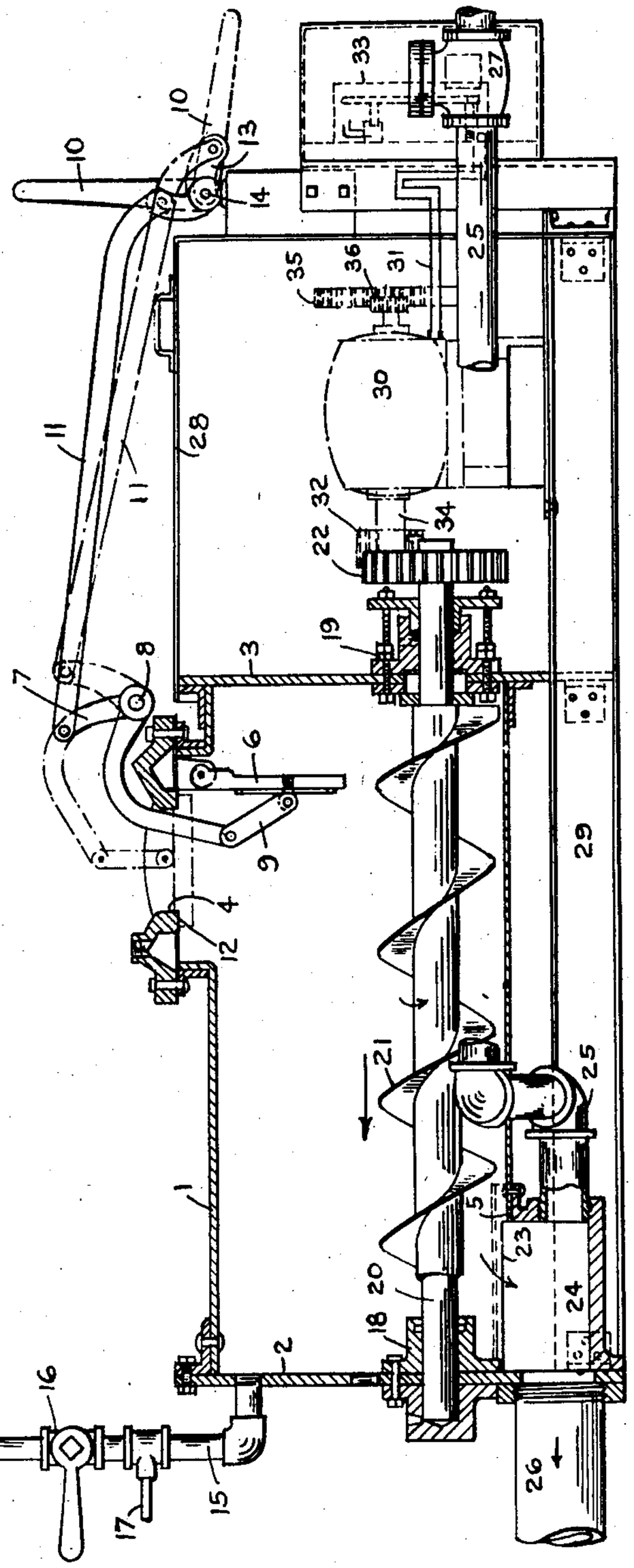
Feb. 7, 1928. 1,658,046

J. H. FITZGERALD

PNEUMATIC CONCRETE CONVEYING AND PLACING

Filed Dec. 9, 1924 2 Sheets-Sheet 1

FIG. 1



Inventor
James H. Fitzgerald.
By his Attorney S. J. Cox.

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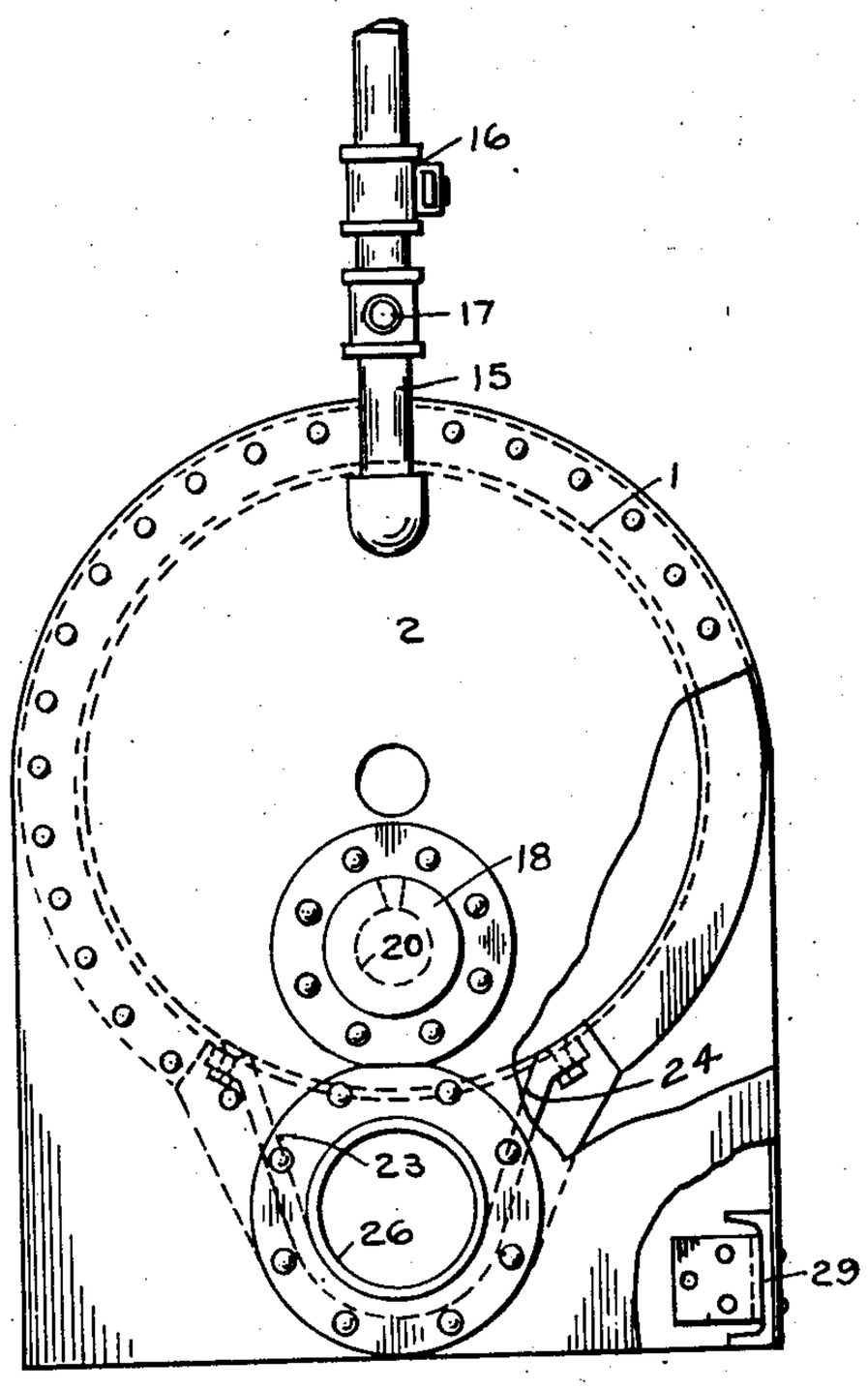

Fig-2

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UNITED STATES PATENT OFFICE.

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PNEUMATIC CONCRETE CONVEYING AND PLACING.

Application filed December 9, 1924. Serial No. 754,717.

The present improvements relate to method and apparatus for placing concrete and the like by means of compressed air, while in a wet or more or less fluent condition immediately after mixing. The improvements are also of such a nature that mixing of the concrete aggregates as well as placing may be accomplished thereby. In the lining of tunnels, and in other places where it is difficult to place concrete by gravity or by hand an immense saving is accomplished, and better results obtained by the employment of compressed air to convey the concrete to the point of placement and place it in the form. Such pneumatic conveyance and placement when properly practiced is convenient, safe and speedy, effects a great saving in cost and results in a much better lining or other structure. This has been demonstrated by many years of experience. Numerous patents have been issued for improvements in methods and apparatus for carrying on this work, and some of them have proved very efficient. Difficulty has been experienced, however, under certain conditions of operation, and one of the conditions which makes pneumatic operation difficult is the necessity for working in a tunnel or other excavation where there is not sufficient head room to permit the employment of gravity in the placing apparatus. In such cases what is known as horizontal apparatus, or apparatus in which the materials move to the discharge outlet in a substantially horizontal instead of a vertical direction, has been employed. Various difficulties in such apparatus however, have been experienced due to the fact that the heavy non-cohesive mass of mixed concrete aggregates must be propelled toward the discharge opening by mechanical means, and such means are not easily or economically operated in such an environment. Thus, a pneumatically operated plunger has been employed to move the aggregates from the charging point to the discharge outlet, but such plunger consumes a relatively large volume of compressed air, which means a large expenditure of power, and is not as thorough in its work or as dependable as it should be. Other devices have been employed with equally unsatisfactory results.

It is the primary object of the present improvements to overcome the difficulties of moving and discharging the materials in a horizontal pneumatic placing apparatus, and to provide for a better mixing and placing thereof and the maintenance of the concrete in a thoroughly mixed state from the pneumatic placing apparatus to the point of application.

The improvements are illustrated in the accompanying drawings, in which Figure 1 is a longitudinal vertical section taken medially of a pneumatic concrete placing apparatus embodying the improvements; and

Figure 2 is a view of the discharge end thereof, with a part of the outer shell or casing broken away to expose interior parts.

In the illustrative apparatus for the embodiment and practice of the present improvements shown in the drawings the vessel or retort in which the concrete aggregates are received, and from which they are discharged pneumatically, comprises a cylinder 1 with front and rear heads 2 and 3, and having a charging opening 4 at its top near the rear end and a discharging opening 23 at the bottom 5 and at its forward end. The charging opening is provided with a door 6 mounted to swing inwardly and downwardly and is operated by a lever 7 pivoted at 8, a link 9 connecting the door with the lever and a hand lever 10 connected with the lever 7 by link 11. A suitable annular seat 12 is provided for the sealing of the door, and it is held in closed position by the short arm 13 fixed to the hand lever 10 in such position that it is on dead center behind its pivot 14 when the door is closed. A pipe 15 with a valve 16 communicates with the forward head of the vessel, and from this pipe a small branch pipe 17, to which a pressure gage may be connected, extends. This pipe 15 may be used for the purpose of washing out the apparatus, or to inject air or water thereinto during the operation thereof, if desired.

Mounted in suitable bearings 18 and 19 in the heads of the retort is a shaft 20 bearing a worm or screw conveyor 21, and the end of this shaft which extends through the head 3 has a gear 22 keyed thereon. This gear is provided for the purpose of connecting the screw conveyor with a suitable source of power whereby it may be rotated. As the particular character of the power employed

is not of the greatest importance, it is not illustrated in detail. The power supplied, however, should be under absolute control, so that the speed of the conveyor can be regulated and adjusted to meet variations in the nature of the material acted upon, the speed and pressure of the compressed air employed and other conditions. An electric motor geared down to a relatively slow speed has been found most satisfactory, but the power may be furnished by air or other fluid under pressure. The screw conveyor rotates clockwise—as viewed from the discharge end of the vessel—as indicated by the arrow, and propels the concrete, which is dumped into the vessel through the charging opening 4 in a batch or charge, to the discharge opening and not only conveys it and feeds it to said opening at a regular rate and in a manner best calculated to secure its proper conveyance and placement, but breaks up the batch or charge and mixes it to a certain extent. Should the discharge opening become clogged in any manner it is possible to reverse the rotation of the screw and thus clear the opening.

The discharge opening 23 is located at the bottom of the vessel at its forward end and permits the material to fall into the box 24 where it is taken up by the compressed air supplied by the pipe 25 and passed into the conduit 26 through which it is conveyed to the point of placement. The supply of compressed air through the pipe 25 is controlled by a valve 27, and should be regulated to do its work properly and give the most desired results. The regulation of the supply of air and the relative speed of the screw conveyor are matters to be determined by the conditions of use which vary to a considerable extent. The supply of air, however, should be at a high rate of speed, and the speed of the conveyor should be such as to give the air a sufficient load to carry without danger of causing clogging. Under normal conditions the conduit 26 is open at both ends, so that the air and the concrete conveyed thereby will be permitted to pass therethrough freely and at a considerable rate of speed. If, however, the conditions make it advisable the conduit may be provided with a reducing nozzle or a valve or reducer intermediate its ends.

A suitable housing 28 for the gear 22 and the power device is provided, and this, and the other parts of the apparatus are mounted on a base 29.

In operation a batch or charge of concrete is dumped into the vessel through the charging opening 4 and the opening closed; the compressed air valve is then opened and air under pressure permitted to pass through the discharge chamber or box 24 into the retort and through the conveying conduit 26. The screw is then started and operated at a rate of speed calculated to give the best results; and the adjustment of the conveyor speed and the air supplied may be made by observing the manner in which the material is discharged from the conduit 26.

The discharge and conveyance of the material is caused by the nozzle action of the air issuing from the mouth of the pipe 25, and passing through the box 24 and conduit 26 and by a certain pressure differential produced thereby, aided by the screw conveyor. At the same time the material is not broken up or disintegrated by the air but is conveyed and delivered to the point of placing in a comparatively solid column or stream, and this is due largely to the fact that it is possible to regulate the feeding of the material to the discharge conduit so that it will be supplied thereto in exactly the proper volume.

The power device indicated comprises a motor 30 governed by a controller 33 through conductor 31, a gear 32 in mesh with the gear 22 on the end of the worm shaft 20, a shaft 34 on which the gear 32 is keyed and a large gear 35 keyed to the other end of the shaft and in mesh with the pinion 36 on the end of the motor shaft.

The discharge chamber 24 is substantially U-shaped in cross section, and its open top is approximately the same size as the discharge opening 23. It tapers toward the bottom, which is substantially the same diameter and shape as the conduit 26. This provides for the free movement of the material into the discharge, and tends to prevent the said material from spreading and being disintegrated by the blast of air from the pipe 25. It also ensures a sufficient supply of material to give the air a sufficient load and thus reduce the danger of blowing and other undesirable results.

What I claim is:

1. In an apparatus for discharging and placing concrete and the like pneumatically, an air-tight vessel adapted to receive and hold the material in a mass, said vessel having a discharge opening at its lower part and being of greater length than depth and horizontally disposed, a conveyor positioned within the lower confines of said vessel and spaced from the walls thereof arranged to convey the material from one end thereof towards the discharge opening and being capable of regulation to different speeds, a discharge conduit in communication with said opening in the vessel and means for supplying compressed air to said conduit and to said vessel and maintaining the same therein and in the discharge opening including a pipe of relatively small diameter, said pipe constructed to direct air in line with the discharge conduit, said conveyor and discharge opening being exposed to the pressure maintained in the vessel, and means for regulat-

ing the volume and speed of the air discharged from said pipe.

2. The combination of elements specified in claim 1, the conveying means in the vessel comprising a screw conveyor in the bottom thereof and spaced therefrom, and means for operating the same to pass the said materials at a regulated rate to the said discharge opening.

3. In an apparatus for discharging and placing concrete and the like pneumatically, an air-tight vessel adapted to receive and hold the material in a mass, said vessel having a discharge opening at its lower part and being of greater length than depth and horizontally disposed, a conveyor positioned within the lower confines of said vessel, spaced from the walls thereof and supported adjacent said discharge opening, arranged to convey the material from one end of said vessel toward the discharge opening and being capable of regulation to different speeds, a discharge chamber communicating with said discharge opening, a discharge conduit in communication with said chamber, a pipe of relatively small diameter having an outlet positioned adjacent said discharge opening for supplying compressed air to said conduit and to said vessel through said chamber and discharge opening, said pipe positioned to direct air into said conduit, and means for regulating the volume and speed of the air discharged from said pipe, the said conveyor and outlet being constructed and arranged to be subject at all times to direct air pressure from the upper part of the vessel.

Witness my hand this 4th day of December, 1924, at the city of New York, county of New York, State of New York.

JAMES H. FITZGERALD.