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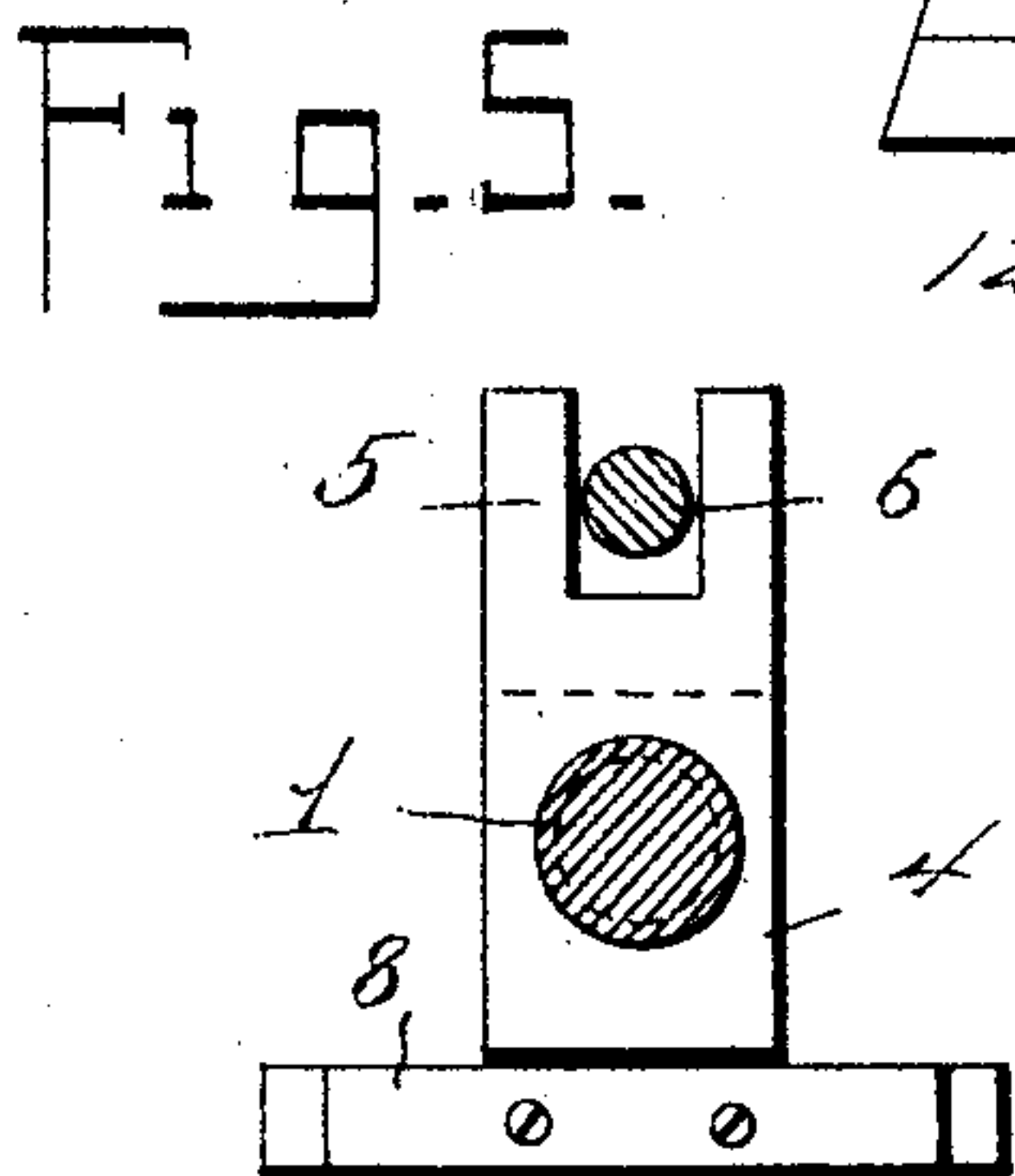
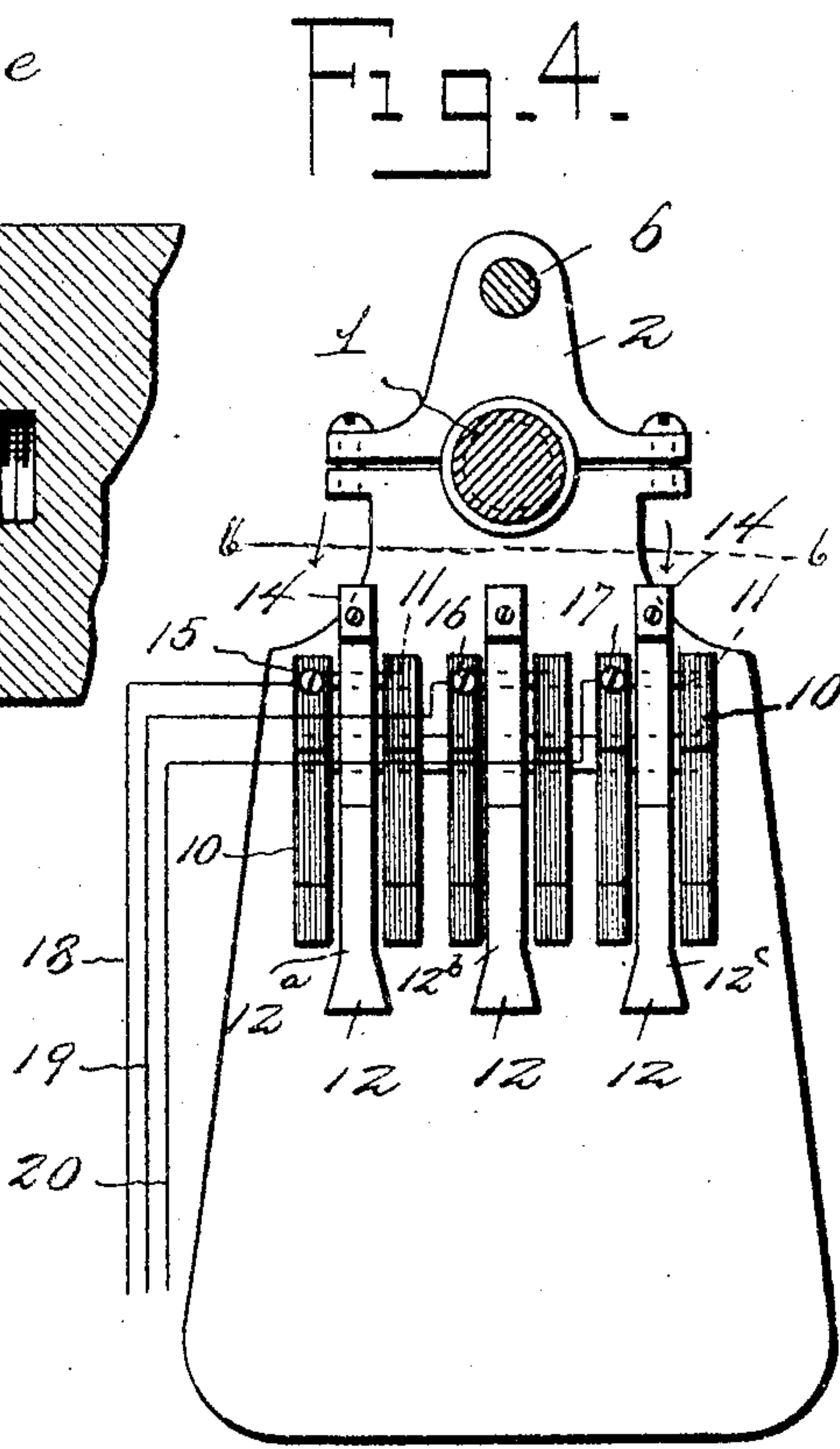
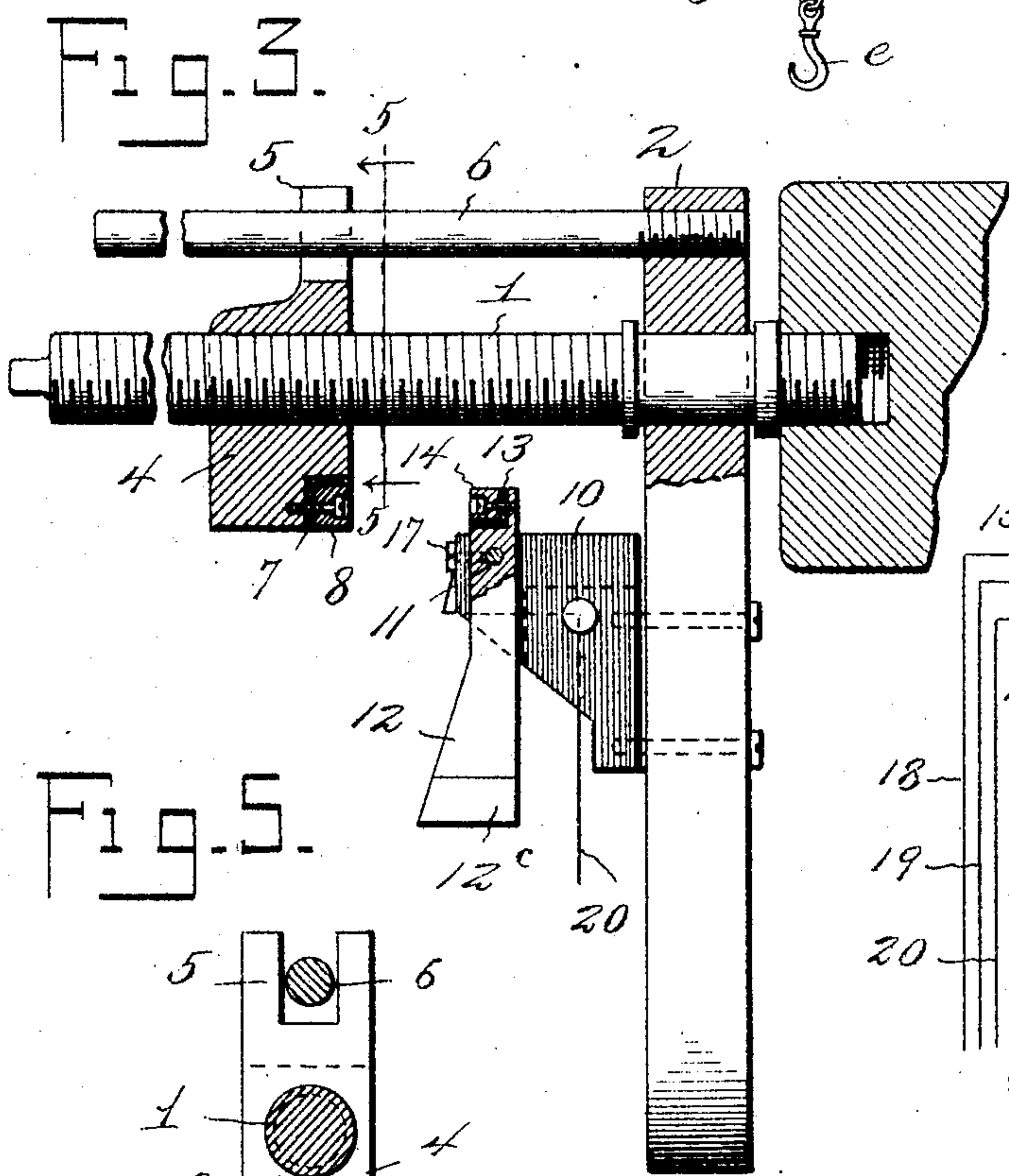
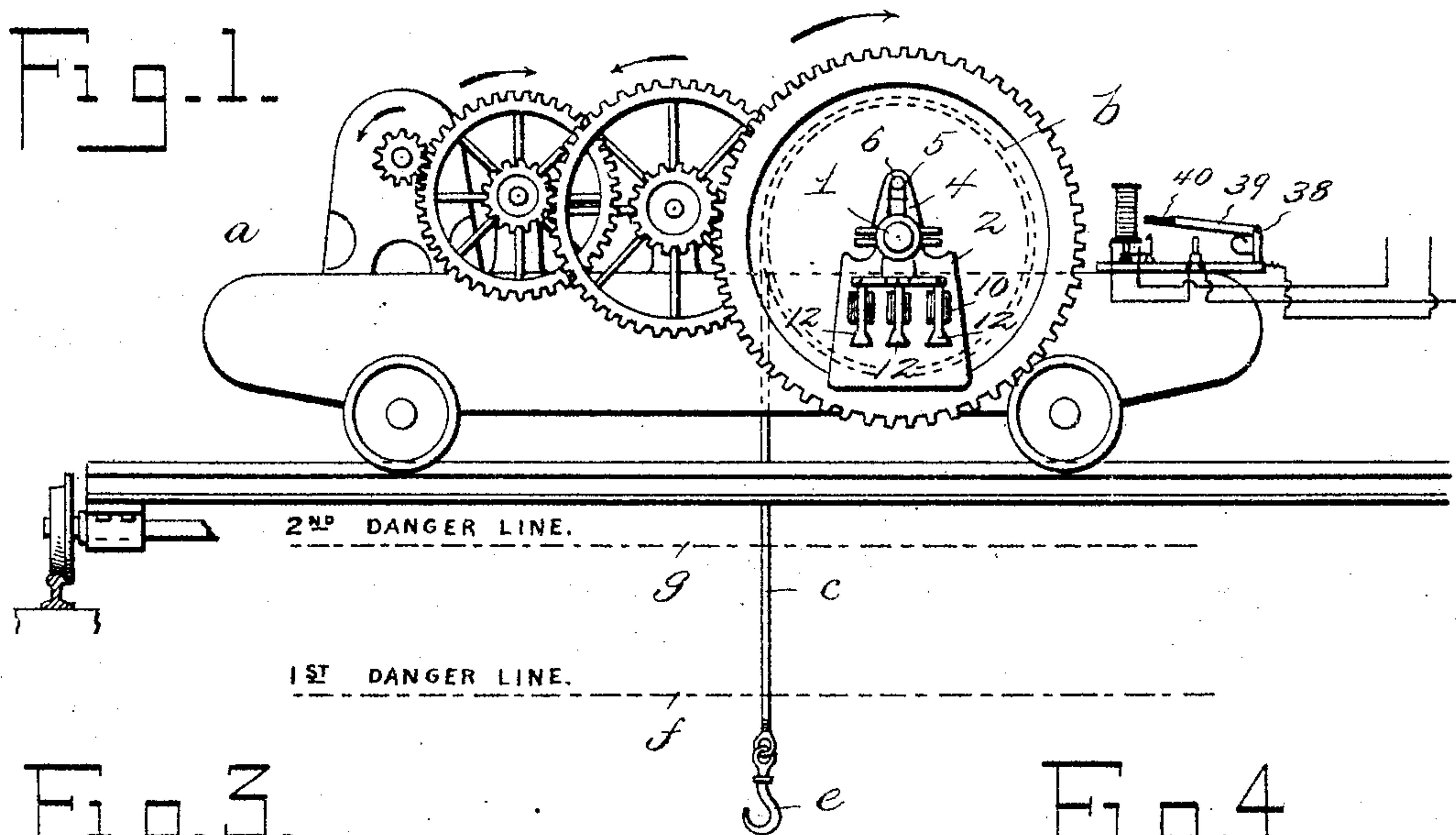
PATENTED APR. 11, 1905.

O. S. HERTZOG.

AUTOMATIC SAFETY SWITCH FOR HOISTING MACHINES.

APPLICATION FILED APR. 25, 1904.

2 SHEETS—SHEET 1.



Witnesses

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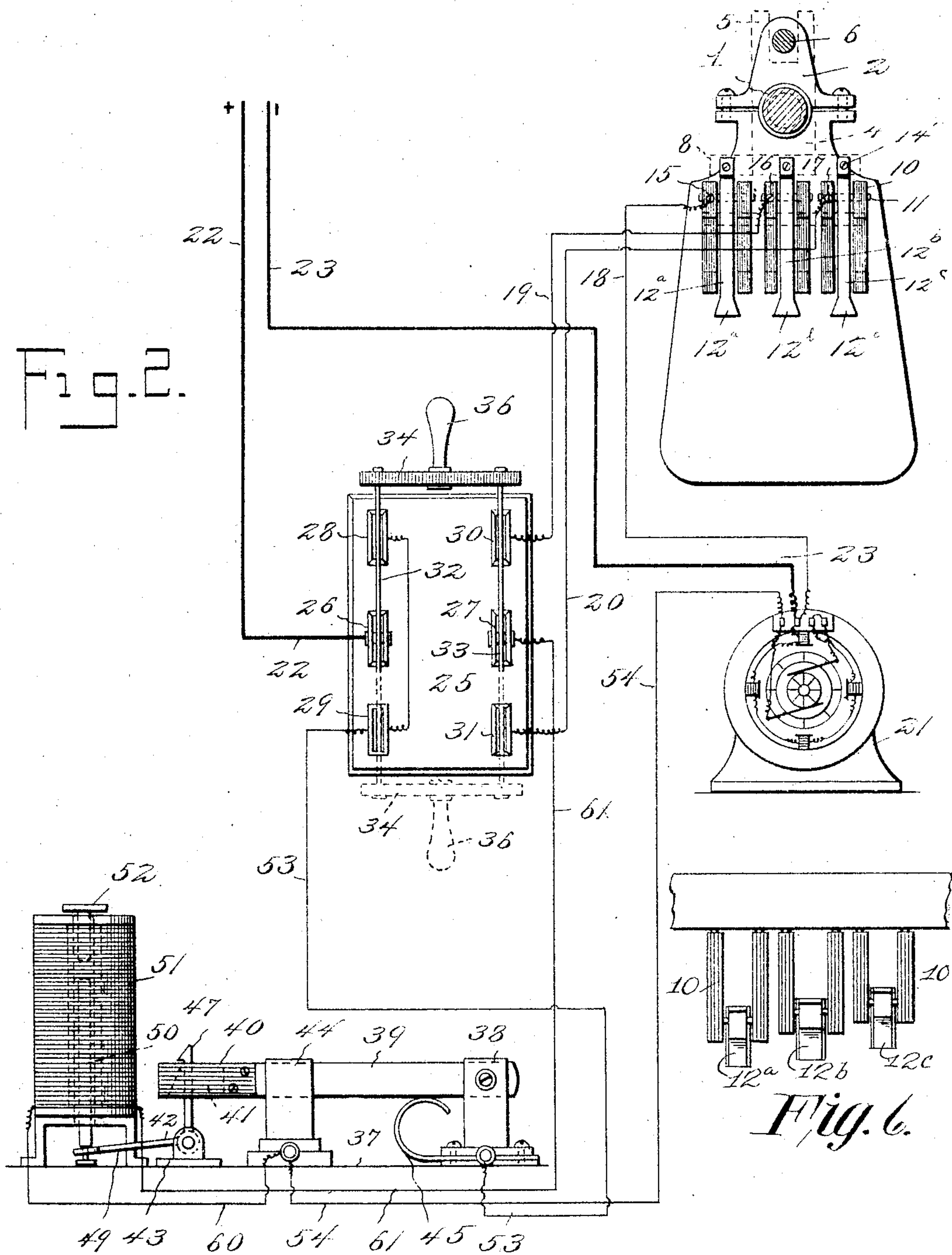
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UNITED STATES PATENT OFFICE.

OSCAR S. HERTZOG, OF BIRDSBORO, PENNSYLVANIA.

AUTOMATIC SAFETY-SWITCH FOR HOISTING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 786,809, dated April 11, 1905.

Application filed April 25, 1904. Serial No. 204,819.

To all whom it may concern:

Be it known that I, OSCAR S. HERTZOG, a citizen of the United States, residing at Birdsboro, in the county of Berks and State of Pennsylvania, have invented a new and useful Automatic Safety-Switch for Hoisting-Machines, of which the following is a specification.

This invention relates to improvements in mechanism for automatically controlling the movements of electrically-actuated winding-drums and similar hoisting devices, and has for its principal object to provide means for cutting off the operating-current when the hook or similar element of the hoisting mechanism approaches the winding-drum, and thereby preventing breakage or disarrangement of the parts from overwinding of the hoisting cable or chain.

A further object of the invention is to provide a safety device of this class in which a cut-out mechanism is so arranged that when the hook approaches a position adjacent to the limit of winding movement the current will be cut off, and thereafter, if necessary, the operator may readjust the parts to continue the hoisting operation for a short distance, and if at the second hoist or second stage of the hoisting operation the hook approaches the danger zone the current will be again cut off.

A still further object of the invention is to provide mechanism of this class which will insure proper readjustment of all of the parts after each operation, so that it will be impossible to lower the hoisting-hook or similar element for a second hoisting operation until the safety device has been adjusted to operative position.

With these and other objects in view, as will more fully hereinafter appear, the invention consists in the novel construction and arrangement of parts, hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportions, size, and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings, Figure 1 is

a side elevation of a traveling hoist provided with an automatic safety-switch constructed in accordance with the invention. Fig. 2 is a diagram illustrating the switch and a portion of the circuit-closing devices and the wiring connections between them and the motor. Fig. 3 is a detail sectional view of the circuit-closing devices operable by the winding-drums. Fig. 4 is a face view of the pivotally-mounted circuit-closers and their support. Fig. 5 is a transverse sectional view of a portion of the traveling circuit-closer on the line 5 5 of Fig. 3. Fig. 6 is a sectional plan view of the pivoted circuit-closers on the line 6 6 of Fig. 4.

Similar characters of reference are employed to indicate corresponding parts throughout the several figures of the drawings.

In electrical cranes and similar hoisting mechanisms serious damage occurs at times from overwinding of the cables or chains, the hooks which are usually employed for connection with the articles to be lifted being at times wound partly around the drums and resulting in breakage or derangement of the machinery or in serious damage to the article being moved.

It is the principal object of the present invention to provide means whereby on the approach of a hook or similar hoisting element to the periphery of the winding-drum the current will be cut off, shunted, or otherwise rendered inoperative for further hoisting purposes, so that damage from this source will be prevented, and while the invention is described in the present instance as intended principally for use in connection with cranes where an electric current is used for the motor-power it will be understood that it is applicable also in cranes actuated by steam or any other power, the current-conductors being unaltered, while the circuit and circuit-closer are so arranged and disposed as to operate the means for controlling the actuating fluid—such as steam, air, or other fluid—instead of cutting off the operating-current.

In the preferred embodiment of the invention the mechanism is used in connection with a traveling crane *a*, having an ordinary winding-drum *b*, from which extends a cable *c*,

having at its lower end a hook or similar element *e* for connection with the article to be raised, and for convenience two danger-lines *f* and *g* have been shown, the former being
 5 at some distance from the winding-drum, indicating the fact that the hook or similar member is approaching the winding-drum, while movement of the hook to the second danger-line will result in positive cutting out of the
 10 operating mechanism and render it impossible to further elevate the hook.

The end of any one of the shafts of the hoisting mechanism, the shaft of the main hoisting-drum in the present instance, is adapted
 15 for the reception of the inner end of a screw 1, which is firmly secured to the end of the shaft and rotates therewith during winding and unwinding movements of the drum. An intermediate portion of the shaft is provided
 20 with a smooth peripheral surface extending through an opening in a plate 2, the weight of which will normally tend to maintain it in proper position. This screw is provided with a threaded portion of any suitable length corresponding to the winding capacity of the
 25 drum, and on the threaded portion is mounted a nut 4, having a vertically-disposed bifurcated arm 5 for the reception of a pin 6, that is carried by the upper portion of the plate 2. The
 30 pin 6 extends parallel with the screw and serves to maintain the nut in proper position and prevent revoluble movement thereof.

In the lower portion of the rear face of the nut is a recess having one or both of its walls
 35 lined with non-conducting material 7, serving to insulate the conducting-strip 8, which may be formed of carbon or metal.

Secured to the outer face of the plate 2 are a number of brackets 10, that are formed of
 40 vulcanized fiber or other non-conducting material, these brackets being arranged in three pairs and each receiving a pivot-pin 11, formed of brass or other good conducting metal, and serving as a support for a pendent finger 12, the pivotal point of the latter being considerably above the center of gravity, so that the
 45 finger will normally be maintained in an approximately vertical position, and the upper end of said finger is provided with a lining 13, of insulating material, and to this lining is secured a block 14, formed of carbon or metal and adapted to be engaged by the contact
 50 block or strip 8 of the nut 4. Two of the fingers, 12^a and 12^b, are disposed in horizontal alinement, so that both will be engaged simultaneously by the block or strip 8, while the
 55 third finger, 12^c, is disposed somewhat to the rear of the crane and will not be engaged by the strip 8 under ordinary circumstances, and
 60 it is only when excessive movement of the nut occurs that this block and its contact will be brought into play. Each of the pivot-pins is secured in place by a binding-screw, these being designated for convenience 15, 16, and 17,
 65 the inner ends of the screws impinging on the

metal pivot-pins 11 and the outer ends thereof serving as binding-screws for current-conducting wires 18, 19, and 20, respectively.

At a convenient point is placed a motor 21, suitably connected to the hoist or crane, and
 70 to this motor are connected current-conducting wires 22 and 23, the negative wire 23 leading direct to one of the commutator-brushes, while the positive wire 22 is led to a switch in order that the passage of the current to the
 75 motor may be controlled, and in passing it is to be noted that the wire 18, which leads to the binding-screw 15, is connected to the negative wire 23 at a point adjacent to the negative binding-post of the motor or is tapped
 80 thereinto at any convenient point.

At a convenient point within reach of the operator is placed a double-pole double-throw switch that is mounted on a base 25. The
 85 pivot-posts 26 and 27 of the switch are arranged, as usual, in alinement with the contacts 28, 29, 30, and 31, and the two blades 32 and 33 of the switch are connected together at their outer ends by an arm 34, of insulating material, the latter being provided with a man-
 90 ually-operable handle 36.

At a point adjacent to the manual switch is an automatic switch comprising a base 37, having a pivot-block 38, which carries a switch-
 95 blade 39, that is provided at its outer end with an enlarged block 40, of vulcanized fiber or similar non-conducting material, this block having a recess 41, through which extends one arm of a bell-crank lever 42, that is pivoted
 100 on a bracket 43, rising from the base. The blade of the switch normally engages a contact 44, and at a point under the blade is a spring 45, which when the blade is unlocked serves to throw the latter from engagement
 105 with the contact 44. One wall of the recess 41 is inclined, and the approximately vertical arm 47 of the bell-crank lever 42 forms a catch which rides against the inclined wall and when the block is fully depressed serves to engage
 110 therewith and lock the switch in circuit-closing position. The approximately horizontal arm 49 of the bell-crank lever is bifurcated for the reception of the reduced end portion of a solenoid-core 50, having an enlarged head which
 115 normally rests a short distance below the arm 49 of said bell-crank lever. The solenoid-core is disposed within a solenoid-spool 51, which as usual is provided with a short soft-iron core 52 in order to hold the core 50 when the solenoid is energized.
 120

In tracing the circuits from the positive main 22 it will be found that under normal conditions a working circuit is established from
 125 main 22 to the pivot-post 26, blade 32, wire 53, pivot-post 38, switch-blade 39, contact 44, wire 54 to the positive binding-post of the motor, and thence back through the negative binding-post to return-wire 23, so that when the current is on the crane or hoist will be operated by the motor.
 130

The motor will be operated and the crane will continue its movement until the hook or similar hoisting element approaches the danger-line, and it being understood that the nut 4 is properly adjusted said nut will at this time approach the plate 2 and its contact-strip 8 will come into engagement with the two contact-blocks of the fingers 12^a 12^b, and thereupon a circuit will be established from positive main 22 to pivot-post 26, blade 32, contact 28, wire 53, pivot-post 38, blade 39, contact 44, wire 60 to the solenoid, and from thence to wire 61, to pivot-post 27, blade 33, contact 30, wire 19 to the contact-block of finger 12^b, contact 8 of the traveling nut, contact of the finger 12^a, wire 18 to return-wire 23. This energizes the solenoid 51 and the solenoid-core is attracted, its loose play on the bifurcated end of the arm 49 being such that a hammer-like blow will result on the upward movement of the core and the catch-arm of the bell-crank lever will be positively moved from engagement with the switch 39, so that the switch-blade may be thrown up out of engagement with the contact 44 by means of the spring 45. This instantly cuts out or shunts the circuit or otherwise nullifies the operation of the motor-circuit and the winding movement ceases. To again close the circuit through the motor, it is necessary to change the position of the switch, so that the switch-blades 32 and 33 will engage, respectively, with the contacts 29 and 31, and when this is accomplished the previously-energized solenoid-circuit is broken and the bell-crank lever is released from its influence. The operator now closes the safety-switch and the hook member 47 of the bell-crank lever automatically engages and locks the switch in the closed position. The circuit is now through the motor and the operation of the motor may be reversed in order to unwind the cable or chain and lower the contact, during which lowering movement the nut 4 is moved out from the end of the winding-drum for a distance corresponding to the extent of rotative movement of said drum. Should the operator accidentally continue the winding movement or should it be necessary to elevate the hook a short distance, the winding may be continued until the hook approaches the upper danger zone, and when the hook arrives at this point winding cannot be continued further with safety, and the contact-strip 8, carried by the nut, engages the third contact-carrying finger 12^c and still remains in contact with the other fingers engaged at the previous operation. The effect of this is to establish a circuit from the positive main 22 to pivot-post 26, blade 32, contact 29, wire 53, pivot-post 38, blade 39, contact 44, wire 60, solenoid 51, wire 61, post 27, blade 33, contact 31, wire 20, contact-finger 12^c, the current-conducting strip or block of the nut, contact 12^a, wire 18, and return by the negative main 23, thus

again energizing the solenoid and permitting the automatic opening of the safety-switch and the cutting off of the motor-circuit.

It will be observed that under no circumstances can the motor be operated either in winding or unwinding unless the safety-switch is closed, so that it is impossible for the operator to accidentally run the crane or hoist without the switch in closed position, and the switch, therefore, will always be positively in readiness to cut out the motor-circuit when the hook approaches the danger position.

While the invention has been described as applicable generally to cranes and hoists that are operated by electric motors, it will be understood that the same apparatus may be used to advantage in connection with mechanism of any character and operated by any power—as, for instance, in the case of a steam-hoist or one operated by compressed air or hydraulic power—the same circuit-closing mechanism may be employed to establish a circuit through a solenoid electric magnet that is connected to a valve for controlling the flow of the actuated fluid—such as steam, air, or water—and positively cut off the flow of fluid to the cylinder or other point of application.

Having thus described the invention, what is claimed is—

1. The combination with a hoist, of a safety-switch arranged in the working circuit, an electromagnet controlling the movement of the switch, and a plurality of successively-engageable contacts under the control of said hoist and serving to close the circuit in different positions of the hoist.

2. The combination with a revoluble winding means, of a screw receiving movement therefrom, a nut mounted on the screw, a motor for actuating the winding member, a safety-switch, a circuit including the motor and the switch, an electromagnet controlling the movement of the switch, an auxiliary circuit including said electromagnet, and auxiliary circuit-closing contacts under the control of the nut.

3. The combination with a hoist, of an electric motor for operating the same, a revoluble member, a screw carried thereby, a nut mounted on the screw, means for holding the nut from turning movement, a safety-switch, an electromagnet for operating the same, a working circuit including the motor and the switch, a manually-adjustable switch included also in the working circuit, and a plurality of contacts disposed in the path of movement of the nut and electrically connected to the switch thereby to close the circuit through the electromagnet.

4. The combination with a hoist, of a motor for operating the same, a safety-switch, an electromagnet controlling the movement of the switch, a manually-adjustable switch, a circuit including the switches and motor, a revoluble screw, a traveling nut carried there-

by, and a plurality of contacts forming circuit-terminals and adapted to be successively engaged by the nut.

5 5. The combination with a hoisting mechanism, of a motor, a working circuit, a safety-switch, a manually-operable switch, both of the switches being connected in the circuit in series to permit passage of the current when
10 the manually-operable switch is in either position, an electromagnet controlling the movement of the safety-switch, and a plurality of contacts forming terminals to successively establish the circuit of the electromagnet.

15 6. The combination with hoisting mechanism, of a motor, a screw carried by a revolvable member of the hoisting mechanism, a plate hung on an unthreaded portion of the screw,

a nut carried by the screw, a series of insulating-brackets secured to the plate, a plurality of fingers pivotally mounted on the bracket and maintained in position by gravity,
20 contact-blocks carried by the fingers and forming circuit-terminals, a contact-block carried by the block and adapted to engage the blocks on the fingers, a switch member, and a work-
25 ing circuit including the switch member and the motor, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

OSCAR S. HERTZOG.

Witnesses:

C. H. ARMOUR,

LEWIS M. STEWARD.