C. H. MOORES.

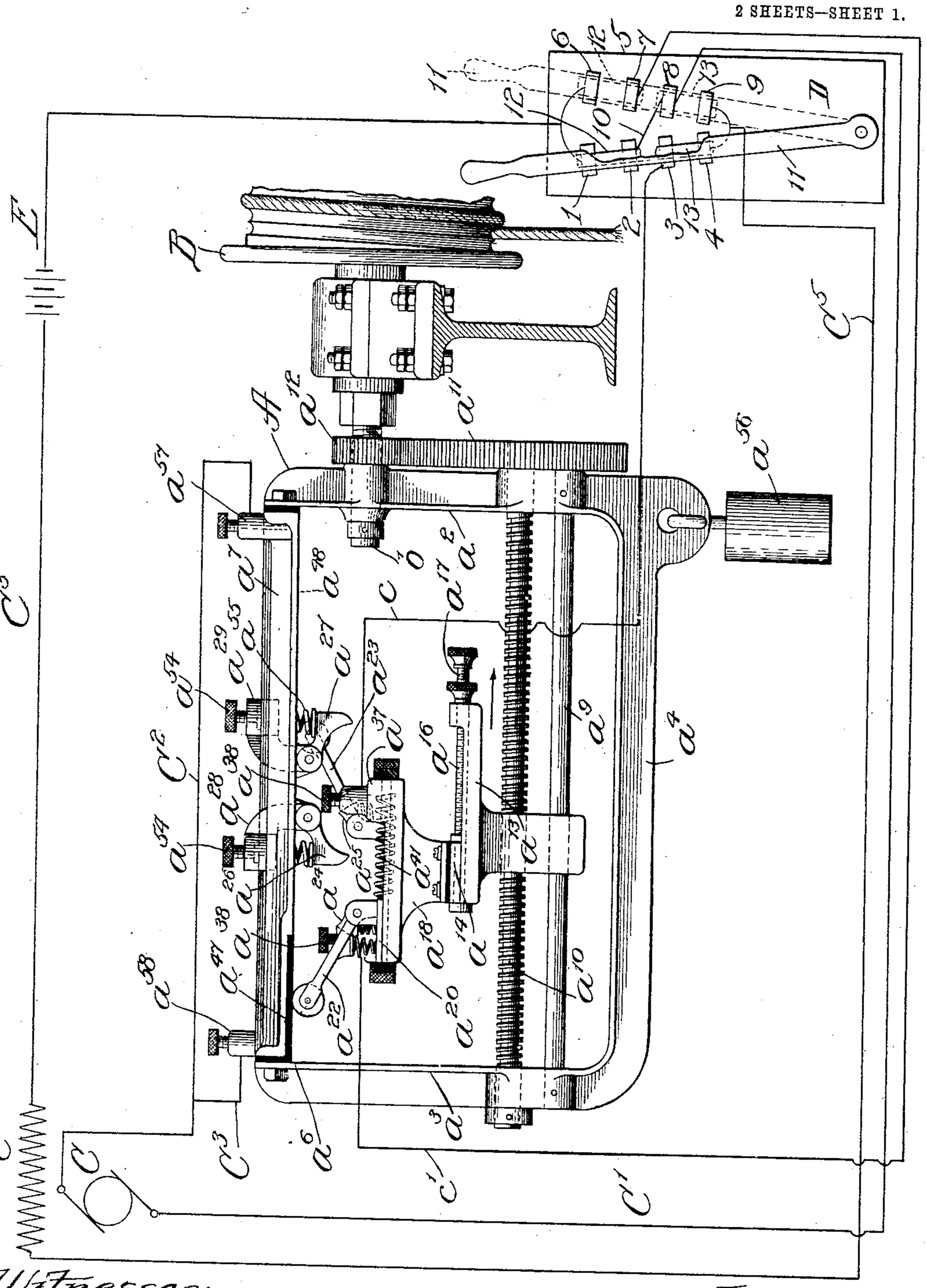
CIRCUIT CONTROLLING MECHANISM.

APPLICATION FILED AUG. 13, 1908.

945,472.

Patented Jan. 4, 1910.

2 SHEETS—SHEET 1.



Witnesses:

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Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

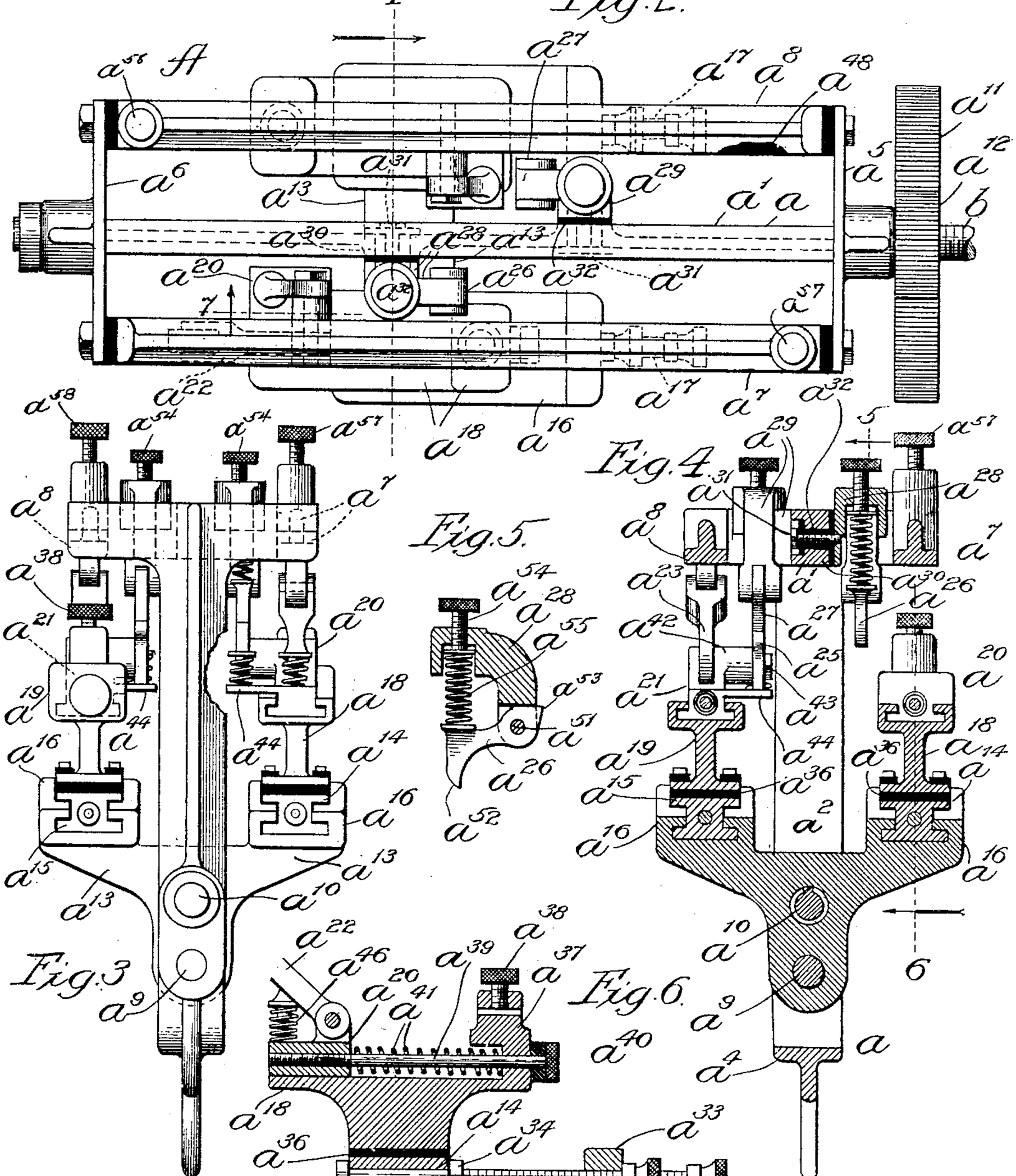


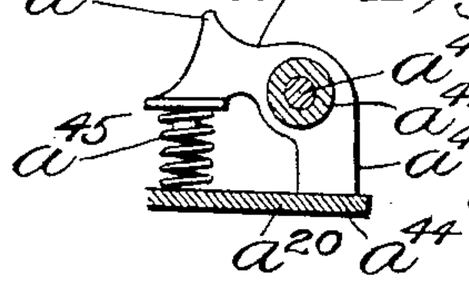
Fig. 3

Fig. 5.

Fig. 4

Fig. 6.

Fig. 7.



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UNITED STATES PATENT OFFICE.

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CIRCUIT-CONTROLLING MECHANISM.

945,472. Specification of Letters Patent. Patented Jan. 4, 1910.

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To all whom it may concern:

Be it known that I, CHARLES H. MOORES, a citizen of the United States, residing at Oak Park, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Circuit-Controlling Mechanism, of which the following is a specification.

This invention relates particularly to circuit-controlling mechanism for use in connection with electric motors employed for hoisting purposes, as, for instance, where electric motors are employed for operating elevators, cranes, etc.

The primary object of the invention is to provide simple, durable and effective mechanism operative to keep the motor within the control of the operator, within certain limits of operation of the hoisting drum, and also operative to automatically stop the operation of the motor and hoisting drum if the limits preparatorily fixed for their operation are transgressed, as sometimes happens through the carelessness of the operator.

A further object is to provide mechanism of the character indicated of such a nature as to enable the operator to immediately regain control of the mechanism in the event that the electric motor shall be automatically stopped, either in the lifting operation or in the lowering operation.

It may be preliminarily stated that various mechanisms have heretofore been suggested for automatically limiting the operation of an electric motor, but, so far as I am aware, there are various practical objections to all of the devices which have heretofore been devised for the general purpose indicated. In some instances, provision has been made for short circuiting the motor armature and blowing a fuse in the supply circuit, in case the hoisting drum operates beyond a predetermined point. In other instances, provision has been made for breaking the supply circuit, by the operation of switches controlled by electro-magnets. These methods are objectionable not only because of the uncertainty of the operation of the devices employed, but also because they usually contain no provision for the immediate regaining of control of the motor by the operator. The result has been that serious accidents have occurred at times, owing to the lack of control of the motor by the operator; and, at other times, great losses have occurred from the same source. For instance, where an electric crane is employed for handling immense charges of molten steel, it is very important that the motor be always within the control of the operator in order that the charge may be expeditiously delivered before the charge chills. In cases where the operator loses control of the motor and time is afforded for the molten steel to solidify the loss is very considerable.

It may be stated here that the present invention involves the use of circuits, or branch circuits, connected with a limit-switch device employing contacts so arranged that the circuits will always be available for use, by the ordinary manipulation of the usual manual controller, except that when the predetermined limit is reached in either direction, the circuit, or branch circuit, through which current is supplied for that direction of movement, will be interrupted.

The invention is illustrated in its preferred embodiment in the accompanying drawings in which—

Figure 1 represents a side elevational view of the improved circuit controlling mechanism in connection with diagrammatic illustration of circuits; Fig. 2, a plan view of the mechanism; Fig. 3, an end elevational view of the same; Fig. 4, a transverse vertical section taken as indicated at line 4 of Fig. 2; Fig. 5, a side elevational view taken as indicated at line 5 of Fig. 4 and showing a yielding catch employed; Fig. 6, a broken longitudinal section taken as indicated at line 6 of Fig. 4 and illustrating the manner in which the traveling contact members are mounted; and Fig. 7, a sectional view taken as indicated at line 7 of Fig. 2 and illustrating a catch adapted to coöperate with the catch shown in Fig. 5.

In the construction illustrated, A represents circuit-controlling mechanism supported on and operated by the shaft *b* of the hoisting-drum B; C, an electric motor having an armature-circuit C^1 equipped with branches C^2, C^3, and having a field C^4 in a circuit C^5; and D, a manual controller connected with said circuits.

While the mechanism A is shown mounted on the shaft of the drum B, it is to be observed that said mechanism may be supported in any desired manner and operated

in any desired manner, so long as the movement of the traveling contacts of the device A have relation to the movement of the hoisting-drum. The mechanism A comprises preferably a rectangular vertically disposed frame a having a top bar a^1, end bars a^2, a^3, a bottom bar a^4, and cross bars a^5, a^6 at the ends of the upper bar a^1; contact bars a^7, a^8 insulatingly supported on the extremities of the cross-arms a^5, a^6 and flanking the top bar a^1; a guide rod a^9 connecting the end members a^2, a^3 a short distance above the bottom bar a^4 of the frame; a feed-screw a^{10} journaled in the end bars a^2, a^3 and equipped at one end with a gear a^{11} meshing with a pinion a^{12} on the drum shaft b; a slide, or carriage, a^{13} having a perforation through which the guide rod a^9 extends and having, at a short distance above said perforation, a threaded perforation through which the screw a^{10} extends; a pair of slides a^{14}, a^{15} mounted in guides a^{16} carried by the slide a^{13} and located on opposite sides of the axis of the frame a; adjusting screws a^{17} serving to adjust the slides a^{14} with relation to the guides on the carrier, a^{13}; guides a^{18}, a^{19} insulatingly mounted on the slides a^{14}, a^{15}, respectively; slides a^{20}, a^{21} mounted in the guides a^{18}, a^{19}, respectively; contact members, or trolleys, a^{22}, a^{23}, carried, respectively, by the slides a^{20}, a^{21}; catches, or trip members, a^{24}, a^{25} carried, respectively, by the slides a^{20}, a^{21}; and catches, or trip members, a^{26}, a^{27}, co-acting, respectively, with the catches a^{24} and a^{25}, and carried, respectively, by members a^{28}, a^{29}, mounted on the central upper bar a^1 of the frame a.

The frame a, while preferably of the construction shown, may be of any desired construction; and, while it is preferred to mount the track members or contact members a^7, a^8 on the upper part of the frame, it will be understood that such arrangement is merely the preferred arrangement. The top frame member a^1 is provided on opposite sides at some distance from its center with bosses a^{30} whereat the members a^{28} and a^{29} are secured, by screws a^{31} passing through bushings a^{32} of insulating material which extend through the member a^1 at said bosses.

The slide or carriage a^{13}, as clearly appears from Fig. 4, comprises a central body mounted on the guide rod a^9 and having threaded connection with the screw a^{10}, and branches carrying the guides a^{16} in which the slides a^{14} and a^{15} are mounted. As has been indicated, the slides a^{14} and a^{15} are adjustably connected with the guides a^{13} by means of the screws a^{17}. This feature of mounting is of importance, inasmuch as it enables the limits of operation to be varied. Each adjusting screw a^{17} has threaded connection with a lug a^{33}, as clearly shown in Fig. 6; and the free end of the screw is journaled in the slide with which it is connected and equipped with collars a^{34}. Each screw is fitted with a lock-nut a^{35}. The guides a^{18}, a^{19} are insulatingly mounted on the slides a^{14}, a^{15}, being separated from said slides by insulating blocks a^{36}, as most clearly shown in Figs. 4 and 6. The guides a^{18} and a^{19} are reversely mounted on the slides a^{14}, a^{15}, as will be readily understood from Figs. 1, 2 and 3. Each of said guides a^{18}, a^{19} is provided with a closed rear end a^{37} equipped with a binding-post a^{38}. Through the end a^{37} of the guide extends a rod or plunger a^{39} having a head a^{40}, the free end of the rod being threaded into the slide a^{20} or a^{21}, as the case may be. Confined between the slide and the end a^{37} is a spring a^{41}, which tends to project the slide away from the end a^{37}, as shown in Fig. 6. Each of the spindles a^{20}, a^{21} is equipped with pivot lugs a^{42} through which extends a pivot a^{43} which supports the corresponding trolley-pole and the corresponding one of the catches or yielding stops a^{24}, a^{25}. Each of said slides a^{20}, a^{21} is equipped with a laterally projecting lug a^{44} upon which is mounted a spring a^{45} coacting with the catch or yielding stop mentioned. Each trolley-pole is equipped with a roller which engages the corresponding track-form contact member a^7 or a^8, as the case may be. Mounted upon each of the slides a^{20} and a^{21} is a spring a^{46} which bears beneath the trolley-arm, as is most clearly shown in Fig. 6.

Each of the track-form contact members a^7, a^8 is preferably composed of copper or other good electricity-conducting material, and said members are insulatingly supported on the cross-arms a^5, a^6 of the frame, as has been indicated. At one end of the track-form contact member a^7 is an insulating strip a^{47}, and at the opposite end of the contact member a^8 is an insulating strip a^{48}. Said insulating strips form a portion of the tracks along which the trolley wheels move.

Each of the catches or yielding stops a^{24}, a^{25} is provided with a stop-arm a^{49} adapted to engage the lug a^{44} and limit the rotation of the member in one direction; and each of said yielding stops is provided with a nose-piece a^{50} which projects into the path of the corresponding catch a^{26} or a^{27}, as the case may be. As most clearly shown in Fig. 5, each of the members a^{26}, a^{27}, is supported on a pivot a^{51} supported by the corresponding member a^{28} or a^{29}. Each of said members a^{26} and a^{27} is provided with a nose-piece a^{52} adapted to engage the nose-piece a^{50} of the corresponding yielding stop. The pivotal portion of the member a^{26} is received in a slot with which the member a^{28} is provided, and the pivotal portion of said member is provided with a shoulder a^{53} adapted to engage the shoulder formed by the bottom of the slot, thereby limiting the turning move-

ment of the member a^{26} in one direction. The member a^{28} is equipped with an adjusting screw a^{54} which serves to vary the tension upon a spring a^{55} which bears at its lower end against the member a^{26}. The construction at the member a^{27} and the supporting member a^{29} is similar, and the parts are correspondingly lettered.

It will be observed that by reason of the reverse mounting of the guides a^{18} and a^{19} the trolley-poles mounted on the slides a^{20} and a^{21} point or extend in opposite directions.

Where the frame a is journaled on the shaft b of the hoisting-drum, it is desirable to provide some means for overcoming any tendency of the frame to rotate with the drum-shaft. This may be accomplished by means of a weight a^{56}, as shown in Fig. 1.

The track-form contact member a^7 is equipped with a binding-post a^{57}, and the track-form contact member a^8 is equipped with a binding-post a^{58}.

The branches C^2, C^3 of the armature-circuit are connected, respectively, with the binding-posts a^{57} and a^{58}. Thus the branch circuit C^2 is extended through the contact member a^7 and may be completed through the trolley a^{22} and a conductor c connected with the binding-post a^{38} of the guide a^{18}; and the branch C^3 is extended through the contact member a^8 and may be completed through the trolley a^{23} and a conductor c^1 connected with the binding-post a^{38} of the guide a^{19}.

The controller D may be variously constructed. As shown, it is provided with a series of contact blocks 1, 2, 3 and 4 on one side of the median line of the insulating plate 5, and with a series of contact blocks 6, 7, 8 and 9 on the opposite side of said median line. The circuit C^5 is connected at one point with the blocks 1 and 6, and at another point with the blocks 4 and 9. The blocks 2 and 8 of the different series are connected by a conductor 10. The controller-lever 11 is equipped with conductor-blocks, or strips, 12 and 13, which will serve to connect the blocks of either series in pairs. The conductor c is connected with the block 3 of the controller D. The conductor c^1 is connected with the block 7.

The operation will be readily understood. Fig. 1 represents the position of the parts of the circuit-controlling mechanism after the carriage a^{13} has moved to the left through the limit of travel permitted to it by the mechanism as adjusted, and after the trolley a^{22} has escaped from the yielding stop a^{26} and sprung, by quick movement, from the contacting surface of the bar a^7 to the insulating surface of the member a^{47}. The position of the controller-lever 11 indicated in full lines in Fig. 1 corresponds with the movement to the left of the carriage a^{13}. During the same movement, current passes from the generator E to the block 1, thence across the bridge-piece 12 of the controller-lever to block 2, thence by the conductor 10 to the block 8, thence to the armature-circuit C^1, through the armature, thence through the branch circuit C^2, contact bar a^7, trolley-arm a^{22} (before it has passed onto the insulating strip a^{47}), thence through the slide a^{18} and conductor c to the contact block 13 of the controller-lever, thence to block 4, and thence back through the circuit C^5 to the generator E.

With the parts of the circuit-controlling mechanism in the position shown in Fig. 1, the controlling-lever 11 may be shifted to the dotted position. The circuit will then be from the battery E to the block 6, thence through the bridge-piece 12 to block 7, thence through conductor c^1 to the binding-post a^{38} of the slide 19, thence through the trolley a^{23} to the contact bar a^8, thence through the branch circuit C^3 to the armature, through the armature and circuit C^1 to block 8, thence through the bridge-piece 13 to block 9 and back through the circuit C^5 to the generator E. In the circuit thus traced, it will be noted that the direction of the current through the armature is reversed. Hence, the motor will turn in the opposite direction, thereby moving the carriage a^{13} to the right. During the movement of the carriage a^{13} to the right, the yielding stop a^{25} of the slide a^{21} will engage the yielding-stop a^{27}, whereby the slide a^{21} will be retarded, while the trolley a^{23} remains in contact with the conducting surface of the bar a^8. When the tension of the spring back of the slide a^{21} becomes sufficient to overcome the tension of the springs of the yielding stops, the slide a^{21} will be projected suddenly forward, and cross, at high velocity, the junction between the conducting surface of the bar a^8 and the insulating strip a^{48}. It will thus be seen that should the operator fail to stop the motor during the operation of the machine in either direction, within the proper limit, the moving contact member a^{22}, or a^{23}, as the case may be, will pass onto the corresponding insulating strip thereby breaking the circuit which chances to be in use. Nevertheless, after the carriage a^{13} has traveled a short distance from either of its limits, the interrupted circuit is reëstablished, so that it is evident that between the limits, the operator may cause the motor to turn in either direction, by shifting the controller-lever 11, at will; and it is also evident that after a branch circuit has been automatically interrupted or broken, the operator may immediately regain control of the machine by shifting the controller-lever.

It is obvious that any suitable controller may be employed and that the circuits may

be variously modified without departure from my invention.

While I have shown the slides a^{20} and a^{21} equipped with spring-projected, retardable contact members or trolley-poles, it is obvious that the use of said devices may be dispensed with where the current is not sufficiently great to cause severe arcing when the slow movement of the screw-feed is depended upon to carry the moving contact member from a conducting surface onto an insulating surface.

The foregoing detailed description has been given for clearness of understanding only, and no undue limitation is to be understood therefrom.

What I regard as new, and desire to secure by Letters Patent, is:—

1. In limit-switch mechanism for the purpose set forth, the combination of a carriage, means for actuating said carriage, contact-bars or members having track-surfaces and connected with a circuit, insulation members having track-surfaces in alinement with and at opposite ends of said first-named track-surfaces, and track-engaging contact-members connected with said circuit, and mounted on said carriage in such position that contact will be broken between one set of contact-members in one direction of movement of the carriage and between the other set of contact-members in the other direction of movement of said carriage.

2. In limit-switch mechanism for the purpose set forth, the combination of a carrage, means for actuating said carriage, a track-form contact-member connected with a circuit, a contact-member mounted on said carriage and normally contacting with said track-form contact bar, means for retarding said second-named contact-member during the actuation of the carriage, and means for projecting said second-named contact-member after a period of retardation, thereby to cause it to pass quickly from said first-named contact-member.

3. In circuit-controlling mechanism, the combination with a circuit, or circuits, of limit-switch mechanism, including track-form contact-members connected with said circuit, or circuits, insulations forming continuations of the tracks, a carriage, means for actuating said carriage, a pair of contact-members independently mounted on said carriage, means for retarding one of said second-named contact-members during the movement of said carriage in one direction, means for retarding the other of said second-named contact-members during the movement of said carriage in the opposite direction, and means for projecting said second-named contact-members after retardation.

4. In circuit-controlling mechanism, the combination of a frame having its upper portion equipped with a pair of substantially parallel insulatingly mounted contact-bars, a guide beneath said contact-bars and substantially parallel therewith, a carriage mounted on said guide, a screw serving to actuate said carriage, and a pair of slides mounted on said carriage and equipped with insulatingly-mounted contact-members, one or the other of said contact-members contacting with a contact-bar, regardless of the position of said carriage for the purpose set forth.

5. In circuit-controlling mechanism, the combination of a frame, a pair of contact-bars insulatingly mounted thereon, a carriage, means for actuating said carriage, slides supported from said carriage, and oppositely pointing trolley-poles mounted on said slides and engaging said contact-bars.

6. In circuit-controlling mechanism, the combination of a frame, a pair of contact-bars insulatingly mounted thereon, a carriage, feed-mechanism for said carriage, spring-held slides supported on said carriage, contact-members carried by said slides and engaging said contact-bars, and yielding retarding means, for the purpose set forth.

7. In circuit-controlling mechanism, the combination with a track-form contact-bar, of a carriage, means for moving said carriage, a retardable spring-projected contact-member mounted on said carriage and normally engaging said contact-bar, and means operative to retard the movement of said second-named contact-member during the movement of said carriage, whereby said second-named contact-member will be projected from said first-named contact-member at a more rapid speed than the speed of the carriage, when the limit is reached.

8. In circuit-controlling mechanism, the combination of a pair of track-form contact-members, insulation strips at opposite ends of said contact-members and forming track-extensions, movable contact-members engaging said first-named contact-members, and means for feeding said second-named contact-members simultaneously in either direction.

9. In circuit-controlling mechanism, the combination of a pair of track-form contact-members arranged in parallel relation and equipped at opposite ends with insulation strips forming track extensions, a carriage, means for feeding said carriage, and contact-members mounted on said carriage and engaging said first-named contact-members.

10. In circuit-controlling mechanism, the combination of a track-form contact-member, a carriage, means for feeding said carriage, a spring-held slide supported by said carriage and equipped with a yielding catch, and a stationary yielding catch co-acting with said first-named catch and serving as a retarding device.

11. In circuit-controlling mechanism, the

combination of a track-form contact-member, a carriage, feed-mechanism for said carriage, a guide supported on said carriage, a slide connected with said guide, a spring connected with said guide and yieldingly engaging said slide, a contact-member carried by said slide, and yielding retarding means for the slide, for the purpose set forth.

12. In circuit-controlling mechanism, the combination of a track-form contact-member, a carriage, feed mechanism for said carriage, a slide adjustably mounted on said carriage and equipped with a guide, a second slide connected with said guide, a spring connected with said slide, a contact-member carried by said slide, and yielding retarding means for said slide, for the purpose set forth.

13. In means of the character set forth, the combination with a hoisting-drum shaft, of a frame journaled thereon, a feed-screw supported by said frame and geared to said drum-shaft, a carriage actuated by said feed-screw and equipped with a pair of guides, slides mounted on said guides, contact-members carried by said slides, and a pair of track-form contact-members insulatingly mounted on said frame and co-acting with said first-named contact members.

14. The combination with an electric motor and circuit therefor, of a hoisting-drum and a limit-switch device, comprising a track-forming contact-member having an extended surface, an insulation member having a surface in alinement with said first-named surface and forming a track-extension, a contact-member co-acting with said first-named contact-member, means gearing one of said contact-members to correspond with the drum movement, and a controller connected with said circuit, said device operative to break the motor circuit, for the purpose set forth.

15. The combination with an electric motor and an armature-circuit therefor having branches on one side of the armature, of track-form contact-bars connected with said branch circuits, movable contact members co-acting with said first-named contact-members, a controller, and conductors connecting the second-named contact-members with said controller, said armature-circuit being also connected on the other side of the armature with said controller, for the purpose set forth.

16. The combination with an electric motor, of an armature circuit having branches at one side of the armature, track-form contact-members connected with said branches, a carriage, feed-mechanism for the carriage, contact-members mounted on said carriage, a controller, and conductors connecting said second-named contact-members with said controller, said armature-circuit being also connected on the other side with said controller, for the purpose set forth.

17. In circuit-controlling mechanism, the combination of a rectangular frame having an upper longitudinal member, a pair of track-form contact-members insulatingly supported on opposite sides of said upper frame-member, a carriage located beneath said contact-members, slides carried by said carriage, springs for said slides, contact-members carried by said slides, yielding stops carried by said slides, and yielding stops carried by said upper frame-member and co-acting with said first-named yielding stops, for the purpose set forth.

18. In circuit-controlling mechanism, the combination of a frame, a track-form contact-bar insulatingly mounted thereon, a carriage, feed mechanism for said carriage, a contact-member movably mounted on said carriage and co-acting with said contact-bar, a spring serving to project said contact-member, thereby to quickly break the contact at the end of the traverse of the carriage, means for placing said spring under tension, and for effecting release of said contact-member to permit projection thereof and a circuit connected with said contact-bar and said movably mounted contact-member, for the purpose set forth.

CHARLES H. MOORES.

In presence of—
R. A. SCHAEFER,
J. G. ANDERSON.