April 5, 1932. A. F. GIESE, JR 1,852,559

MUD GUN

Filed March 13, 1930

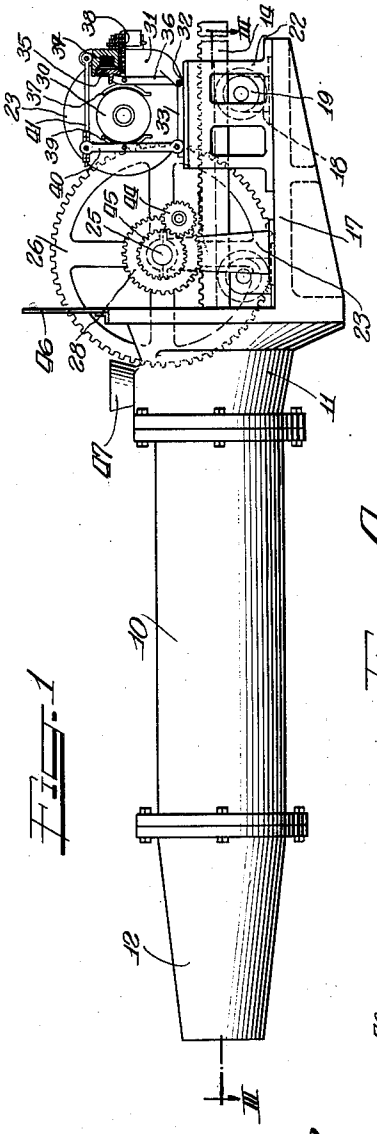

Fig. 1

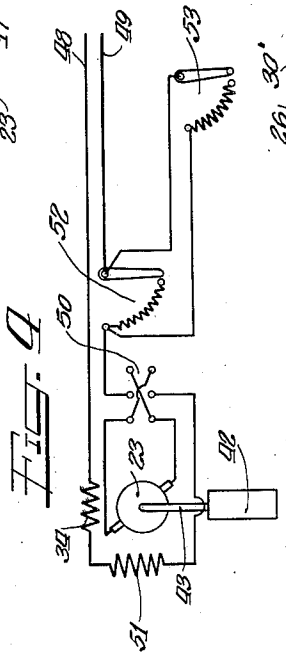

Fig. 4

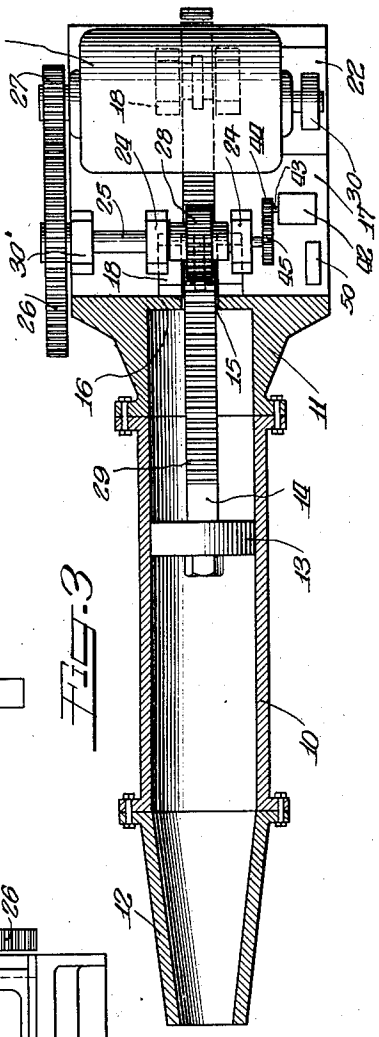

Fig. 3

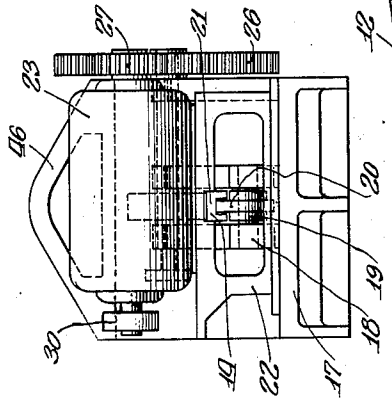

Fig. 2

Inventor:
August F. Giese Jr.
By: Charles W. Hills
Atty.

Patented Apr. 5, 1932 1,852,559

UNITED STATES PATENT OFFICE

AUGUST F. GIESE, JR., OF GARY, INDIANA

MUD GUN

Application filed March 13, 1930. Serial No. 435,435.

My invention relates to clay guns which are particularly applicable and useful for plugging up the tapping holes of blast furnaces to shut off the flow of molten metal therefrom.

An important object of my invention is to provide electrically driven means for actuating the clay ejecting plunger of the gun.

A further object of the invention is to provide a rack driven by an electric motor for shifting the plunger in the gun barrel.

Still another object is to provide electric motor driven means for actuating the plunger, together with means for controlling the motor circuit at the gun or from a remote point.

Another object is to provide means for automatically controlling the motor circuit to stop the motor when the plunger reaches the ends of its strokes.

Still another object is to provide brake mechanism, automatically controlled by the current flow for the motor to brake the motor as soon as the supply current flow is withdrawn therefrom.

A still further object is to provide electrically driven actuating means which can be applied to single cylinder guns or to multiple cylinder guns, together with means for independently controlling the operation of the plungers of the cylinders.

The various features of my invention are incorporated in the structure enclosed on the drawings, in which drawings:

Figure 1 is a side elevation of a gun;

Figure 2 is an end elevation;

Figure 3 is a section on plane III—III of Figure 1; and

Figure 4 diagrammatically shows a circuit arrangement for controlling the operation of the motor.

The gun shown comprises a main barrel or cylinder section 10 secured at one end to the head 11 and at its other end having secured thereto the outlet nozzle 12. Reciprocal within the parts 10 and 11 is a plunger or piston 13 which is secured to the inner end of a rack bar 14 which extends through an opening 15 in the end wall 16 of the head 11.

The head 11 supports a platform 17 on which is mounted the driving apparatus for the rack bar. Mounted on this platform are journalled boxes 18 which journal guide rollers 19 whose guide flanges 20 engage in the guide channel 21 formed in the under side of the rack bar.

At the outer end of the platform is mounted a supporting base or frame 22 through which the rack bar extends and which supports an electric motor 23. Between the motor and the head 11, the platform supports the bearing brackets 24′ and 24 which journal a shaft 25 carrying at one end a gear 26 which meshes with the pinion 27 on the armature shaft of the motor. Between the bearing brackets the shaft carries a pinion 28 which meshes with the rack teeth 29 cut in the upper side of the rack bar, so that, when the motor operates, the rack bar will be shifted at reduced speed to cause the plunger 13 to travel in the gun barrel. To support the outer end of the shaft 25, another bearing bracket 30′ may be provided.

At its other end the armature shaft of the motor carries a brake pulley or drum 30 with which brake structure is associated for automatically braking the motor when the supply current flow is withdrawn therefrom. Such brake structure may be electrically controlled and of the type shown, which is well-known in the art. Briefly, it comprises the field frame 31 pivoted at its lower end as indicated at 32 to a base 33, this field frame carrying an energizing winding 34. The armature 35 is supported on a lever 36 which is hinged concentric with the pivot axis 32, and this lever carries the brake shoe 37. A spring 38 tends to separate the armature and the field frame and swing the lever to apply the brake shoe to the brake drum.

An opposed brake shoe 39 is secured to a lever 40 pivoted at its lower end on the base 33 and having its upper end connected by a rod 41 with the upper end of the field frame. The field winding 34 is connected to receive current when the motor is connected in circuit for operation, and the armature is then attracted against the force of the spring 38, so that the brake shoes will be released from the brake drum. Upon cessation of current flow through the winding the armature will be released and the spring will tend to separate the armature and field frame, and the movement of the field frame is communicated to the rod 41 through the lever 40, the result being that the brake shoes will then be applied to the brake drum to brake the motor.

I also preferably provide a limit switch structure 42 for controlling the motor circuit to stop the motor when it reaches the inner end of its stroke in the head 11 and also when it reaches the outer end of its stroke in the barrel section 10. Such limit switch of itself forms no part of my invention. It may be of a well-known construction, as for example, the Cutler-Hammer type, comprising circuit controlling switch mechanism operated from a screw shaft 43 which, in this case, terminates in a pinion 44 which meshes with a gear 45 on the end of the shaft 25 which is driven by the motor. The connection is such that the limit switch will be driven when the motor is operated and will control the motor circuit to stop the motor automatically when the plunger reaches the set limits of its travel in the gun barrel.

The gun may be supported in various ways to be moved into operative position relative to the furnace tapping outlet. It may be provided with a hanger 46 by means of which it may be suspended from a crane. The head part 11 is provided with a hopper 47 through which a charge of clay may be loaded into the gun barrel.

Normally, the piston or plunger is at the inner end of its travel adjacent to the end wall 16 of the head and behind the feed hopper 47. A charge of clay is then fed into the barrel in advance of the plunger and, after the gun has been properly positioned in front of the tapping hole to be plugged, the motor is started and the charge of clay is ejected therefrom through the nozzle 12 and into the tap hole.

Just before the plunger reaches the nozzle section of the barrel, the limit switch will become effective to shut off the current from the motor and the brakes then become effective to immediately stop the motor.

In Figure 4, I have shown more or less conventionally a circuit diagram for controlling the general operation of the motor. Current is supplied from a suitable supply source (not shown) through the mains 48 and 49. I have shown a series motor and some suitable means for reversing the direction of rotation of the motor, as for example, an ordinary reversing knife switch 50. The mains 48 and 49 connect with the inner contacts of the switch, the main 48 serially including the motor field winding 51 and the energizing winding 34 of the electric brake. The inner contacts of the switch are connected with the armature of the motor, so that, as the switch is set from one position to the other in the well-known manner the current flow through the armature will be reversed to thus reverse the direction of rotation of the motor.

For starting the motor and controlling the speed thereof a suitable rheostat 52 is included in the supply circuit and located preferably on the motor supporting platform. For controlling the motor from a distance, a similar rheostat structure 53 may be provided. The limit switch structure 42 will be connected to cooperate in the well-known manner with the general motor circuit and controlling means so that the motor will be automatically stopped when the plunger reaches the set limits of travel in the gun barrel.

It is to be understood, of course, that the circuit shown is conventional and diagrammatic to illustrate only the general operation of the motor and control, and that in practice more elaborate circuit arrangement and controlling apparatus will be used.

It is evident that instead of using a single cylinder large enough to accommodate sufficient clay to permit the stopping of a tapping hole of a blast furnace in one operation without withdrawing the clay piston in order to permit the reloading or adding of additional clay to what is already in the cylinder, two or more cylinders may be used connected with a common nozzle and with plungers individually controlled by electrical driving mechanism either one at a time or together at the same time.

Other changes and modifications, both in structure and operation, are also possible without departing from the scope and principles of the invention, and I, therefore, do not desire to be limited except as specified in the appended claims.

I claim as follows:

1. In a clay gun, the combination of a barrel, a plunger reciprocable within said barrel to eject material therefrom, an electric motor, a driving train between said motor and plunger, a circuit for said motor, means local to said gun for controlling said circuit, and means remote from said gun for controlling said circuit.

2. In a device of the class described, the combination of a barrel, a plunger reciprocable therein for ejecting material therefrom, an electric motor, a circuit for said motor, a driving train between said motor

and plunger, rheostat means local to said gun for controlling the motor circuit, remote rheostat means for controlling said circuit, and a limit switch driven by said motor for automatically controlling said circuit to cause stopping of the motor when said plunger reaches the end of its stroke in said barrel.

3. In a clay gun, the combination of a barrel, a plunger reciprocable therein for discharging material therefrom, an electric motor, a driving train between said motor and plunger, manually operable means for controlling the circuit of said motor, and a limit switch driven by said motor for automatically controlling said circuit to stop the operation of said motor when said plunger reaches the ends of its strokes in said barrel.

4. In a device of the class described, the combination of a barrel structure having a discharge nozzle and an inlet for material, a plunger reciprocable within said barrel for discharging material therefrom through said nozzle, an electric motor, a driving train between said motor and plunger, a circuit for said motor, and switch mechanism operated by said motor in timed relation therewith for controlling the length of stroke of said plunger.

5. In a clay gun of the class described, a barrel adapted to receive a charge of clay, a plunger reciprocable in the barrel for ejecting clay therefrom, and means for reciprocating said plunger including a rack extending into said barrel and connected to said plunger, a gear element meshing with said rack and driving means for actuating said element to reciprocate said rack.

6. In a clay gun of the class described, a barrel adapted to receive a charge of clay, a plunger reciprocable in the barrel for ejecting clay therefrom, and means for reciprocating said plunger including a rack extending into said barrel and connected to said plunger, a gear element meshing with said rack, driving means for actuating said element to reciprocate said rack, said driving means including reduction gearing for causing a slow but powerful reciprocating movement to be imparted to said rack and plunger, and means for guiding said rack in its aforesaid movement.

7. In a clay gun of the class described, a barrel, a plunger reciprocable within said barrel for discharging material therefrom, an electric motor, a driving train between said motor and plunger, a circuit for said motor, and a limit switch driven by said motor for automatically controlling said circuit to stop the operation of the motor when the plunger reaches predetermined positions within said barrel.

8. In a clay gun of the class described, a barrel having a discharge outlet, a plunger reciprocable within said barrel for discharging material through said outlet, an electric motor, a driving train between said motor and plunger, a circuit for said motor, and switch mechanism automatically operable for controlling said circuit so as to effect operation of said motor to enable predetermined distances of travel of said plunger in said barrel.

In testimony whereof I have hereunto subscribed my name at Gary, Lake County, Indiana.

AUGUST F. GIESE, JR.