March 5, 1929. G. P. McMANAMNA 1,704,623

REFRACTORY GUN

Filed Feb. 8, 1928.

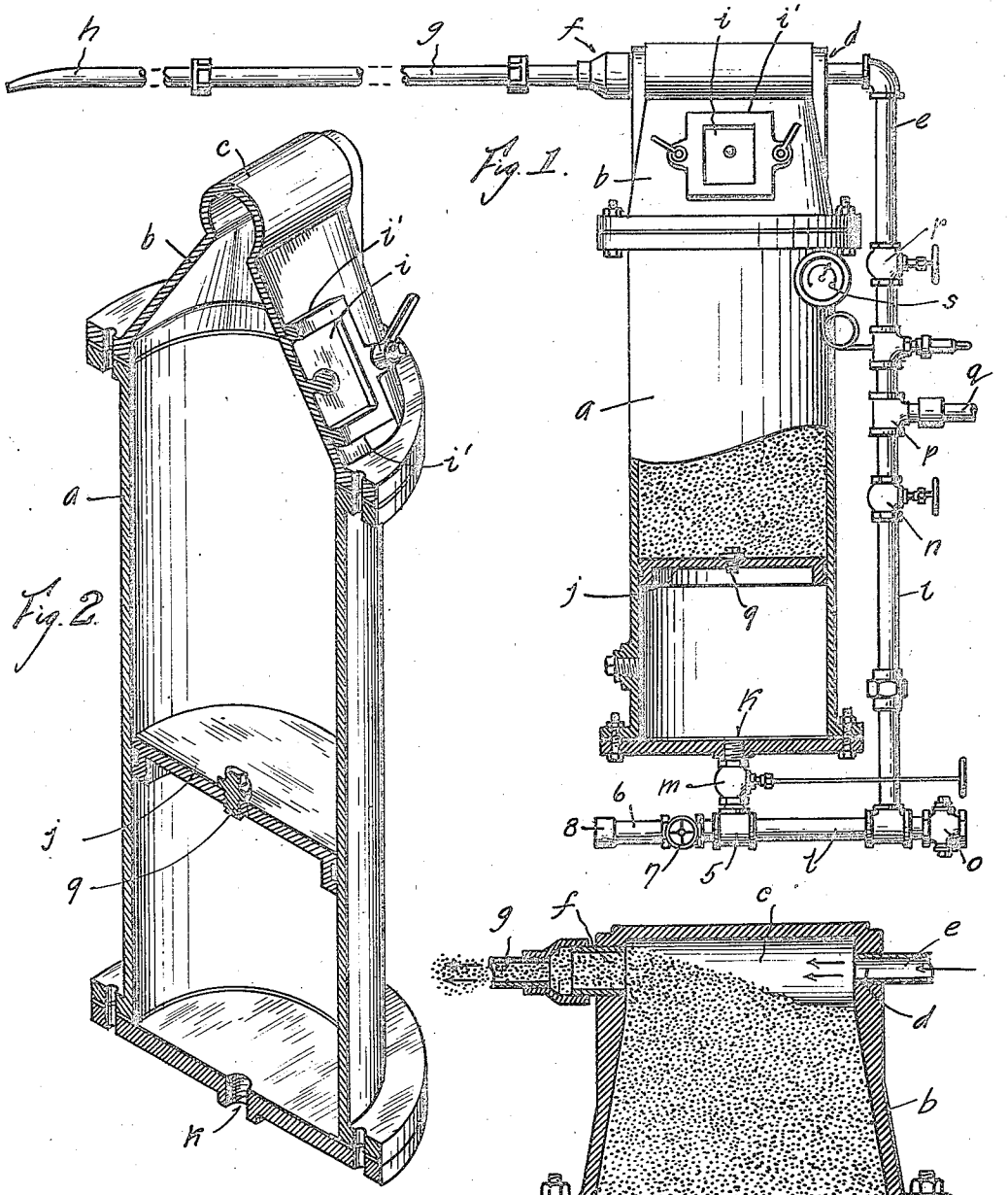


Fig. 1.

Fig. 2.

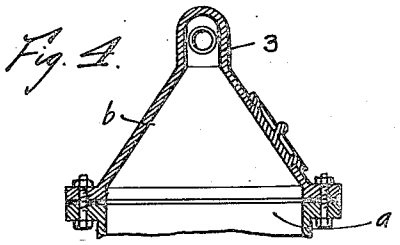


Fig. 4.

Fig. 3.

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UNITED STATES PATENT OFFICE.

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REFRACTORY GUN.

Application filed February 8, 1928. Serial No. 252,806.

My invention relates especially to the so-called refractory guns having for its purpose the spraying of a plastic material upon the walls of a combustion chamber, for relining the same and restoring them to function properly after having been worn away in service.

My invention incidentally relates to devices employed for coating any wall surface with a cementitious material.

The average boiler or industrial furnace burns out the fire brick lining at the rate of one-fourth to one-half an inch a month, in the "heavy duty" zones or parts of the furnace where the greatest wear takes place; and some furnaces will double this average wear.

The re-surfacing of the fire brick lining when done by hand is a slow process, and so there has, heretofore, been devised a so-called refractory gun which was employed for applying the spray or coating of the plastic material to restore the burnt away wall surfaces; and such refractory guns do the work better than can be done by hand.

But these devices, as known to me, do not work satisfactorily nor efficiently, because it is necessary to make the plastic mixture with an excess of water, in order to render it thin enough for use in said refractory guns.

In other words, the plastic material, if made of the proper consistency was too heavy or stiff to be forced through the limited outlet in the gun by the employment of air under pressure, or secondary air blast, as such pressure is commonly referred to.

In order to overcome such result and render the plastic mixture usable for the refractory gun it was, therefore, necessary to intermix therewith an excess of water, to render the composition thin enough to permit it being forced through the restricted outlet of the refractory gun. But when so doing the following difficulties were created:

The excess water materially weakened the bonding strength of the high temperature cement, causing it to separate and fall off. Obviously, a patch that will not stick is no repair at all.

This excess water has to be evaporated out of the patch, which causes excessive and objectionable shrinkage developing large cracks in the patch after the furnace has been fired.

Due to the excess water, the sprayed on refractory material will not build or pile up on the wall, much over a quarter of an inch at a time, being so wet it runs down the wall or drops off entirely, which slows up the operation, as it is necessary to wait considerable time after each application for the material to dry sufficiently to take the next coat; and it will be readily seen this is a serious objection for the time element is paramount in such work.

Restoration of furnace walls sometimes necessitates rebuilding to a depth of three or four inches, and to wait for each coat of one quarter to three eighths of an inch to dry means considerable loss of time, in addition to the time required to dry out the vast amount of excess water.

Further, the time required in emptying the gun is too long to be economical of even the labor required, not to mention the loss due to the time the plant is out of use.

The object of my invention is to provide a refractory gun, adapted to spray plastic material of the proper consistency without clogging or creating air pockets within itself while it is discharging which would tend to prevent the mixture from flowing uninterruptedly through the discharge orifice.

A further object of my invention is to provide a refractory gun of simple construction and which will operate in an efficient manner.

I attain my object, in a gun of the character described comprising the combination of a container provided with a head constituting a surge chamber, said head having converging walls terminating in a tubular elongate projection chamber arranged transverse of the axis of the container, the surge chamber and the projection chamber being connected by an elongate opening in combination with means for elevating the plactic material in the container into the said head, and means for applying fluid pressure to project the material from the said projection chamber.

Further details of my invention and the

construction and operation thereof are hereinafter fully described with reference to the accompanying drawings, in which:

Fig. 1 shows a side elevation of my invention partly in section and illustrates the details of construction thereof.

Fig. 2 shows a longitudinal, sectional perspective view of the container and head and illustrates the proportions of the projection chamber.

Fig. 3 shows a fragmentary, section of the removable head taken longitudinally through the projection chamber and illustrates diagrammatically the movement of the plastic material and the action of the secondary air blast.

Fig. 4 shows in a fragmentary, transverse section a modification in the form of the projection chamber.

With reference to the figures my refractory gun comprises a cylindrical container *a* provided with a removable head *b*, circular at its base, but the walls converging upwardly, forming a wedge-shaped surge chamber terminating in an elongate cylindrical projection chamber *c* transverse of the vertical axis of the container.

Ports are provided at each end of the said projection chamber, forming respectively, an inlet orifice *d*, connected with a fluid pressure line *e*, which provides the secondary air blast, and a discharge orifice *f* connected to a suitable hose, *g*, provided at its end with a nozzle *h* through which the plastic material from the container is discharged.

A filling door *i* is provided in one of the sidewalls of the head provided with offset flanges *i'*, in order that the said door may be seated flush with the interior surface of the wall and at the same time provide a fluid tight closure without obstructions on its interior surface to the movement of the material through the head.

A free moving piston *j* is provided in the container *a* and an orifice *k* is provided in the bottom of the container, connected with a pressure line *l* in which are provided shut-off valves *m* and *n* and an exhaust valve *o*, arranged between them, the exhaust valve serving to release the pressure under the piston and permit it to return to the bottom of the container, by gravity.

The pressure lines *e* and *l* are connected by a T *p* to the main pressure line *q*. A shut-off valve *r* is also provided in the pressure line *e* and a pressure gauge *s* is connected to the pressure line *e* on the intake side of the valve *r*.

In the operation of my refractory gun, the valves *m*, *n* and *r* being closed and the fluid pressure shut off, the plastic, integrally mixed material is loaded into the container through the door *i* and filled up to the base of the head *b*, the piston *g* resting on the bottom of the container.

The container being loaded and the door *i* tightly closed and the work ready to be started, the valves *m*, *n* and *r* are opened, the exhaust valve *o* being already closed, and fluid pressure is permitted to enter the container, beneath the piston *g*, forcing it upward and the plastic material into the head *b*, and the secondary air blast entering the projection chamber through the orifice *d*, blows the plastic material out through the orifice *f*, the hose *g* and nozzle *h*, as a spray onto the surface being coated.

When the plastic material is all discharged from the gun which will be in approximately two minutes, the valves *m*, *n* and *r* are shut off and the exhaust valve *k* is opened which permits the pressure in the container to escape and the piston to return by gravity to the bottom of the container.

To repeat the operation, the container will again be filled, the exhaust valve closed, and the valves *m*, *n* and *r* opened and the work of lining a furnace wall with refractory material may go on.

Thus it may be plainly seen that in the work of lining the furnace walls of industrial plants, in which the time element is of importance, will be carried on rapidly and efficiently, with only the necessary interruption for filling the container.

Also, by providing the head or surge chamber *b* of the container with converging walls and an elongate, cylindrical projection chamber, the plastic material being forced into it by the upward pressure of the piston *j*, will not be retarded by any obstructions on the said walls and further by constructing the angle of convergence at the angle of rest of the plastic material, the friction with the walls is materially reduced, and any tendency of the plastic material to form air pockets or cross currents is avoided, which would result in the material not being delivered through the outlet orifice continuously, causing the flow therefrom to be uneven and contain more moisture sometimes than others.

The tendency of the material to be compressed to too great a degree and to squeeze out some of the moisture by the compression of the material into a smaller volume is also avoided, the area of the inlet of the projection chamber being four times as great as the cone shaped head of the refractory guns of the type now in general use.

Further by providing an elongate projection chamber with an inlet orifice at one end admitting a secondary air blast and the outlet orifice at the other, the plastic material is rapidly picked up as it enters the projection chamber and atomized and blown out the outlet orifice and through the hose, as illustrated in Fig. 3.

This action is further accelerated by forming the projection chamber nearly cylindri-

cal in cross section, which permits a slight expansion of the material, so that it may be more rapidly blown out and in a finer spray and further avoids the tendency to squeeze out some of its moisture content and cause the plastic material to be too dry and stick and clog the projection chamber.

In Fig. 4 is shown a modification of the head *b*, in which the projection chamber 3 is not cylindrical, the side walls being parallel, thereby providing an increased area for the admission of the material therein, but at the same time permitting the plastic material to expand slightly in the increased cross sectional area.

A T 5 is provided in the connection of the pressure line to the valve *m* and a short pipe section 6 is connected thereto, provided with a valve 7 and a cap 8.

By this means the hose *g* may be removed from the outlet orifice *f* and connected to the pipe section 6, the cap 8 then being screwed over the orifice *f*, and a plug 9 provided in the piston *j* will be removed, the piston being permitted to rest on the bottom of the container *a*, the container then being filled with dry sand.

By closing the valve *n* and opening the valves *m*, *r* and 7, the sand may be blown out through the hose *g* and my refractory gun used for sand blasting, which is an efficient method of preparing wall surfaces for receiving a coating of refractory or cementitious material.

I claim:

1. In a sprayer for plastic material, a container provided with a head constituting a surge chamber, said head having converging walls terminating in a tubular elongate projection chamber arranged transverse of the axis of the container, the surge chamber and the projection chamber being connected by an elongate opening, in combination with means for elevating the plastic material in the container into the said head, and means for applying fluid pressure to project the material from the said projection chamber.

2. In a sprayer for plastic material, a container provided with a head constituting a surge chamber, said head having converging walls terminating in a tubular elongate projection chamber arranged transverse of the axis of the container, the surge chamber and the projection chamber being connected by an elongate opening, the cross sectional area of the projection chamber being greater than the width of said opening, in combination with means for elevating the plastic material in the container into the said head, and means for applying fluid pressure to project the material from the said projection chamber.

3. In a sprayer for plastic material, a container provided with a head constituting a surge chamber, said head having converging walls terminating in a cylindrical elongate projection chamber arranged transverse of the axis of the container, the surge chamber and the projection chamber being connected by an elongate opening, the diameter of the projection chamber being greater than the width of said opening, in combination with means for elevating the plastic material in the container into the said head, and means for applying fluid pressure to project the material from the said projection chamber.

4. In a sprayer for plastic material the combination of a container provided with a removable head constituting a surge chamber, said head having converging walls terminating in a tubular elongate projection chamber arranged transverse of the axis of the container, the surge chamber and the projection chamber being connected by an elongate opening and a fluid pressure pipe connected to one end of said projection chamber, the opposite end of the latter being adapted to have a delivery pipe attached thereto.

5. In a sprayer for plastic material the combination of a container provided with a head constituting a surge chamber, said head having converging walls terminating in a tubular elongate projection chamber arranged transverse of the axis of the container, the surge chamber and the projection chamber being connected by an elongate opening and one of said converging walls provided with a door.

6. In a sprayer for plastic material the combination of a container provided with a head constituting a surge chamber, said head having converging walls terminating in a tubular elongate projection chamber arranged transverse of the axis of the container, the surge chamber and the projection chamber being connected by an elongate opening and one of said converging walls provided with a door whose inner surface is flush with the interior surface of such wall.

7. In a sprayer for plastic material the combination of a container provided with a head constituting a surge chamber, said head having converging walls terminating in a tubular elongate projection chamber arranged transverse of the axis of the container, the surge chamber and the projection chamber being connected by an elongate opening, a fluid-pressure pipe connected to one end of said projection chamber, the opposite end of the latter being adapted to have a delivery pipe attached thereto and the cross section of the projection chamber being greater than that of said fluid pressure pipe.

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