W. M. HUMMEL.

MINE DOOR OPERATING APPARATUS.

APPLICATION FILED JUNE 24, 1916.

1,218,404.

Patented Mar. 6, 1917.

2 SHEETS—SHEET 1.

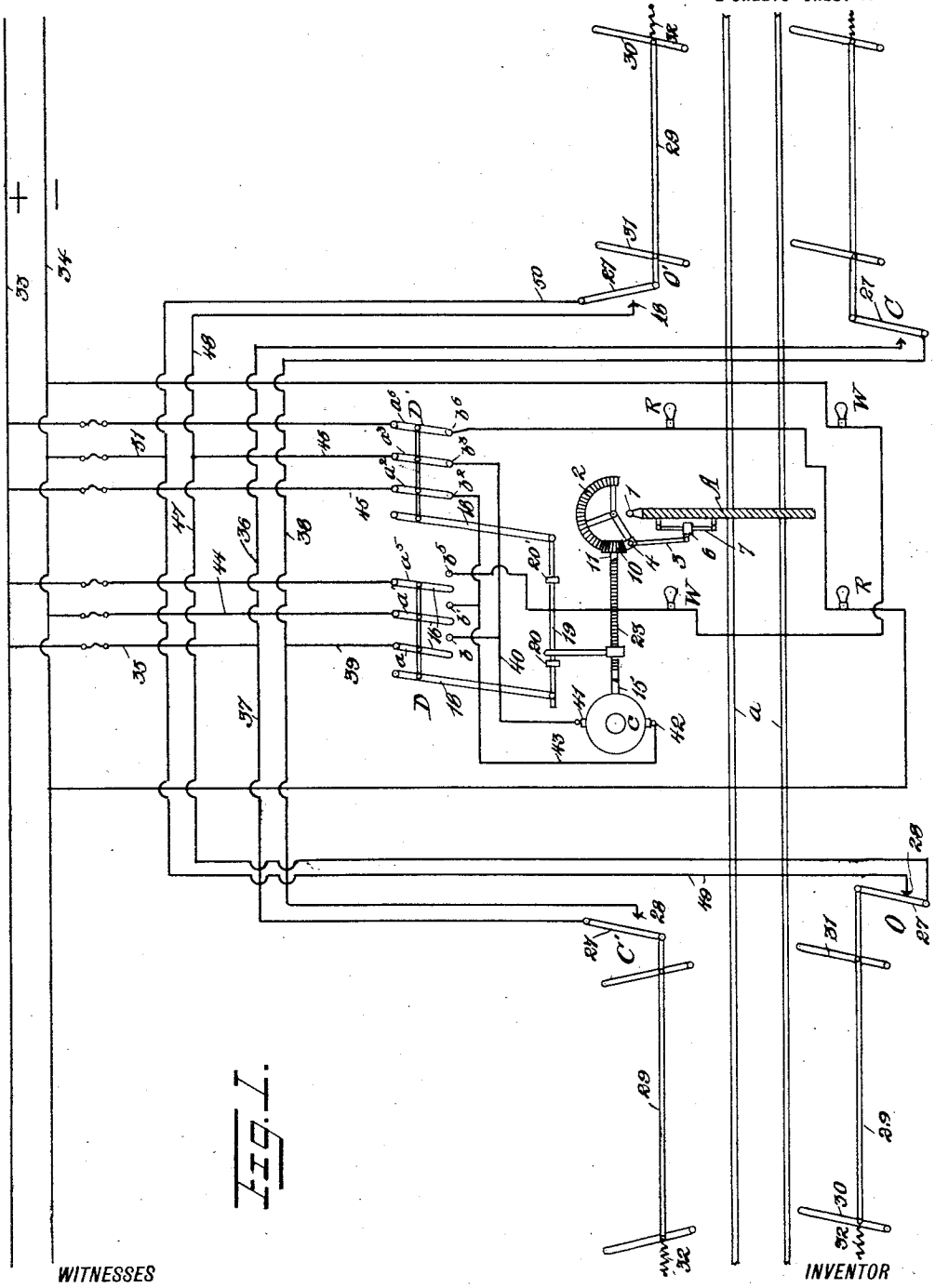


Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

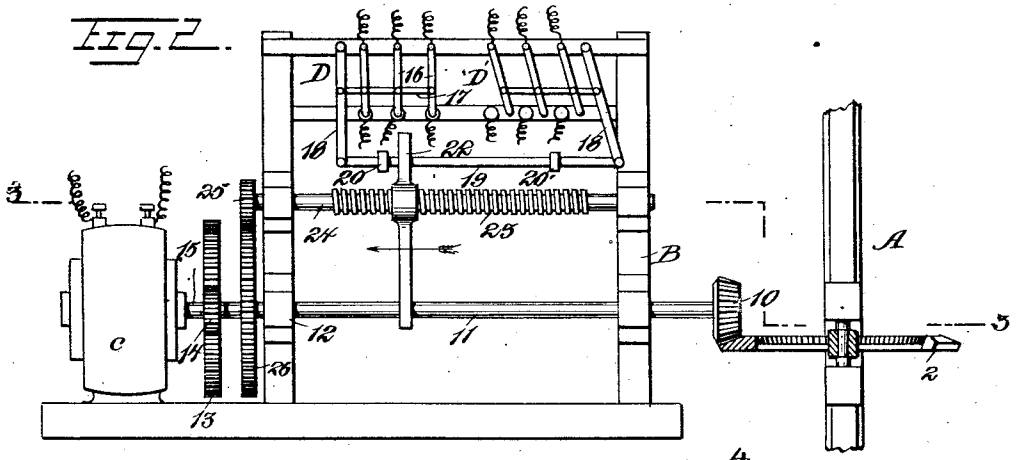


Fig. 3.

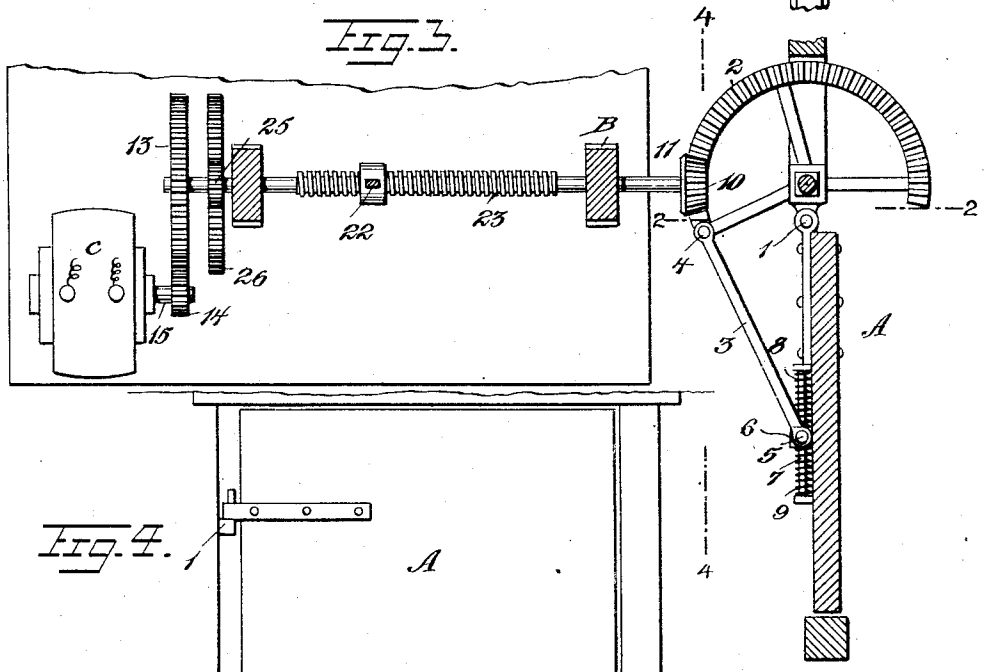
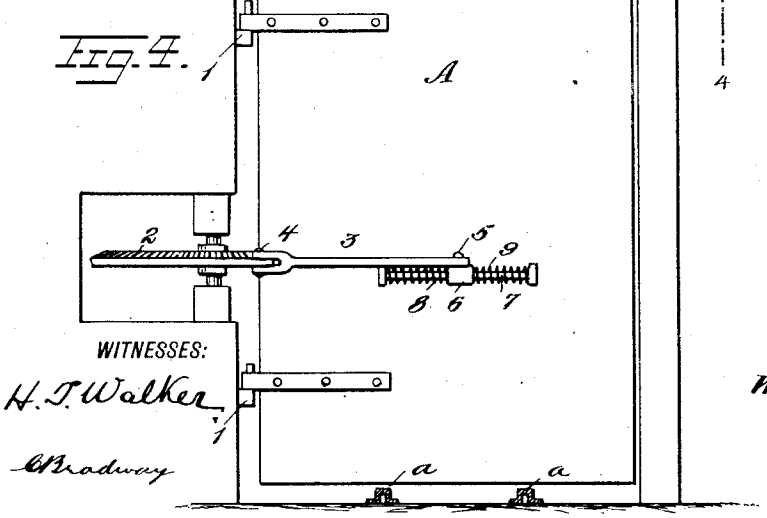


Fig. 4.



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MINE-DOOR-OPERATING APPARATUS.

1,218,404. Specification of Letters Patent. Patented Mar. 6, 1917.

Application filed June 24, 1916. Serial No. 105,557.

To all whom it may concern:

Be it known that I, WILLIAM M. HUMMEL, a citizen of the United States, and a resident of Lewistown, in the county of Mifflin and State of Pennsylvania, have invented a new and Improved Mine-Door-Operating Apparatus, of which the following is a full, clear, and exact description.

This invention relates to automatic door opening and closing apparatus and deals particularly with an apparatus for opening mine or air chamber trap doors and for operating signals to indicate the open or closed position of the door, the apparatus enabling the driver of a car to himself look after the opening or closing of a door and thereby do away with the need of boys for this purpose.

The invention has for its general objects to improve the construction and operation of door actuating means so as to be reliable and efficient in use, comparatively simple and inexpensive to manufacture, and so designed as to enable the car driver to open or close the door from suitable points distant from the door.

A more specific object of the invention is the provision of a motor actuated door, the circuits of the motor being controlled by manually actuated switches disposed along the track and at opposite sides of the door, and motor-actuated reversing switches so that the circuit will be automatically opened after the door is opened or closed and the motor circuit placed in condition for operating the motor when a switch at the far side of the door is actuated by the car driver so as to close the door.

Still another object of the invention is the provision of a novel driving means between the motor and the door for swinging the same opened and closed, such means including a device for automatically actuating the motor reversing switches.

With such objects in view, and others which will appear as the description proceeds, the invention comprises various novel features of construction and arrangement of parts which will be set forth with particularity in the following description and claims appended hereto.

In the accompanying drawings, which illustrate one embodiment of the invention and wherein similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a diagrammatic view of the electrical devices and circuit connections used in conjunction with a mine door and its operating means;

Fig. 2 is a front view of the electric motor, the transmission between it and the door, and the motor reversing switches, portion of the view being shown on the section 2—2, Fig. 3;

Fig. 3 is a horizontal section on the line 3—3, Fig. 2;

Fig. 4 is a side view of a door as viewed from the plane 4—4, Fig. 3.

Referring to the drawing, A designates a mine or air chamber trap door mounted to swing on suitable hinges 1. In the door frame at the hinged side of the door is a segmental gear 2 which serves as an operating crank that is connected by a pitman 3 with the door. The pitman is hingedly connected at 4 with the gear 2 and pivotally connected at 5 with a block 6 which is slidable on a horizontal bar 7 fastened to the door, and at opposite sides of the block are oppositely acting compression springs 8 and 9 carried by the rod 7 so that the pitman will have a yielding connection with the door and compensate for the slight over-travel of the motor shaft.

Meshing with the segmental gear 2 is a pinion 10 mounted on a shaft 11 which is journaled in bearings 12 on the frame B. This shaft has a gear wheel 13 which meshes with a pinion 14 on the shaft 15 of the electric motor *c*. The pinion 14 and shaft 15 and pinion 10 and gear 2 constitute a speed reduction transmitting means between the motor and door. Mounted on the frame B are reversing switches D and D′, each composed of three contacts 16 connected together by a link 17, and the links are in turn connected with a lever 18. These levers are connected with a shift rod 19 which has stops 20 and 20′ which are alternately engaged by the traveler or tappet 22. This traveler 22 is operated by a worm 23, the shaft 24 of which has a pinion 25 which meshes with a gear wheel 26 on the shaft 11, so that the motor will operate the traveler 22 and cause the latter to automatically open the motor circuit and reverse the switches D and D′ one with respect to the other. The movable members of the switches D and D′ are so connected that one switch will be open while the other switch is closed, or vice versa.

In the diagram shown in Fig. 1, *a* designates the rails of a track, and normally extending across the track is the door A. The

opening and closing of the door is primarily controlled by manually operated switches located at suitable distant points from the door. The opening switches are designated O and O′ and the closing switches C and C′, the switch O being closed by a car driver for instance when the door is approached from the left, and after the car or train has passed the open door the switch C on the leaving side of the door is closed so that the door will be automatically closed. When the train is traveling to the left from the right, the switch O′ is first closed to open the door, and then the switch C′ is closed to close the open door after the train has passed. Each manually operated switch comprises a movable contact 27 and a fixed contact 28, the movable contact being connected with a rod 29 which extends along the track and is operatively connected with actuating levers 30 and 31, these levers being suitably spaced apart so that the switches can be conveniently operated from suitable points. It is to be understood that the switches are kept closed only long enough to effect the opening or closing of the door A, and before releasing the levers 30 or 31 the attendant restores them to normal position, or springs 32 may be used for this purpose.

Current is derived from a suitable source (not shown) through positive and negative leads 33 and 34. A wire 35 extends from the lead 33 and has branches 36 and 37 connected respectively with the contacts 28 and 27 of the switches C and C′, the contacts 27 and 28 of these same switches being connected together by a wire 38. The wire 38 is connected by a wire 39 with the contact a of the switch D which is adapted to engage a contact b which is connected by a wire 40 with one terminal 41 of the motor c, and the other terminal 42 of which is connected by a wire 43 with the contact b' of the switch D, this contact being engageable by the switch member a' that is connected by a wire 44 with the lead 43. It will thus be seen that when either switch C or C′ is closed while the switch D is closed, the motor will receive current to cause the same to close the door. A wire 45 connects the lead 33 with the member a^2 of the switch D′, which switch member is adapted to engage a contact b^2 that is connected with one side of the motor by the wire 43, the other side of the motor being connected by the wire 40 with the contact b^3 of the switch D′, and this contact is engaged by the switch member a^3. This switch member is connected with a wire 46 which has branches 47 and 48 that lead respectively to the contacts 27 and 28 of the door-opening switches O and O′, the other contacts of these switches being connected by wires 49 and 50 with a wire 51 that connects with the lead 43. The various instrumentalities shown in Fig. 1 represent a condition in which the door A is closed and the car driver is closing the open switch O on the left-hand side of the door so as to open the latter. Current flows through the closed switches O and D′ and the motor c so as to rotate the same and cause the door to swing open in an anti-clockwise direction, Fig. 1. As the door moves open the traveler 22 shifts toward the abutment 20′ on rod 19 and finally actuates the reversing switches D and D′, closing the latter and opening the former. By this action the motor is cut out of circuit because the switches O and D′ are no longer in series, and although the switch D′ is closed, no manually controlled switch is closed in circuit therewith. As soon as the door is opened the car driver releases the switch O so that it will automatically open. Nothing further is done until the car passes the door and the latter must be closed when the switch C is closed by the car driver so that current will pass through the motor c in the reverse direction by way of the two closed switches C and D in series, and then the door will swing to closed position, and upon reaching this the traveler 22 will engage the stop 20 and cause the switches D and D′ to reverse. As soon as the door is closed the switch C is allowed to open by the car driver releasing it. In case of a car traveling in the opposite direction, that is to say, from right to left, the opening and closing of the door is effected in the same manner, except that the switches O′ and C′ are successively actuated.

The member a^5 of the switch D coöperates with the contact b^5 to open and close a circuit which includes the white signal lamps W located respectively at opposite sides of the door to indicate when the door is open. The switch member a^6 coöperates with a contact b^6 for controlling a circuit in which red lamps are included, which like the others are located at opposite sides of the door and serve to indicate when the door is closed. Thus, when the door is approached from either side, the red lamps will indicate that the door is closed and must be opened by operating either switch O′, and when the door is fully open the circuit of the lamps W will be completed and the circuit of the lamps R opened so that the white lights will show that the door has reached its open position.

From the foregoing description taken in connection with the accompanying drawings, the advantages of the construction and method of operation will be readily understood by those skilled in the art to which the invention appertains, and while I have described the principle of operation, together with the apparatus which I now consider to be the best embodiment thereof, I desire to have it understood that the appa-

ratus shown is merely illustrative and that such changes may be made when desired as fall within the scope of the appended claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. In a door operating mechanism, the combination of a swinging door, a motor, a transmission means between the motor and door, a pair of normally open separate opening and closing switches at each side of the door and suitably remote therefrom, reversing switches, one adapted to be in series circuit with the opening switches and the other in series circuit with the closing switches, one reversing switch being normally open and the other normally closed, and mechanical means separate from the door and driven by the motor and operatively connected with the reversing switches for opening one and closing the other when the door is fully opened or closed.

2. In a door opening and closing apparatus, the combination of a door, an electric motor, a transmission between the door and motor and including a yielding connection with the door, a screw operatively connected with the motor to be driven thereby, reversing switches for controlling the motor, means operatively connecting the switches together, whereby one will be open while the other is closed, a traveler movable by the screw, and means with which the traveler engages when the door is fully opened or fully closed to reverse the switches, normally open manually actuated opening switches at opposite sides of the door and adapted to be in series circuit with one of the first-mentioned switches, and normally open manually actuated closing switches at opposite sides of the door and adapted to be connected in circuit with the other of the first-mentioned switches.

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