

April 22, 1947.

S. B. MAURER

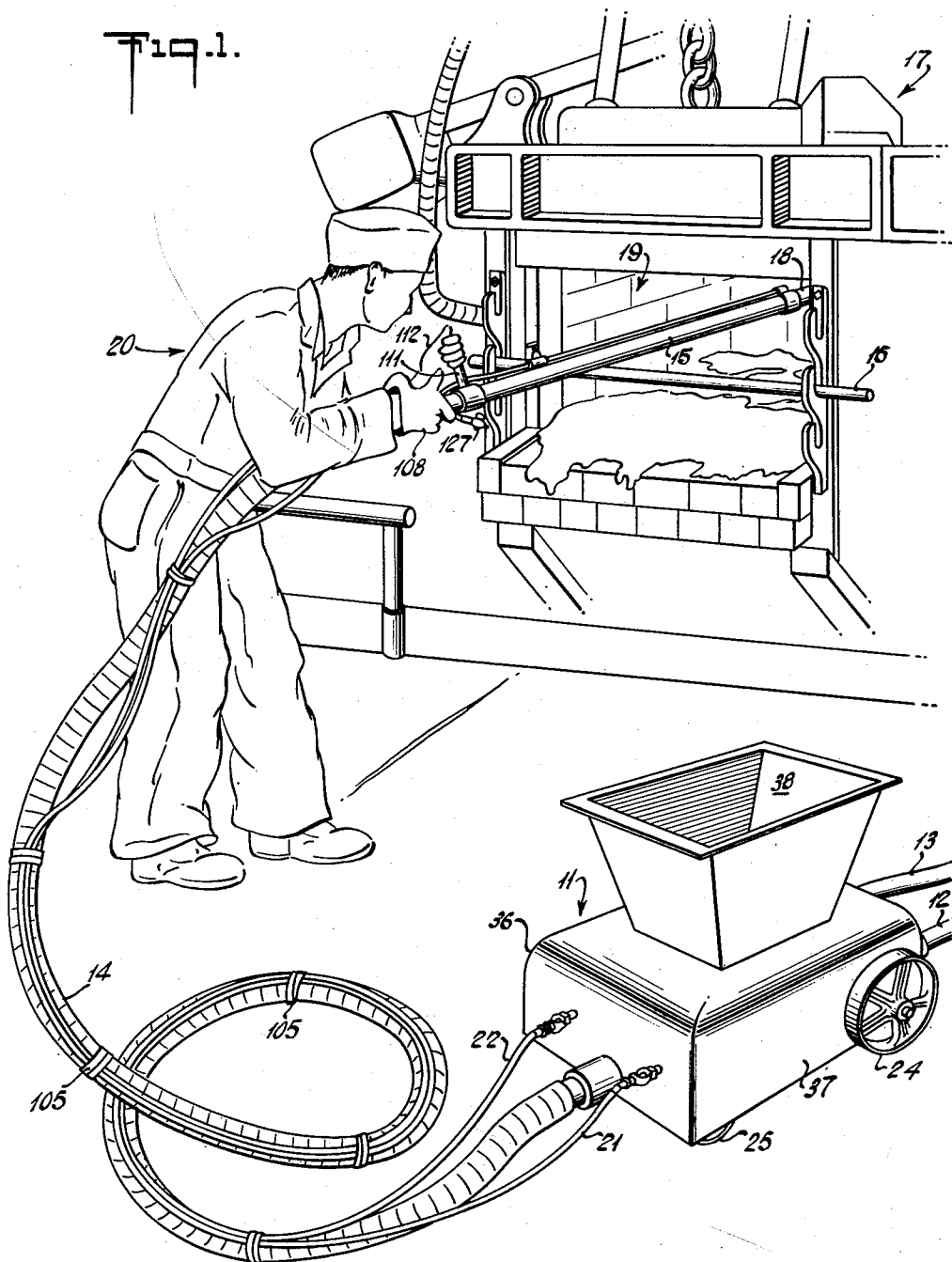
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CEMENT OR REFRACTORY MATERIAL GUN AND SUPPLY SYSTEM FOR SAME

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6 Sheets-Sheet 1

Fig. 1.



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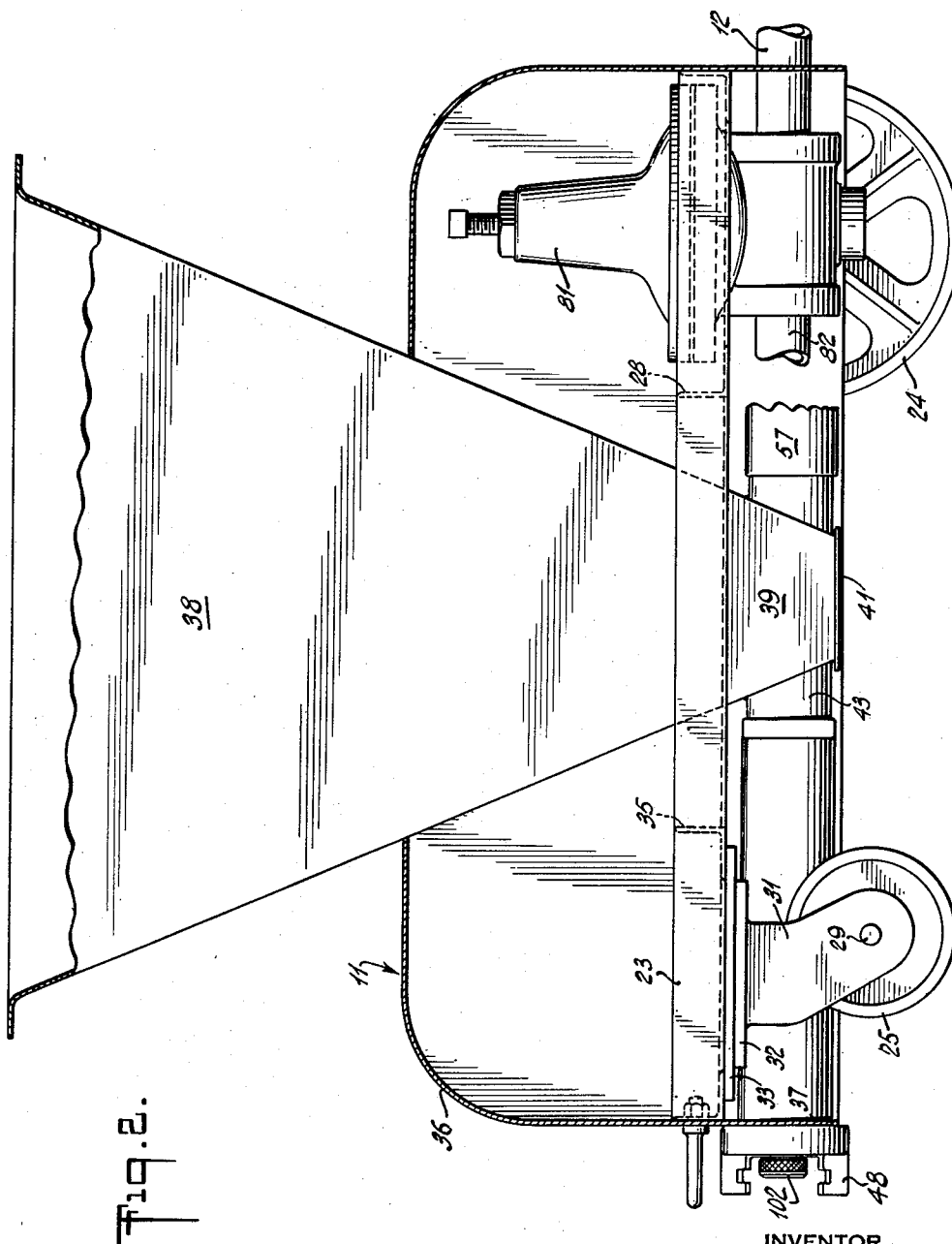
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6 Sheets-Sheet 2



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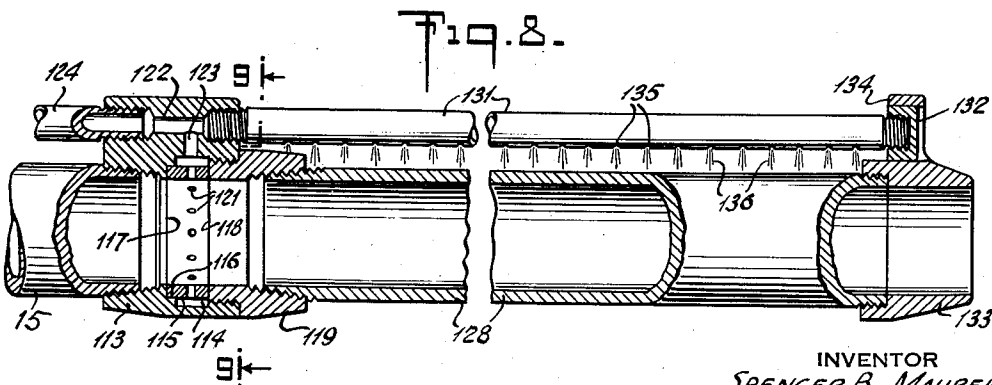
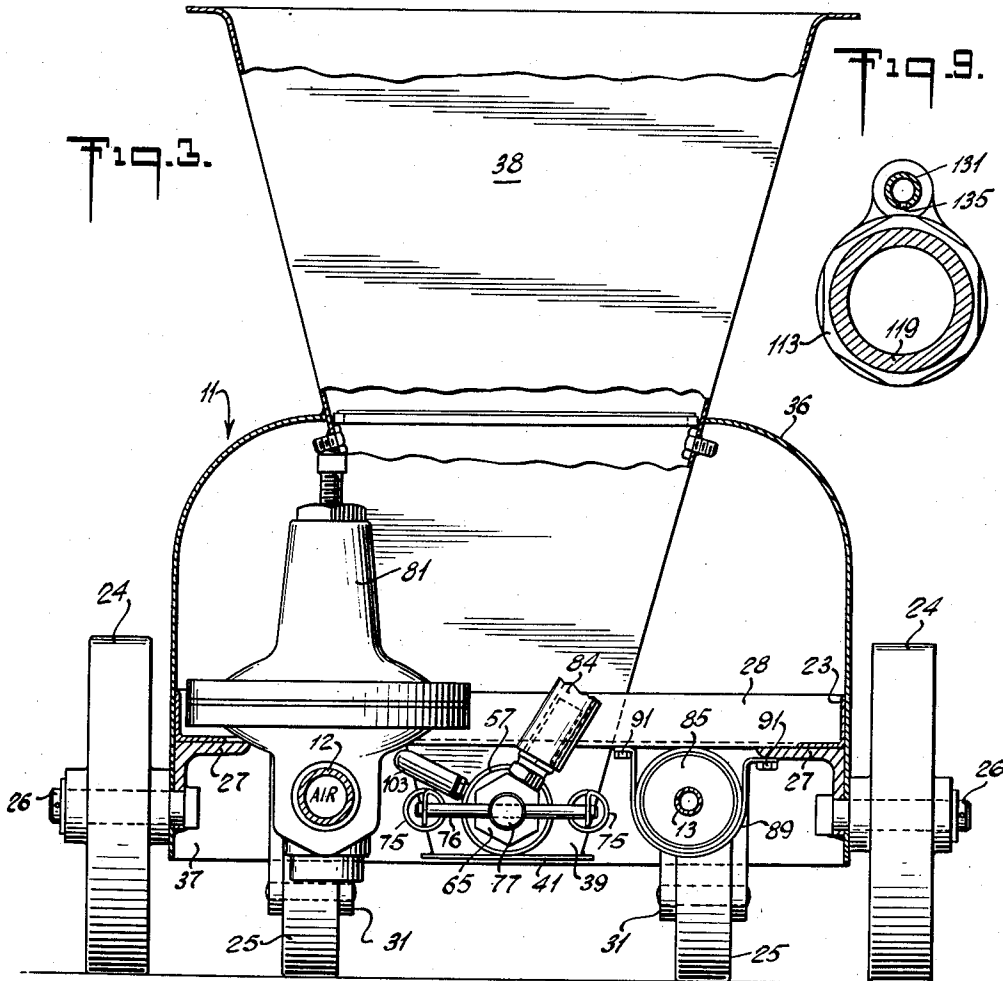
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CEMENT OR REFRACTORY MATERIAL GUN AND SUPPLY SYSTEM FOR SAME

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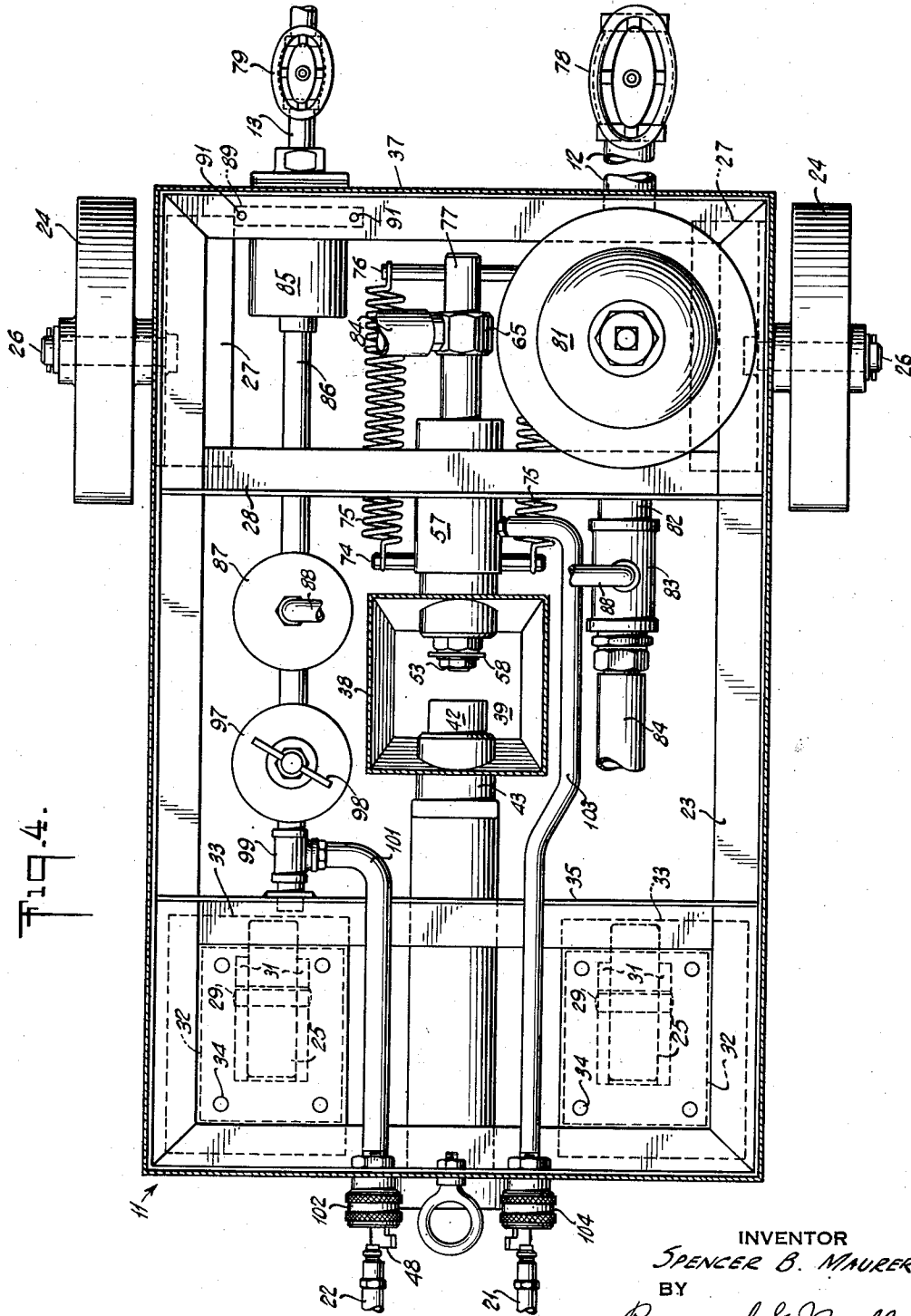
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6 Sheets-Sheet 4



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CEMENT OR REFRACTORY MATERIAL GUN AND SUPPLY SYSTEM FOR SAME

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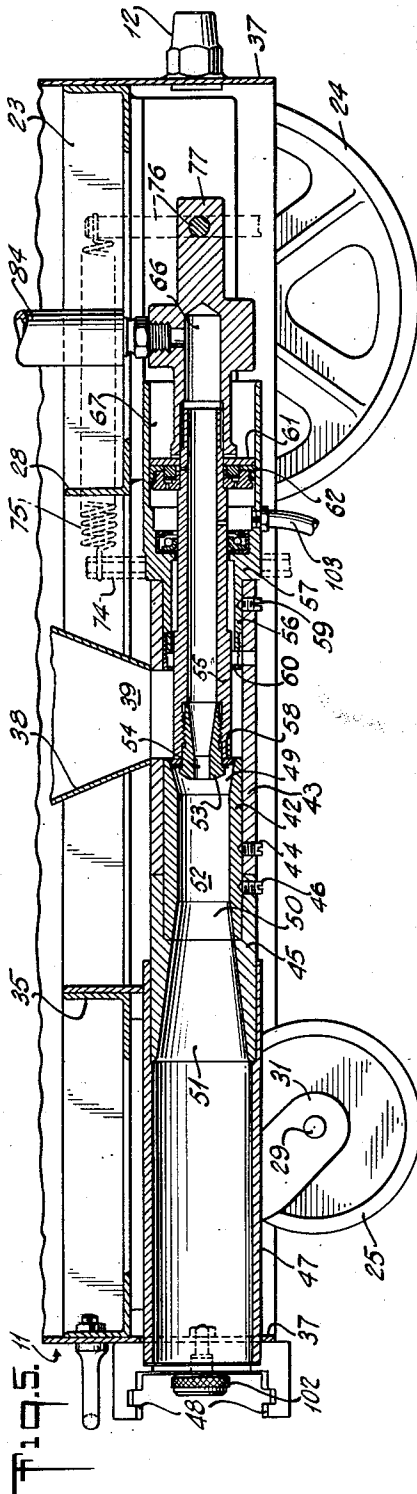
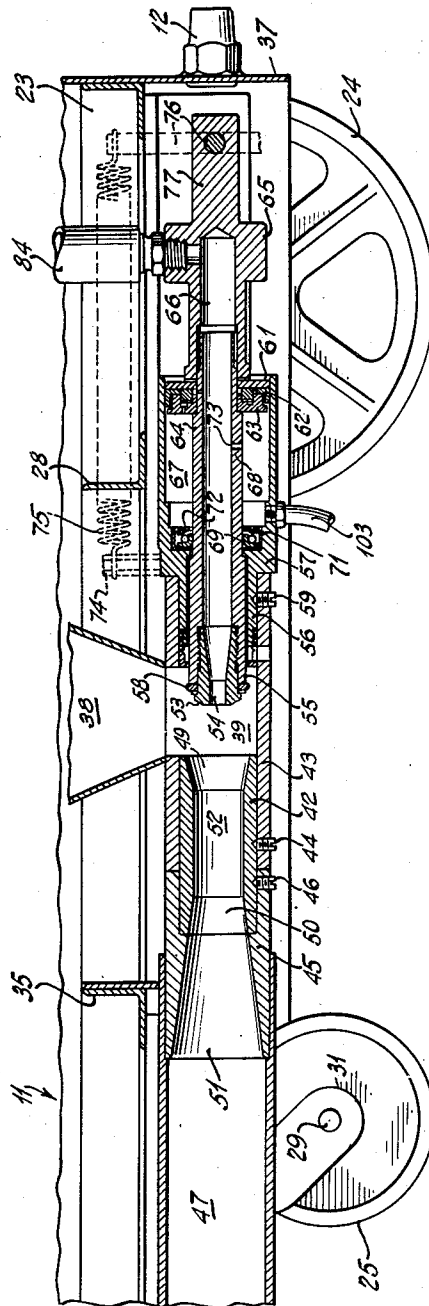


Fig. 5.



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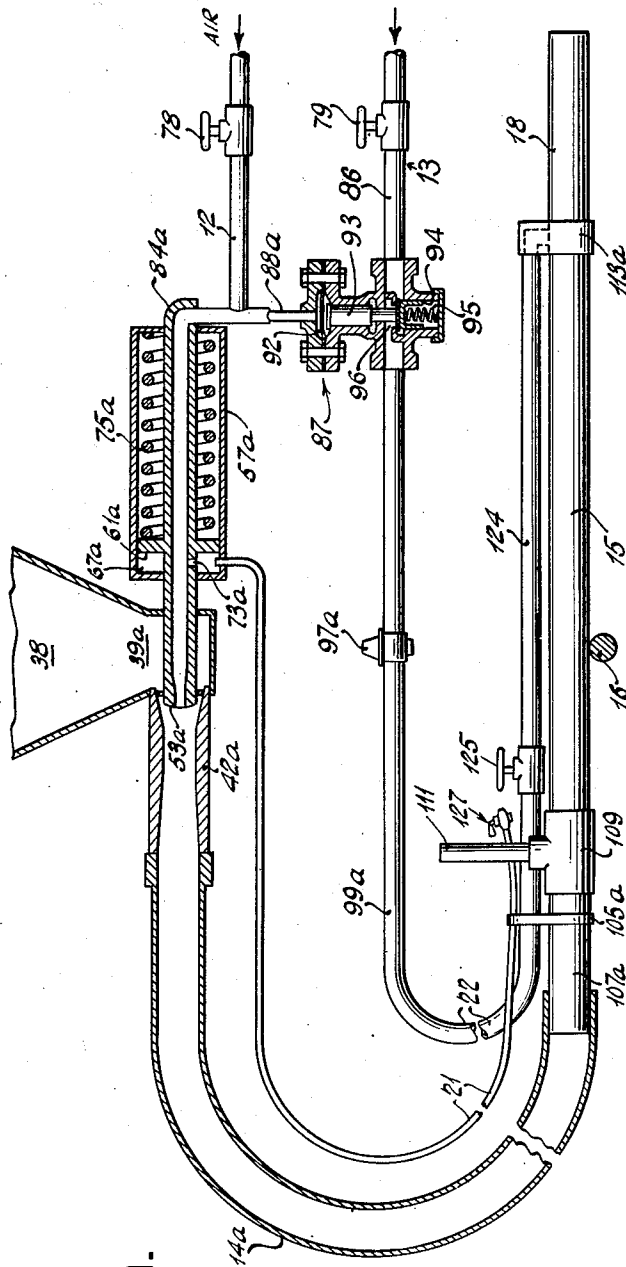
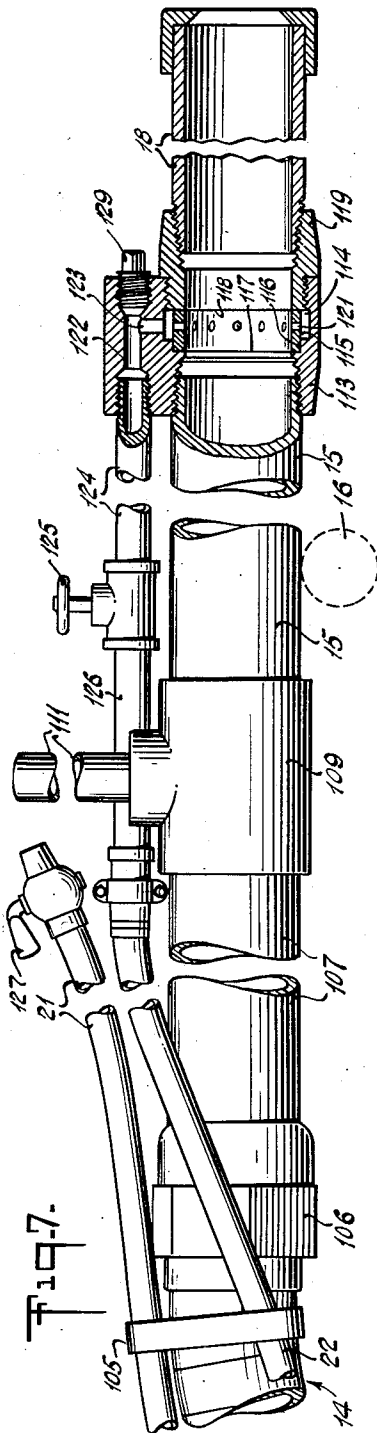
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CEMENT OR REFRACTORY MATERIAL GUN AND SUPPLY SYSTEM FOR SAME

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UNITED STATES PATENT OFFICE

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CEMENT OR REFRACTORY MATERIAL GUN
AND SUPPLY SYSTEM FOR SAMESpencer B. Maurer, Cleveland, Ohio, assignor to
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Application August 26, 1944, Serial No. 551,407

15 Claims. (Cl. 91—45)

1

This invention relates to a material feeding and depositing system and particularly to control apparatus in which the components of a spray are automatically mixed before entering the discharge nozzle.

The main object of the invention is to provide apparatus for depositing cement or refractory material upon a given surface by projecting the material against the latter by a constantly flowing stream of compressed air together with a predetermined admixture of water, and controlling the quality and thickness of the deposit by controlling the feeding of the material alone independently of the continued flow of the air and water and particularly the flow of the air.

Another object is to provide apparatus of the indicated character with remote control means associated with the nozzle portion of the apparatus for adjustably controlling the feeding of the material to be ejected from said nozzle.

A further object is to produce a transportable feeding unit capable of receiving a charge of cementitious and/or refractory material in dry form and provided with a material feed control valve and a compressed air hose with an associated water hose connected thereto and terminating in a material mixing and ejecting nozzle which is equipped with a water regulating valve in addition to the remote control valve for controlling the feeding of the material to the nozzle.

Other objects and advantages of the invention will appear in further detail as the specification proceeds when considered in conjunction with the accompanying drawings, in which:

Fig. 1 is a general perspective of the apparatus embodying the present invention in practical form as used by an operator at an open hearth furnace for coating the interior of the latter with more or less cementitious refractory material;

Fig. 2 is a side elevation of the transportable feed unit of said apparatus drawn on an enlarged scale with respect to Fig. 1 and with the rear side torn away to disclose the arrangement of a group of parts of said unit;

Fig. 3 is an elevation of one end of the feeding unit as seen from the right in Fig. 2 and with the exterior cover torn away to disclose the arrangement of the visible parts;

Fig. 4 is a plan view of the same feeding unit as seen from above when the entire superstructure or cover is removed;

Fig. 5 is a fragmentary central longitudinal section of the lower portion of the feeding unit drawn on a further enlarged scale and showing the material feed control valve in closed position;

Fig. 6 is similar to Fig. 5 but shows the material feed control valve in open position;

Fig. 7 is a greatly enlarged side elevation of the material ejecting nozzle, partly in section and showing the associated hose and its connections;

2

Fig. 8 on the same scale shows a modification of the nozzle of Fig. 7;

Fig. 9 is a transverse section taken on the line 9—9 in Fig. 8; and

Fig. 10 is a diagram of the material feed and control system as a whole, certain portions being simplified or modified for the purpose of said diagram, the latter particularly illustrating the control of the entire apparatus from a single point or station and including the remote control of the material feed valve.

In furnaces lined with a coating of firebrick or other refractory material, the heating and the operations carried on within said furnaces eventually erode or burn away portions of the refractory material and the latter then requires replacement in order to restore the furnaces to useful condition. If such a furnace should be cooled sufficiently to allow a repairman safely to enter the same, much time would be lost, both in waiting and in actually applying the replacement material and thereafter in carefully reheating the furnace to harden said material and set it finally in place. In other words, the invention obviates the necessity for shutting down a furnace in order to apply the refractory or cementitious material which is effected by spraying it in wet condition on the surfaces to be coated, and the invention is therefore designed to facilitate ejecting such material under pressure without loss of time and under convenient control from a nozzle at a hot furnace wall or surface spaced some distance from the handle of said nozzle to avoid overheating said handle.

Hence, referring again to the drawings, it may be noted in Fig. 1 that the apparatus includes a number of cooperating instrumentalities including a transportable mixing and feeding unit generally indicated at 11 supplied through a pair of connections 12 and 13 to outside sources (not shown) with compressed air and water respectively. From the feeding unit a main material hose 14 extends to the nozzle handle or pipe 15 adapted to rest midway of its length on a transverse supporting bar 16 at the door or on the doorsill of the furnace generally indicated at 17, with the nozzle or discharge pipe 18 projecting into the interior 19 of said furnace and guided by the operator indicated at 20. A pair of smaller hose lines 21, 22 are associated with the main hose 14 for conducting air and water in a manner and for purposes which will presently be explained.

The material feeding unit 11 has a substantially rectangular frame 23 (Figs. 2 to 6) preferably made of angle iron or steel and supported upon a pair of rear wheels 24 and a pair of casters 25 located beneath the forward end of the unit, the wheels and casters primarily making said unit readily transportable to any location and thereby

adapting it for wide service. The mentioned rear wheels rotate on studs 26 welded, brazed or otherwise secured to angle plates 27 fixed by welding or brazing beneath frame 23 and the transverse angular iron or steel crossbar 28 rigid upon said frame, while the casters are adapted to rotate on transverse pins 29 mounted on downwardly directed lugs 31, each pair being surmounted by the integral cap 32 secured to a plate 33 by means of screws or rivets 34, the latter plate being welded or brazed to the underside of the frame and of the angle iron or steel crossbar 25 rigid with and forming an intermediate part of said frame.

An exterior cover 36 of sheet metal is preferably welded to frame 23, completely concealing it and extending down past the latter so as to form an apron 37 partly concealing the casters 25 and more completely concealing all interior parts of said unit. In its upper portion the cover supports a hopper 38 welded to said cover and projecting a distance above the latter, said hopper extending interiorly down into the cover with the small end or well 39 closed at the bottom 41 and provided with a tubular throat member 42 opening into said small end in the forward direction. A substantially horizontal tube 43 (Figs. 5 and 6) connects rigidly with the lower end or well 39 of the hopper and surrounds the major portion of the throat member. Said throat member is fixed in said tube by a set screw 44 and an interiorly flaring or tapered tube 45 is aligned with the forward end of tube 43 and secured upon the forward end of the throat member by another set screw 46 while projecting forwardly into the delivery tube 47 secured to and extending through apron 37 at the forward end of the unit, there to terminate exteriorly in a hose coupling member 48. The throat member is preferably made of more tough and abrasion resistant alloy than the tubes and pipes as it must receive granular and pulverized dry materials blown into the same from the hopper, the rear end being interiorly flared at 49 to facilitate the introduction of said materials by the air blast and furthermore, for another purpose which will likewise be explained, the forward end also being internally flared or tapered at 50 to allow expansion and mixture of the material carried by the air blast by forming the beginning of the tapering portion 51 in tube 45 so as to connect in continuous fashion the small interior 52 of the throat member with the considerably greater interior of pipe 47.

A hollow valve 53, virtually constituting an air ejecting nozzle, has a relatively small orifice 54 and is screwed into the forward end of the hollow valve stem 55 mounted in the smaller forward end 56 of cylinder casing 57 in a position to be slidable in line with the throat member, so that in extreme forward position the resilient ring 58 of rubber, leather or other material upon the valve engages tightly in the rear tapered interior portion 49 of the throat member as shown in Fig. 5. The forward portion 56 of the cylinder casing extends a short distance into tube 43 and is secured therein by set screw 59 and terminates in a lubricating gland 60 screwed into the same and surrounding the valve stem. The latter also serves as a piston rod, for upon its rearward portion it carries a piston head in the form of a disk 61 fixed thereon and provided with a cup leather 62 held between the block 63 engaging shoulder 64 and the disk by the rearwardly extending hollow cap member 65 which is screwed upon the rear end of the piston rod against said disk with the hollow interior 66 of the cap member communi-

cating directly through said piston rod with the orifice 54 of valve 53. The piston rod as such extends through the piston chamber 67 with a reduced diameter at 68 onward toward the valve stem proper 55, past a second cup leather 69 confined beyond the forward end of the piston chamber by an interiorly hollow retaining collar 71 and washer 72. The result of this arrangement is that the piston is slidable in piston chamber 67 and piston rod 68 in casing 57 in air tight condition, the piston obviously serving directly to shift control valve 53 from the closed position of Fig. 5 to the open position of Fig. 6 and vice versa.

Assuming that air under pressure is supplied to the interior 66 of cap member 65 as will be described, the piston is adapted to be driven rearwardly to open the valve and thereby open the lower end or well 39 of hopper 38 to the ejector throat interior 52 to allow air from nozzle or valve 53 to blow dry refractory material from the hopper into delivery pipe 47. For this purpose, a bleeder duct 73 piercing the wall of the piston rod releases compressed air from within said piston rod by leakage into piston chamber 67 until the pressure in the latter rises to a sufficient level to shift the piston rearwardly and thereby the control valve to open position. In order to return the piston in the forward direction and thus close the valve, a pair of studs 74 (Fig. 4) are screwed into the cylinder casing 57 and are connected by a pair of tension springs 75 to the outer ends of transverse rod 76 mounted in the rear extension 77 of cap member 65, so that if the air accumulated in the piston chamber is in some way allowed to escape, the springs will take control and draw the piston forward and thus close material feed control valve 53. The opening and closing of the material feed valve is effected by remote control at the will of the operator 20 indicated in Fig. 1, who controls the entire course of the operation from his station before the furnace 17.

However, before more closely considering the remote control and the nozzle ejecting the material to be applied, the introduction of the compressed air into the unit will be noted. The air connection 12 has a manual cut-off or portal valve 78 (Figs. 4 and 10) while the water connection 13 similarly has a manual cut-off or portal valve 79 immediately outside the rear end of the unit. The air connection leads to pressure regulating valve 81 which may be of more or less conventional construction and adjusted in known manner to maintain the pressure of the air supplied to air supply pipe 82, T fixture 83 and the flexible hose 84 as well as cap member 65. The hose is preferably looped widely about hopper 38 so that the short movement of the piston and cap member will not be impeded, it being noted that only the ends of the loop are actually shown in Fig. 4 in order to clarify the view.

The water entering connection 13 past valve 79 passes through the filter 85 (Fig. 4) and by pipe 86 reaches cut-off valve 87 which has a branch air pipe connection 88 with fixture 83 on air supply pipe 82. The filter is secured in place by one or more straps 89 held to frame 23 by screws 91. The mentioned valve is of the conventional diaphragm type (Fig. 10) having a diaphragm 92 capable under pressure from branch pipe 88, of shifting valve plunger 93 and valve member 94 down against compression spring 95 into open relation with seat portion 96 of said valve. Thus, when portal valves 78 and 79 for the air and water supply are opened the air pressure in pipe 12 will open valve 94 and allow water

5

to flow from pipe 86 through pressure regulating valve 87, adjustable by finger piece 88 to desired pressure and from T fixture 89 through pipe 101 to coupling member 102 on the front end of the feeding unit 11 adapted for connection with the water hose 22 associated with main operating hose 14.

Cylinder 57 has an air pipe 103 (Figs. 3, 4, 5 and 6) communicating with the piston chamber within and terminating at the front end of the unit in coupling member 104 adapted for connection with the remote control air hose 21 associated with main hose 14. Along the latter (Fig. 1) the two smaller hose lines 21 and 22 are attached to the main hose at spaced intervals by bands or straps 105 to maintain the one main and two smaller hose lines associated in such fashion as to be capable of being handled virtually as a single hose. However, the main hose 14 (Fig. 7) is connected by a coupling 106 to a relatively short pipe 107 adapted to be held in one hand 108 of the operator indicated at 20 (Fig. 1) and in turn connected to a T 109 (Fig. 7) from which pipe 15 extends and to which a hand grip 111 is secured in convenient position to be gripped by the other hand 112 for maintaining the position of the nozzle and guiding the latter through such movements as may be required during operation. Upon the end of pipe 15 a nozzle fixture 113 is secured which has an internal groove 114 with an annulus 115 occupying counterbore 116 against shoulder 117 in a position to cover groove 114, the inner end 118 of the nipple 119 screwed into the end of nozzle fixture 113 serving to retain said annulus in place, the nozzle or pipe 18 being screwed into nipple 119. The mentioned annulus has a series of perforations or water holes 121 connecting the groove 114 with the interior of said annulus and nipple for introducing jets of water into the mixture passing forward through the nozzle, the water entering the groove from passage 122 in the fixture through duct 123 and being brought to passage 122 by pipe 124 controlled by manual valve 125 which in turn is connected by pipe section 126 to water hose 22.

It should be mentioned that when portal valve 78 is closed, no air pressure is exerted on diaphragm 92 and water pressure then tends to keep automatic valve 94 closed, but when valve 78 admits compressed air into the system, full jet pressure is immediately exerted on top of the diaphragm, opening valve 94 with consequent introduction of water through nozzle fixture 113 into the nozzle. This arrangement eliminates the possibility of water running back into hose 14 from the water mixing nozzle 113 and creates a condition which might cause plugging of the hose when the unit is again put in operation.

Valve 125 is used for regulating the flow of water through pipe 124 and when once set properly for a given operation is preferably maintained in the attained condition of adjustment, but the actual starting and checking of the flow is automatically controlled as just mentioned, by valve 87 in dependence on the supply of compressed air to the apparatus past portal valve 78 by way of connection 12. In order to facilitate control of the operation by the operator the water adjusting valve 125 is located in the vicinity of his station represented by hand grip 111, while near the latter the petcock or remote control valve 127 terminates the air hose 21, and hence the opening of petcock 127 allows the air in cylinder 57 to escape to atmosphere and

6

springs 75 to close material feed control valve 53 in hopper 38.

If the operation of the entire system is considered, the hopper being filled with dry pulverulent or granular refractory and/or cementitious material, the air and water portal valves 78 and 79 are first opened to throw unit 11 into operation, it being also assumed that connections 12 and 13 have been connected to sources of supply for water under operating pressure and compressed air respectively, when compressed air will immediately pass through pressure regulating valve 81 into pipe 82, T 83, and hose 84 to cap 65 and the interior of valve and piston rod member 55, 68, thence through tapered orifice 54 of valve nozzle 53 into ejector throat 49, 52, 50 and 51 as well as pipe 47 and thereafter through main hose 14 and finally out through nozzle 18. Interiorly, the orifice 54 in valve 53 tapers to a minimum diameter at the opening to create a high velocity air stream through tube 52 which acts substantially as a jet pump in sucking the material from the hopper. On the other hand, as already set forth, the opening of air valve 78 has of course allowed the compressed air to open valve 87 and start the water flowing, assuming that valve 125 is already open. At the same time, compressed air will begin to leak into piston chamber 67 through bleeder 73 but if petcock 127 is open, the air leaks out through hose 21 and said petcock as fast as it enters the piston chamber and thus no effect will be produced upon piston 61 or valve 53, and air and water without any solid matter will issue from nozzle or pipe 18.

When the operator seizes pipe section 107 and hand grip 111 and introduces the nozzle a proper distance into the furnace 17 while causing the pipe 15 to rest in substantially balanced condition on cross bar 16 at the furnace opening 19, it is but necessary to close petcock 127 to initiate operation, as the air pressure within the piston chamber will begin to rise until it becomes sufficient to overcome the tension of springs 75 and shift piston 61 rearwardly from the position of Fig. 5 to that of Fig. 6. Such rearward movement of the piston causes corresponding opening movement of the material feed control valve 53, so that dry comminuted refractory material in the hopper well 39 will immediately gravitate in front of orifice 54 of said valve 53 and be carried along with the strong air current flowing through the valve and ejected from orifice 54 into throat interior 52 and thereafter be projected into the main hose 14 and out through nozzle or discharge pipe 18. An example of the refractory material which is suitable for use in the hopper is commercially known as "gunmix." It is supplied in a dry condition and is prepared from a mixture of 67% coarse fraction dead burned dolomite or dead burned magnesite sized so that all passes a screen having 10 meshes to the inch and essentially all remains on a 100 mesh screen; and 33% fine fraction dead burned magnesite ground so that essentially all passes a 100 mesh screen; to this is added approximately 2% of finely ground bentonite. Alternatively, a small amount, 2 to 5%, of dry pulverized sodium silicate (G Brand) may be incorporated in the dry refractory mixture where sodium silicate is desired as a bond.

However, when the air is first turned on at portal valve 78, the diaphragm 92 in valve casing 87 (Fig. 10) will be moved by the pressure of the air from pipe 88 to shift plunger 83 and

thereby move valve 84 from valve seat or opening 96, with the result that water will flow from pipe 86 through valve casing 87, through hose 22 and pipe sections 126 and 124 into nozzle fixture 113 within which the water will be projected through apertures 121 into the material being carried toward nozzle 18 in order to wet said material immediately before it escapes from said nozzle. The wet material is ejected against eroded or burnt portions of the interior furnace lining or walls and becomes deposited or emplaced thereon and quickly dries and hardens, as the furnace is preferably repaired while still quite hot. The heat of the furnace is actually useful to fix the refractory material thus deposited and the time which might be lost while waiting for the furnace to cool is saved if operation is begun immediately after ceasing to heat the furnace, it being evident that the moisture present in the mixture being projected against the defective portions of the furnace walls will be very quickly dried by the high temperature prevailing in the furnace, and if the temperature is still sufficiently high the mixture thus deposited will also become agglomerated in proper condition for actual use. The residual heat of such a furnace is often considerable, as just indicated and may be sufficient to tend to bend pipe 15 merely by radiant heat, and in order to counteract this tendency the operator may use grip 111 to turn the pipe and nozzle first part way in one direction and then part way in the other direction, and so on.

It has already been mentioned that annulus or ring 115 has a series of water apertures or holes 121 for admitting jets of water into the dry material being carried along by the air stream through nozzle fixture 113, and it is pointed out that this ring is interchangeable with others having fewer or more holes, as conditions may require. In any case, the water pressure is greater than the static pressure of the air stream and hence, a series of water jets are produced which are initially directed inward toward the center of the air stream but deflected from their original paths by the velocity of the air stream. The water pressure is controlled at will by the operator adjusting the valve 125 which thus adjusts the rate of flow of water into the material being handled.

An adequate mixing of the dry material and the water spray effecting a proper wetting of said material with minimum dusting is accomplished by the resulting turbulent flow of the mixture through the length of nozzle or discharge pipe 18 which forms the normal pipe extension beyond nozzle fixture 113. The increased drag of the wet material over that of the dry material in passing through the discharge pipe 18 makes it desirable to keep the latter as short as is consistent with proper wetting of the material to be ejected from the nozzle. Too great a length would impede the flow of the material and in extreme cases the wetted material may even adhere to the inside of the pipe, thus greatly increasing the back pressure of the air and reducing the rate of material flow. The actual length of the nozzle from discharge pipe 18 may be varied to suit each individual case and will also depend to some extent on the air pressure available at the feeding unit 11.

At this point it may be well to mention that the air and water are always left on while the discharge pipe 18 is in the furnace, whether or not any "gunmix" material is being fed to said dis-

charge pipe in order to prevent overheating the latter.

A modification for counteracting the bending of the pipe is illustrated in Fig. 8 in which the normally short nozzle or discharge pipe 18 is replaced by a longer nozzle extension or pipe 128 and the plug 129 previously described as closing one end of passage 122 in nozzle fixture 113 is replaced by water pipe 131 screwed into the fixture at one end and provided with a cap 132 at the outer end, the latter being retained in association with the nozzle member 133 upon pipe 128 by an integral loop or ring portion 134 enveloping the cap and preventing shifting thereof. Upon the side of pipe 131 facing the pipe or nozzle extension 128 a series of holes 135 are bored to allow issuing water jets 136 to continuously spray said nozzle extension and thereby cool it while exposed to the heat radiating from the hearth and walls of the furnace undergoing repairs by ejecting and depositing the refractory material through said nozzle extension upon the eroded portions of said walls. The operation of emplacing the refractory material is of course determined by the operator 20 in guiding the nozzle or nozzle extension and controlling the operation of the system as a whole so that the walls within the furnace become coated to be of uniform thickness and of generally smooth form. When the operation is finished the supply of refractory material from hopper 38 is cut off by the operator opening petcock 127 to release the air from hose 21 and piston chamber 67 and thereby allowing springs 75 to shift piston 61 forward and thus also shift valve 53 to closed position in the flaring throat portion 49 forming the seat therefor.

It may be well to mention that in Figs. 3 and 4 the air pipe 103, studs 74, springs 75 and transverse rod 76 are shown in proper assembled position in the apparatus forming the feed unit, but in the interest of better disclosure, in Figs. 5 and 6 the pipe 103 has been swung down diagrammatically and one stud 74 as well as part of transverse rod 76 have been indicated in broken lines in erect position with one spring 75 disposed between them in order to bring these parts into view in comprehensible operating position and bring out certain contrast in the positions of the parts in Figs. 5 and 6. Also in the diagram of the system in Fig. 10 the references used are substantially the same as in the other figures with an added "a" for parts corresponding to those in the latter figures but modified for the purpose of said diagram.

It is to be noted that during operation of the nozzle, no air is consumed by cylinder 57 as the pressure within piston chamber 67 is at maximum, and as petcock 127 is closed no further supply of air leaks into the piston chamber through bleeder 73. When the petcock is opened however, the air in said piston chamber escapes more rapidly from the air hose and the petcock than it can be replenished from said bleeder, and the result is then that the return springs 75 shift the piston and material feed control valve forward to closed position and maintain said valve in closed position until the petcock is again closed by hand for a new cycle of operation.

Re-stating the operation briefly, unit 11 is brought near to the furnace to be repaired and hopper 38 is filled with "gunmix," then the nozzle or discharge pipe 18 is inserted into the furnace through a door or other opening thereof, after which both air and water portal valves 78 and 79 are opened. Thereafter the furnace wall in-

9

tended to be repaired is cooled to the desired temperature by discharging air and water at the same, and the remote control valve 127 subsequently closed, causing the material feed valve 53 to open and allow the material to be deposited on the cooled furnace wall, and while the material is thus being deposited, the water pressure is adjusted by means of valve 125 to obtain the desired mixture of material and water. When the wall has been properly coated or built up the operator opens remote control valve 127, causing the material feed valve 53 to close and thereafter the discharge pipe or nozzle is withdrawn from the furnace and the main or portal air valve 78 is closed, this last operation also automatically turning off the water. The valve 78 is maintained in open position at all times while the pipe 18 is in the furnace, whether or not material is being applied, to prevent overheating of the pipe.

While in the foregoing the water control valve 125 and petcock 127 controlling the air pressure or escape of the air in the piston chamber have been described as distinct devices located within reach of the operator's station when said operator grasps the hand grip 111 it is quite evident that the hand grip can be replaced by a wheel surrounding pipe 15 to replace the T 109 and the hand grip for the purpose of turning the pipe slightly to the right and then to the left to counteract bending and/or the valves 125 and 127 may be incorporated in a single fixture which may include said hand wheel or a structure replacing or resembling hand grip 111. Other modifications within the scope of the appended claims are also possible and may be resorted to as conditions may require.

What is claimed is:

1. A system for feeding refractory and/or cementitious material from a supply thereof at various predetermined locations, and applying the refractory material together with a suitable amount of water by means of pressure fluid, including a supply and feeding unit capable of holding a supply of refractory material, means including a nozzle for directing a stream of pressure fluid adjacent to the supply of refractory material toward a predetermined work surface, an ejector throat member arranged coaxially with the nozzle to receive the stream therefrom and tapering inwardly away from the nozzle, manually operable means for effecting relative axial movement between the nozzle and throat member thereby initiating and stopping the feeding of refractory material during operation from said supply into the stream of pressure fluid independently of the flow of the latter and thereby providing a flow of refractory material toward the work surface, and means for introducing water into said stream of pressure fluid.

2. A system according to claim 1, having automatic means responsive to the starting or stopping of the flow of the pressure fluid for correspondingly starting or stopping the introduction of the water into the pressure fluid being directed toward the work surface.

3. A system according to claim 1, in which the manually operable means includes manually operated remote control means for initiating and stopping the flow of the refractory material from the supply thereof toward the work surface.

4. A system according to claim 1, in which the manually operable means is independent of the flow of the water introduced into the pressure

10

fluid and wherein means is included for regulating the flow of the water during operation.

5. In a system of the character described, a transportable supply and feeding unit having means for carrying a supply of refractory and/or cementitious material and feeding the latter to an ejecting nozzle adapted to be connected to the feeding unit, said feeding unit comprising a wheeled truck having a hopper fixed thereon, means adapting said feeding unit for receiving a continuous flow of pressure fluid and of water, a main hose connection disposed upon a portion of said feeding unit for supplying pressure fluid together with refractory material from the hopper through said hose connection to the nozzle, an ejector throat member communicating with and leading from said hopper to said hose connection, a water supply connection and a pressure fluid connection also disposed on the feeding unit, means for introducing water from the water supply connection into the pressure fluid before it issues from said nozzle, and operable means for causing the feeding of refractory material from said hopper to said ejector throat member, said operable means comprising a nozzle type valve having a central opening arranged to discharge live pressure fluid continuously into the throat member, thereby sucking refractory material from the hopper into the throat member, said valve being adapted to be moved axially into contact with the throat member to cut off communication between the hopper and throat member.

6. In a system of the character described, a transportable supply and feeding unit having means for carrying a supply of refractory and/or cementitious material and feeding the latter to an ejecting nozzle adapted to be connected to the feeding unit, said feeding unit comprising a wheeled truck having a hopper fixed thereon, means adapting said feeding unit for receiving a continuous flow of pressure fluid and of water, a main hose connection disposed upon a portion of said feeding unit for supplying pressure fluid together with refractory material from the hopper through said hose connection to the nozzle, an ejector throat member communicating with and leading from said hopper to said hose connection, a water supply connection and a pressure fluid connection also disposed on the feeding unit, means for introducing water from the water supply connection into the pressure fluid before it issues from said nozzle, and operable means for causing the feeding of refractory material from said hopper to said ejector throat member, including a shiftable material feed control valve capable of moving axially away from and toward the ejector throat member thereby successively opening and interrupting the communication between the throat member and the supply of refractory material in said hopper, and remote control means accessible to the operator when manually guiding and controlling the nozzle during operation, effective to cause the shifting of said material feed control valve at will.

7. In a system of the character described, a transportable supply and feeding unit having means for carrying a supply of refractory and/or cementitious material and feeding the latter to an ejecting nozzle adapted to be connected to the feeding unit, said feeding unit comprising a wheeled truck having a hopper fixed thereon, means adapting said feeding unit for receiving a continuous flow of pressure fluid and of water, a main hose connection disposed upon a portion

of said feeding unit for supplying pressure fluid together with refractory material from the hopper through said hose connection to the nozzle, an ejector throat member communicating with and leading from said hopper to said hose connection, a water supply connection and a pressure fluid connection also disposed on the feeding unit, means for introducing water from the water supply connection into the pressure fluid before it issues from said nozzle, and operable means for causing the feeding of refractory material from said hopper to said ejector throat member, including a shiftable material feed control valve capable of opening and interrupting the communication between the throat member and the supply of refractory material in said hopper, a cylinder having a piston slidably mounted therein and adapted for fluid operation in at least one direction from initial position to operated position, and capable of shifting said material feed control valve from and toward said throat member to open or close the communication between the latter and the interior of said hopper, and thereby feed refractory material to said throat member and toward said main hose connection or shut off the refractory material therefrom, and manually operable control means effective to initiate operation of said piston and thereby open the material feed control valve at will and cause or stop the feeding of refractory material to said throat member, and means for causing the pressure fluid to continue flowing to said throat member irrespective of the position of said material feed control valve.

8. A system according to claim 7, having distinct means for returning the piston from operated to initial position corresponding to closed position of the material feed control valve.

9. A system according to claim 7, having resilient means including one or more springs effective to return the piston from operated to initial position corresponding to closed position of the material feed control valve.

10. A system according to claim 7, in which the manually operable control means includes remote control means accessible to an operator manually guiding and controlling the position and movements of the nozzle during operation.

11. A system according to claim 7, in which the material feed control valve is hollow and has an intermediate member rigidly interconnecting the piston and material feed control valve in order to cause the latter to shift in unison with said piston, and includes means for introducing a constant supply of pressure fluid into and through said material feed control valve and thence into the throat member and for maintaining the flow of the pressure fluid substantially constant into said throat member irrespective of the position of said material feed control valve with respect to the throat member.

12. A system according to claim 7, in which the material feed control valve and piston are both hollow and have a hollow piston rod directly interconnecting the two in order to cause a continuous stream of pressure fluid to flow freely and constantly through the piston, piston rod and control valve into the throat member and thereby maintain the flow of the pressure fluid substantially constant into said throat member irrespective of the position of said material feed control valve with respect to said throat member.

13. A system for feeding refractory and/or cementitious material from a supply thereof at various predetermined locations, and applying the refractory material together with a suitable amount of water by means of pressure fluid, including a supply and feeding unit capable of holding a supply of refractory material and having an aperture adapted to feed such material for transmission, means for directing a stream of pressure fluid adjacent to the supply of refractory material toward a predetermined work surface, a feed control valve reciprocable axially across the aperture of the supply and feeding unit into and out of contact with the pressure fluid directing means, said valve when out of such contact being in open position to provide a path for the continuous flow of refractory material from the supply to the pressure fluid stream and when in such contact being closed to prevent such flow, manually operable means for moving said valve to open and closed position thereby initiating and stopping the feeding of refractory material during operation from said supply into the stream of pressure fluid independently of the flow of the latter and thereby providing a flow of refractory material toward the work surface, and automatic means responsive to the starting and stopping of the flow of the pressure fluid and capable of correspondingly starting and stopping the introduction of water into said stream of pressure fluid.

14. In a system for feeding refractory material, a hopper capable of holding a supply of such material, an outlet at the bottom of the hopper, said outlet having a throat tapering away from the hopper, a material feed control valve positioned to be embedded in the refractory material and shiftable into and out of engagement with said outlet to respectively prevent and permit the flow of refractory material from the hopper to the outlet, said valve being hollow to provide a path for the flow of live air discharged in a stream in said throat, whereby the outlet provides a passage for live air in the closed position of the valve and a mixture of live air together with entrained particles of refractory material in the open position of the valve.

15. A system as defined in claim 14 in which the means for shifting the valve comprises a cylinder providing a piston chamber, a piston reciprocable therein and connected to the valve to actuate the latter, yieldable means biasing the piston and valve toward closed position, means for supplying live air to the piston chamber to actuate the piston and valve to open position, and remote control means for venting the piston chamber to permit the valve to be closed.

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