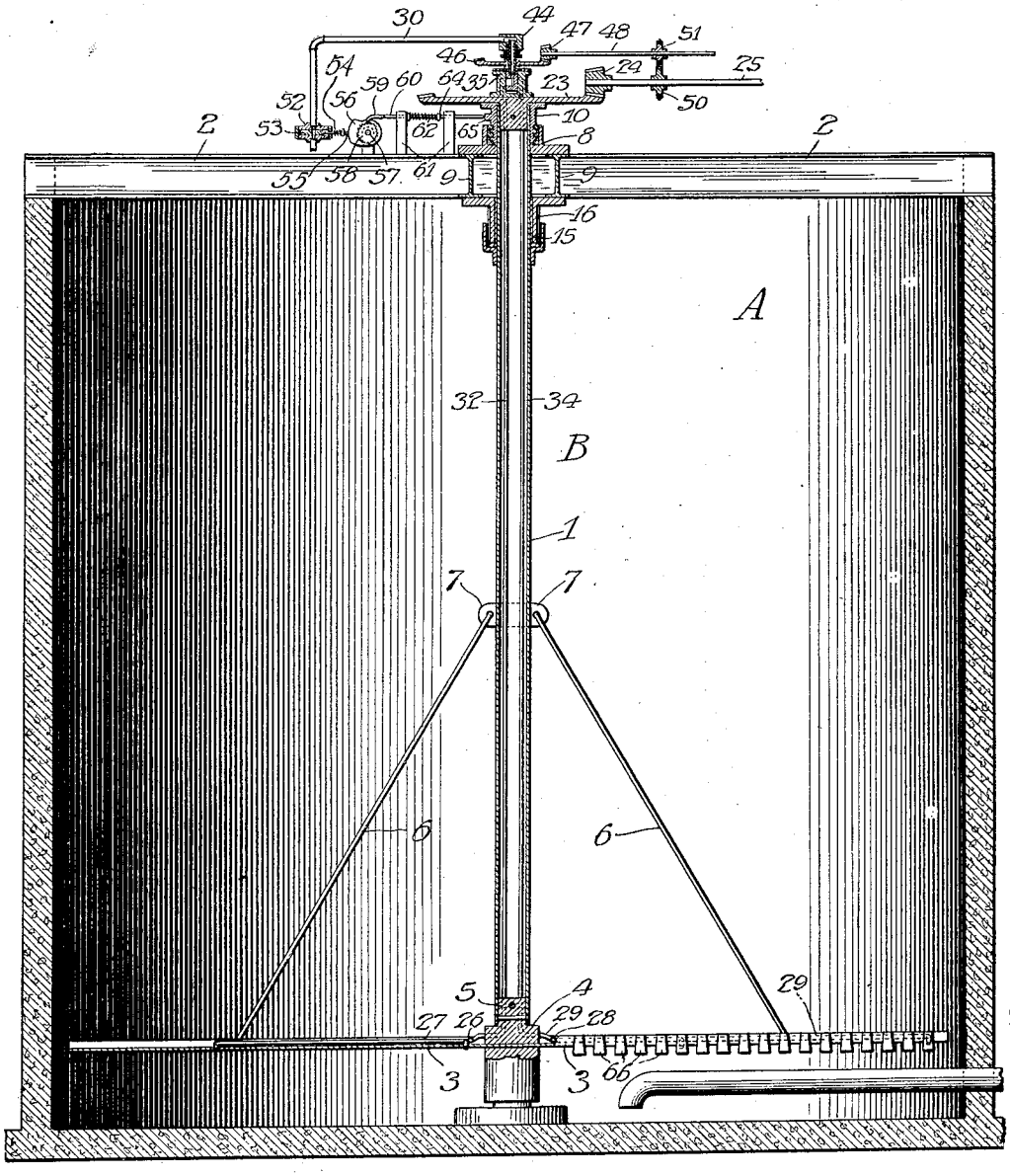
June 28, 1927. 1,633,708

R. E. MINOGUE

AGITATOR

Filed Sept. 28, 1925 2 Sheets-Sheet 1

Fig. 1.



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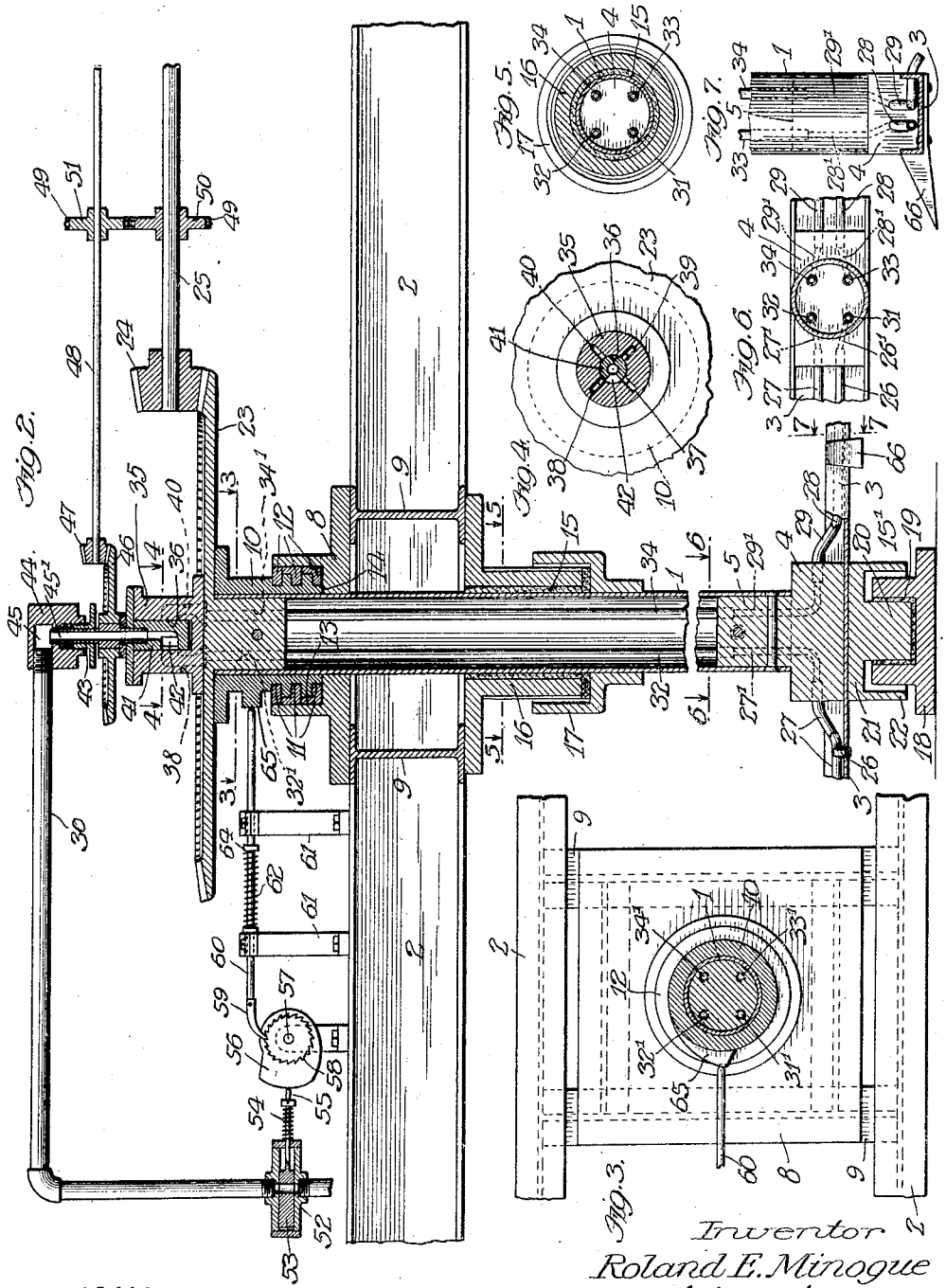

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UNITED STATES PATENT OFFICE.

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AGITATOR.

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This invention relates to agitators and relates particularly to agitators for mixing slurry in the manufacture of cement, and other liquid or semi-liquid products, in which agitation is effected in whole or in part by compressed air discharged into a tank containing a quantity of the material to be agitated.

In accordance with the present practice of agitation by means of compressed air, the air is discharged into the tank by means of stationary pipes which communicate with a source of supply of air under pressure, the discharge ends of which extend into desired proximity to the bottom of the tank in which the material to be agitated is contained and which are controlled by manually operated valves, which are opened at intervals to discharge air under pressure into said material, said air, rising through the material, operating to agitate and mix the same.

This method of agitation is more or less haphazard and in the manufacture of cement, is objectionable for the reason that, excepting in immediate proximity to the discharge ends of the air supply pipes, a deposit of solid material gradually accumulates in the bottom of the tank, which has to be removed from time to time, necessitates closing down the tank and also involves considerable expense for time and labor.

The object of the present invention is to overcome the foregoing objectionable features, by providing an agitator in which agitation is effected primarily by compressed air, constructed and arranged to discharge air into a tank equipped with my improved agitator at predetermined intervals, substantially uniformly over the entire area of the bottom of the tank.

To effect the objects of the invention, an agitator embodying my invention and improvements comprises the various features, combinations of features and details of construction hereinafter described and claimed.

In the accompanying drawings in which my invention is fully illustrated,

Figure 1 is a central sectional elevation, showing the same installed for use in a suitable tank.

Figure 2 is an enlarged view, substantially similar to Fig. 1, the tank and certain other parts being omitted.

Figures 3, 4, 5 and 6 are sectional plan views on the lines 3—3, 4—4, 5—5 and 6—6, respectively, of Fig. 2; and

Figure 7 is a fragmentary sectional elevation on the line 7—7 of Fig. 2.

For purposes of clear and definite illustration, I have, in the drawings, shown an agitator embodying my invention and improvements as applied in use to a tank designed and adapted for containing slurry to be used in the manufacture of cement.

Describing the invention with particular reference to the drawings, A designates a tank designed to contain slurry, which may be one of a series of tanks from which the slurry is withdrawn in succession and delivered to the kilns, not shown.

Mounted within the tank A is an agitator embodying my invention and improvements, designated as a whole B, which, in the preferable construction shown, comprises a hollow shaft 1, rotatably mounted in suitable bearings supported on I-beams 2 which extend across the tank A and the ends of which are supported by the said walls thereof. Secured to the lower end of the shaft is an agitator bar 3 consisting, as shown, of a channel bar disposed with its channeled side up. As shown, said agitator bar 3 is secured directly to a metal block 4, the lower face of which is proportioned to fit the channel of the agitator bar 3 and which comprises a boss 5 fitted to the lower end of the shaft 1 and which is pinned or otherwise rigidly secured thereto.

The agitator bar 3 may be riveted or bolted directly to the block 4.

The agitator bar 3 extends substantially parallel with the bottom of the tank A at a short distance above the same and is preferably reenforced and strengthened by diagonal braces 6, which connect said agitator bar at opposite sides of its center with lugs 7 on the shaft 1. In practice, said agitator bar is usually positioned two or three feet above the bottom of the tank, but this distance may be varied as desired.

The shaft 1 is rotatably mounted in a bearing formed in a bearing block 8 which is supported on I-beams 9 connected to and which connect the I-beams 2.

As shown, the bearing for mounting the shaft 1 is a familiar form of thrust bearing constructed and arranged to carry the weight of the shaft 1, agitator bar 3 and as-

sociated parts, consisting of a bearing sleeve 10, pinned or otherwise rigidly secured to the upper end of the shaft 1, formed in which, adjacent to its lower end, are grooves 11 adapted to receive bearing rings 12, preferably made of suitable bearing metal, said bearing rings 12 being confined in an opening 13 in the upper end of the bearing block 8, and transmitting the weight of the shaft 1 and parts supported thereby, to the thrust surface 14 at the bottom of the opening 13. To provide for assembling the bearing, the rings 12 are split.

Preferably, also, the bearings for the shaft 1 comprise steady bearings adapted to maintain said shaft in fixed axial alignment. As shown, there are two steady bearings, designated, respectively, 15, 15′. The bearing 15 is formed in a bearing block 16 secured to the undersides of the I-beams 9, access of slurry or other gritty material contained in the tank A, to the bearing 15, being prevented by a mud-guard 17 secured to the shaft 1, which closes the lower end of said bearing. The lower end of the bearing block 16 and the opposed surface of the mud-guard 17 form an upward thrust bearing which will prevent lifting of the agitator shaft 1.

The steady bearing 15′ consists of a bearing block 18 secured to the bottom of the tank A provided with a journal bearing 19, fitted to which is a journal 20 formed on a journal block 21 secured to the block 4 on the lower end of the agitator shaft 1. A depending flange or skirt 22 is formed on the journal block 21 and, when the bearing is assembled, is adapted to surround the portion of the block 18 in which the journal bearing 19 is formed. With this construction, it is obvious that, when slurry or other liquid or semi-liquid substance is admitted to the tank A and the level thereof rises above the lower edge of the depending flange or skirt 22, air will be trapped in the space within said depending flange or skirt, which will effectually prevent access of material contained in the tank to the journal bearing 19.

In operation, rotation is adapted to be imparted to the agitator by suitable means consisting, as shown, of bevel gears 23 and 24 secured to the upper end of the agitator shaft 1 and to a driven shaft 25.

In accordance with my invention, air under pressure is adapted to be discharged into the tank A from pipes 26, 27, 28 and 29 supported on the agitator bar, the inner ends of which communicate with air channels 26′, 27′, 28′ and 29′ formed in the block 4 secured to the lower end of the shaft 1, as heretofore described.

The ends of said pipes terminate at different distances from the axis of the shaft 1 and are directed at an angle downwardly and rearwardly relative to the direction of rotation of the agitator bar in operation, the ends of said pipes forming nozzles from which air under pressure is discharged into the tank A. With the described construction, it is obvious that, as the agitator rotates, the nozzles formed by the discharged ends of said pipes will describe circles concentric with the axis of the shaft 1, the relation being preferably such that the circles described by said nozzles will be arranged substantially equal distances apart and will be disposed symmetrically over the cross sectional area of the tank.

Air under pressure is adapted to be delivered to the pipes 26, 27, 28 and 29 from a pipe 30 adapted to communicate with a source of air under pressure, not shown, thru pipes 31, 32, 33 and 34 supported within the agitator shaft 1, the lower ends of which communicate with the channels 26′, 27′, 28′ and 29′ in the block 4, and the upper ends of which communicate with air channels 31′, 32′, 33′ and 34′, respectively, formed in the bevel gear 23 secured to the upper end of the agitator shaft 1.

In what I now consider the preferable embodiment of my invention, the admission of air under pressure from the supply pipe 30 to the pipes 31, 32, 33 and 34 is controlled by a distributing valve constructed and arranged to admit air to said pipes, respectively, one at a time and during any desired interval—usually during one entire revolution of the agitator.

What I now consider preferable means for this purpose are as follows: Secured to the gear 23 so as to rotate therewith is a valve casing 35, which is provided with a valve seat 36, and formed in which are air channels 37, 38, 39 and 40, see Figure 4, the lower ends of which, respectively, are in open communication with and which form extensions of the air channels 31′, 32′, 33′ and 34′ formed in the bevel gear 23, and the upper ends of which open into the valve seat 36. Seated in said valve seat 36 so as to rotate therein, is a valve member 41, formed in a side of which is a recess 42, which is adapted to be brought successively into communication with the air channels 37 to 40, by rotation of said recessed valve member. As shown, said recessed valve member comprises a valve stem 43, the upper end of which is fitted to turn in a bearing formed in a fixed housing 44 provided with a cavity or chamber 45 into which the end of the valve stem 43 extends, said valve stem being hollow, thus providing an air channel 45′, which connects the chamber or cavity 45 with the recess 42 in the valve member 41. The air supply pipe 30 is also connected into an opening in the housing 44, which communicates with the cavity or chamber 45.

In operation, rotation is adapted to be

imparted to the recessed valve member 41, convenient means for this purpose consisting of bevel gears 46 and 47 secured, respectively, to valve stem 43 and to a shaft 48, having driving connection with the shaft 25, consisting, as shown, of a chain belt 49 adjusted to sprocket wheels 50 and 51, secured to said shafts, respectively.

With the described construction, it is obvious that rotation of said recessed valve member 41 will bring the recess 42 therein successively into communication with the air channels 37 to 40. Said air channels are preferably spaced equal distances apart, and the dimension of the recess 42 circumferentially of the valve member 41 and the relative rates of rotation of the agitator and of said recessed valve member are such that said recess 42 will be separately in communication with each of the air channels 37 to 40 during substantially a full revolution of the agitator. With four distributing pipes 26 to 29, and corresponding air channels 31′ to 34′ and 37′ to 40′ in the gear 25 and valve casing 35, respectively, spaced equal distances apart circumferentially of the valve seat 36, I attain this end by means of a recess 42 defined by a sector of the valve member 41 of approximately ninety degrees and a rate of rotation of the valve member 41 to the agitator A of approximately one and one-quarter (1¼) to one (1).

My invention contemplates that the agitator shall run continuously, thus overcoming the objection of hit or miss agitation by means of air pipes controlled by manually operated valves. To provide proper agitation, it is usually not necessary that air under pressure be supplied to the distributing pipes continuously during the operation of the agitator. In accordance with my invention, therefore, I preferably provide a valve for controlling the air supply pipe and means for operating the same, whereby said valve will be opened at and for predetermined intervals, a desirable relation for mixing slurry being such that said control valve will be open during approximately 4 in each 20 revolutions of the agitator; or stated differently, air will be admitted to each of the pipes 26 to 29, respectively, during one in each twenty revolutions of the agitator.

In the preferable construction shown, I attain this end by means as follows: Connected into the air supply pipe 30 is a slide valve 52, the movable member 53 of which is maintained yieldingly in position to close the valve by a spring 54 applied to the valve stem 55 and which is adapted to be moved endwise to open said valve by means of a circular cam 56 secured to a shaft 57, the effective length of which is equal to one-fifth of the circumference of a circle of which said cam forms an arc. Rotation is adapted to be imparted to the cam shaft 57 by means of a ratchet gear comprising a ratchet wheel 58 secured to said cam shaft and a pawl 59 adapted to engage the teeth of said ratchet, pivoted to a rod 60 mounted in bearing in standards 61 so as to be movable endwise. Said rod is adapted to be moved endwise to retract the pawl by a spring 62 inserted between a bearing standard 61 and a collar 64 fast on said rod, and which is adapted to be advanced at each revolution of the agitator shaft by means of a cam 65 on the sleeve 10 of the thrust bearing of the agitator shaft. As shown, the ratchet wheel 58 contains twenty (20) teeth and the height of the cam 65 is proportioned to advance the rod a distance corresponding to a feed of one tooth.

Preferably, also, my improved agitator comprises lifting teeth on the agitator bar 3, which project frontwards from said bar in the direction of rotation, the upper surfaces of which are downwardly and frontwardly inclined.

Obviously, my improved agitator admits of a wide range of modification as regards details of construction and operation within the principle and scope of my invention, and I do not, therefore, desire to limit myself to the particular construction shown, nor to any particular construction, as in view of my disclosure, skilled mechanics can readily make necessary changes and alterations therein to adapt it for use under different conditions and for agitating different materials.

I claim:—

1. In an agitator, the combination of a rotatable shaft, means for rotating said shaft, an agitator bar secured to said shaft, a source of supply of air under pressure, means defining channels adapted to communicate with said source of air supply comprising pipes the discharge ends of which, respectively, are positioned on the agitator bar at different distances from the axis of the agitator shaft, and means for controlling the admission of air from said source of air supply to said distributing channels operating to admit air thereto during predetermined spaced intervals of time.

2. An agitator as specified in claim 1, in which each air pipe is provided with one discharge nozzle only.

3. An agitator as specified in claim 1, in which the discharge nozzles of the pipes supported on the agitator bar are positioned at different distances from the axis of the agitator shaft, the relation being such that, in operation, said nozzles, respectively, will describe circles spaced substantially equal distance apart, and said nozzles comprising a nozzle positioned adjacent to the agitator shaft and another adjacent to an outer end of the agitator bar.

4. An agitator as specified in claim 1, which also comprises teeth on the agitator bar, the top sides of which are forwardly and downwardly inclined.

5. An agitator as specified in claim 1, in which the means for controlling the admission of air from the air supply pipe to the channels in the agitator shaft comprises a valve which controls said pipe, and means for operating said valve, the relation being such that said valve will be open for predetermined periods only during operation of the agitator.

6. An agitator as specified in claim 1, in which the means for controlling the admission of air from the air supply pipe to the channels in the agitator shaft comprises a valve which controls said pipe, and means controlled by rotation of the agitator shaft for operating said valve, the relation being such that said valve will be open for predetermined periods only during operation of the agitator.

7. An agitator as specified in claim 1, in which the means for controlling the admission of air from the air supply pipe to the channels in the agitator shaft comprises a valve which controls said pipe, and means for operating said valve constructed and arranged for maintaining it open for predetermined periods only during the operation of the agitator, said means comprising a cam on the agitator shaft, a rotatable ratchet wheel, a rod mounted so as to be movable endwise, an end of which projects into the path of said cam, a spring applied to said rod for retracting the same, a pawl mounted on said rod adapted to engage the teeth of said ratchet wheel, and operating connection between said ratchet wheel and valve.

8. An agitator as specified in claim 1, in which the means for controlling the admission of air from the air supply pipe to the channels in the agitator shaft comprises a valve which controls said pipe, means for maintaining said valve yieldingly closed, and means for opening said valve comprising a cam shaft, a cam thereon, a stem on said control valve a part of which projects into the path of said cam and means for rotating said cam shaft, the length of said cam corresponding to the period of time said valve remains open.

9. An agitator as specified in claim 1, in which the means for controlling the admission of air from the air supply pipe to the channels in the agitator shaft comprises a valve which controls said pipe, means for maintaining said valve yieldingly closed, and means for opening said valve comprising a cam shaft, a cam thereon, a stem on said control valve a part of which projects into the path of said cam and means for rotating said cam shaft, the length of said cam corresponding to the period of time said valve remains open, the means for rotating said cam comprising a ratchet wheel, a reciprocating rod, a pawl pivoted to said rod adapted to engage the teeth of the ratchet wheel, a cam on the agitator shaft adapted to advance said rod and pawl and yielding means for retracting said rod and pawl.

10. In an agitator, the combination of a rotatable shaft, means for rotating said shaft, an agitator bar secured to said shaft, a source of supply of air under pressure, means defining channels adapted to communicate with said source of air supply comprising pipes the discharge ends of which, respectively, are positioned on the agitator bar at different distances from the axis of the agitator shaft, means for controlling the admission of air from said source of air supply to said distributing channels operating to admit air thereto during predetermined spaced intervals of time, and a distributing valve comprising a casing secured to the agitator provided with a valve seat and with air channels which communicate with the distributing air channels and which open into the valve seat in said casing, and a valve member rotatably seated in said casing provided with a recess adapted to be brought into communication with the air channels in the valve casing by relative rotation of said valve casing and said recessed valve member, said recessed valve member also being provided with an air channel which connects the recess therein with the air supply pipe.

11. An agitator as specified in claim 10, which comprises means for rotating said recessed valve member, the circumferential dimension of said recess and the relative rates of rotation of said recessed valve member and agitator being such that the recess in said valve member will communicate with the different air channels in the casing of said distributing valve during predetermined intervals.

12. An agitator as specified in claim 10, which comprises means for rotating said recessed valve member, the circumferential dimension of said recess and the relative rates of rotation of said recessed valve member and agitator being such that the recess in said recessed valve member will be in continuous communication with each of the air channels in the valve casing during substantially a full revolution of the agitator.

13. An agitator as specified in claim 10, which comprises means for rotating said recessed valve member, the different air channels in the casing of said distributing valve being arranged equal distances apart, and the circumferential dimension of the recess in said recessed valve member and the relative rates of rotation of said valve member

and agitator being such that said recess will be in communication with the different air channels, respectively, during substantially a full revolution of the agitator.

14. An agitator as specified in claim 10, which comprises means for rotating said recessed valve member, the different air channels in the casing of said distributing valve being arranged equal distances apart, and the circumferential dimension of the recess in said recessed valve member and the relative rates of rotation of said valve member and agitator being such that said recess will be separately in communication with the different air channels during substantially a full revolution of the agitator.

15. In an agitator, the combination of a rotatable shaft, means for rotating said shaft, an agitator bar secured to said shaft, a source of supply of air under pressure, means defining channels adapted to communicate with said source of air supply comprising pipes the discharge ends of which, respectively, are positioned on the agitator bar at different distances from the axis of the agitator shaft, and means for controlling the admission of air under pressure to said channels comprising a distributing valve comprising a casing secured to rotate with the agitator provided with a valve seat and with air channels which communicate with the air distributing channels on the agitator and which open into the valve seat of said valve casing, and a valve member rotatably seated in said casing provided with a recess adapted to be brought into communication with the air channels in the valve casing, said recessed valve member also being provided with an air channel which connects the recessed valve member with the source of air supply.

16. An agitator as specified in claim 15, which comprises means for rotating said recessed valve member, the circumferential dimension of said recess and the relative rates of rotation of said recessed valve member and agitator being such that the recess in said valve member will communicate with different air channels in the casing of said distributing valve during predetermined intervals.

17. An agitator as specified in claim 15, which comprises means for rotating said recessed valve member, the circumferential dimension of said recess and the relative rates of rotation of said recessed valve member and agitator being such that the recess in said recessed valve member will be in continuous communication with each of the air channels in the valve casing during substantially a full revolution of the agitator.

18. An agitator as specified in claim 15, which comprises means for rotating said recessed valve member, the different air channels in the casing of the distributing valve being arranged equal distances apart, and the circumferential dimension of the recess in said recessed valve member and the relative rates of rotation of said valve member and agitator being such that said recess will be in communication with the different air channels, respectively, during substantially a full revolution of the agitator.

19. An agitator as specified in claim 15, which comprises means for rotating said recessed valve member, the different air channels in the casing of the distributing valve being arranged equal distances apart, and the circumferential dimension of the recess in said recessed valve member and the relative rates of rotation of said valve member and agitator being such that said recess will be separately in communication with the different air channels during substantially a full revolution of the agitator.

20. In an agitator, the combination of a rotatable shaft provided with a plurality of air channels, means for rotating said shaft, an agitator bar secured to said shaft, pipes supported on said agitator bar which communicate, respectively, with different air channels in the agitator shaft and are provided with discharge nozzles arranged, respectively, at different distances from the axis of the agitator shaft, a pipe for connecting the channels in said agitator shaft with a source of supply of air under pressure, and means for controlling the admission of air under pressure to said channels operating to admit air thereto during predetermined spaced intervals of time.

21. An agitator as specified in claim 20, in which the agitator shaft is hollow and the air channels therein are formed by pipes supported inside thereof.

22. An agitator as specified in claim 20, in which the agitator shaft is hollow and the air channels therein are formed by pipes supported inside thereof, and a fitting is secured in the lower end of the agitator shaft to which the agitator bar is secured and which is provided with air channels with which the pipes supported in said agitator shaft and on the agitator bar communicate.

In witness that I claim the foregoing as my invention, I affix my signature this 15th day of September, 1925.

ROLAND E. MINOGUE.