No. 837,400. PATENTED DEC. 4, 1906.

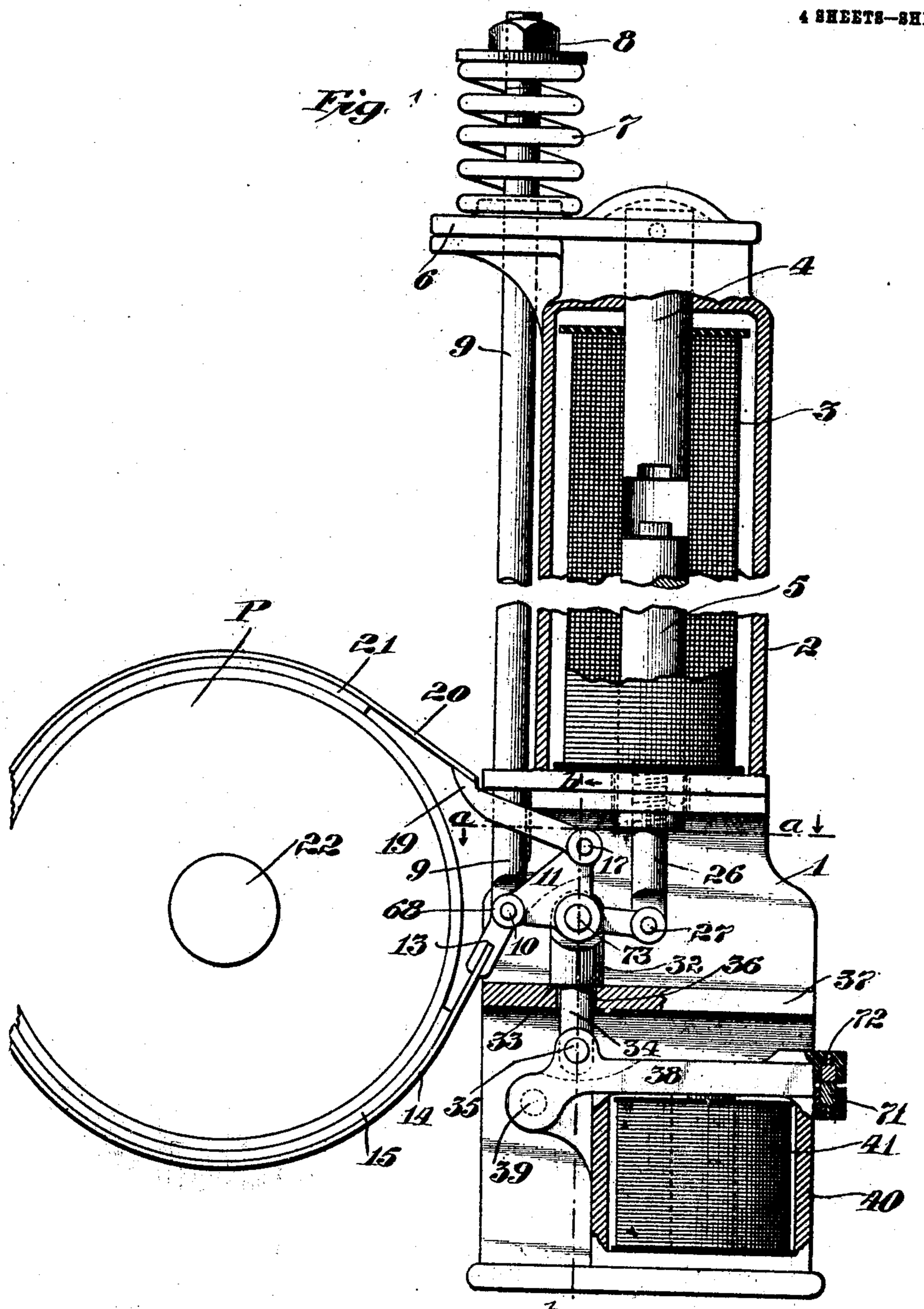
G. B. GROSVENOR.

COMBINED EMERGENCY AND MAIN BRAKE.

APPLICATION FILED MAR. 22, 1906.

4 SHEETS—SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

Fig. 2.

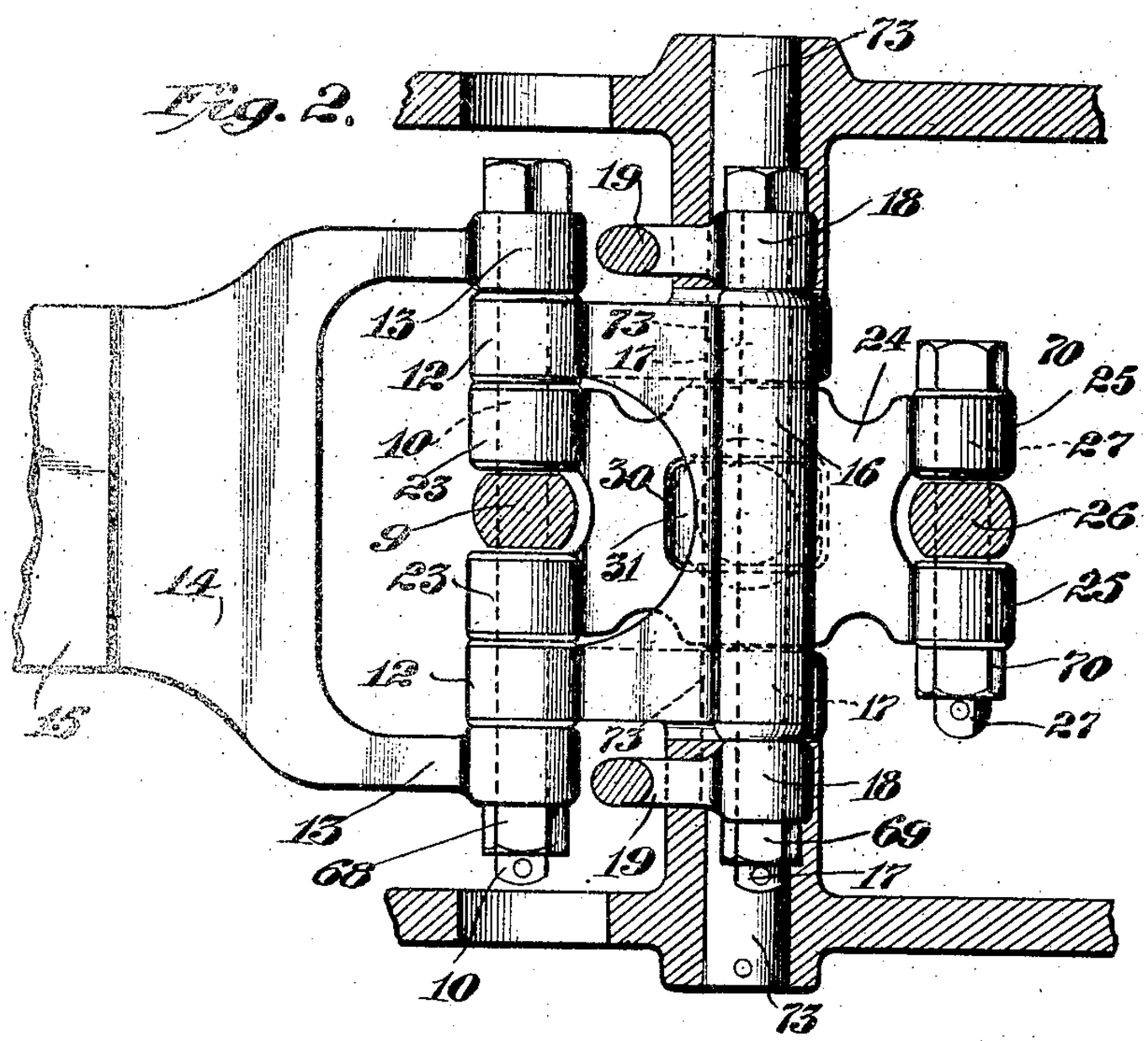
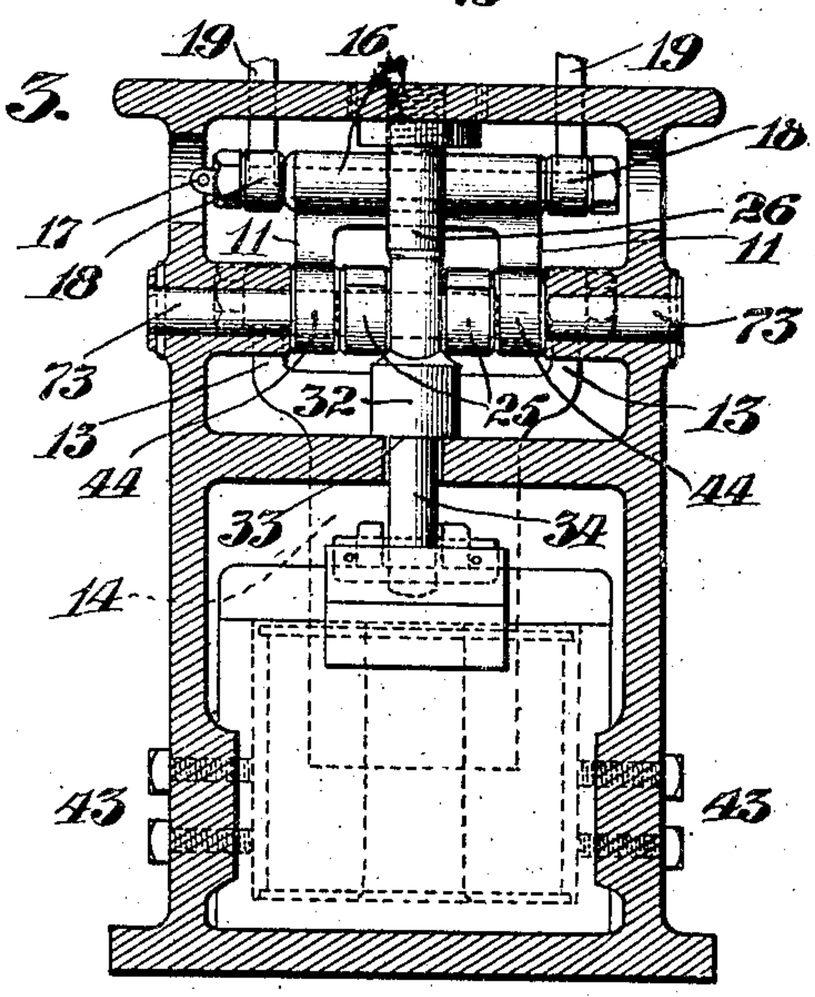


Fig. 3.



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4 SHEETS—SHEET 3.

Fig. 4

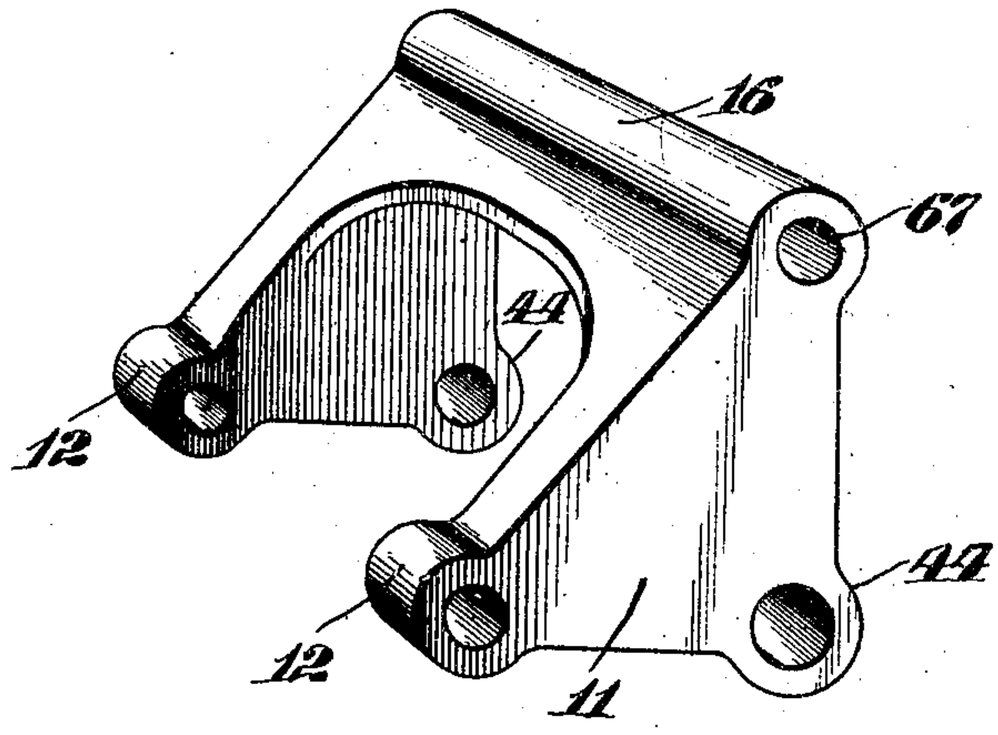

Fig. 5.

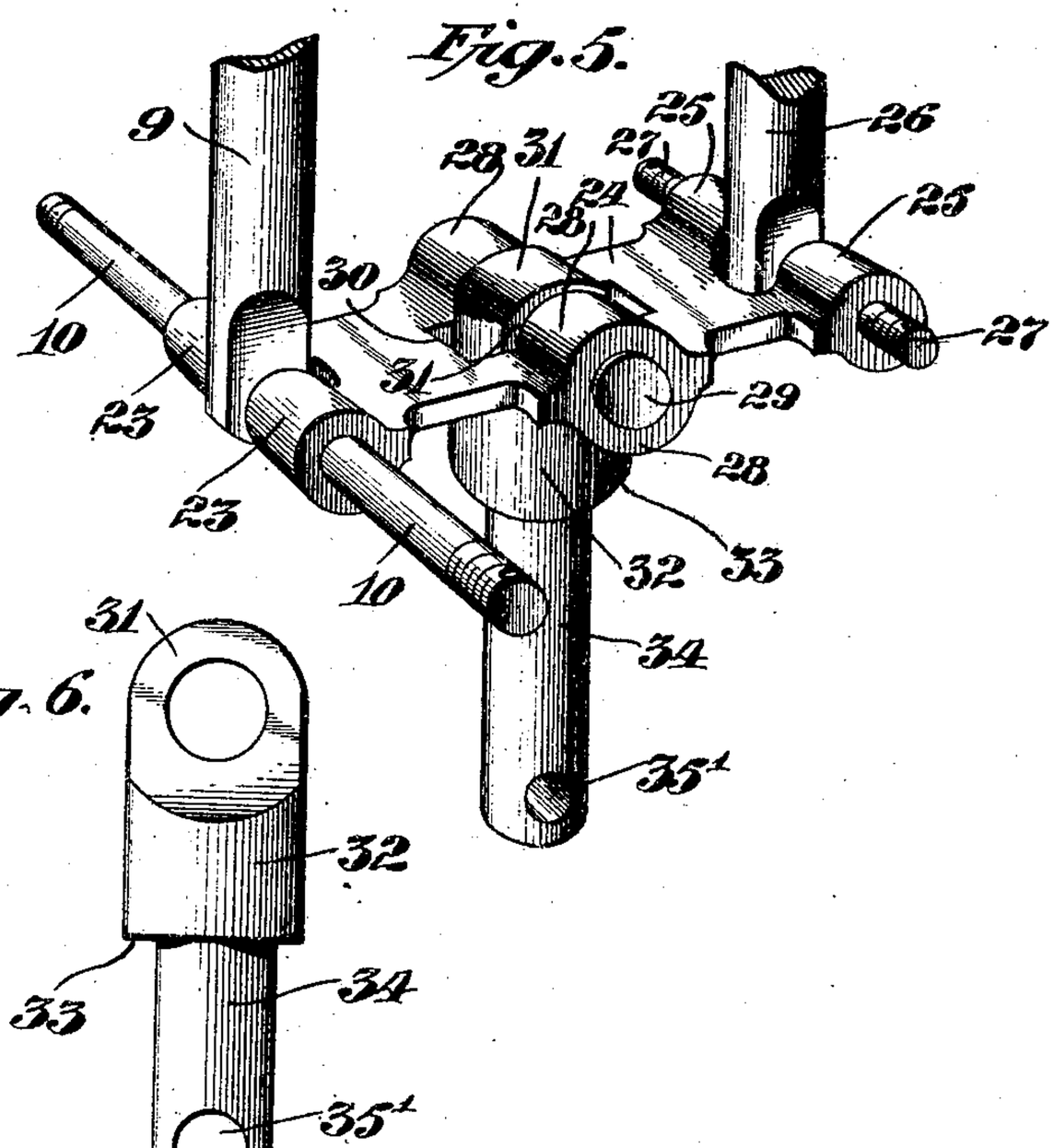

Fig. 6.

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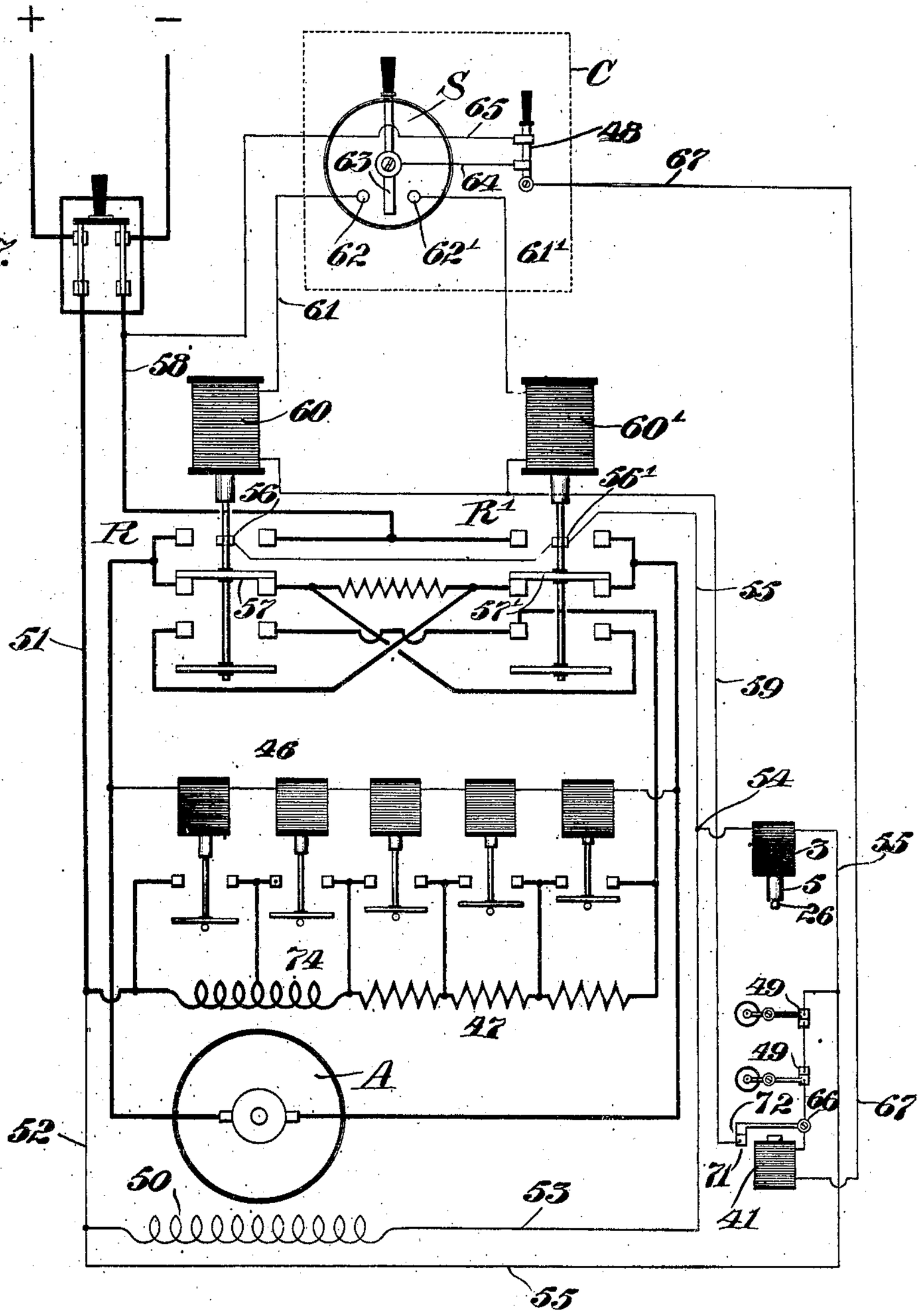
4 SHEETS—SHEET 4.

Fig. 7.



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UNITED STATES PATENT OFFICE.

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COMBINED EMERGENCY AND MAIN BRAKE

No. 837,409. Specification of Letters Patent. Patented Dec. 4, 1906.

Application filed March 22, 1906. Serial No. 307,335.

To all whom it may concern:

Be it known that I, GRAHAM B. GROSVENOR, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented a new and useful Improvement in a Combined Emergency and Main Brake, of which the following is a specification.

My invention relates to brake apparatus, and is particularly adapted for stopping electric motors employed in the operation of elevators; but it may have a general application.

One of the objects of my invention is the provision of a combined emergency and main brake for electric elevators, which brake shall be simple, compact, efficient, and reliable.

A further object of the present invention is the provision of an improved and more efficient emergency-brake in connection with an ordinary brake and electric contact controlled by the emergency-brake.

Another object of my invention is to provide means for relieving the strain on the emergency-brake apparatus when the main-brake spring acts to apply the brake-shoes.

Another object of the invention is to provide an emergency-brake apparatus including contacts in the controlling-circuit of an electric elevator and means for automatically restoring such contacts to normal position upon the stopping of the elevator-car.

Other objects of this invention will appear hereinafter, the novel combination of elements being pointed out in the claims.

Referring to the drawings, Figure 1 represents in side elevation, partly in section, my improved combined emergency and main brake. Fig. 2 represents a plan view of Fig. 1 taken on the line *a a*. Fig. 3 is a sectional elevation of the lower portion of Fig. 1 taken on the line *b b* and looking in the direction of the arrows. Figs. 4 and 5 represent in perspective certain details of Figs. 2 and 3. Fig. 6 is an elevation of a detail of Fig. 5, and Fig. 7 represents a wiring diagram of an elevator apparatus in which my improved emergency and main brake apparatus may be used.

In Fig. 1 the reference-number 1 designates a frame or support on the upper portion of which is mounted the casing which incloses the brake-magnet solenoid 3. To the upper end of the casing 2 is secured the pole-piece 4, which extends downwardly into the solenoid 3 a short distance, which may be varied as desired. Also attached to the upper portion of the casing 2 is a laterally-extending bracket 6 for supporting the brake-spring 7, which is held in position by the nut and washer 8, which appear at the upper screw-threaded end of the brake-applying rod 9. The lower end of the rod 9 is pivoted to the central portion of the shaft 10, as indicated in Fig. 2. Also mounted on this shaft 10 are the bearings 12 12 of the double bell-crank 11. At the outer ends of the shaft 10 are mounted the perforated arms 13 13 of the brake-band 14, which latter is provided with a brake-shoe 15.

Through a longitudinal opening 67 in the upper portion 16 of the bell-crank 11 extends a shaft 17, to the outer ends of which are connected in any suitable manner the arms 19 19 of the brake-band 20, to which is secured the brake-shoe 21. The brake-shoes 15 and 21 are adapted to be applied to the brake-pulley P, fastened to the motor-shaft 22, when the brake-spring 7 is free to move the rod 9 upwardly in the well-known manner. In this instance the shafts 10 and 17 are shown as bolts, which are provided, respectively, with nuts 68 and 69 for securing said bolts rigidly to the arms 13 13 and 19 19 of the brake-bands. The bearings 12 12 and 16 are freely movable on said shafts. However, these details of construction may be varied as desired by those skilled in the art without altering the principle of my invention. Also mounted on the shaft 10, so as to be freely moved thereon, are the bearings 23 23 of a rocking plate 24, the other end of which is provided with perforated lugs or arms 25 25, through which passes the rod or bolt 27. The rod 27, as shown in Fig. 5, as well as the shaft 10, is a stud-bolt, and in Fig. 2 are shown nuts 70 70 for securing the stud-bolt 27 rigidly to the arms 25 25. The rod 27 passes through an opening in the extreme lower end of the vertical rod 26, which is secured rigidly in any suitable manner to the vertically-movable magnet core or plunger 5. It will thus be seen that whenever the brake-magnet 3 is energized the rod 26 will be drawn upwardly and the plate or le-

ver 24 rocked upon the bearings 23 23 as a fulcrum; but this action can in no way affect the brake-bands or the brake-rod 9. In order to change this fulcrum to some point midway between the ends of the rocking plate 24, I pass a rod-bolt 29 through enlarged portions 28 28 in said lever or plate.

As shown in Fig. 5, the rectangular opening is placed in the central portion of the plate 24 between the bearings 28 28, and through this opening passes the bearing 31 of the upper end of the emergency-brake rod 32. The shaft 29 passes through this bearing 31, as well as those designated 28 28. The lower portion of the emergency-brake rod 32 is of reduced diameter, as indicated at 34, so as to leave a shoulder 33. The rod 34 passes downwardly through an opening 36 in a partition 37, which separates the compartment of the brake-frame containing the emergency-brake magnet from that compartment which contains the leverage, already referred to. As shown in Figs. 5 and 6, the extreme lower end of the rod 34 has an opening 35′, through which passes a connecting-rod 35, the latter being secured to the armature 38 of the emergency-brake magnet 41, as indicated in Figs. 1 and 3.

The emergency-brake armature 38 is pivoted at 39 to a bracket which extends from the emergency-brake cup or inclosing cylinder 40. Also secured to the emergency-brake pot 40 is an insulated contact 71, which is adapted to coöperate with an additional contact 72, which is mounted on and insulated from the outer end of the emergency-brake 38. When the armature is in attracted position, as indicated in Fig. 1, the contacts 71 and 72 are in engagement with each other, and when in this condition they close any circuit which is desired to be controlled. In Fig. 7 I have illustrated these contacts in the controlling-circuit of an electric elevator system; but I do not desire to be limited to such use, as Fig. 7 merely illustrates one application of my invention.

So long as the emergency-brake armature is held attracted the shaft or rod 29 is held stationary, and therefore whenever the brake-magnet is energized and its core 5 consequently lifted the rod 9 will be pulled downwardly by reason of the lever-plate 24 being rocked on the shaft 29 as a fulcrum. When the rod 9 is thus moved downwardly, the shaft 10 is moved with it, and so, also, the arms 13 13 of the brake-band 14. When the shaft 10 is thus moved downwardly, the double bell-crank will be moved on its bearings 44, which are mounted on the inwardly-extending rods 73 73, as indicated in Figs. 2 and 3. Motion will thus be transmitted by the bell-crank 11 to the arms 19 19, which are connected to the outer ends of the rod 17, which extends through the opening 67 in the bearing 16. The brake-band 20 will therefore be moved at the same time a brake-band 14 is moved. Consequently both brake-shoes 15 and 21 will be moved out of engagement with the pulley P, after which the shaft 22 may be moved as desired.

When the emergency-brake magnet 41 is deënergized and the brake-magnet 3 is energized, the fulcrum will change from the shaft 29 to the shaft 10, and in this case no effect will be produced on the brake-bands, as the lever-plate 24 will move freely up and down between the bearings 44 44. Obviously each time the magnet 3 is energized when the magnet 41 is deënergized the emergency-brake rod 32, and consequently the armature 38, will be moved upwardly with said lever-plate 24. When, however, the brake-magnet 3 is deënergized, the rod 32 and armature 38, together with the magnet-core 5, will drop back to their normal positions. When this occurs, it is preferable that the weight of the parts connected to the armature 38 and extending upwardly should be taken by the shoulder 33 striking against the partition 37. There should be sufficient downward movement of the armature 38, however, to insure a firm engagement of the contacts 71 and 72; but the armature should not in most instances be allowed to fall directly upon the top or upper peripheral portion of the emergency-brake pot 40. Although this is the preferable arrangement to prevent the least injury and wear to the emergency-brake apparatus, these details may be varied as deemed necessary and most expedient.

Referring now to Fig. 7, one application of my invention will be explained. A designates a motor-armature of an electric motor which is connected to suitable hoisting apparatus for operating the car, in which is placed a manual controlling-switch S and also a safety or emergency switch 48. R R designate reversing-switches for directing the current of the motor to the motor-armature to operate the same in one direction or the other in the well-known manner; also, to effect the energization of the accelerating-magnets 46, which control the series field 74 and the resistance 47, as well as the shunt-field 50 and brake-magnet 3. The emergency-brake magnet 41 is connected to the emergency-switch 48 in the car, and the contacts 71 and 72, controlled by the emergency-brake magnet, are in series with the reversing-switch magnets 60 60 and the manual reversing-switch S in the car, so that whenever the contacts 71 72 are out of engagement the reversing-switches cannot be operated. So, also, when lever-switches 49 49 are operated the reversing-switches cannot be operated. Assuming that the car-switch is moved so that its contact-lever 63 engages with contact 62, a circuit will be closed from the positive main from the wires 51, 52, and 55, limit-

switches 49 49, contacts 71 72, wire 59, solenoid 60, wire 61, contact 62, lever 63, wire 64, emergency-switch 48, wire 65 to the negative main. The bridge-piece 57 will now be lifted and the shunt-field coil 50 connected across the mains, and so, also, the brake-magnet 3, which is connected in parallel in this instance with the shunt-field 50. The emergency-brake magnet 41 is always energized so long as there is potential across the mains and the emergency-switch 48 is closed. This circuit may be traced from the positive main to the point 66 and thence through the emergency-brake magnet 41, wire 67, emergency-brake switch 48, and wire 65 to the negative main.

As hereinbefore described, so long as the emergency-brake magnet 41 is energized sufficiently to hold down its armature 38 the brake-magnet 3 is effective in releasing the brake-shoes from the pulley P against the action of the brake-spring 7. When, however, the emergency-switch 48 in the car is opened, the circuit of the magnet 41 is interrupted, and if the core 5 of the main-brake magnet 3 is lifted at this time the armature 38 will immediately fly up by reason of the spring 7 acting on the rod 9 to move the same upwardly. This will effect the application of the brake to the pulley, although the controlling-switch S in the car may be in such position as to correspond with a movement of the car in one direction or the other. The emergency-brake magnet being thus deënergized and the main brake applied and the operating-circuits opened, the car will be stopped, or it will be materially reduced in speed until the switch is moved to central position, when the car will come to an absolute stop. It should be particularly noted, however, that when the brake-magnet 3 is deënergized the parts connected to the core 5, including the armature 38, will drop back to their normal positions with the core 5, thus avoiding any necessity of the operator going to the motor apparatus to restore the emergency-brake mechanism. Furthermore, it should be noted that the contacts 71 72 are also automatically brought into engagement, so that when the emergency-switch 48 is again closed the car may be operated as before.

In emergency-brake devices employed heretofore when the current to the magnet is cut off in most every instance the cover of the emergency-brake pot, or, in other words, the armature of the emergency-brake magnet, will be lifted, thus breaking the contacts and leaving them broken, thus making it necessary for the attendant to go down to the motor-room and reset the armature-contacts, when current is again turned on. By the use of my construction when the main-brake coil is not excited with current there is no strain or very little strain upon the armature of the emergency-brake magnet, and, furthermore, a cutting off of the current from the emergency-brake-magnet coil does not cause the armature 38 to rise and break its contacts when the brake-magnet 3 is energized at this time.

The condition mentioned involving the necessity of an attendant to manually restore emergency-brake apparatus is annoying and often overcome by placing some object under the weight-arm, thus rendering the emergency device inoperative. With my construction, however, such cover does not at any time rise when the brake is in normal working order, and therefore there is no motive for an attendant to render the device inoperative.

Through the agencies of rust, dirt, or improper adjustment it is possible that emergency devices heretofore used will not apply the brake-bands with sufficient force to stop the hoisting-machine; but with the apparatus herein disclosed the brake-bands are applied in exactly the same manner and the same pressure when released by the emergency-magnet as when released by the main magnet. As can be readily seen, every stop under normal conditions is a test of the efficiency of the emergency-brake. Also in previous emergency-magnet devices, owing to the fact that nuts for adjusting the brake-spring are so situated that they can be reached only with a special wrench, it is customary to use a chisel and a hammer in turning them, which not only spoils the nuts, but consumes considerable time. It should be noted that the spring 7 and the adjusting nut and washer in my device are situated on top of the brake-stand and are not inclosed.

Heretofore when the conditions were such that it was necessary to increase the tension of the brake-spring to a sufficient extent to make the brake effective the jar of applying the brake-bands was often so hard as to break the contacts controlled by the emergency-brake magnet, or at least to cause a chattering of the armature-contacts. As disclosed herein, however, the instant the main-brake coil is deënergized the strain is removed from the cover of the emergency-brake-magnet pot. Consequently the shock of the brake-bands gripping the coupling or brake-pulley has no effect upon the armature 38 or the contacts 71 72.

Owing to the small amount of space back of brake-stands of many electric elevator-machines, principally large-drum external-geared machines, residence, and back-geared machines, it is difficult to mount such stands and also to make adjustments and repairs. My invention, however, contemplates the placing of both the emergency and the main brake magnets on one stand with the brake-applying device, so that my brake apparatus occupies the same base-space now occupied by the main-brake magnet alone. For use on alternating-current residence-elevators the

emergency-magnet coil would preferably be connected across the direct-current-generator armature-leads and would get full voltage at the same time as the reversing-switch coil, which is before the main-brake coil receives current. This will insure that the emergency-brake armature be held with its contacts together and a firm fulcrum established for the main-brake magnet to act upon to release the brake-shoes and allow the motor to operate elevator apparatus in the desired manner.

In addition to the above features, which have been pointed out so that the operation may be readily understood, my improved combined emergency and main brake lends itself readily to standardization. This is for the reason that on the same stand either interchanged mechanical parts or a magnet can be used without any change in the emergency-brake and parts connected with the brake-bands.

Although I have herein shown a single embodiment of the principles of my invention, I wish it to be understood that I do not desire to be limited to any of the details of construction herein shown and described, as various modifications may be made by those skilled in the art without departing from the spirit and scope of the invention.

I claim—

1. In brake apparatus, the combination with a brake, of means for applying the same, a main magnet, an auxiliary magnet, and means acted upon by said auxiliary magnet for effecting the release of the brake upon the energization of said main magnet.

2. In brake apparatus, the combination with a brake, of mechanical means for applying the said brake, an electromagnet, connections between said electromagnet and said brake, and electromechanical means for establishing a fixed fulcrum in said connections to effect a release of said brake upon the energization of said electromagnet.

3. In brake apparatus, the combination with a brake and brake-applying means, of brake-releasing means, and electromechanical means for positively controlling said brake-releasing means.

4. In brake apparatus, the combination with a brake and brake-applying means, of an electromagnetic brake-releasing device, and electromagnetic means acting positively on said brake-releasing device to render the same operative.

5. In brake apparatus, the combination with a brake and a brake-applying device therefor, of a main-brake magnet, connections between said magnet and the brake, an emergency-brake magnet, and connections between said emergency-brake magnet and said first-named connections to establish a fixed fulcrum in the latter when the emergency-brake magnet is energized and permit the main-brake magnet to effect a release of the brake when the same is energized.

6. In brake apparatus, the combination with a main-brake magnet, of an emergency-brake magnet, a brake, brake-applying means, brake-releasing means, and positive connections between the said brake-releasing means and said emergency-brake magnet to render the brake-releasing means operative only when the emergency-brake magnet is energized.

7. In brake apparatus, the combination with a brake, of brake-applying means, exposed adjusting means for the latter, a main-brake magnet, an auxiliary-brake magnet, and means coacting with said magnets for releasing said brake.

8. In brake apparatus, the combination with a brake and a brake-applying device, of a main-brake magnet and an auxiliary-brake magnet, means operated by both of said magnets for releasing the brake, and a single brake-stand for supporting the said magnets, the brake-applying device, and the brake-releasing device.

9. In brake apparatus, the combination with a brake, of brake-applying means, a main-brake magnet, an emergency-brake magnet, an electric switch controlled by said last-named magnet, and connections between the aforesaid parts to effect a release of the brake when both magnets are energized, and the closing of the switch when the main magnet is deënergized whether the auxiliary magnet is energized or not.

10. In brake apparatus, the combination with a brake, of brake-applying means, a main-brake magnet, and an auxiliary-brake magnet, an armature for said auxiliary magnet, connections between said main magnet and said brake, a connecting-rod between said armature and connections, and means coacting with said rod for relieving the strain on the armature when the emergency-brake magnet is deënergized and the main magnet lifts and lets fall the said armature.

11. In brake apparatus, the combination with a brake and a brake-applying device, of a main magnet, an auxiliary magnet comprising a cup or pot nearly inclosing the coil and core of the magnet, an armature movable over said core and cup, loose connections between said main magnet and said brake and brake-applying device, a connecting-rod between said armature and connections for establishing a fixed fulcrum in the latter when the auxiliary magnet is energized, and means for relieving the strain of the armature on the cup when the armature is lifted by the main magnet through said connections and connecting-rod.

12. In brake apparatus, the combination with a brake, of brake-applying means, a main-brake magnet, an auxiliary-brake magnet, an electric switch controlled by the lat-

ter magnet, a rock-plate connecting said main magnet and brake, connections between an intermediate portion of said plate and said emergency-brake magnet to effect a fixed fulcrum at such intermediate portion when the emergency-brake magnet is energized, and a bell-crank pivoted independently of said connections but connected thereto and also to the brake and brake-applying means.

13. In emergency-brake apparatus, the combination with an elevator system, of a controlling-switch in the car, a safety-switch, a brake, brake-applying means, a main-brake magnet, an auxiliary-brake magnet in circuit with said safety-switch, an electric switch in circuit with the controlling-switch in the car and held closed when the emergency-brake magnet is energized, and means coacting with said magnets for releasing said brake when both magnets are energized.

14. In emergency-brake apparatus, the combination with a brake, of a brake-applying device, a main magnet, an emergency-magnet normally energized, an armature for said emergency-magnet, an electric switch operated by said armature, a rock-plate connecting the main magnet to the brake and to the brake-applying device, an independently-mounted bell-crank connected to the brake and brake-applying device, a link connecting the armature and an intermediate portion of said rock-plate, a single brake-stand for the aforesaid parts, and a partition in said stand for limiting the movement of said armature against the emergency-brake magnet.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GRAHAM B. GROSVENOR.

Witnesses:
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