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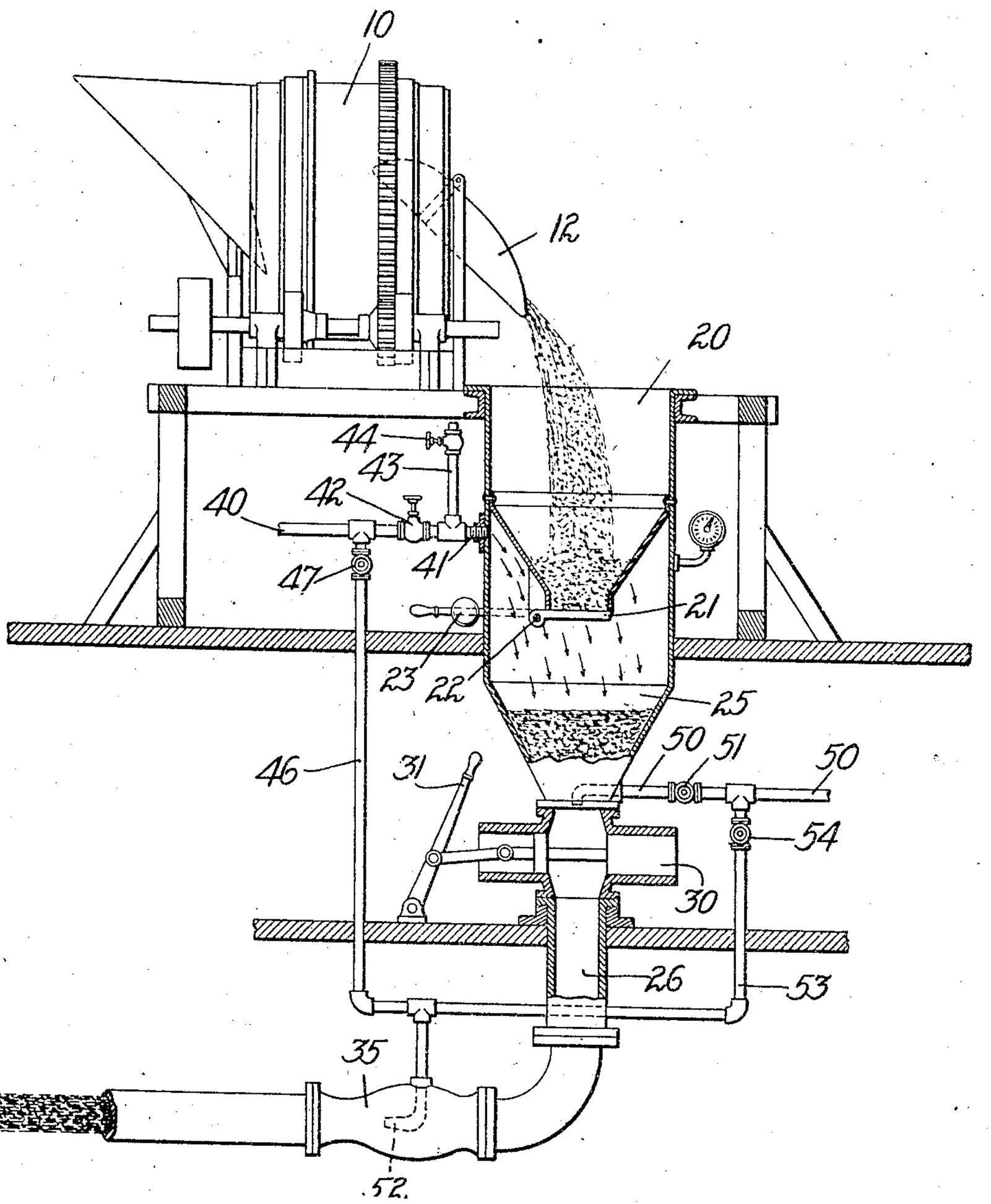
METHOD OF HANDLING PLASTIC MATERIAL.

APPLICATION FILED JAN. 25, 1909.

951,754.

Patented Mar. 8, 1910.



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METHOD OF HANDLING PLASTIC MATERIAL.

951,754. Specification of Letters Patent. **Patented Mar. 8, 1910.**

Application filed January 25, 1909. Serial No. 474,045.

To all whom it may concern:

Be it known that we, JOSIAH WILLIAM BUZZELL and WILLIAM H. LARKIN, Jr., both citizens of the United States, and residents, respectively, of East Orange, in the county of Essex and State of New Jersey, and of Laporte, in the county of Laporte and State of Indiana, have invented an Improvement in Methods of Handling Plastic Material, of which the following description, in connection with the accompanying drawings, is a specification, like numerals on the drawings representing like parts.

This invention relates to the handling of concrete or the like.

Our invention has special reference to the handling of concrete or the like by the use of air or fluid under pressure so applied to the mixed material as to propel or project the same through a conduit or pipe. Concrete or like materials are segregated rock bearing cementitious mixtures containing sand, stone and cement usually and substantially in the proportion of 60 per cent. segregated rock matter and 40 per cent. water, sand and cement. The segregated rock material owing to its mass and specific gravity inherently tends to separate from the lighter particles or substances of the mixture when dropped or thrown through space or pneumatically conveyed through a conduit.

Our invention aims so to convey concrete or like material as to preserve the integrity of the original mixed mass, that is to say, to maintain the distributive relation of the segregated rock material through the water, sand and cement.

The drawing in elevation and partial section illustrates one form of apparatus by which to practice the method of our invention.

The apparatus shown in the drawing is particularly designed for the handling of concrete which furnishes an excellent material with which to illustrate the nature of our invention.

In the drawing is shown a mixer 10, which may be of any desired type or construction, capable of mixing the stone, sand and cement or other elements deposited therein in proper or desired proportions for the production of concrete or the like and mixed in the present instance by rotation of the barrel of the mixer. Upon completion of the mixing operation ~~wherever~~ or however performed, the mixed segregated rock bearing concrete or like mixture mass is discharged through a spout 12 into a hopper 20 having a frusto-conical bottom closed at its outlet by a valve, as 21 pivotally supported at 22 and provided with a suitable counterbalancing handle 23.

The material discharged into the open hopper 20 may by opening said valve 21 be dropped into or deposited in a chamber 25 having also and preferably a conical outlet end. The outlet from said chamber 25 is controlled by a suitable valve, here represented as a piston valve 30 having traverse across the mouth of the chamber outlet and controlled as to its position by a handle lever 31. Beyond said valve and communicating with the chamber outlet is a pipe or conduit 26 leading to the point of discharge of the concrete.

Air or other fluid under pressure may be admitted to the chamber 25 in any suitable manner to act therein upon the contained concrete to expel it through the pipe 26 to its destination. In the present instance, we have provided near the upper end of the chamber an air inlet 41 controlled by a valve 42 connected with an air supply 40. Between the valve 42 and the chamber is a discharge pipe 43 controlled by a valve 44, whereby to relieve the pressure within said chamber when desired, to facilitate opening the valve 21.

From the air supply 40 leads a branch 46 controlled at its upper end by valve 47 and provided near its lower end with a branch pipe leading to a jet device 52 within an enlarged or bellied fitting 35 in and constituting a part of the pipe or conduit 26 and adapted to project fluid under pressure into and from within the mass of concrete flowing through said pipe 26. Another branch 53 of said pipe 46 leads beyond and upward to a second jet pipe 50 which enters the chamber 25 near the outlet thereof and has its downturned end pointed in the direction of travel of the concrete escaping from said chamber. The pipes 53 and 50 are controlled respectively by valves 54 and 51. The jet devices or "boosters" 50, 52, or their equivalents are especially serviceable where the material is to be transmitted over long distances. The jet devices 50 and 52 are employed merely to supplement the main air or fluid supply in forcing the concrete

onward and do not destroy the condensed concrete column hereinafter referred to, nor impair the consolidation thereof.

In operating the apparatus, the piston valve 30 controlling the outlet for the chamber 25 is moved to the left to close said outlet, whereupon the concrete which may have been previously deposited in the hopper 20 is permitted to drop through the open valve 21 into and more or less to fill said chamber 25, whereupon said valve 21 is closed and pressure is admitted to the chamber 25 from the pressure inlet 41. This pressure may be admitted either before or after the outlet of the chamber has been opened by moving the piston valve 30 into its position shown in the drawing. However this may be, when the said valve is open and the pressure is or has been admitted to the chamber above the mass of concrete therein, said pressure acting upon the entire exposed surface of the contained mass of concrete will cause the latter to be expelled in a solid column through the conduit or pipe 26 to its destination. It is important that the mixed mass be gradually or progressively compacted by contracting the diameter of the mass to that of a condensed, consolidated column. That is to say, in order to transfer the concrete in its properly mixed condition in the conduit and without permitting the lighter ingredients of the mixed mass to break through and be driven in advance of the other constituents thereof, the mass is compacted or progressively reduced or contracted by the conical lower end of the chamber 25 to substantially the diameter of the conduit. By progressively compacting or contracting the mass into a condensed or consolidated column, we are enabled to discharge the concrete in that thoroughly mixed condition in which it was massed in the chamber 25.

We are aware that it has heretofore been attempted to transport grout under pneumatic pressure, but grout and concrete are essentially different in their constituents and nature and must be handled quite differently. Grout is essentially liquid and may be handled like water, whereas concrete is a mix made up of watery elements as well as segregated stone and the greatest care must be taken to prevent the separation of the water from the stone and similarly to prevent separation of the other particles which go to make up concrete, such as sand, cement and the like. If air pressure be applied to the surface of a body of water or grout, the latter will eventually be forced out through a stop cock or hole or outlet provided therefor, and the mobility of the mass permits and causes it under the action of the pressure constantly to find its level and eventually the exit from the receptacle. Concrete, on the contrary, unless properly handled will lose its mixed condition, the lighter and liquid particles leaving the heavier segregated stone, thus not only destroying the mix but leaving all the heavier particles unacted upon by the air, and therefore undelivered at the required point.

In conveying concrete to a distant point, the nature of the mass makes it important to present to the air as large a superficial area as possible in order to obtain the required pressure to move so heavy a mass, and we have discovered that if a mass when acted upon by this relatively large surface area be gradually compacted in opposition to the action of the air and reduced to a relatively small condensed column leading to the delivery point, the mass as a whole will gradually be expelled through the outlet in this condensed column form without separating and destroying the parts of the mix and without leaving any of the mass in the receptacle undelivered. We have found that concrete may be so transmitted for considerable distances amounting to hundreds of feet, varying, of course, with the dimensions of the mass and the degree of pressure employed.

Whatever be the pressure or the size and shape of the segregated rock bearing mixture or the distance found most convenient to employ, such pressure by acting upon the entire exposed surface of the mixed mass in the chamber 25 expels such mass without in any sense destroying its integrity. That is to say, the distribution of the segregated rock material through the other constituents of the mass is preserved throughout the transmission thereof so that the material is received at its destination in precisely that mixed and distributive condition in which it was deposited in said chamber 25. As suggested in the preamble, this is of the utmost importance in the handling of concrete because if the mixture once carefully prepared were substantially disturbed in transmission, it would be practically useless when received at its destination.

While we prefer to employ surface pressure applied to the mass in the chamber 25, our invention nevertheless comprehends the use of jet devices, such as indicated at 50 and 52. It will be observed that these jet devices are so placed as to deliver their respective jets within the mass flowing through the pipe 26, and consequently do not disturb the mixture or condition of the mass, because the pressure is projected by said devices, so to speak, against the solid walls of material standing in front thereof.

We are aware that it has been attempted to transmit grain and other dry articles by the use of air currents, but so far as we know this has almost invariably been accomplished either by delivering the grain laterally into a conduit through which a current of air is maintained in motion and

which picks up the particles as they enter and carries them along individually in suspension, or else a current of air has been employed which contacts with the mass exteriorly, contradistinguished from interiorly, and picks off the particles in a more or less segregated condition, resulting, as in the first instance, in carrying them along in suspension.

Contradistinguished from such method as the foregoing, our method aims to maintain the integrity of the mass, even though its form may be changed, and to push the mass along in its integral state, either by pressure applied wholly from behind it and squeezing it along, so to speak, or else by air jets so delivered into or behind the mass or portions thereof as to push it along without segregating or separating its particles.

We are aware that attempts have been made to handle mud and the like by the use of a vacuum chamber communicating at one side through the inlet pipe with the river bottom and at its opposite side through the delivery pipe with the point of destination at which the mud is to be deposited. In such apparatus a vacuum is first created in the chamber which draws mud from the river bottom into and so as substantially to fill the vacuum chamber, after which the inlet is closed, the outlet opened and air or steam under pressure admitted to expel the mass through the outlet pipe to its destination. In such apparatus, the use of a vacuum for filling the vacuum chamber is quite as apt to destroy the nature of a proper mixture by causing some of the particles drawn along to outrun others, as is a flight of air carrying segregated particles in suspension, and furthermore a permanently closed chamber is required for the filling thereof whereas in the handling of concrete upon a commercial scale it is important to be able to fill the charging or discharging chamber in the open air.

Grout which is practically a liquid, consisting of water with sand and cement in suspension, has been pneumatically conveyed, but the method of mixing the same has invariably been such as would destroy the distributive relation of the segregated rock materials with respect to the other substances of which concrete and the like are composed.

While our invention is especially adapted for handling concrete and other cementitious segregated rock bearing materials, it is nevertheless adapted for use in conveying or transmitting any semi-liquid or fluent segregated rock bearing mass, since, when used in connection with such mass, it provides for the highest efficiency combined with the greatest economy; that is to say, it permits of the greatest amount of material being delivered in a given time at a given distance with a minimum of fluid under pressure for the propulsion or transmission thereof.

In practice, either the surface pressure or the jet devices may be used or they may be employed conjointly as occasion may require and in lieu of air we may employ steam or other fluid under pressure.

Whenever it is desired to use fluid or a liquid material such, for example, as water, either for assisting the flow of the materials or for flushing out the apparatus, the same may be admitted to the pipe 40 in any convenient manner. The pipe 50 is shown as extended beyond the branch 53 and broken off to permit of its connection with another similar apparatus should it be desired to use a series instead of one.

The apparatus here shown as adapted for the use of our improved system is substantially identical with that shown in Letters Patent of the United States issued to us under date of August 4, 1908, and numbered 894,813, although our invention is not restricted to that apparatus.

Claim.

That method of conveying concrete to a distant point without destroying the original distributive relation of its constituent parts, to wit;—segregated stone, sand, cement-mortar and water; which method consists in massing said concrete in desired completely mixed condition in a receptacle having a charging opening and also an outlet conduit leading to said distant delivery point, and, having closed said receptacle, subjecting the contained mass to the surface action of expelling air under pressure and gradually and progressively contracting the said mass as it moves under the action of said pressure toward said outlet, to form a contracted and condensed delivery column and to prevent said expelling pressure from breaking through into the delivery conduit and varying the mix of the concrete during the conveyance thereof.

In testimony whereof, we have signed our names to this specification in the presence of two subscribing witnesses.

JOSIAH WILLIAM BUZZELL.
WILLIAM H. LARKIN, Jr.

Witnesses to signature of Josiah William Buzzell:

W. H. Laine,
Georgie H. Clegg.

Witnesses to signature of William H. Larkin, Jr.:

Herman R. Miller,
William E. Higgins.