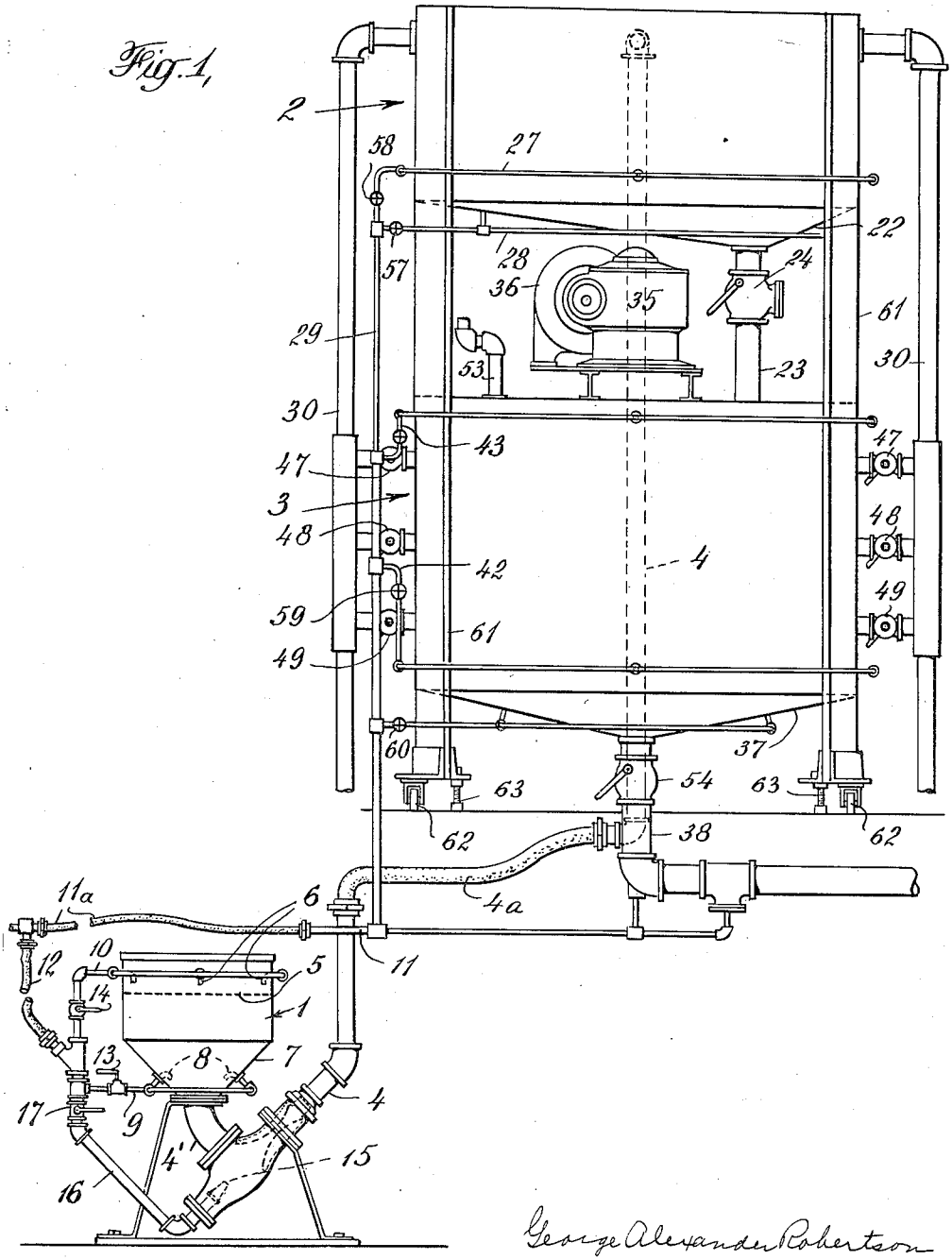
Dec. 18, 1934. G. A. ROBERTSON 1,984,431

SAND CLEANING MACHINE AND METHOD

Filed Aug. 25, 1930 2 Sheets-Sheet 1

Fig. 1.



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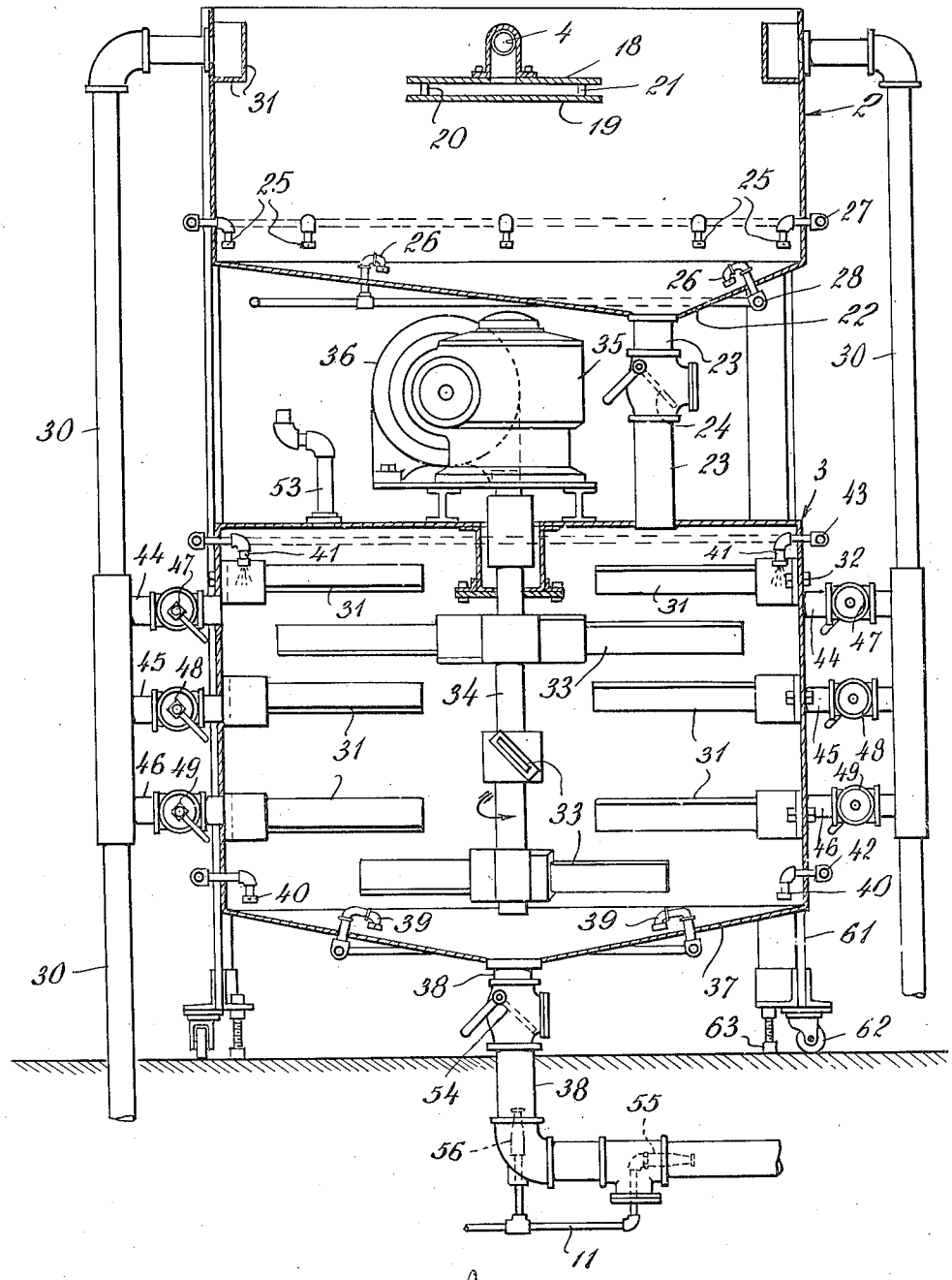
BY Pennie, Davis, Marvin & Edmonds
his ATTORNEYS

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Fig. 2.



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Patented Dec. 18, 1934 1,984,431

UNITED STATES PATENT OFFICE

1,984,431

SAND CLEANING MACHINE AND METHOD

George Alexander Robertson, Richmond, Va.

Application August 25, 1930, Serial No. 477,564

3 Claims. (Cl. 209—159)

This invention relates to apparatus and method especially suitable for cleaning sand used for filtration purposes. The apparatus constituting the subject matter of this invention may be used for the purpose of conveying and washing sand, or other granular material and is adapted to handle such material in a very efficient manner.

This invention was developed with a view to providing efficient apparatus for cleaning sand, or the like, and in general the improved apparatus comprises a washing chamber containing means for thoroughly agitating a mixture of sand and water. The washing chamber may be provided with means for rinsing the sand after the mixture of sand and water has been agitated to loosen foreign particles adhering to the sand, and I may employ means for flushing the sand out of the washing chamber after the cleaning operation has been completed. In some cases it is desirable to provide a storage chamber in close proximity to the washing chamber whereby a charge of sand and water may be accumulated ready for the washing operation. This storage receptacle may be arranged at an elevation above the washing chamber and I may employ means for flushing the sand out of the storage chamber into the washing chamber.

The apparatus may include a charging hopper from which the sand may be conveyed to the washing apparatus. This hopper may contain a sieve adapted to remove large foreign objects from the sand before the same is conveyed to the washing apparatus, and I prefer to employ means for facilitating the passage of the sand through the hopper and to the washing apparatus. Water jets may be employed for preventing the sand from becoming lodged in any part of the apparatus and the jets are preferably arranged in such a manner as to facilitate the movement of the sand through the apparatus under control of the operator.

The washing chamber may be equipped with a plurality of stationary blades or deflectors and these blades may cooperate with a set of rotatably mounted blades whereby the mixture of sand and water may be thoroughly agitated. The washing chamber and the storage receptacle (where such a receptacle is provided) may be provided with means for draining off excess water.

The various objects and advantages of my invention will be more apparent upon considering the following detailed description which relates to that embodiment of my invention disclosed in the accompanying drawings in which

Fig. 1 is an elevation of sand cleaning apparatus embodying my invention and

Fig. 2 is a vertical section view of the washing apparatus illustrated in Fig. 1.

In Fig. 1 of the accompanying drawings I have illustrated a charging hopper 1, a storage receptacle 2 and a washing chamber 3, the storage chamber being located directly above the washing chamber and adapted to receive material discharged from the hopper 1 through a conduit 4 made up in part of a rubber hose 4*a*.

The hopper 1 is open at the top and is provided with a screen or sieve 5 adapted to separate large foreign objects from sand dumped into the hopper. A plurality of nozzles 6 are provided for supplying jets of water to the sand to facilitate its passage through the sieve into the base of the hopper. The base of the hopper, shown at 7, is tapered and is provided with a discharge port communicating with a pipe 4′ which is in direct communication with the pipe 4 leading to the storage receptacle 2. Nozzles 8 may be provided in the base of the hopper to facilitate the discharge of sand from the same. Water is supplied to these nozzles 8 and to the nozzles 6 near the top of the hopper by suitable pipe connections 9 and 10, respectively, which communicate with a main water supply pipe 11 through a hose 11*a* and a pipe connection 12. Valves 13 and 14 control the supply of water to the nozzles 8 and 6 respectively. A nozzle 15 faces in the direction of the flow of the material and removable Venturi throat, which connects with pipe 4. Water may be supplied to this nozzle through the pipe 16 and the flow of water to the nozzle may be controlled by a valve 17. It will be understood that by supplying water to the nozzle 15, the sand is withdrawn from the hopper 1 and forced through the pipe 4 to the washing apparatus.

The washing apparatus, comprising the washing chamber 3 and the storage chamber 2, is shown in detail in Fig. 2. The mixture of sand and water entering the storage receptable 2 by the pipe 4 is delivered into the chamber 2 through a distributor comprising two plates or discs 18 and 19 spaced apart by suitable spacers 20 and 21. It will be understood that the mixture of sand and water enters the space between the discs 18 and 19 near the center thereof and is discharged into the receptacle 2 in the form of an outwardly and downwardly projecting curtain of liquid which strikes the bottom of the

receptacle 2 adjacent its periphery. The sand is thus distributed within the receptacle 2 and settles to the bottom 22 of the receptacle, which is tapered toward a discharge opening communicating with a discharge pipe 23. A cut-off valve 24 is located in this pipe and may be used to control the discharge of sand and water from the storage receptacle into the washing chamber. A plurality of nozzles 25 may be arranged around the circumference of the storage chamber for the purpose of supplying jets of water to flush the sand out of this chamber into the pipe 23. Additional nozzles 26 may be provided in the base portion 22 of the storage receptacle for supplementing the action of the nozzles 25. The nozzles 25 and 26 are preferably of the construction shown in the drawings, that is, they comprise a downwardly projecting pipe or nipple with its lower end capped and perforated on one side so as to provide small lateral jets of water discharging out of the sides of the caps. This construction of nozzle has been found particularly satisfactory and was arrived at only after considerable experimentation. With nozzles formed of horizontally projecting open-ended nipples, it is the tendency of the sand to force back into the pipe. This is particularly true with the nozzles employed in the lower chamber of the apparatus, as will be later described.

Water may be supplied to the nozzles 25 and 26 through suitable pipe connections 27, 28 and 29, the pipe 29 being connected to the main water supply pipe 11 as shown in Fig. 1. Drain pipes 30 communicate with the upper portion of the storage receptacle for the purpose of removing excess water from the storage chamber. The open ends of these drain pipes are protected by baffles 31 which prevent the passage of sand into the drain pipes.

The washing chamber 3, located below the storage chamber 2, contains a set of stationary baffles 31 which may be fixed to the sides of the washing chamber by suitable means such as the bolts 32. By loosening these bolts the blades 31 may be adjusted to any desired angle and they are preferably set at an angle to the horizontal in such a way that they cooperate with a set of rotatably mounted blades 33 to produce a turbulent condition of the sand and water mixture in the washing chamber. The blades 33 are mounted on a vertical shaft 34 which projects into a gear box or housing 35 containing suitable speed reduction gearing driven by a motor 36. The blades 33 on the shaft 34 may be set at an angle to the horizontal in such a relation with respect to the direction of rotation of the shaft that these blades tend to lift, or force upward, the mixture of sand and water in the washing chamber, and the stationary blades 31 may be arranged so that they tend to force the mixture of sand and water downward. In this way the sand and water are thoroughly agitated and the sand is effectively cleaned.

The base 37 of the washing chamber may be tapered toward a discharge port communicating with the discharge pipe 38 and a plurality of nozzles 39 may be mounted in this base 37 for the purpose of flushing the cleaned sand out of the washing chamber into the discharge pipe. Other nozzles 40 may be arranged around the circumference of the washing chamber near the base thereof and the water jets issuing from these nozzles may be used to supplement the water jets from the nozzles 39 to facilitate the discharge of sand from the washing chamber.

The nozzles 39 and 40 are preferably of the same construction as the nozzles 25 and 26 described above. The tendency of the nozzles to become clogged with sand is greater in the lower chamber than in the upper, due to the operation of the mechanical agitator used in this chamber. By using the construction shown and with the openings in the nozzles in the sides facing in the direction in which the sand is moving so that the sand will not be forced directly into the nozzles, little trouble from clogging is experienced. The side discharge of the nozzles is also important in order to avoid abrasion of the metal of containers 2 and 3. Were the nozzles arranged to discharge directly against the walls the resulting sand blast effect would soon cut through the metal.

Downwardly discharging nozzles 41 may be arranged near the top of the washing chamber for supplying jets of water to the same. It will be understood that the nozzles within the washing chamber, which may be supplied with water through suitable pipe connections 42, 43, can be used for cleaning the washing chamber, and the nozzles near the base of this chamber can be used for the purpose of supplying rinse water which percolates up through the sand to remove all foreign material from the sand. All of the nozzles in the washing chamber are preferably arranged so that they face downward thus preventing the sand from clogging the nozzles. The drain pipes 30 may be connected to the washing chamber 3 by a plurality of pipes 44, 45 and 46 located at different levels and therefore adapted to remove water from the washing chamber at various levels. Valves 47, 48 and 49 may be used to control the flow of water through the pipes 44, 45 and 46, respectively. An air vent pipe 53 may be provided at the upper end of the washing chamber to permit the escape of air from this chamber.

The discharge pipe 38 which communicates with the base of the washing chamber is provided with a cut-off valve 54, and I prefer to employ a pair of nozzles 55 and 56 located inside this discharge pipe to supply jets of water to facilitate the movement of sand through the discharge pipe. The nozzle 56 faces toward the washing chamber and water issuing from this nozzle tends to prevent the sand from becoming lodged in the discharge pipe near the valve 54. The other nozzle 55 faces away from the washing chamber and water issuing from this nozzle forces the sand through the discharge pipe 38 away from the washing chamber. Water is supplied to the nozzles 55 and 56 through the water supply pipe 11.

In using the apparatus illustrated in the accompanying drawings, sand to be cleaned is shoveled into the charging hopper 1 and the valves 13 and 14 are manipulated to facilitate the passage of the sand through this hopper into the charging pipe 4. The valve 17 may be opened to supply water to the nozzle 15 in the charging pipe 4 whereby the sand is forced through this pipe into the storage chamber 2. When it is desired to discharge the sand from the storage chamber into the washing chamber valves 57 and 58 may be opened to flush the sand out of the storage chamber into the discharge pipe 23. After the washing chamber has been supplied with a charge of sand and water from the storage chamber, the cut-off valve 24

may be closed and another charge of sand accumulated in the storage receptacle. When the motor 36 is started, the blades 33 in the washing chamber rotate and the agitation of the mixture of sand and water may be continued as long as may be desired. Upon shutting down the motor the appropriate drain valve 47, 48 or 49 (depending upon the level of the sand in the washing chamber) may be opened and the valves 59 and 60 may be opened to supply water to the base of the washing chamber. This water flows upward through the sand and then out through the drain pipe removing with it all of the foreign particles which have become loosened from the sand during the agitating operation. If desired, the motor may be again started and the washing operation repeated. After the washing and rinsing operations have been performed, the cut-off valve 54 may be opened and the contents of the washing chamber discharged through the discharge pipe 38 with the aid of water supplied through the nozzles 55 and 56 in the discharge pipe.

It is convenient to locate the storage chamber 2 directly above the washing chamber 3; in fact these two chambers may be carried by common supports such as those illustrated at 61. The motor 36 and the speed reduction gearing may be conveniently mounted between the storage chamber and the washing chamber thus providing a compact arrangement of the various parts of the apparatus. The supports for the washing apparatus are preferably carried by castors 62 to facilitate movement of the apparatus whenever desired, and jack screws 63 may be provided for holding the apparatus in position during operation thereof. These jack screws serve not only to prevent accidental movement of the apparatus during operation, but they also serve to carry at least a portion of the weight of the apparatus which is considerable when it is filled with sand and water.

By using my improved cleaning apparatus, sand or other granular material can be effectively cleaned with a minimum of effort. It is merely necessary to deposit the sand in the charging hopper and then manipulate the various valves to cause the sand to pass through the apparatus under control of the operator, and the actual cleaning of the material is effected by merely starting the motor which drives the rotatable blades within the cleaning chamber.

It is to be understood that my invention is not limited to the specific embodiment herein illustrated and described in detail, but includes such modifications thereof as fall within the scope of the appended claims.

I claim:—

1. Apparatus of the type described comprising a sand washing chamber, means for charging sand and water into said chamber, a plurality of stationary blades in said chamber, and a plurality of rotatable blades therein, the rotatable blades being arranged to force the sand upward and the other blades being arranged to force the sand downward, and a plurality of downwardly facing nozzles in said chamber for supplying water thereto.

2. The method of washing sand which consists in agitating a batch of sand to be washed in a receptacle, allowing the sand to settle by discontinuing the agitation, then forcing water under pressure upwardly through the settled sand to a discharge opening above the sand to thereby carry away the wash water and rinse the settled sand of adhering matter and finally discharging the cleaned sand from the apparatus.

3. The method of washing sand which consists in agitating a batch of sand to be washed in a receptacle, allowing the sand to settle by discontinuing the agitation, then forcing water under pressure upwardly through the settled sand to a discharge opening above the sand to thereby carry away the wash water and rinse the settled sand of adhering matter, and finally discharging the cleaned sand in a fresh stream of water from the apparatus.

GEORGE ALEXANDER ROBERTSON.