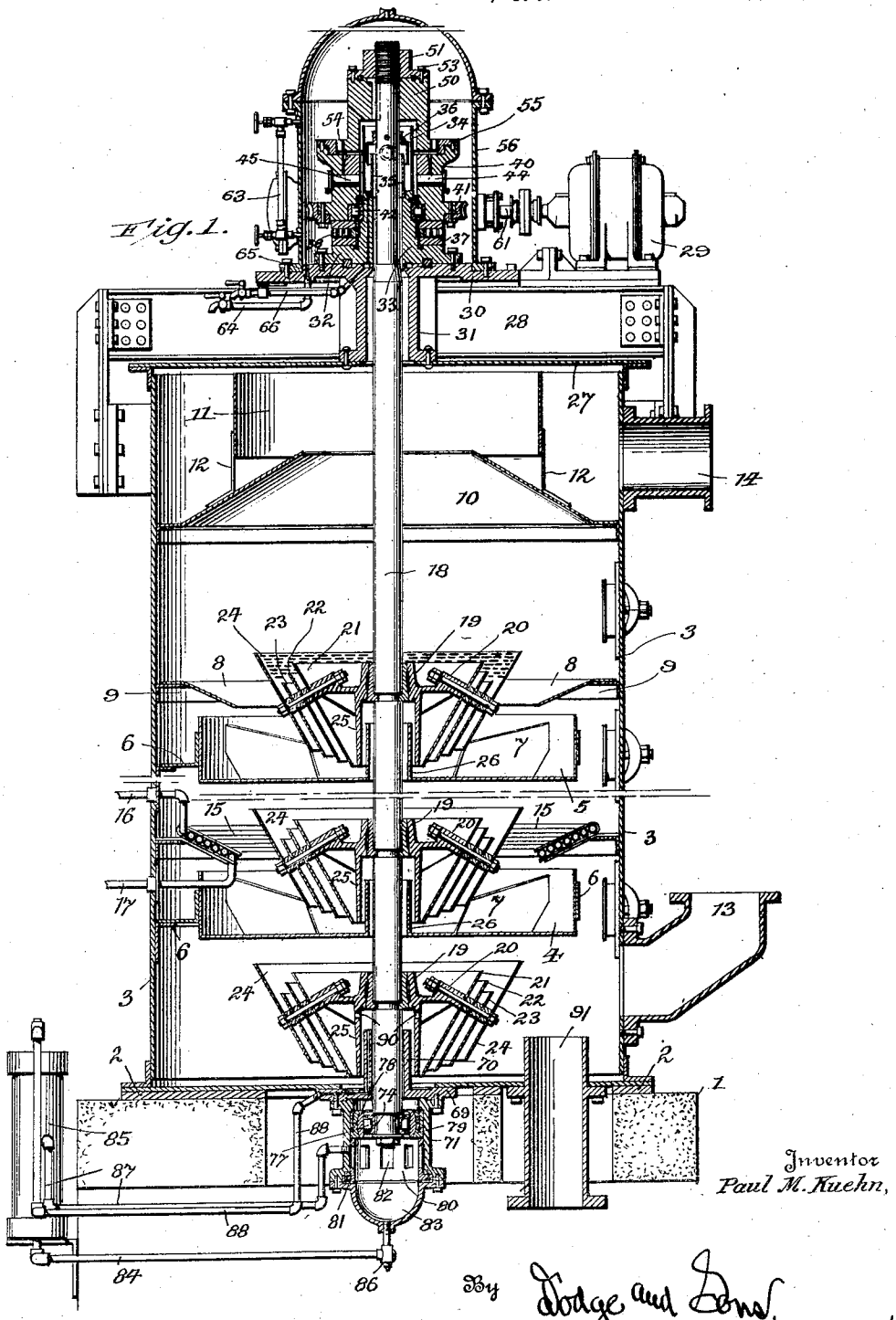
June 28, 1927. 1,634,199

P. M. KUEHN

CENTRIFUGAL CONTACT APPARATUS

Filed Feb. 2, 1923 4 Sheets-Sheet 1

Fig. 1.



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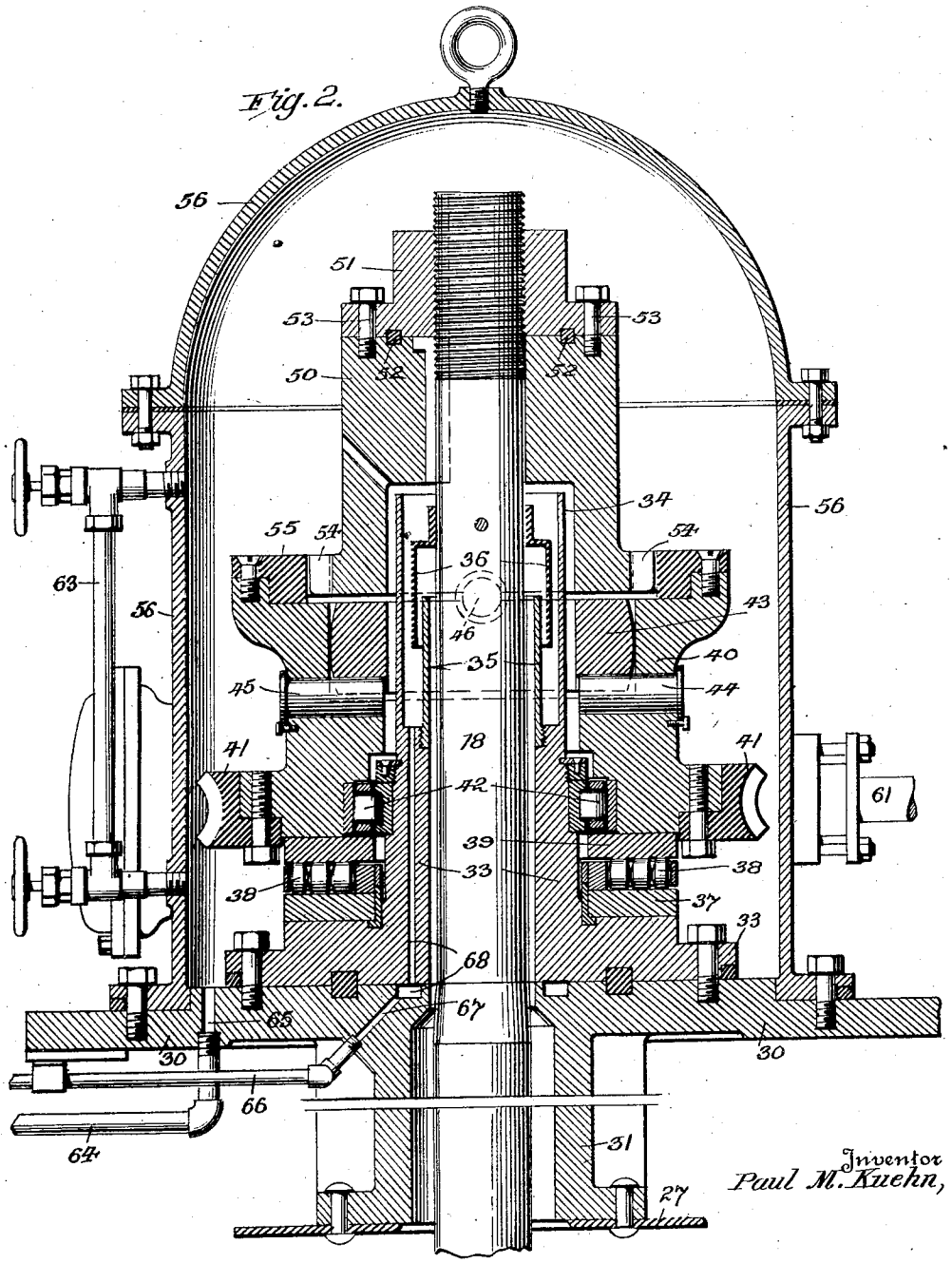
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Fig. 2.



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CENTRIFUGAL CONTACT APPARATUS

Filed Feb. 2, 1923 4 Sheets-Sheet 3

Fig. 3.

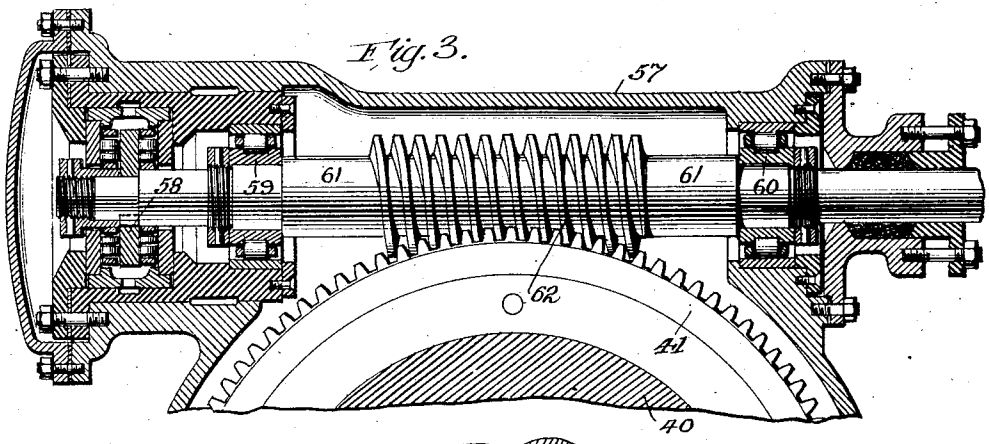
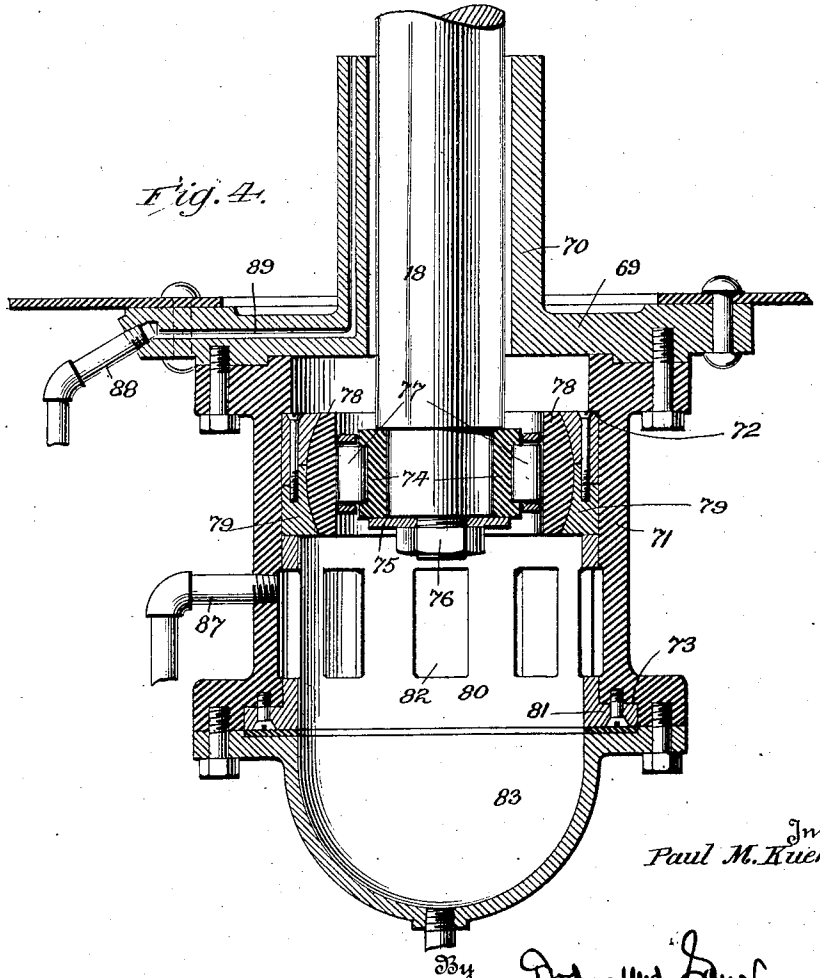


Fig. 4.



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Fig. 5.

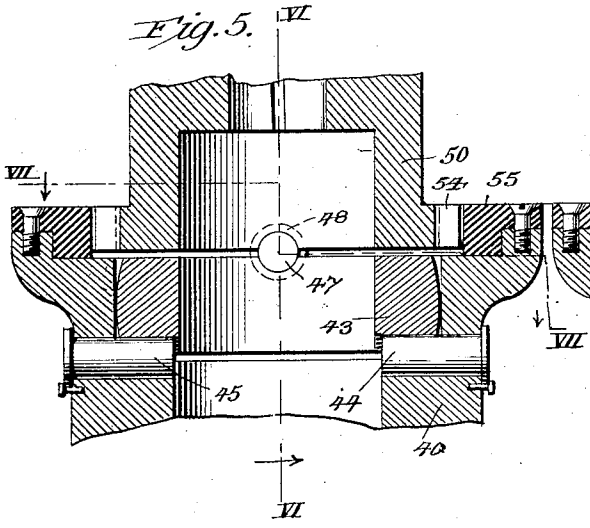


Fig. 6.

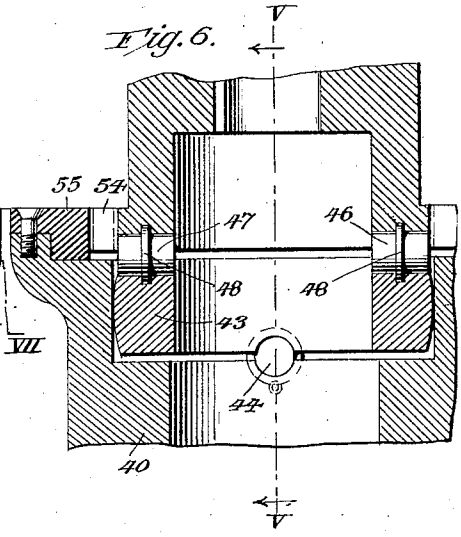


Fig. 7.

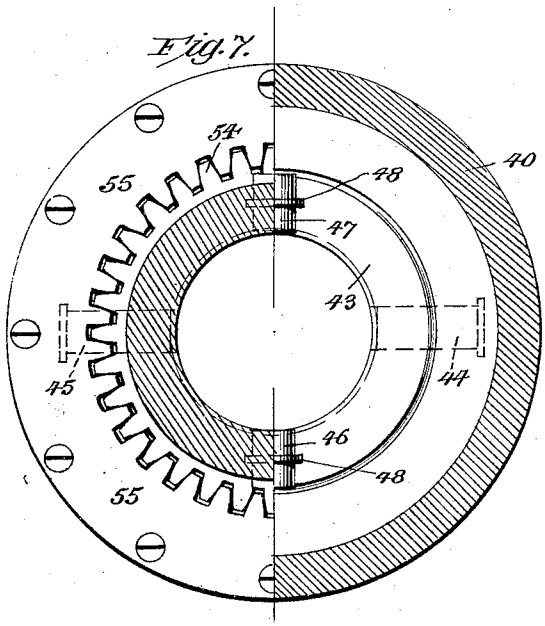
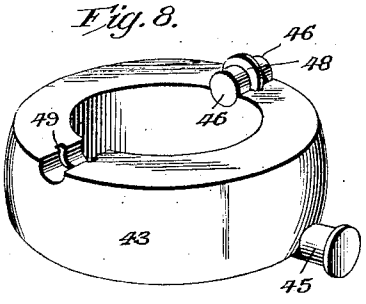


Fig. 8.



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UNITED STATES PATENT OFFICE.

PAUL M. KUEHN, OF BALTIMORE, MARYLAND, ASSIGNOR TO THE BARTLETT HAYWARD COMPANY, OF BALTIMORE, MARYLAND, A CORPORATION OF MARYLAND.

CENTRIFUGAL CONTACT APPARATUS.

Application filed February 2, 1923. Serial No. 616,512.

This invention pertains to contact apparatus of the centrifugal type, and more particularly to that type known in the arts as the "Feld scrubber" such as is shown in Letters Patent Nos. 829,261, dated Aug. 21st, 1906, 935,601, dated Sept. 28th, 1909, 940,103, dated November 16th, 1909, and 983,037, dated January 31st, 1911.

The main object of the present invention is to produce an improved machine of the general type set forth in said patents, including, among other things, a superior means of sustaining and rotating the impeller supporting and driving shaft, whereby a minimum expenditure of power is essential to operate the apparatus. Special means is likewise provided to insure at all times a proper distribution of the load and to ensure an alinement of the upper and lower shaft bearings so that no strain, by reason of cramping or binding, will be placed upon the shaft. A special form of overhead drive for the shaft is provided, as well as means whereby the driving and shaft supporting elements are efficiently lubricated.

With these and other objects and advantages as will hereinafter appear, reference will be had to the annexed drawings, wherein,—

Fig. 1 is a vertical sectional view of the apparatus.

Fig. 2 a similar view on an enlarged scale of the upper end of the shaft and its supporting and driving means;

Fig. 3 a horizontal sectional view illustrating the driving worm and the manner in which it is sustained;

Fig. 4 a vertical sectional view of the bearing for the lower end of the shaft;

Fig. 5 a detail sectional view on the line V—V of Fig. 6, illustrative of the universal support and driving connection for the shaft;

Fig. 6 a like view taken on the line VI—VI of Fig. 5;

Fig. 7 a horizontal section taken on the line VII—VII of Fig. 5; and

Fig. 8 a perspective view of the universal or rocking supporting collar.

In the drawings, 1 denotes the foundation upon which the apparatus is mounted, and 2 the base thereof, which latter is surmounted by a cylindrical casing designated generally by 3, and which may be made in sections or as an integral structure, as indicated in Fig. 1. Said casing is divided into a series of compartments or chambers by a series of pan-like members 4 and 5, which are alike in form, and separated from the side walls of the casing 3 by suitable bracket 6, or any other suitable means, such brackets spacing the upstanding walls of the pans from the walls of the casing so as to form an opening or passage around each pan. The pans will likewise preferably be provided with upstanding radially disposed partitions or walls 7 which act to prevent surging of the liquid placed therein as it is subjected to the action of the rotary impellers which dip down into the liquid and cause a spraying thereof, as will be hereinafter set forth. Overlying the annular space or channel formed between the upstanding wall of the pan and the adjacent wall of the casing, are ring-shaped deflectors 8, supported at their outer edges by channel bars 9 secured to the casing 3, said deflectors inclining downwardly toward the pans and the inner edges whereof extend inwardly beyond the upstanding walls of the pans, as is clearly shown in Fig. 1. In the upper part of the chamber there is provided a frusto-conical deflector 10, the upper end of which extends slightly into a ring shaped baffle plate 11, supported in any suitable way, as by brackets 12. The inlet for the gas is denoted by 13 and opens into the lowermost chamber in the casing, while the outlet for the gas, denoted by 14, opens from the upper part of the chamber above the deflector 10. The deflectors 8, (one or all of them) may be provided with pipe coils 15 provided with suitable inlet and outlet pipes 16 and 17, any suitable heating or cooling medium being caused to circulate through the coils and to react with the liquid flowing thereover, to heat or cool the same, according to the particular operation which is being effected in the machine. Extending vertically of the chamber and mounted in suitable upper and lower bearings, to be hereinafter described, is a shaft 18, said shaft carrying in each of the chambers spraying apparatus of the form set forth in the patents above enumerated. The various spraying devices in each chamber are alike in form, and, consequently, a description of one will suffice. It may be said to comprise a hub-like element 19 secured to the shaft in any suitable manner and from which hub extend radially dis-

posed arms 20, to which arms are attached a series of inverted frusto-conical members denoted by 21, 22, 23 and 24. These members are spaced apart, and preferably the lower edges extend different depths into the liquid contained in the pan 5, that is to say, the innermost member 21 extends to the greatest depth and the others successively to a less depth. The upper edges are arranged in reverse order, with the exception of the outer one. That is to say, the member 21 terminates above the adjacent member 22 and said member 22 lies in a plane above the upper edge of the member 23. The upper edge of the outer member 24 lies in a plane above the upper edge of the member 21, and said member 24 may be perforated, if so desired. The hub is also provided with a depending skirt 25 which surrounds an upstanding sleeve 26 extending upwardly from the bottom of the pan and spaced away from the shaft 18 which extends therethrough, the skirt also being spaced away from the sleeve 26. Thus a trap is formed which prevents the passage of gas upwardly through the center of the pan, and causes the gas to flow beneath the pan and upwardly around the edges of each pan in its passage through the chamber 3. Located above the top 27 of the chamber 3 is a suitable supporting frame, denoted generally by 28, upon which the motor 29 for driving the shaft is mounted. Mounted and secured upon the supporting frame 28 is a bed or supporting plate 30 for the upper bearing for the shaft, said plate being provided with a depending sleeve 31 to which is attached the cover or top plate 27. Bolted and keyed to plate 30, through a flange 32, is a second sleeve 33, said sleeve and flange being formed as a single casting. The bore of the sleeve is somewhat larger than the diameter of the shaft, and said sleeve is provided with an upward extension 34, and a somewhat shorter extension 35 likewise extends from the upper inner portion of the sleeve. These two extensions are spaced apart, and a skirt 36 secured to the shaft 18 projects down into the space thus formed, producing a seal which prevents ingress of oil or other foreign material to the space surrounding the shaft and down into the body of the apparatus. Mounted on the flange 32 is a bearing plate or race 37 for an annular series of roller bearings 38 overlying which is a second bearing plate or race 39. Said last named member is secured to the under face of a driving hub, denoted by 40, to the lower peripheral portion whereof is secured a worm gear 41. An annular series of spaced rollers 42, interposed between said hub and the sleeve 33, serves to take care of any side thrust imposed upon the hub, while the rollers 38 sustain the weight of the shaft and the parts carried thereby, such weight being transmitted to the hub through the connections about to be described. The upper central portion of the hub is cut away forming a chamber to receive a rocker block 43, see Fig. 8, the outer face of which is rounded so that it may tip with reference to the hub. The under face of the hub is provided with two diametrically disposed semi-circular sockets forming seats which rest upon a pair of pins 44 and 45 mounted and secured within openings formed in the wall of the hub. The upper face of the rocker block is provided with a second pair of seats or sockets adapted to receive bearing pins 46 and 47, each of said pins having formed thereon a collar, as 48, adapted to enter a groove 49 formed in the sockets. Said pins 46 and 47 are diametrically disposed and are placed at right angles to the lower pair of pins 44 and 45. Pins 46 and 47 form the support for a second hub 50 keyed to the upper portion of the shaft 18 and held in its adjusted position in relation thereto by means of a nut 51 mounted upon the upper threaded end of the shaft. An annular key 52 and machine screws 53 hold the nut and hub in the desired adjusted position. Hub 50 at its lower portion is formed with an annular gear or series of teeth 54 which mesh with the teeth formed upon the inner face of a ring 55 rigidly affixed to the upper portion of the lower hub 40.

From the foregoing it will be seen that the shaft is pendulously supported, and will always swing or tend to move to a truly vertical position by reason of the interpositioning of the rocker block 43 between the two hub elements 40 and 50, and the placing of the rocker bearings or supports for said hubs, which function with the rocker block, at right angles to each other. At the same time the toothed connection between the hubs will always ensure a proper and adequate driving connection between the parts.

A dome or cover 56 secured at its lower edge to the plate 30 houses the upper end of the shaft and its allied parts. At one side it is provided with a lateral extension 57, see Fig. 3, in which are mounted the bearings denoted generally by 58, 59 and 60 for a shaft 61 carrying a worm 62 which meshes with the worm gear 41. Said shaft is driven from the motor 29 or other source of power. The housing is designed to be filled with oil so that all the moving parts of the shaft bearing and the driving elements will be submerged in oil, and a suitable sight gage 63 is provided so that the oil level may be readily determined. A drain pipe 64 opens directly into the housing through a hole 65 formed in plate 30, while a second pipe 66 is in communication with an opening 67 in plate 30, said opening in turn being in communication with a bore 68 extending through hub 33.

To steady the shaft 18 and yet permit it to come to its vertical position, I provide a special bearing at the lower end thereof, which is best shown in Fig. 4. Secured to the base or bottom plate 2 is a casting or supporting member 69 provided with an upstanding sleeve 70, the bore of which is sufficiently large to insure quite a clearance between it and the shaft. Secured to the under face of the casting 69 is a cylindrical shaped casting or member 71 provided with internal shoulders 72 and 73. The lower end of the shaft is slightly reduced and a circular race or bearing member 74 is secured thereon by any suitable means, as, for instance, a washer 75 and a nut 76 screwed upon the outer threaded end of the shaft. A series of spaced rollers 77 bear upon the race 74 and against an annular race or block 78, the outer face of which is formed upon a curve and finds its bearing in a two-part block 79 which is held against the upper shoulder 72 by a cylindrical shaped casting 80, having an outwardly extending flange 81 at its lower edge which takes against the lower shoulder 73 of the cylindrical member 71 and to which it is fastened by any suitable means. Said member 80 is provided with a series of openings 82 in order to lighten it for another purpose which will presently appear.

Secured to the lower face of the cylindrical member 71 is a water drain pocket 83, which is connected by a pipe 84 to the lower portion of an oil receiving tank 85. A draw-off plug or cock 86 will be provided for this line. The oil reservoir 85 is connected through a pipe 87 with the lower bearing, the pipe being threaded through the cylindrical member 71 and registering with one of the openings 82 formed in the element 80. Oil will be kept in the reservoir to such a level as to submerge the lower bearing for the shaft. A second pipe 88 is connected into the top of the oil reservoir and at its opposite end opens into a drilled port or passage 89 formed in the casting 69 and the sleeve 70 which extends upwardly therefrom. This pipe and the ports act to equalize the pressure existing under the hub of the lowest cone or atomizing element, the equalizing pipe 88 at all times keeping the oil in the container and in the lower bearing at the same level.

The skirt 25 of the lowest spraying element will preferably be provided with openings, as 90, to equalize the pressure within the skirt or member 25.

An overflow pipe 91 extends into the lowermost chamber and will, of course, be provided with a suitable valve not shown.

It is thought that the operation and advantages of the apparatus will be apparent from the foregoing description, but they may be briefly recapitulated as follows:

Motion is imparted to the shaft 18, and to the impellers carried thereby, through the motor 29 and the worm gearing. Such motion is transmitted through what may be termed in general language, the universal supporting bearing, comprising the upper and lower hubs 40 and 50, the toothed interconnection between said members and the rocking block or element 43 which carries the weight of the shaft and its allied parts through the pins 44 and 46. As above set forth this top bearing is fully equipped with rollers both to carry the vertical load of the shaft and the attached cones, and also with a bearing to take the radial thrust from the worm. The proper distribution of the load is insured through the rocker block 43 and the pins just mentioned. This rocking block, as above set forth, together with the two pairs of pins arranged at the upper and lower surfaces of the block, and located 90° apart, sustains the weight and insures at all times the perfect distribution of the load from the shaft to the lower horizontal roller bearing located at the lower end of the shaft. The transmission of the torsional stresses from the worm wheel to the shaft takes place through the intermeshing of the teeth 54 and the teeth formed upon the inner face of the ring 55. These teeth insure proper transmission of the motion, and at the same time allow for a slight rocking in any direction of the rocker block 43 and its allied parts. As above set forth, the skirt 36 attached to the shaft 18, is so arranged that none of the lubricating oil can find its way into the interior of the washer.

Upon rotation of the shaft rotary motion is imparted to the cone-shaped impellers in the various chambers, and the liquid within the pans is drawn upwardly along the surfaces thereof and thrown laterally therefrom through the gas which initially passes in through the pipe 13 and thence upwardly around the edges of the successive pans and beneath the deflectors 8 toward the cones. The gas is thus caused to take a circuitous path through the apparatus and to be brought into direct contact with the spray being thrown outwardly by the cones, and, in fact, to pass substantially at right angles through such spray as the gas tends to pass upwardly into the next chamber above. The sprayed liquid, after contacting the wall of the chamber, drains backwardly over the upper faces of the deflectors 18, and comes into intimate contact with the cooling or heating pipes, as the case may be, and is thus cooled or heated, according to the medium being passed through the coils 15. The gas finally passes out through the discharge pipes 14, it being understood that the gas is caused to flow by reason of the employment of a suitable blower or suction device or both.

What is claimed is,—

1. In combination with a vertically dis-

posed shaft; a rockable side thrust bearing for the lower end of the shaft; a fixed supporting member located adjacent the upper end of the shaft and through which said upper end passes in spaced relation; a driven hub-like member supported on said supporting member; a second hub-like member secured to the upper end of the shaft; toothed driving connections between said hubs; a ring-shaped block encircling the shaft and interposed between the adjacent ends of the hub-like members; a pair of diametrically disposed pins interposed between the lower hub and said block; and a second set of pins interposed between the block and the lower face of the upper hub, the two sets of pins being arranged at right angles to each other, said pins and blocks permitting the shaft to tilt or swing.

2. In combination with a vertically disposed shaft; a rockable side thrust bearing for the lower end of the shaft; a fixed supporting member located adjacent the upper end of the shaft and through which said upper end passes in spaced relation; a hub-like member mounted on said fixed supporting member; a weight sustaining bearing between said parts; a second bearing between said parts to take care of side thrust; a worm gear on the hub; a worm meshing with said gear to drive the hub; a pair of oppositely disposed pins secured in the upper portion of the hub and extending inwardly into a recess formed in the upper end of the hub; a rocker block, of ring form freely mounted in said recess and having seats bearing on the pins, said block likewise having a second pair of seats upon its upper face, the upper and lower seats standing at right angles to each other; a second hub-like member secured to the upper end of the shaft; a second pair of pins resting on seats formed in the lower end of said second hub and block and a toothed driving connection between the adjacent ends of the hubs.

3. In combination with a vertically disposed shaft; a fixed supporting member located adjacent the upper end thereof and through which the shaft passes in spaced relation; a driven hub-like member supported on said supporting member; a second hub-like member secured to the upper end of the shaft; toothed driving connections between said hubs; a ring-shaped block encircling the shaft and interposed between the adjacent ends of the hub-like members; a pair of diametrically disposed pins interposed between the lower hub and said block; and a second set of pins interposed between the block and the lower face of the upper hub, the two sets of pins being arranged at right angles to each other, said pins and block permitting the shaft to tilt or swing.

In testimony whereof I have signed my name to this specification.

PAUL M. KUEHN.