval between two successive operations. Thus, assuming the conditions are such that the hands are advanced each minute, then it is intended that the motor will run for only a part of a minute. By such disposition of the mechanism, the movement of the hands is slowly but surely effected, and with the most economical utilization of current. Whether the work be heavy or light, comparatively, the quantity of current consumed will be in proportion thereto, and there will be no waste of power due to working against reserve or stored pressure.

Shaft 9 carries the drum 13, which contains the disk 14 loosely mounted on the shaft so as to have a partial rotation relative to the drum, screws 15 passing through circular slots in the disk and into the drum serving to hold the disk to position on the drum. A spring 16 fastened at its ends respectively to the drum and to the disk, tends to hold the disk in the position against the screws. The disk bears the stop-lug or tooth 17 which projects to beyond the peripheral rim of the drum and may engage the pin 18 on the lever armature arm 19 of the electro-magnet 20, which arm rests normally upon the drum.

21 is a gravity hook pivotally supported on the frame 3 and hanging in front and out of the path of the lug 17, and resting by gravity against the pin on the armature lever.

22 is a contact arm, which is supported on but insulated from the frame 23 of the electro-magnet 20, the contact spring 24 of which is just separated from a contact point 25 on the armature arm 19.

26 is a pin projecting from the drum forward to about the front face of the hook 21.

It is to be understood that the circuit through the motor 12 is to include the armature lever and the contact spring in such manner that the closing of these contacts will connect a battery or other source of electrical energy with the motor; that the magnet 20 is in a time circuit controlled by a master clock or regulator, and, also, that for a given movement of the tower clock hands, the shaft 9 is, under normal conditions, to rotate once. The parts being, as shown, the action thereof to impart an interval movement to the clock hands, is this: As the regulator closes the time circuit, the magnet 20 will pull down its armature, thus raising the free end of lever 19, whereupon hook 21 will drop under pin 18 and hold the lever up and to close contact with the spring 24, thus closing the motor circuit and starting the motor. As the shaft 9 rotates, the stop-lug 17 passes behind the hook, and the pin 26 advances toward and hits against the lower end of the hook, thus pushing it from under the lever pin and permitting the lever to fall and thus break the motor circuit. The motor by this time has gained its full momentum, and continues to run for a time that under ordinary conditions will effect substantially the rotation of the shaft 9. Should the motor have too great momentum, or such as would rotate shaft 9 farther than desired, then stop lug 17 on the disk will come in contact with the armature lever pin and further rotation will be prevented. The shock of the stop is taken up by the disk-spring, which by its elasticity permits the motor and its connections with shaft 9 to gradually come to rest. Should the conditions be such that the shaft 9 stops before the lug reaches the lever pin, then, it will be seen, upon the next closing of the circuit the motor will run on circuit for a greater length of time than before, and so acquire greater momentum and thus rotate the shaft 9 farther. By these means I avail of the momentum, or what otherwise would be lost motion of the motor, to do much of the work of moving the hands, thus saving in current and avoiding the wear to the motor that would be incident to abruptly stopping the same. Further I adapt the work to the conditions of resistance or power to be overcome. The pressure upon the hands may, at a given time be such that a full movement of the hands would not be effected; but upon the next movement thereof, a full movement, together with what was before wanting, may be effected.

It is desirable that such a battery power be employed as will suffice to properly drive the motor at all times, and that the acquired momentum of the motor be availed of to do a part of its work. But these are not conditions upon which depend the successful operation of the mechanism, for such a low battery power might be employed, or such resistance might occur, as would result in the motor stopping practically with the cessation of the energizing current, and yet the efficiency of the mechanism would not be impaired. It is to be assumed that, ordinarily, the battery power is sufficient to properly overcome any probable temporary resistance, in which case the mechanism acts to most economically apply and utilize such battery power. The mechanism for thus driving the clock hands by an electric-motor running, when the conditions permit, by an acquired momentum, is I believe entirely new with me; as also is a yielding stop mechanism for preventing the excessive run of the motor, and therefore I do not limit myself to the particular forms of mechanisms herein shown, they serving to illustrate, in the above recited respects, the type of mechanism that can be used.

Geared to the driving shaft 4, is the shaft 27, which actuates directly the minute, and indirectly the hour hands, of the dummy clock 28, employed to indicate the position of the hands of the tower dials. On the shaft 27 is mounted the disk 29, and against this disk bear the contact springs 30 and 31. An insulated lug 32 carried on this disk is in the circle of contact of spring 30, and is so arranged that during each fifty-ninth minute movement of the motor and this disk, it will lift the spring 30 and so break the circuit through these springs, which circuit will be held open at the time of the movement of the motor to shift the tower minute-hand to the sixtieth or XII position, and the hour-hand to some hour position. Referring to Fig. 4, the regulator is indicated by 33. It is in the circuit *a a* with the minute-mechanism magnet 20 and also with the striking-mechanism magnet 34, which is designed to preliminarily close a battery and circuit 35 containing and arranged to properly operate the striking-mechanism. This striking mechanism forms the subject of another application, and so does not call for full explanation here. The magnet 34 is cut from circuit *a a* by the circuit *b b* which includes the disk 29 and springs 30 and 31. It will now be plain, that during the hour, or fifty-nine minutes thereof, the striking magnet will be inactive, but upon the regulator closing the working circuit for the sixtieth movement of the hands, the striking magnet will be operated conjointly with the minute magnet, and thus the striking-mechanism will be brought into operation at the proper time. By these means, I am enabled to successfully operate the hands of a tower clock from a regulator located at a distance therefrom, and with an economical consumption of battery power. Weights and the attention and time for winding them up; the usual heavy and costly pendulum; and other parts and the cost of their erection and care, are all obviated. Whenever there is space for the hands-shafting and coupling connections, there would be space for the electric motor and its attachments to the shafts without necessity for special construction or alteration of the tower or building. The wiring may run to any suitable place for the location of batteries and a regulator; and generally, in many other respects, the original cost, the cost of installation and maintenance of such an electric tower-clock system, are greatly below that required, in a given case, by the common weight-actuated and pendulum-controlled mechanism.

What is claimed as new is—

1. In combination with an electric-motor mechanism adapted to be operatively connected to the hands of a tower or similar clock, an electric circuit through which to operate the motor, and mechanism for opening said circuit and permitting the motor to run by acquired momentum, for the purpose set forth.

2. In combination with an electric-motor mechanism adapted to be operatively connected to the hands of a tower or similar clock, an electric circuit through which to operate the motor, and mechanism for opening said circuit and controlling the run of the motor by acquired momentum within prescribed limits, for the purpose set forth.

3. In combination with an electric-motor mechanism adapted to be operatively connected to the hands of a tower or similar clock, an electric circuit through which to operate the motor, and mechanism operated by the motor for opening said circuit and permitting the motor to run by acquired momentum within prescribed limits, for the purpose set forth.

4. In combination with the hands-operating mechanism of a tower clock, an electric motor operatively connected to and for operating said mechanism, an electric circuit including said motor, circuit-controlling mechanism adapted to be operated by a separate regulator or master-clock, and circuit-breaking devices operated by the motor and controlling its time of running or number of rotations, substantially as set forth.

5. In combination, the mechanism of and for operating the hands of a tower clock, an electric motor connected to and for operating the said mechanism, and a spring stop for arresting the rotation of the motor after its op-

erating circuit has been broken, substantially as described.

6. In combination, the mechanism of and for operating the hands of a tower clock, an electric motor connected to and for operating the said mechanism, and a spring stop mechanism constructed and arranged to break the motor circuit at a predetermined point of the movement of the hands-mechanism and to gradually arrest the rotation of the motor, substantially as described.

7. In combination, the hands-operating mechanism of a tower clock driven by an electric motor, the operating circuit of a striking mechanism and a magnet operating to close the same, and a circuit making and breaking mechanism operated by the said hands-mechanism and controlling the circuit to said magnet, substantially as described.

8. In combination in a tower clock system, the circuit of a motor-actuated hands-mechanism, the circuit of an electrically-operated striking-mechanism, a regulator circuit including electric devices for closing the circuits of said mechanisms, and a circuit making and breaking mechanism operated by the hands-motor and controlling the circuit-closing mechanism of the striking mechanism, substantially as described.

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