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1,624,567

MACHINE FOR DISPERSING VARIOUS SOLIDS AND LIQUIDS

Filed Aug. 22, 1924.

2 Sheets-Sheet 1

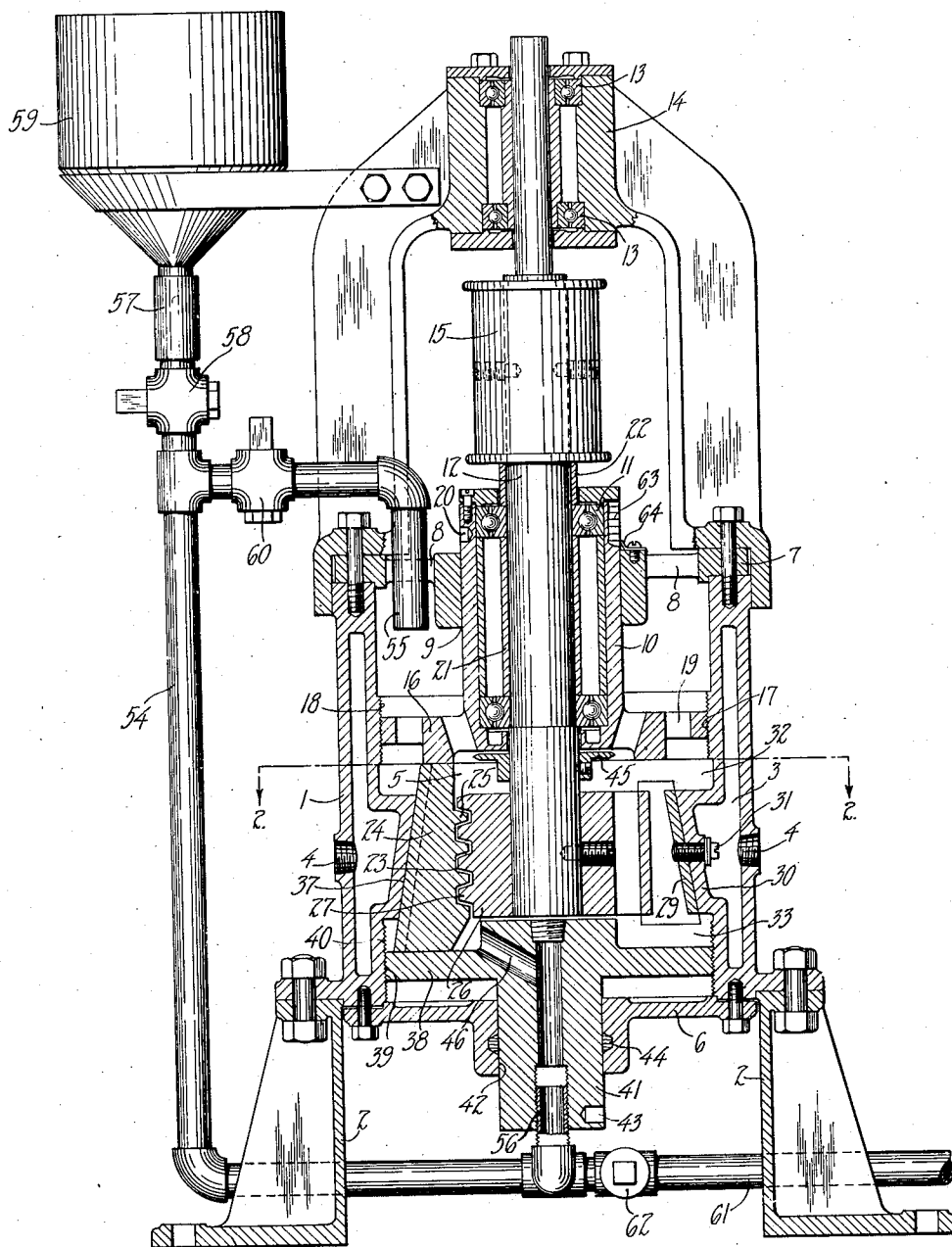


Fig. 1.

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2 Sheets-Sheet 2

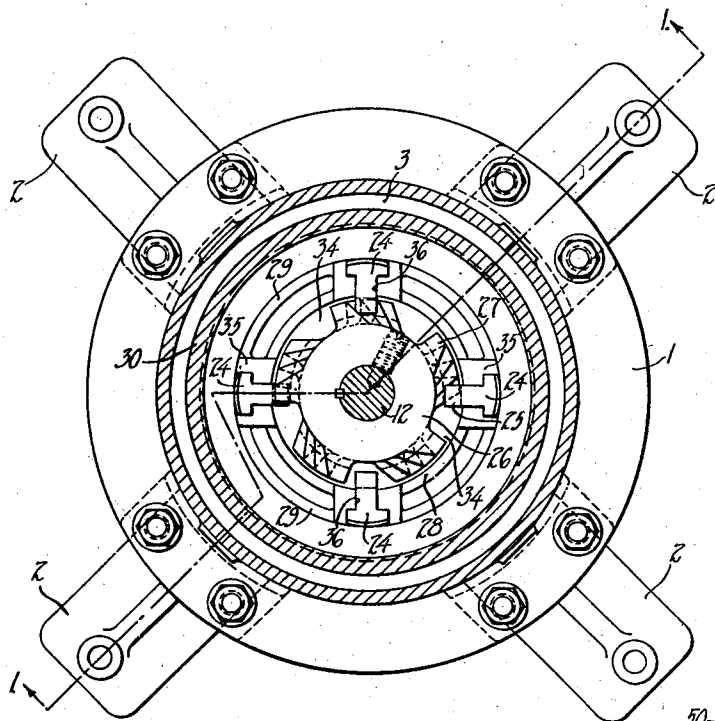


Fig. 2.

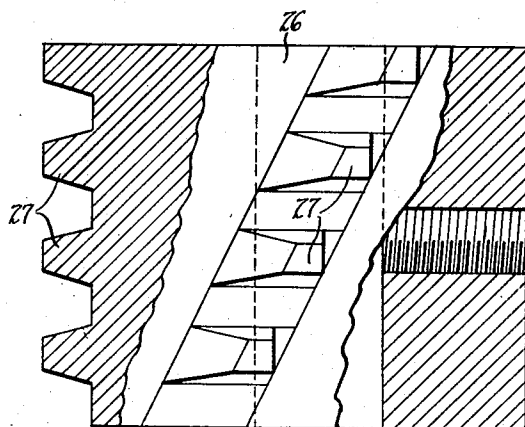


Fig. 3.

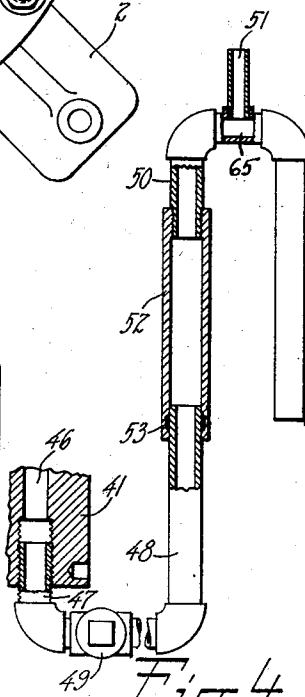


Fig. 4.

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UNITED STATES PATENT OFFICE.

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MACHINE FOR DISPERSING VARIOUS SOLIDS AND LIQUIDS.

Application filed August 22, 1924. Serial No. 733,524.

This invention relates to machines for dispersing various solids in liquids and various liquids in other liquids.

The principal object of the invention is to provide means insuring a definite continuous path of travel of the materials through the treating means whereby the desired treatment may be accomplished in a shorter time and in a much more efficient manner than has heretofore been possible.

A further object of the invention is to provide a continually operating machine that will produce a continuous flow of the treated materials from the machine while the treatment of the materials in the machine is taking place.

With the foregoing and other objects in view, the invention consists of the novel construction, combination and arrangement of parts, as hereinafter more specifically described and illustrated in the accompanying drawings, wherein is shown an embodiment of the invention, but it is to be understood that changes, variations and modifications can be resorted to which come within the scope of the claims hereunto appended.

In the drawings wherein like reference characters denote corresponding parts throughout the several views:—

Figure 1 is a vertical sectional view of the machine substantially through the broken plane 1—1 of Figure 2.

Figure 2 is a horizontal sectional view through the plane 2—2 of Figure 1,

Figure 3 is a vertical part sectional view of the movable members of the co-acting means for treating the materials, and

Figure 4 is a vertical part sectional view of an outlet connection of modified construction.

The machine is intended for use in treating materials by subjecting them to a beating action, or a grinding or shearing action, or both a beating and shearing action. In most instances both actions probably occur to a greater or less extent and participate in satisfactory treatment of the materials prior to their removal from the machine. In each instance either or both of these actions may occur, the adjustment made in the co-acting means governing the effectiveness of the disintegration, as will be obvious later when the machine is more fully described. For the sake of simplicity in the

specification and claims, a beating or a shearing action, or both of such actions when present together, that is to say a dispersion action strictly speaking, a disintegrating action, or both of such actions when present together, are referred to by the common term—dispersion action, and the machine is termed—a dispersion machine. In any case there is also present a decided pumping action which will later be more fully described.

Among the many uses for which the machine is adapted may be mentioned as a few of these, the preparation of emulsions, the dispersion of clays, ferric oxide, whittings, sulphur and numerous other rubber compounding ingredients, including accelerators, softeners, fillers, solids in organic solvents, and color materials. Also, many chemical reactions can be made to proceed more rapidly as a result of the intimate contact between the reacting substances. Also hydrolytic reactions such as that of casein in the presence of dilute alkalis can be greatly hastened. Also the formation of sodium resinate, the products of fat hydrolysis and numerous other similar reactions. These are only a few examples of the many possible uses to which the machine may be put.

Among the advantageous novel features of the machine may be mentioned principally the provision of a mixing chamber of relatively small volume for the co-acting means employed for treating the materials to operate in, and the provision of means for insuring a definite path of travel through the chamber of the materials, to and from the co-acting means whereby the materials will pass through the co-acting means and then through the definite and short path provided and back again to the co-acting means for a further treatment.

A further feature of the machine is the provision of an outlet for removing the treated materials from the chamber and an inlet for admitting untreated materials to the chamber that may be regulated to permit the materials to remain in the mixing chamber for a sufficient time to insure a thorough treatment thereof and to permit of a substantially constant flow of the treated materials from the machine.

A further feature of the machine is the

provision of adjusting means for varying the distance between the co-acting means to effect the most suitable adjustment thereof for the particular materials to be treated and the results sought.

The machine in the present instance is of the vertical type but with suitable obvious slight changes it can be transformed to a horizontal machine, if desired. The cylindrical drum 1 constituting the main body portion of the machine is bolted upon the legs 2. The drum is double-walled to provide a jacket 3 for the circulation of cooling water or other medium. The jacket is provided with the tapped orifices 4 to connect it with means (not shown) for supplying the medium and circulating same through the jacket.

The cylindrical drum 1 is provided interiorly with a vertical cylindrical mixing chamber 5. A circular plate 6 is bolted to the drum to serve as a closure for the lower end and a circular plate 7 is likewise bolted to the drum to serve as a closure or cover for the upper end. This cover is provided with orifices 8 through which the materials being treated may be seen and through which the machine may be thoroughly washed when desired. These orifices may be eliminated if desired to provide a tightly enclosed chamber which will be necessary in instances where a variation in pressure from the atmospheric pressure, as for instance a partial vacuum or a positive pressure, is desired. The cover is provided with a central orifice 9 for engaging a cylindrical casing 10 in which are housed the ball bearings 11. A vertical shaft 12 is rotatably mounted in these bearings and has its upper end rotatably mounted in other bearings 13 housed in the frame 14 bolted with the cover 7 to the drum 1. A pulley 15 is secured on the shaft between the sets of ball bearings.

The casing 10 is formed integral with a circular plate 16. The plate is threaded on its exterior cylindrical wall 17 to engage the interiorly threaded portion 18 of the cylindrical wall forming the drum 1. The plate is provided with orifices 19 for the same reasons that the orifices 8 are provided in the cover 7 and to further permit the chamber to be filled above this plate when desired, although it will rarely happen that it will be desirable to fill the chamber above this plate. The plate 16 may be turned about the shaft and thereby raised or lowered due to its threaded connection with the chamber, the engagement between the casing 10 and orifice 9 being such as to permit a rotating and longitudinal movement of the casing in said orifice. Means are provided in the casing 10 as for instance recesses, one being shown at 20, for engaging a wrench or other suitable tool for turn-

ing the casing and integrally formed plate 16 for raising or lowering the plate, this movement of the plate being for a purpose that will later appear. A collar 21 is secured on the shaft 12 between the sets of ball bearings 11 and another collar 22 is secured on the shaft on the opposite side of the upper set of ball bearings 11 whereby the shaft will be secured against axial movement relative to the plate 16 and will therefore move up and down with this plate.

The mixing chamber proper is beneath the plate 16 within which is disposed the co-acting means 23 comprising fixed members 24 each formed with a row of tooth-like projections 25 and movable members 26 each formed with a row of tooth-like projections 27 for co-action with the projections 25 for producing the dispersion and pumping actions upon the materials as will later more fully appear. The movable members 26 are secured upon the shaft 12 to rotate therewith.

The members 24 are termed fixed members on account of their being fixed during the treatment of the materials, but means are provided for moving them with the rotatable members axially whereby a simultaneous relative radial movement will be effected to adjust the distance between the co-acting parts of the fixed and rotatable projections when in functioning relation. This is accomplished in the present instance by providing adjusting means for positively moving the members 24 in a radial direction in a manner that will presently be described.

The mixing chamber 5 is provided with an outer wall 28 which in the present instance is divided into a number of parts, each constituting a front wall of a cored-out segmental member 29 secured to a portion 30 of the inner wall of the cylindrical drum 1 by screws 31. The wall of the cylinder upon which the members 29 are secured is inclined to the axis of the shaft 12 and the wall 28 is supported to leave a space at the top and bottom to thereby provide annular portions 32 and 33 at the top and bottom of the mixing chamber to afford communication between the chamber 5 and the space beyond the wall 28 provided by the cored-out portions of the segmental members 29. As thus described the interior of the drum 1 is divided by the partition or wall 28 into a mixing chamber disposed interiorly of the partition and an auxiliary passage disposed exteriorly of the wall or partition. The passage is in communication with the chamber at spaced points for repeatedly circulating the materials being treated through the mixing chamber and through the coacting means. It is to be understood however that my invention includes broadly means for producing a defi-

nite circulating path in a dispersion machine and that the construction of this feature as just described sets forth merely a single embodiment for it is obvious that other constructions of by paths or passages may be employed to produce the definite path if desired. The mixing chamber 5 and the passage beyond the wall 28 are divided transversely to form sections 34. The segmental members 29 are closed at their ends by walls 35 to separate the portions of the sections 34 within the passage, one from another, that is to say, on the outer side of the wall 28. The walls 35 are shaped to provide dove-tailed grooves 36 for slidably engaging the members 24 which are T-shaped to fit within the said grooves and are provided with the inclined rear walls 37 to engage the inclined walls of the portions 30. The projections 25 of these members 24 extend transversely into the mixing chamber and serve to separate the portions of the sections 34 within the chamber, that is to say on the inner side of the wall 28 opposite to the walls 35. The chamber and passage being thus divided circumferentially by the wall 28 and the two being divided transversely to form the sections 34 provides not only a definite circulating path from one side to the other side of the wall through the chamber and passage, but also provides a definite circulating path wherein the materials move from one section to the adjacent forward section in a progressive manner as they pass around the partition or wall 28 as will later more fully appear.

A circular plate 38 is threaded on its outer circumference 39 to engage the threads 40 on the inner circumference of a portion of the drum 1 in a similar manner to the plate 16 and serves as a support for the members 24, and like plate 16, may be rotated to raise or lower it for a purpose that will presently appear. The plate is provided with a centrally disposed hub 41 extending through an orifice 42 formed in the plate 6. The hub 41 is provided with recesses, one being shown at 43 for the reception of a wrench or other device for turning the plate 38, the connection between the hub 41 and orifice 42 being suitable for permitting the hub to rotate and move axially therein. A packing 44 is preferably provided in the orifice 42 for preventing leakage from the chamber and a similar packing will preferably be provided between the casing 10 and orifice 9 where the cover 7 is of the entirely closed type and especially in constructions where the cover is disposed in closer proximity to the plate 16, that is to say, in close proximity to the filled portion of the chamber, in which instance there would be a greater likelihood of the materials working out through the joint. Likewise, a stuffing

box or packing may be provided between the casing 10 and shaft 12 adjacent the chamber to prevent the materials from working into the ball bearings 11, but satisfactory results have been obtained by providing a disc 45 which is secured to the shaft 12 close to the casing 10 which will serve to check the materials from working into the joint and tend to throw off whatever liquid may come in contact therewith by centrifugal force as the shaft rotates.

The co-acting rows of projections 25 and 27 are arranged to produce a pumping action on the materials passing between them to force the materials through the path around the wall 28 and progressively from one of the sections 34 to the next section in advance and back again through the co-acting means in the most effective manner. This is accomplished by setting the projections of the rows of one set of the members in step fashion. In the present instance the projections 27 in the rows of rotatable members 26 are stepped as clearly shown in Figures 2 and 3 to permit of their consecutive co-action with the projections in the rows of the fixed members 24 in the direction of movement of the materials produced by this pumping action, which in the present instance is in a downward direction through the chamber 5.

The projections are further arranged to permit the movable projections to pass in close proximity to the fixed projections one at a time. This is accomplished by stepping the teeth in the several rows at a sufficient angular distance apart to permit only one tooth in any pair of co-acting rows to be in effective cooperative relation with another at a time, and to provide more rows in one of the series than in the other. In the present instance four rows of projections are stationary and five rows are movable, as clearly shown in Figures 2 and 3. By this construction only three projections will be in cooperation at a time so that a maximum amount of applied power may be centered thereon to most effectively produce the actions upon the materials.

By controlling the outlet and inlet to the chamber 5 they may be made to operate to maintain the desired amount of materials in the chamber for the desired length of time to produce the complete treatment of the materials before they leave the machine. To this end, the outlet and inlet may be regulated with any given speed of the pumping means to provide a repeated movement of the materials through the circulating path and co-acting means a sufficient number of times to effect a complete treatment of the materials, while at the same time permitting a continuous flow of the treated materials from the chamber. There are several ways of accomplishing this. In the present

instance the plate 38 and hub 41 are provided with an exit orifice 46 threaded at its lower end. In this lower end may be secured the piping shown in Figure 4. This comprises
 5 a nipple 47 for screwing into the exit 46, a section 48 provided with a control valve 49, and an inverted U-shaped section 50 provided with an opening 51 and a sleeve 52 telescoped upon the section 48, the sleeve being provided with a packing 53 to prevent
 10 leakage. The inlet (not shown) may be merely a pipe passing through one of the orifices 8 and connected with a source of supply and provided with a valve.

15 By the foregoing construction the valve in the inlet may be adjusted to furnish a continual supply of the untreated material in the required amount, and the valve 49 may remain open but with the height of
 20 65 in inverted U-section 50 adjusted so as to provide the desired height of the materials in the chamber 5. The outlet and inlet may thus be adjusted to cooperate to maintain a continuous flow from the machine and at
 25 the same time to maintain a uniform amount of materials in the chamber, the materials being treated at any time being held in the chamber a sufficient length of time to produce through the further action of the
 30 co-acting means the required number of circulations to thoroughly treat the materials as above set forth. The section 50 is made of rather large size pipe so as not to restrict the outflow and is provided with the opening
 35 51 to prevent siphoning of the materials from the chamber. If desired several inlets may be furnished for separately admitting the various materials into the chamber.

40 In the form of construction just described the treatment may be said to be dependent upon the feed control. In Figure 1 a different construction is shown where the treatment may be said to be under the outlet
 45 control. Here a conduit 54 is provided having its opposite ends 55 and 56 in communication with the chamber 5 at opposite sides of the co-acting pumping means, the end 55 being conveniently inserted through one
 50 of the orifices 8 as shown, and the end 56 being screwed in the outlet 46. A supply conduit 57 provided with a control 58 is connected to the conduit 54 at one end and at its other end to a receptacle 59 which
 55 contains the supply of the untreated materials. The conduit 54 is furnished with a control valve 60 between the valve 58 and the end 55. An outlet conduit 61 is connected to the conduit 54 near the end 56 and is provided with a control valve 62, which
 60 corresponds with valve 49 in Fig. 4. The operation of this piping system will later appear.

The operation of the machine is as follows:—First the proper adjustment of the

co-acting means 23 is effected. This is ac- 65
 65 complished, for instance if a closer inter-fitting of the co-acting means is desired, by first rotating the plate 16 in a proper direction to raise it the required amount. The casing 10 is suitably calibrated about its 70
 70 upper circumference as at 63 and an index 64 is secured to the cover plate 7 so that the plate 16 may be raised or lowered as indicated by the index to the exact position required. The raising of the plate simultane- 75
 75 ously raises the shaft 12 and co-acting means 23. The members 24 being slidably mounted on the walls inclined to the axis of the shaft are not only moved axially by the rotation of the plate 16, but in moving along 80
 80 said inclines are simultaneously moved radially to cause their projections to more closely interfit with the projections 27 of the rotating members to effect the desired adjustment. The plate 38 is then turned in 85
 85 the proper direction to raise it and bring it into contact with the members 24. Obviously if an adjustment in the reverse direction is desired the operation just described will be reversed, namely, the plate 38 will 90
 90 first be lowered out of the way and then the plate 16 will be lowered until the indicator 64 designates the proper adjustment after which the plate 38 will be raised into 95
 95 contact with the members 24. The co-acting parts may thus be brought into the most effective positions to exert the maximum shearing, beating and pumping actions upon the particular materials that are to be 100
 100 treated.

While the machine may be operated simply by pouring a charge of the material into the chamber and after it has been sufficiently treated removing it from the chamber and placing a fresh supply therein, I 105
 105 prefer to employ suitable feeding and discharging means that will permit the machine to operate continuously. Therefore, after making the desired adjustment of the co-acting 110
 110 means the machine may be operated either by the "feed control" or "outlet control" method as mentioned above. In case the feed control method is employed the material to be treated is simply introduced 115
 115 into the chamber 5 through a control valve, passed through the machine at the desired rate and through the valve 49 and the inverted U tube 48—52, Figure 4. The admission of the untreated materials will be made to the chamber at a continuous rate 120
 120 sufficient to permit them to be acted upon by the co-acting means the required number of times, that is to say, to permit a circulation of the materials through the chamber and through the co-acting means the 125
 125 required number of times to effect the desired treatment before leaving through the exit 46. The height of the material in the

reaction chamber is of course maintained by the adjustment of the height of 65 in Figure 4.

If, on the other hand, the "outlet control" method is employed the piping is arranged as shown in Figure 1. The admission of the untreated material into the machine and the flow of the treated material out of the machine through exit pipe 61 is controlled by valve 62. In this set-up, valve 58 is partially open and valve 60 somewhat less widely opened in such a way that when valve 62 is closed or partially closed the portion of the treated material flowing out through 46 is returned through conduit 54 and automatically retards the inflow of the untreated material through valve 58 and returns to the chamber through valve 60 and inlet 55. Thus in the same proportion as the treated material is retained by valve 62 just so the admission of the untreated material through valve 58 is retarded. Obviously the machine could be operated intermittently, as in the former method, by merely retaining a quantity of the material in the machine for a desired length of time before removing any of it; or in the latter case, by repeatedly passing the material through the machine and likewise through conduit 54.

In the specific embodiment shown in the drawings the materials will be forced by the consecutively acting projections 27 of each row downward on the inner side of the wall 28. They will pass under the base of the wall and upwardly through the passage exterior to the mixing chamber. They will then pass over the top of the wall 28 into the chamber at the top thereof. From here the materials will be forced or pumped through the co-acting means into the next section in advance. The downward and upward circulating movement will thus be repeated in this section around the wall 28 in a similar manner as just explained, which circulating movement is repeated progressively from one section to another. The materials thus pass around the wall and progressively from one section to the section in advance, and at each complete circulation around the wall 28 pass through the co-acting means until the required treatment is effected.

As many apparently widely different embodiments of this invention may be made without departing from the spirit thereof, it is to be understood that I do not intend to limit myself to the specific form of the invention as set forth except as indicated in the appended claims.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:—

1. A dispersion machine comprising a mixing chamber, series of stationary and movable interengaging projections disposed

in said chamber, and means for simultaneously adjusting both said series of projections.

2. A dispersion machine comprising a mixing chamber, series of stationary and movable interengaging projections disposed in said chamber, and means for simultaneously adjusting said series of projections in unison in one direction and relatively to each other in another direction.

3. A dispersion machine comprising a mixing chamber, series of stationary projections around the wall of same, series of rotary projections interengageable with the stationary ones, and means for adjusting both series along the axis of rotation of the rotary projections.

4. A dispersion machine comprising a mixing chamber, co-acting means within the chamber for treating the material contained therein, and an auxiliary passage divided into sections each in communication with said chamber at spaced points for repeatedly circulating the material being treated through said mixing chamber.

5. A dispersion machine comprising a mixing chamber, co-acting means within the chamber for treating the material contained therein having fixed members dividing the chamber into sections, and an auxiliary passage divided into sections in communication with the sections of said chamber at spaced points for repeatedly circulating the material being treated through said mixing chamber.

6. A dispersion machine comprising a mixing chamber, co-acting means within the chamber for treating the material contained therein having fixed and movable simultaneously adjustable members formed each with a plurality of tooth-like interengaging projections, and an auxiliary passage in communication with said chamber at spaced points for repeatedly circulating the material being treated through said mixing chamber.

7. A dispersion machine comprising a mixing chamber, and co-acting means within the chamber for treating the material contained therein having fixed and movable members formed each with series of tooth-like projections, said projections in one of the series being stepped and being arranged to permit a series of movable projections to enter into engagement with a series of fixed projections only one at a time.

8. A dispersion machine comprising a mixing chamber, and co-acting means within the chamber for treating the material contained therein including pumping of the material having fixed and movable members constituting respectively series of rows of tooth-like projections, the projections in the rows in one of said series being stepped to permit the engagement of the projections of

a movable row with those of a fixed row being effected consecutively in the direction of movement of the material produced by the pumping action.

5 9. A dispersion machine comprising a mixing chamber, and co-acting means within the chamber for treating the material contained therein including pumping of the material having fixed and movable members
10 constituting respectively series of rows of tooth-like projections, one of said series having more rows than the other, the projections in the rows in one of said series being stepped to permit the engagement of the pro-
15 jections of a movable row with those of a fixed row being effected consecutively in the direction of movement of the material produced by the pumping action.

20 10. A dispersion machine comprising a mixing chamber, and co-acting means within the chamber for treating the material contained therein including pumping of the material having fixed and movable members constituting respectively series of rows of
25 tooth-like projections, one of said series having more rows than the other, the projections in the rows in one of said series being stepped to permit the engagement of the projections of a movable row with those of a fixed row
30 being effected consecutively in the direction of movement of the material produced by the pumping action, said projections being arranged to permit the movable projections to enter into engagement with the fixed pro-
35 jections one at a time.

40 11. A dispersion machine comprising a mixing chamber, and co-acting means within the chamber for treating the material contained therein including pumping of the material having fixed and movable members formed each with a row of tooth-like projections; there being a greater number of movable rows than fixed rows, the projections in said movable rows being stepped to permit of their engagement with the projections of the fixed rows consecutively in the direction of movement of the material produced by the pumping action, said projections being arranged to permit the movable
50 projections to enter into engagement with the fixed projections one at a time.

55 12. A dispersion machine comprising a mixing chamber, co-acting means within the chamber for treating the material contained therein having fixed and rotary members formed each with a plurality of tooth-like interengaging projections, and adjusting means for imparting a compound adjustment to said fixed projections.

60 13. A dispersion machine comprising a mixing chamber, co-acting means within the chamber for treating the material contained therein having fixed and rotatable members formed each with a plurality of tooth-like

projections, and means for moving said fixed 65 members simultaneously axially of said rotatable members whereby a relative radial movement will be effected to adjust the distance between the engaging parts of said fixed and rotatable projections when in func- 70 tioning relation.

14. A dispersion machine comprising a chamber for the material treated, a shaft having its axis disposed axially of the chamber, co-acting means within the chamber for 75 treating the material contained therein having members slidably mounted on walls of said chamber inclined to said axis and rotatable members mounted on said shaft, said slidably mounted and rotatable members being formed each with a plurality of tooth-like projections, and means for moving said members simultaneously axially of said shaft whereby said slidably mounted members will move along said inclines to effect a radial movement thereof to vary the distance between the engaging parts of said projections when in functioning relation. 85

15. A dispersion machine comprising a chamber for the material treated, a shaft 90 having its axis disposed axially of the chamber, co-acting means within the chamber for treating the material contained therein having members slidably mounted on walls of said chamber inclined to said axis and rotatable members mounted on said shaft, said slidably mounted and rotatable members being formed each with a plurality of tooth-like projections, plates threaded in said chamber at each end of said slidable members adapted to move axially when rotated whereby said members will move simultaneously axially of said shaft and said slidably mounted members will move along said inclines to effect a radial movement thereof to vary the distance between the engaging parts of said projections when in functioning relation. 100

16. A dispersion machine comprising a chamber, co-acting means within the chamber for treating the material contained therein including pumping of the material, a conduit having its ends in communication with the chamber at opposite sides of the co-acting means, an outlet for removing the treated material from the chamber, an inlet for admitting untreated material to the chamber through said conduit, and controls for said conduit, outlet and inlet, whereby the pumping action will produce a repeated circulation of the material through said conduit and chamber until the treatment is completed and a continuous discharge of the treated material from the machine. 110

Signed at New York, County and State of New York, this 20 day of August, 1924. 125

MERWYN C. TEAGUE.