

W. G. WILSON.
CONCRETE MIXING AND CONVEYING MACHINE.
APPLICATION FILED MAY 14, 1917.

1,372,385.

Patented Mar. 22, 1921.

2 SHEETS—SHEET 1.

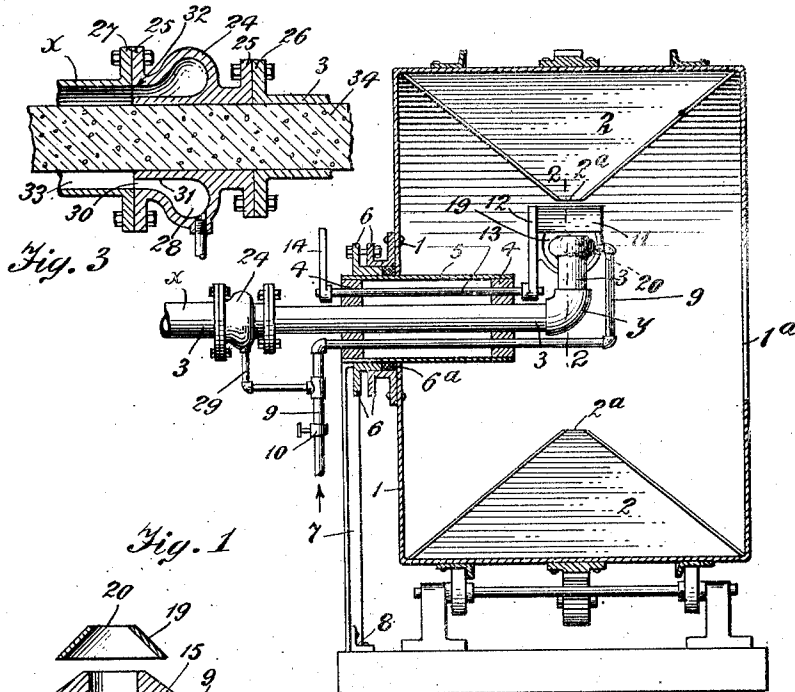


Fig. 3

Fig. 1

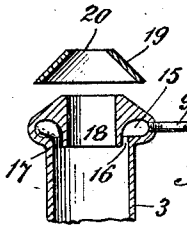


Fig. 2

Fig. 4

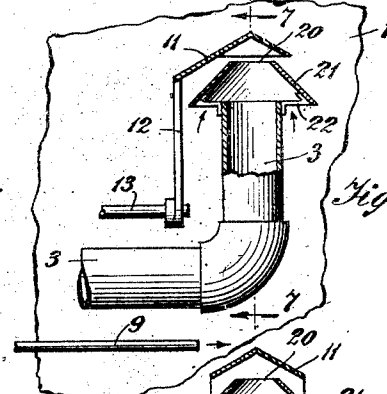
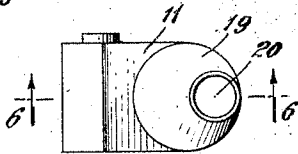


Fig. 5

Fig. 6

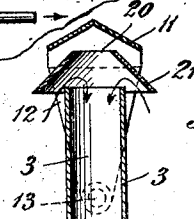
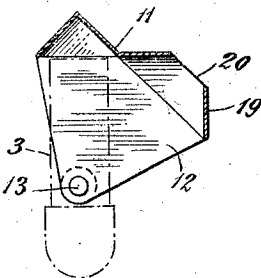
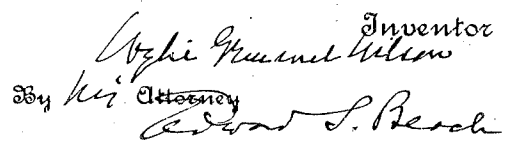


Fig. 7

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1,372,385.

2 SHEETS—SHEET 2.



UNITED STATES PATENT OFFICE.

WYLLIE GEMMEL WILSON, OF ELIZABETH, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO EVERLASTING VALVE COMPANY, A CORPORATION OF NEW JERSEY.

CONCRETE MIXING AND CONVEYING MACHINE.

1,372,385.

Specification of Letters Patent. Patented Mar. 22, 1921.

Application filed May 14, 1917. Serial No. 168,510.

To all whom it may concern:

Be it known that I, WYLLIE GEMMEL WILSON, a subject of the King of Great Britain, residing at Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Concrete Mixing and Conveying Machines, of which the following is a specification.

The main object of this invention is to effect an increased rapidity of discharge of mixed concrete-forming aggregates in their proper mixed condition without segregation of the aggregates. Another object is to construct the apparatus in such way that considerable volumes of compressed air heretofore established and lost on the opening up for introduction of new loads to be mixed, do not require to be established and therefore cannot be lost. While the present invention relates particularly to concrete, yet the apparatus described may be useful in mixing and placing other kinds of material that may or may not present the peculiar difficulties inherent in concrete. While the conveying fluid herein referred to will generally be air, yet in some cases steam may be usefully employed instead of air. The air conveying-current hereinafter alluded to in operative relation to a mass of concrete in a conduit has velocity because it flows from a volume of compressed air, but such current itself can hardly be accurately termed compressed air.

In the accompanying drawings forming a part hereof and illustrating the principle of my invention in the best mode now known to me of applying that principle,

Figure 1 is a vertical, central, sectional elevation of my new concrete mixing and placing machine through the axis of the rotation of its drum.

Fig. 2 is an enlarged vertical sectional detail at line 2—2 of Fig. 1, illustrating one construction of a more or less perfect annular conveying-current-former at the intake mouth of the receiving end of the discharge pipe.

Fig. 3 is an enlarged sectional detail at line 3—3 of Fig. 1, showing my new form of booster for creating a more or less perfect annular conveying current within any desired portion of a discharge or placing pipe.

Fig. 4 is a top plan view of a movable shield for covering within the chamber of the drum the inward intake end or mouth of the discharge pipe, this shield being located above such mouth during the mixing operation. The view also shows a conveying current annulus former movable with the shield over said mouth, and having a hole through it for passage of a gravitating stream of concrete into the mouth of the discharge pipe during the discharging operation.

Fig. 5 is a sectional elevation of a different form of the invention.

Figs. 6 and 7 further illustrate the shield and the current former, Fig. 6 being in vertical section at line 6—6 of Fig. 4, and Fig. 7 in vertical section at line 7—7 of Fig. 5.

Fig. 8 is a view wherein the placing pipe shown in Fig. 1 is replaced by a conoidal small-work section to the smaller outward end of which a small-work distributing or placing hose having a discharge nozzle is attached. The small-work hose is shown of an interior diameter very considerably less than the interior diameter of the discharge pipe. This view also shows on the current former a small-work concrete-stream controller which is used in conjunction with the small-work hose and the conoidal section therefor. Such conoidal section is for the purpose of reducing the diameter of the conduit formed by it and the discharge pipe.

Fig. 9 shows a form of the placing conduit differing from that shown in Fig. 1 by the interposition therein of my new boosters, at intervals apart. Its intake section is also shown as a casting having conveying fluid-annulus-formers at each end.

Fig. 10 is a diagrammatic view showing the discharge pipe removed from the machine and without the current former or the shield; and indicates a falling stream of concrete, and shows arrows which indicate a conveying-fluid current flowing from all directions exterior to the intake-end portion of the discharge pipe, up the sides thereof, over its edge, and downwardly within the pipe, as obtains in that form of my invention shown in Fig. 5.

Referring to the drawings, the drum 1 constitutes one example of apparatus or means for loading the discharge pipe with

material to be discharged or placed. It is of known form and is open to the atmosphere at the central opening in its intake end. It is provided with interior mixing, lifting and spilling blades 2. In the form shown, the blades 2 are carried by the interior wall of the drum and in the preferred form as shown are each scoop-shaped, being of approximately triangular shape in plan view. Each end portion of a blade is inclined toward its mid-section, and its apical portion 2^a is at the front edge of the mid-section. The form of the blades is not new with me. Blades of any other practical form may be used. As the blades successively come to the top of the drum in its rotation for discharge of the material, in the case of concrete, after the aggregates have been properly mixed by previous rotation of the drum, they severally discharge *seriatim* into the open upstanding end of the discharge pipe 3, the open-end portion being a form of hopper or receiver. This upstanding receiving-end portion of the discharge pipe 3 curves downwardly to a horizontal portion of the pipe which is fixed in a stationary bearing for the center of the discharge end of the drum. In the form shown such bearing comprises a pair of collars 4 that are supported in an annulus 5 which leads out of the drum through a central opening in its discharge end. Annular glands 6 are used to hold a lubricating ring 6^a in place and to rotate with the drum on the annulus 5 as a bearing in such central opening of the drum. The collars 4 are fixed in the annulus around the pipe 3, and the assemblage of the collars, annulus, discharge pipe and stuffing-box members is stationary and is in part supported by a strut 7 which is fixed at its upper end to the projecting end of the annulus 5 and fixed at its lower end by its foot 8 to the frame base. Any other form of stationary bearing may be used.

A conveying-fluid pipe 9, assumed in this form of the invention to lead from an air receiver of an air-compressing apparatus, and having a control valve 10, extends into the drum chamber through the collars 4 and its inner discharge end portion leads to an annular chamber at its discharge mouth, as described below.

Each mixing operation is performed by several rotations of the blades after the concrete-forming aggregates have been put in the drum in the usual way.

During the mixing of the aggregates the open end of the discharge pipe within the drum chamber is closed against admission into it of the mixed aggregates by means of a shield 11 which as shown is fixed to the inner arm 12 of a horizontal rocker shaft 13 which is journaled in holes through collars 4 and provided at its exterior end with a

crank handle 14 by a movement of which the shield is rocked into or out of position above the open up-turned end of the discharge pipe 3. The upper surfaces of the shield are downwardly slanted so that concrete dropped on it by the blades during the mixing operation will not lodge thereon, but will slide off and drop to the bottom of the drum chamber wherein the aggregates are mixed by the movement of the mixing, lifting and spilling blades, as usual.

The annular chamber above mentioned, indicated by 15, is formed in an enlargement of the upper end of the discharge pipe 3, and its mouth 16 which opens downwardly into the discharge pipe is formed between the inner wall of pipe 3 and the outward wall 17 of a tubular projection 18 of the enlarged upper end of the pipe into the chamber of the pipe; the opposed walls being parallel and the exterior and interior diameters of the pipe inwardly of the inward end of the tubular projection 18 being less than the inner diameter of the pipe. Such a mouth discharges into the pipe a more or less perfect annulus of conveying fluid, and in the direction of the material entering the pipe and moving through it; and such annulus forms in a very practical way a more or less continuous film of conveying fluid around the material in the pipe, with the important result of diminishing skin-friction between the material and the opposed wall of the pipe; and the current of conveying fluid thus formed transmits its movement and velocity to the material, mainly by friction.

The concrete discharge pipe 3 is shown of uniform diameter, its outwardly projecting end being constructed to be coupled with a pipe or flexible placing hose or conduit *a*. This placing hose or conduit may be some hundred feet long and either flexible or stiff. It has substantially a larger interior diameter than that of the discharge pipe 3 and is customarily used as the normal discharge conduit for the larger work requiring a maximum normal output of the machine. For filling cracks, patching and other relatively small work, special provision is made as is hereinafter set forth.

The shield 11 has an integral conoidal extension 19, the shield and its extension being rockable intermittently into and out of position over the open end of the discharge pipe. The apical upper end of extension 19 has a hole 20 of less diameter than the interior diameter of the discharge pipe so that when it is interposed between the infed material and the receiving end of the discharge pipe it not only excludes unduly large stones, if any, as sometimes do come in concrete, but also makes the fed-in stream of material of a lesser cross-sectional dimension than the receiving end of the discharge pipe so that space is formed between the

stream of material and the inner surface of the pipe for the more or less perfect annulus of conveying fluid. The point is that the cross-sectional area of the fed-in stream should be less than the cross-sectional area of the discharge pipe itself.

In another form of my invention shown by Figs. 5 and 7, a drum having a door (not shown, but well known) for its intake opening may be used as shown in my Patent 1,290,459, of January 7, 1919, and in such case instead of the current former at the mouth of the intake pipe being formed as described in connection with Figs. 1 and 2, the intake end of the discharge pipe within a more or less air-tight drum may have a conoidal current-former 21 supported on struts 22 fixed to the pipe, the upper apical opening 20 forming a passageway for the descending stream of material and compressed air in the drum, the compressed air forming currents which flow upwardly and come from all directions within the drum chamber, into the larger bottom opening of the current former, and over the edge of the intake mouth of the discharge pipe, and down into it, as indicated in Fig. 10 wherein 23 indicates falling material. In Figs. 6 and 7 the shield 11 will of course be moved from over the hole 20 during the discharge operation, and the drum chamber be charged with compressed air at the proper time through the pipe 9 the discharge end of which is open within the drum chamber. It will be observed that the current former 21 serves both as a current former and also as a stream regulator for the material.

Heretofore the desirable rapidity of discharge of the mixed concrete from the chamber of a mixing drum by use of compressed air has not been obtainable in practice for a variety of reasons, one of which is that at the greater bend of the discharge pipe within the drum, as at *y*, the concrete usually encounters undue skin-friction with the inner wall of the discharge pipe; and generally speaking, with reference to drum and other types of concrete machines, and according to my experience, the compressed air used for effecting the discharge has tended either to wedge a conoidal mass of concrete or to force the outer walls of a concrete mass of other shape, against the inner wall of the discharge pipe, thereby hindering the requisite rapidity of discharge and very often resulting in either non-discharge or an intermittent discharge of the concrete from the machine. It has been hitherto proposed to form a conoidal mass of the mixed aggregates in the discharge conduit, compacting the mass as a plug or wad by compressed-air pressure on its inward end, and then to move the wad or plug in more or less balanced pressure out of the discharge pipe. This mode of operation as above indicated

results in forcing the soggy concrete mixture against the inner wall of the pipe to a considerable extent, and involves undue skin-friction. Again, it has been proposed to drive a body of the mixed concrete out of a concrete-containing hopper by means of an air blast which pushes a charge of the mixture out of the hopper into a discharge pipe. And again, it has been proposed to introduce a blast of compressed air into the base of a discharge hopper and so entrain a charge of the wet mass on the principle of an injector and force it through a discharge pipe. The latter case often results in a bridging of the material above the air entraining current, and the air blast itself at the base portion of a hopper offers undesirable resistance to the movement thereinto of the mixed aggregates.

By my invention the chamber of the drum may be open to the atmosphere, the drum itself being merely one form of means for supplying the discharge pipe.

Heretofore for the placing through conduits of concrete in a wet and soggy mass of mixed aggregates comprising cement that more or less quickly produces an initial setting action in the concrete mass, the placing or conveying apparatus when dependent in whole or in part on the use of an air current from a volume of compressed air have frequently been constructed with one or more compressed-air blast-nozzles often referred to as boosters. Such boosters have hitherto in concrete-discharging apparatus been constructed to act on the entraining principle, and have been arranged concentrically within a discharge conduit or hopper in such wise that they have directed their blast either into or against a mass of the plastic concrete either in passing or after passing the booster nozzle, the center of the impingement of the blast being at the axis of the mass. The consequence is that while the idea of using a booster is alluring, and while such boosters may have and often do have in some locations a beneficial action, their blast being discharged as stated forcibly expands and presses the outer wall of the traveling mass of concrete directly against the inner wall of the discharge conduit, thereby creating a skin-friction that is very objectionable at times and very often occasions defective discharge. The force of such expanding and pressure of the concrete mass against the inner wall of the discharge pipe of course varies with and according to the compressed-air pressure used. Such artificially-augmented skin-friction not only retards or tends to retard the discharge of the concrete, but also often disintegrates the mixed concrete-forming aggregates of sand, cement, and broken rock or stone, and water, as will be readily appreciated on consideration of the fact that the specific gravities

and other characteristics of such aggregates are various. When any such disintegrating action occurs and the mixed aggregates of the cementitious mass are thereby more or less segregated out of their proper mixture, it often results that the air current with more or less sand or cement, but usually with more or less sand and small particles of stone, are driven through the discharge conduit together with more or less water in advance of the heavier aggregates and adhesive cement, the latter lagging behind with heavier aggregates.

By my invention, both as regards the creation of the described fluid conveying-current at the mouth of the intake end of the discharge pipe, and as regards the boosters, for both features are on the same principle, mixed concrete or other material can be continuously delivered with rapidity in proper mixed condition and without the disintegration mentioned, by bringing the gravitating stream of the material to be discharged into the mouth of the discharge pipe with a then thereinto-flowing air or stream current coming from all directions from the volume of conveying fluid within the chamber 15 or other chamber, so that in a practical way the flowing stream of concrete is more or less inclosed by a more or less continuous annular film of conveying-fluid which may be considered as acting somewhat as a lubricant between the wall of the concrete stream and the inner wall of the discharge pipe. At the moment of approach to or of entrance in and near the mouth portion of the discharge pipe, the concrete stream under the mere force of gravitation does not reach for the moment the velocity of the conveying current, but almost instantly acquires, and afterward has that velocity, and the concrete mass is carried safely around the bend at *y* without either clogging therein or thereabove or setting up the bridging action often encountered.

My new booster 24 is shown as a tubular casting having end flanges 25 one of which in Fig. 6 is attached to the flange 26 of the outer end of the discharge pipe, and the other of which is attached to the flange 27 of the placing pipe *x* which is of greater interior diameter than the discharge pipe. The booster is formed with an annular chamber 28 which communicates with the supply pipe 9 by a branch pipe 29. The annular mouth 30 which discharges into the placing pipe *x* is formed between the outer wall of a tubular extension 31 of the intake end portion of the booster and the opposed wall of the chamber, these walls being parallel one to the other and to the axis of the passageway through the booster casting. The construction is such that by reason of the placing pipe encircling the booster mouth, an annular space is formed

therein at 33 to permit the conveying current coming from the booster, tubularly to inclose the mass 34 of concrete and form, as it were, a tubular lining for the placing conduit adjacent the booster of my conveying fluid whereby the skin-friction between the material and the conduit is minimized or obviated.

For small work, such as filling up cracks and patching, it is not desirable to feed a stream of maximum size to the discharge pipe or to use a placing pipe *x* of the large size. Therefore, for such small work I provide a conoidal cover 24 (Fig. 8) for the current former, such cover having a smaller apical hole than the hole 20; set it on the current former, partially covering the hole 20 to reduce the cross-section of the descending stream; attach the larger end of a conoidal conduit-reducing section 25 to the outer end of the discharge pipe; and connect the small end of the section 25 to a small diameter hose 26 having a delivery nozzle 27.

In Fig. 9 I show a sectional discharge pipe which may be supplied with either compressed air or steam, or in part with one and in part with the other. A compressed-air receiver is indicated by A, and a source of steam by S. Herein, the receiving end section 40 of the discharge pipe has an annular chamber 41 adjacent its open intake end, the chamber having an annular mouth 42 formed by a tubular projection 43 from the upper end portion of the section into the chamber thereof and the opposed wall 44 of the section; such walls being parallel one to the other and to the axis of the mouth portion of the section wherein an annular current of conveying fluid is established, in the same way as above explained.

The discharge end portion 45 of section 40, which is shown as a bent section with its upper end upstanding as a hopper, is surrounded by an annular chamber 46 for reception of the conveying fluid, the annular mouth 47 of the chamber discharging into an annular enlargement 48 which extends beyond the end portion 45 and has a flange 49 connected to the flange 50 of a conoidal conduit-diameter-reducing section 51 the forward end flange of which is connected at 52 to the end of a conduit section 53, and this in turn is connected to one of the boosters such as already described and having an annular fluid-receiving chamber 54 the annular mouth of which is constructed and discharges an annulus such as described.

The air-supply pipe 55 from the source A of compressed air is shown in communication by pipe 56 with the chamber 41. A branch pipe 57 from pipe 55 leads from air pipe 55 to the chamber 46, and a branch pipe 58 leads from air pipe 55 to the chamber 54. The branch pipes 56, 57 and 58

are each provided with a regulating valve 59, and the air-pipe 55 has a regulating valve 60 whereby the air supply can be shut off from chamber 41, this valve 60 being interposed in pipe 55 forwardly of the branch pipe 61 leading from the steam supply S to the pipe 55. Pipe 61 is provided with a regulating valve 62. Whenever desired the valve 60 may be closed to prevent the flow of air to chamber 41 and valve 62, and that valve 59 which is in branch 56 opened to permit steam to flow into chamber 41, while if the valves 59 in branch pipes 57 and 58 are open, air will be admitted to the chambers 46 and 54. If steam be admitted to the chamber 40 it will entrain outside air which will form an air current or currents flowing as illustrated in Fig. 10. Such air currents will form a kind of lubricant for the material as above stated, and the steam contacting with the air and material will be partially condensed and will then transmit its velocity with great rapidity to the moving mass of material and air, and this operation involves economy of compressed air, less compressed air being required. The traveling water particles of condensation having mass and velocity tend to prevent back-blast in the discharge or placing pipe.

As shown in Fig. 9, a supply chute may constitute another means than the drum for supplying the intake mouth of the discharge pipe with material. The open intake end of the drum shown in Fig. 1 is indicated by 1^a. As the drum in the preferred construction herein set forth is open to the atmosphere, as shown in Fig. 1, it is not material that the bearing in the opposite end wall of the drum and comprising in the form shown the annulus 5, should be literally a bearing in the mechanical sense. It is shown as an actual mechanical bearing, but this is only incidental to the main function of the so-called bearing as a center support for the discharge pipe and such bearing is to be regarded as a pipe support, rather than as a mechanical bearing.

What I claim is,—

1. The combination of a drum having an inlet opening for material, and interior revoluble, lifting and spilling blades, said drum having a pipe support at one end, with a bent discharge pipe which is tubular from end to end and which has within the drum chamber an upstanding tubular portion, the upper tubular end of which is open adjacent and below the discharge end of a blade as the blade comes to the top of the drum, the discharge pipe within the drum chamber being closed to admission of air except at its said upper open tubular end, and means for forming at said upper end a fluid current entrant into such upper end simultaneously with the discharge of material thereinto.

2. The combination of a revoluble drum having an inlet opening for material at substantially the center of one of its end walls and a central pipe support in its opposite end wall, the drum being provided with interior lifting and spilling blades; a bent discharge pipe having a horizontal portion mounted in said central support and also having an upstanding portion formed with an open upper end for reception of material spilled from a blade as it comes to the top of the drum, such upper end portion forming a mouth and being provided with a pressure fluid chamber which opens downwardly into the interior of the upper end or mouth portion adjacently the upper end of the discharge pipe and above its bend; a compressed fluid pipe discharging into said chamber and entrant into the drum chamber; and a shield for said open end of the discharge pipe; the compressed fluid chamber structure being constructed to deliver the conveying fluid under pressure into the mouth of said open end simultaneously with the discharge of material thereinto; and a device for making the stream of material spilled from a blade of less dimensions cross-sectionally than the cross-sectional area of the mouth portion of the discharge pipe.

3. The combination of a revoluble drum having interior lifting and spilling blades; a discharge pipe having an upstanding open end below and in the line of discharge of said blades; a current former above said open end and having an opening through it for the flow of the material therethrough into said open end; the current former being spaced apart from such open end; and a pressure fluid means discharging into said former; and a means for making the stream of material spilled from a blade of less cross-sectional area than the cross-sectional area of the mouth portion of the discharge pipe.

4. The combination of a revoluble drum having interior lifting and spilling blades; a bent discharge pipe having an opening for the reception of material spilled from a blade as it comes to the top of the drum; and a current former in the path of the material as it is spilled from said blade, the current former being spaced from said opening of the discharge pipe and located between the bend of the pipe and said blade; and a pressure-fluid means discharging into said former.

5. The combination of a revoluble drum having interior lifting and spilling blades; a discharge pipe having a mouth within the drum chamber for simultaneous reception of material spilled from a blade as it comes to the top of the drum and of a conveying fluid current; said mouth being itself constructed with means for discharging conveying fluid downwardly into the pipe adjacent and below said mouth and in the

direction of the flow of material into the mouth portion of the discharge pipe; and means for directing a current of conveying fluid downwardly into the mouth portion of
5 the discharge pipe simultaneously with the entrance therinto of the descending stream of material.

6. The combination of a revoluble drum having interior lifting and spilling blades
10 with a discharge pipe having an opening

within the drum chamber for reception of material spilled from a blade as it comes to the top of the drum; and a current former spaced outwardly from said opening; the current former having a hole through it of
15 lesser dimension than the dimension of such opening.

In testimony whereof I have hereunto set my hand this 12th day of May, 1917.

WYLIE GEMMEL WILSON.