A. E. CARVER AND H. HILDENBIDDLE.

SAFETY CONTROL MEANS FOR FURNACE CHARGING APPARATUS.

APPLICATION FILED DEC. 11, 1919.

1,355,453.

Patented Oct. 12, 1920.

2 SHEETS—SHEET 1.

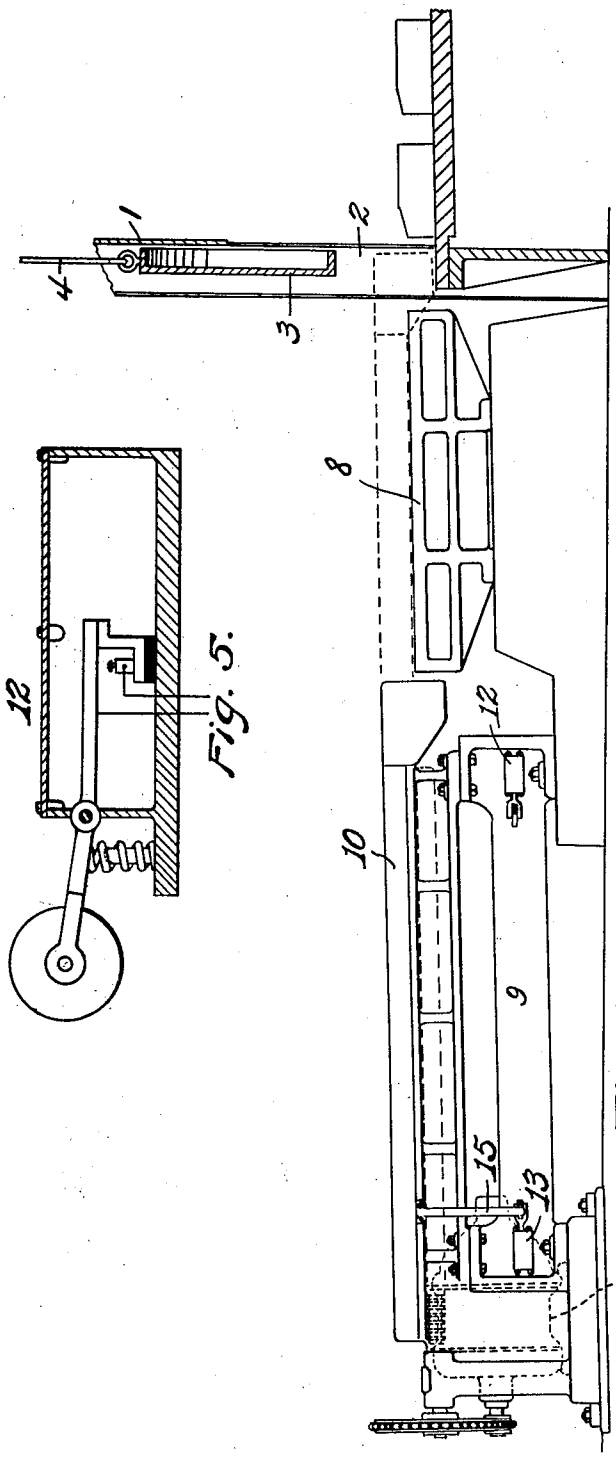


Fig. 1.

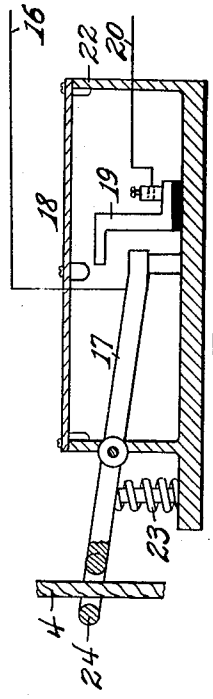


Fig. 4.

Fig. 5.

INVENTORS,
H. Hildenbiddle.
A. E. Carver.
By H. C. Dunlap.
ATTORNEY.

A. E. CARVER AND H. HILDENBIDDLE.

SAFETY CONTROL MEANS FOR FURNACE CHARGING APPARATUS.

APPLICATION FILED DEC. 11, 1919.

1,355,453. **Patented Oct. 12, 1920.**

2 SHEETS—SHEET 2.

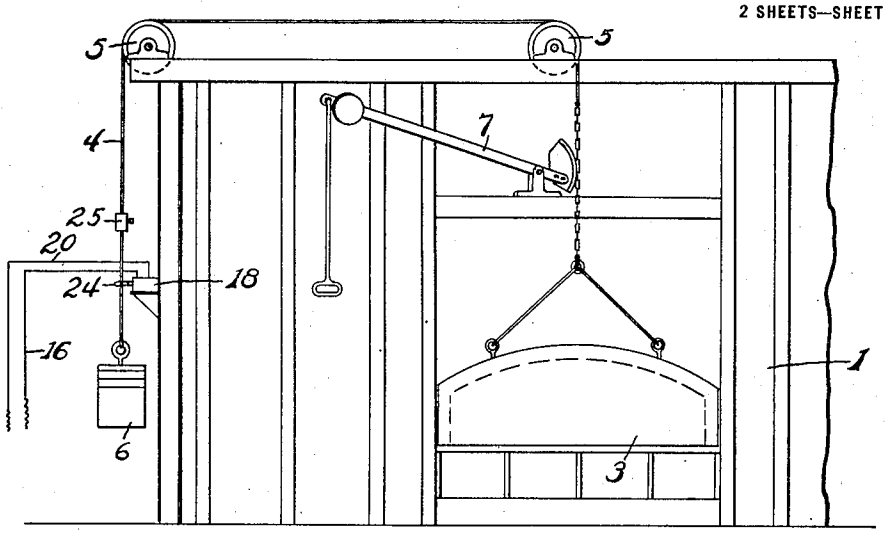


Fig. 2.

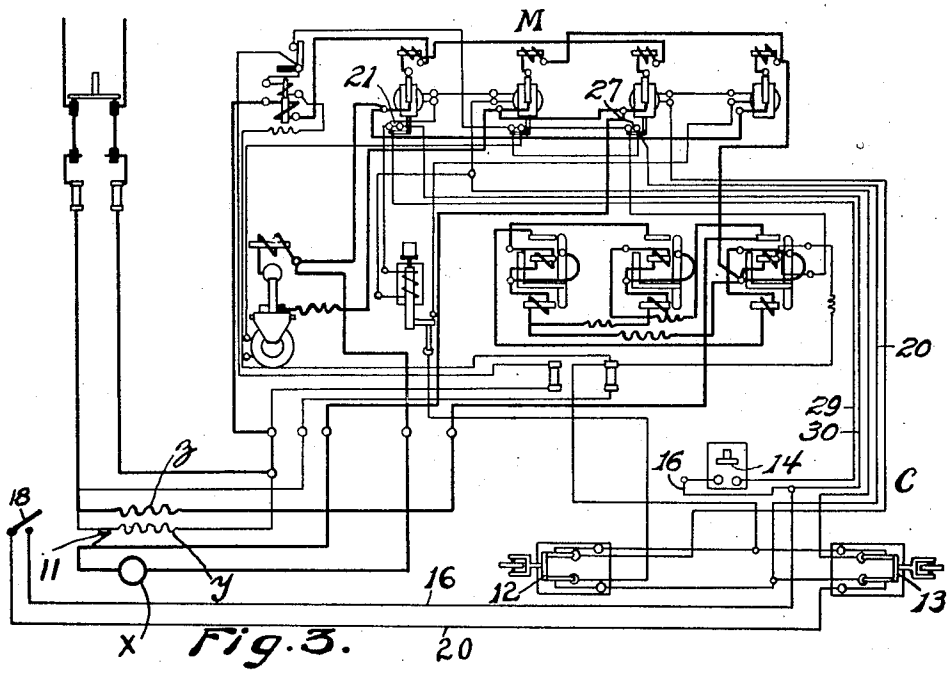


Fig. 3.

WITNESSES,
L. B. Wood

INVENTORS,
H. Hildenbiddle.
A. E. Carver.
By H. E. Dunlap
ATTORNEY.

UNITED STATES PATENT OFFICE.

ALBERT E. CARVER AND HOMER HILDENBIDDLE, OF WHEELING, WEST VIRGINIA.

SAFETY CONTROL MEANS FOR FURNACE-CHARGING APPARATUS.

1,355,453. Specification of Letters Patent. Patented Oct. 12, 1920.

Application filed December 11, 1919. Serial No. 344,581.

To all whom it may concern:

Be it known that we, ALBERT E. CARVER and HOMER HILDENBIDDLE, citizens of the United States of America, and residents of Wheeling, county of Ohio, and State of West Virginia, have invented certain new and useful Improvements in Safety Control Means for Furnace-Charging Apparatus, of which the following is a specification.

This invention relates broadly to furnace charging mechanism, and more specifically to motor control means for the charging devices of rolling-mill furnaces.

The primary object of the invention is to provide in association with an electric control for a motor employed in connection with a furnace charger actuated by such motor, means whereby the motor control circuit is rendered non-closable except when the door of the furnace is in open charge-admitting position.

In rolling-mill-furnace charging mechanisms, as heretofore commonly employed, the control circuits for the motor used to actuate the pusher whereby packs of metal are introduced within the furnace have uniformly been closable irrespective of the position occupied by the furnace door through which the packs are introduced. Consequently, it frequently happens that the pusher is actuated to advance when the furnace door is closed, and this almost invariably results in injury either to the door or to the charging mechanism. Another more or less frequent result of the premature closing of said motor control circuit is injury inflicted upon the operator or attendant in an effort to stop the motor before the pack being advanced by the pusher collides with the closed door.

As hereinbefore indicated, it is a purpose of the present invention to obviate the resultant injuries referred to by the provision of means which render it impossible for the operator to start the advance movement of the pusher prior to the opening of the furnace door. In other words, our principal aim is to provide a safety appliance which effectually prevents accidents of the character mentioned.

A further object is to provide a mechanism of the character mentioned embodying means whereby the lowering of the furnace door, either designedly or by chance, produces instantaneous interruption of the forward travel of the charger, followed by the automatic prompt return of the charger to initial position.

With the above-recited objects in view, the invention resides in the features which will hereinafter be specifically described, reference being had to the accompanying drawings, in which—

Figure 1 is a view showing in side elevation a charging mechanism of a more or less common type disposed in operative relation to the front end of a furnace, the latter being shown in section;

Fig. 2 is a front elevation of the furnace illustrating the application of the invention thereto;

Fig. 3 is a diagrammatic view of the motor circuit and the motor control circuit, the latter embodying the circuit-closing, or motor-starting, switch;

Fig. 4 is an enlarged detail view, in sectional elevation, of the adapted switch; and—

Fig. 5 is a similar view of a limit-switch of the general character commonly employed in motor control systems of the type herein referred to.

Referring to said drawings, in which like designating characters distinguish like parts throughout the several views—

1 indicates the front wall of a rolling mill furnace having therein the usual opening or passageway 2 through which the sheets or packs are introduced. A door 3 is vertically movable into and out of closing relation to said passageway, the same being suspended upon one end of a chain or cable, as 4, carried by pulleys or sheaves 5 and having a counterweight 6 suspended upon its opposite end which is located in an appropriate vertically movable position, as adjacent to one of the side-walls of the furnace. A conveniently located operating lever, as 7, is associated with said chain or cable 4 whereby the latter may be manually shifted for elevating and lowering the door 3.

Located directly in front of the door-opening 2 is a stationary rack 8 upon which the sheets or packs to be introduced in the furnace are preliminarily deposited; and located in front of said rack is a charging mechanism, herein designated generally by the numeral 9, which may be of any appropriate or ordinary type embodying a longitudinally reciprocating pusher or charger 10 whereby sheets or packs carried by said rack may be pushed or thrust from the latter through said door-opening. Such charging mechanism also includes an electric motor 11 whereby said charger 10 is actuated to advance for performing its function and to return.

The motor 11, embodying the armature x, shunt field y and series field z, shown in Fig. 3, has connected therewith a suitable system of electric control embodying therein a motor circuit, herein designated generally by the reference letter M, and a control circuit, herein designated generally by the letter C, said control circuit being associated with said motor circuit and including limit switches 12 and 13 located upon the frame of the charging mechanism 9 and adapted to be engaged, respectively, at the forward and rearward limits of movement of the charger 10 for opening said control circuit, whereby said motor is stopped.

While the entire motor circuit M, illustrated diagrammatically in heavy lines in Fig. 3, and almost all of the control circuit C, illustrated in light lines in said figure, including the limit switches 12 and 13, constitute a standard type or system of control employed in furnace charging apparatus and generally known as the Cutler-Hammer installation, it will be understood that such system is not essential to the present invention, the same being herein employed as illustrative merely of a system or type of control to which our invention is readily applicable.

Included in the control circuit C is a normally open, manually-closable switch 14, preferably of the push-button type, embodying a spring-pressed button-contact. The momentary closing of said switch 14 accomplishes the closing of the motor circuit in a manner well understood by those skilled in the art, with resultant starting of the motor 11 and advance of the pusher 10. Once so started, the pusher is propelled forward until, at the limit of its forward movement, a finger-like element, or shifter, 15 carried by said pusher engages the forward limit switch 12 and shifts the latter, or the shiftable element thereof, thus opening the motor circuit, permitting the motor to stop. When the timing switch embodied in the circuits mentioned has performed its function, which is to close the reversing circuit, the motor is started in the reverse direction, returning said pusher to its original position. When said original position is reached, the shifter 15, or an equivalent device, engages the rear limit switch 13 and shifts or deflects the latter, or the shiftable element thereof, to motor-circuit-opening position, thereby stopping the motor.

One of the conductor wires, as 16, leading to the push-button switch 14, which will hereinafter be termed the "starting switch," leads from a movable contact 17 composing a part of a switch which is herein generally designated by the numeral 18 and which will herein be termed the "adapter switch." Said adapter switch also includes a fixed contact 19 to which current is conducted by a wire 20 leading from one pole, as 27, of the control circuit through the two limit switches 12 and 13. The opposite contact member of said starting switch 14 is connected to a pole 21 of the control circuit by a wire 29, and the companion pole of said circuit is connected by a wire 30 to the said conductor 16.

As is obvious, it is impossible to close the control circuit while the adapter switch 18 remains open. Further, closing of said adapter switch serves only to prepare said circuit for closing, as the starting switch 14 must be subsequently closed to effect closing of said circuit.

The movable member or contact 17 of the adapter switch is of pivoted lever form, being mounted in a suitable manner as upon a casing 22 which incloses the contact-making portions of the switch. Said contact is yieldably supported out of engagement with its companion contact 19, as by means of a spring 23, the outer or projecting end thereof being normally held by said spring in an elevated position. A ring or loop 24 is preferably carried by said projecting end of said contact 17, and depending vertically through and freely movable in said ring is the counterweight-supporting end of the chain or cable 4 upon the opposite end of which the door 3 is suspended as aforesaid. A trip member 25 is fixed upon said cable in such position that, when the door 3 is fully opened, it rests upon said ring 24 and holds the contact 17 against the tension of its supporting spring 23 in engagement with the fixed contact 19 of the adapter switch, thus adapting the control circuit for closing, or rendering said circuit closable through closing of the starting switch.

Another important advantage attained by locating the safety switch in the starting circuit is that the furnace door may be closed instantly following the withdrawal of the charger head to a point clearing the door opening, whereas, were said switch located in the motor circuit, it would be neces-

sary that the furnace door be kept open until the charger returned to its neutral, or initial, position, during which time cold air would be permitted to freely rush into the furnace through the open door.

With the safety, or adapter, switch located in the starting circuit, the forward travel of the charger may be instantly stopped at any point by lowering the furnace door. The opening of the safety switch effected through closing movement of the door to the extent that the contacts of said switch are separated, is productive not only of instant stoppage of the motor, but also of a reversal of the motor and charger precisely as if the charger had reached the forward limit of its movement, this being due to the fact that, when the adapter switch is opened, the forward propulsion portion of the motor circuit is opened through the limit switch 13 precisely as when the last mentioned switch is opened through engagement with the shifter 15, after which the timing switch functions to close the reversing circuit, starting reversal of the motor. In practice, the opening of the adapter switch, effected through dropping of the door by manual operation of the lever 7, constitutes the only means herein disclosed by which the charging mechanism, once started, can be stopped prior to the completion of its cycle of operation.

From the foregoing it will be readily apparent that the furnace door must be fully opened preliminary to starting the forward movement of the charger. Until such preliminary step is performed the control circuit is not in condition to be closed by the closing of the starting switch. It is obvious, therefore, that the danger of breakage of the furnace door and derangement or injury to the charging mechanism resulting from carelessness or inattention to duty on the part of the operator is effectually eliminated by the provision of the invention herein described.

What is claimed is—

1. The combination with a furnace having a door, of a reciprocable charger for said furnace, an electric motor for actuating said charger, a motor control system embodying a motor circuit and a control circuit, said motor circuit being closable and rendered operative independent of said control circuit by momentary closing of said control circuit and embodying automatically shiftable means whereby the motor is stopped and reversed at the end of the forward stroke of the charger and whereby said motor circuit is reopened at the end of the return stroke of the charger, said control circuit having therein two normally open switches of which one is an adapter switch adapted to be closed by movement of the furnace door to open position, and the other is a starting switch ineffective for closing said circuit prior to the closing of said adapter switch and is manually closable, said starting switch being adapted for momentary closing following which it automatically resumes its open position.

2. The combination with a furnace having a door, of a reciprocable charger for said furnace, an electric motor for actuating said charger, a motor control system embodying a motor circuit and a control circuit, said motor circuit being instantly closable and rendered operative independent of said control circuit by momentary closing of said control circuit and embodying automatically shiftable means whereby the motor is stopped and reversed at the end of the forward stroke of the charger and whereby said motor circuit is reopened at the end of the return stroke of the charger, said control circuit being ineffective except to initially close said motor circuit and including therein an adapter switch closable only by movement of the furnace door to open position, and also including a manually closable circuit-completing switch which is ineffective for closing said control circuit prior to closing of said adapter switch and which, following closing of said circuit immediately resumes its circuit-opening position and remains functionless during the entire reciprocation of the charger.

3. The combination with a furnace having a door, of a reciprocable charger for said furnace, an electric motor for actuating said charger, a motor control system embodying a motor circuit and a control circuit, said motor circuit being closable and rendered fully operative independent of said control circuit by momentary closing of said control circuit and embodying automatically shiftable means whereby the motor is stopped and reversed at the end of the forward stroke of the charger and whereby said motor circuit is reopened at the end of the return stroke of the charger, and means in said control circuit whereby the aforesaid momentary closing of said control circuit may be effected, the last-mentioned means consisting of a switch closable by opening of the furnace door and remaining closed during the interval in which said door is opened, and a manually closable self-opening switch which requires only momentary closing.

4. The combination with a furnace having a door, charging mechanism for said furnace, and an electric motor for actuating said mechanism, of a motor control system embodying a motor circuit and a control circuit, said motor circuit including means whereby said motor is actuated to propel said charging mechanism throughout a complete cycle of

operation, a normally open adapter switch located in said circuit, means actuated by movement of said furnace door to open position whereby said switch is closed, a manually closable switch in said control circuit, said starting switch being operative for closing said control circuit only when said adapter switch is closed, and means adapted to be actuated by opening of said adapter switch following closing of said control and motor circuits whereby said motor is stopped and reversed for stopping advance movement of said charging mechanism and for returning the latter to initial position.

In testimony whereof we affix our signatures in presence of two witnesses.

ALBERT E. CARVER.
HOMER HILDENBIDDLE.

Witnesses:
THOS. J. RUDGE,
H. E. DUNLAP.