(No Model.) 3 Sheets—Sheet 1.

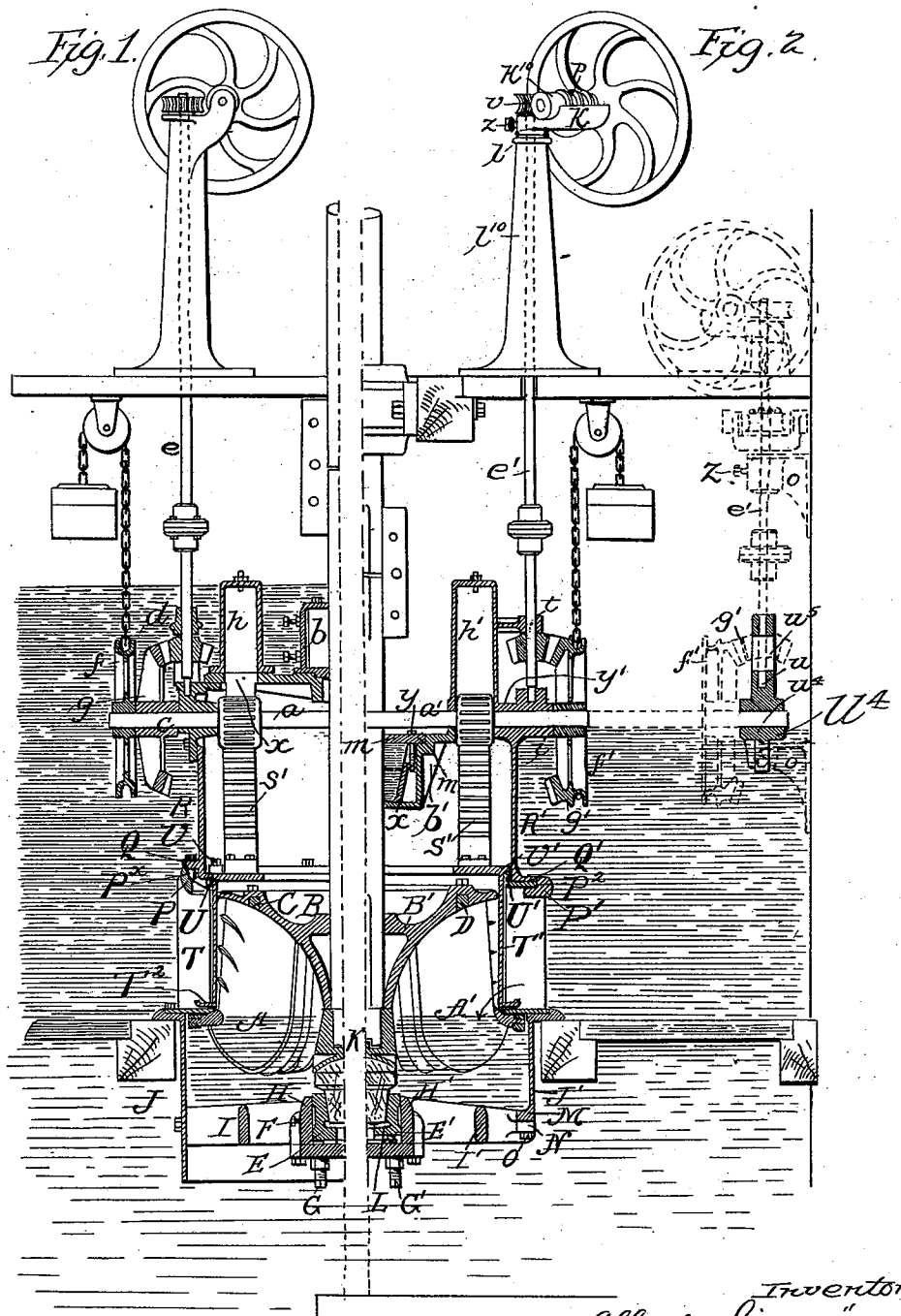
A. SINGRÜN.

TURBINE.

No. 550,139. Patented Nov. 19, 1895.

Fig. 1.

Fig. 2.



Witnesses
Malle Donaldson
F. L. Middleton

Inventor
Albert Singrün
by Richards & Co
Attys

(No Model.)

3 Sheets—Sheet 2.

A. SINGRÜN.

TURBINE.

No. 550,139. Patented Nov. 19, 1895.

Fig. 3.

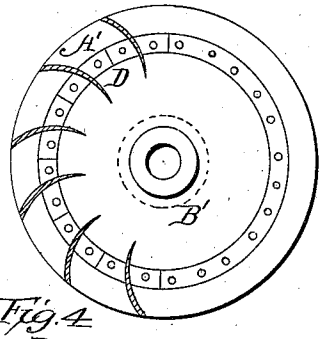


Fig. 8.

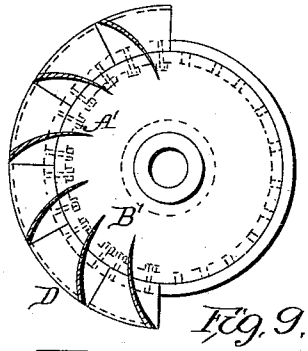


Fig. 4.

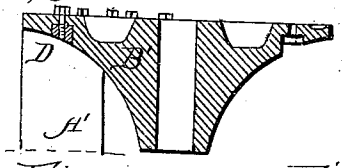


Fig. 9.

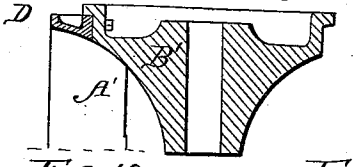


Fig. 5.

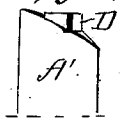


Fig. 7.

Fig. 6

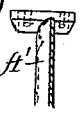


Fig. 10.

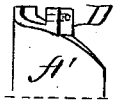


Fig. 12.

Fig. 11.

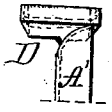


Fig. 13.

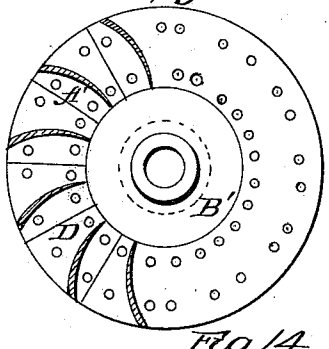


Fig. 18.

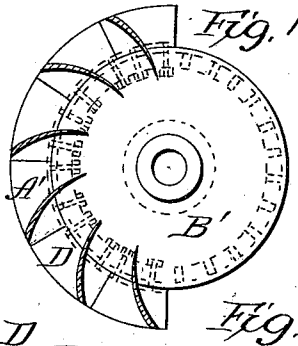


Fig. 14.

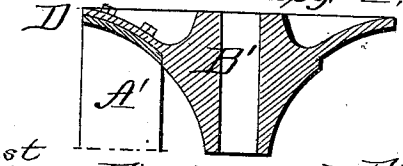
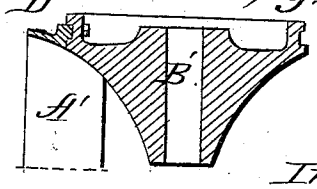


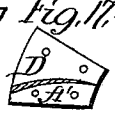
Fig. 19.



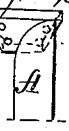
Attest
Walter Dewey
F. L. Middleton

Fig. 15.

Fig. 17.



D Fig. 16.



Inventor
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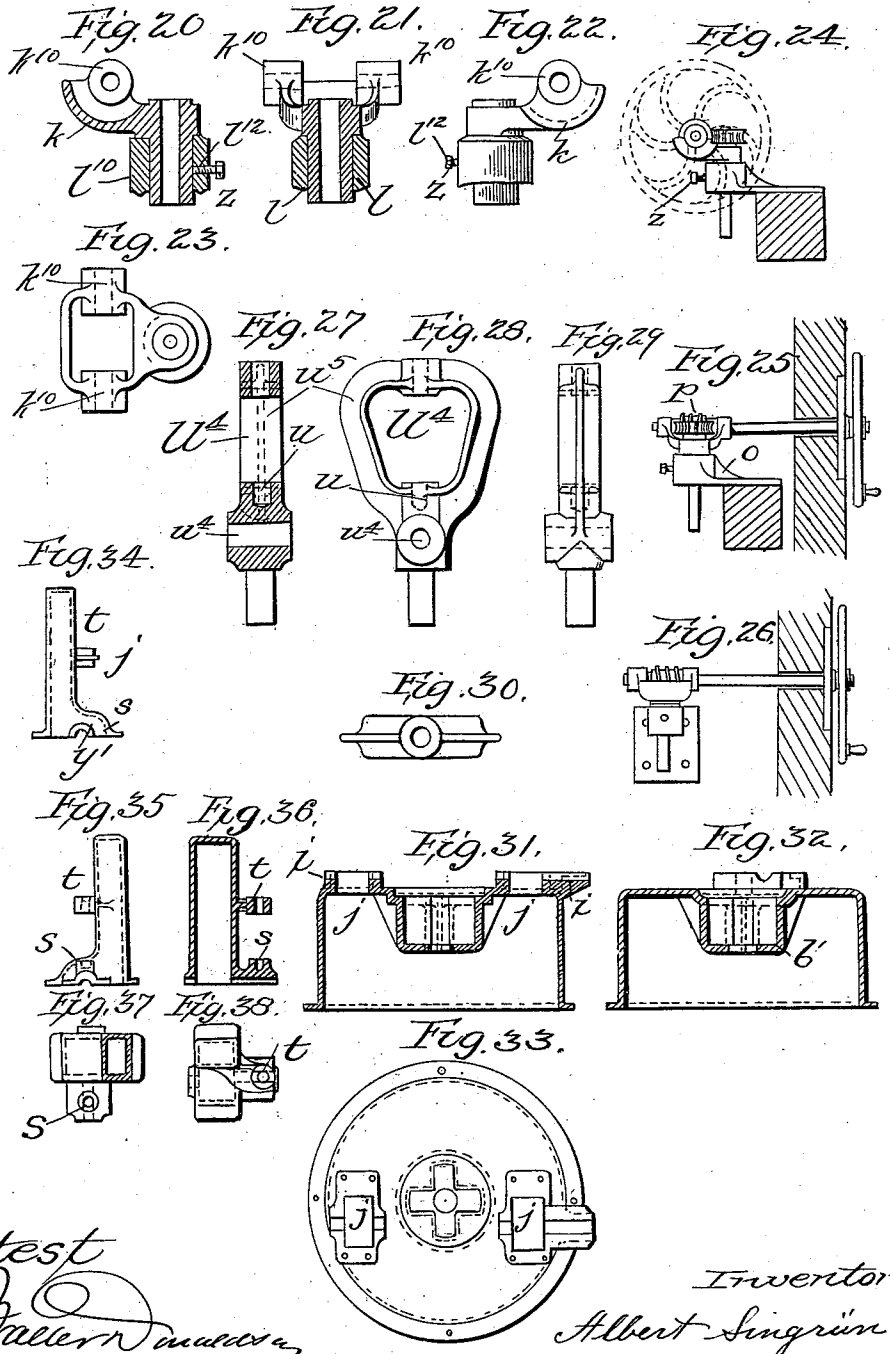
by Richards & Co
Attys.

(No Model.) 3 Sheets—Sheet 3.

A. SINGRÜN.

TURBINE.

No. 550,139. Patented Nov. 19, 1895.



Attest
F. L. Middleton

Inventor
Albert Singrün
by Richards & Co
Attys.

UNITED STATES PATENT OFFICE.

ALBERT SINGRÜN, OF EPINAL, FRANCE.

TURBINE.

SPECIFICATION forming part of Letters Patent No. 550,139, dated November 19, 1895.

Application filed February 23, 1895. Serial No. 539,471. (No model.) Patented in France June 18, 1894, No. 239,255.

To all whom it may concern:

Be it known that I, ALBERT SINGRÜN, a citizen of France, residing at Epinal, Vosges, France, have invented certain new and useful Improvements in Turbines, (for which I have obtained Letters Patent in France, dated June 18, 1894, No. 239,255,) of which the following is a specification.

The object of the improvements in hydraulic turbines with centripetal injection is to increase the yield of the turbines, to make them stronger and lighter, and to make their construction, assemblage, and examination easier.

They consist of modifications made in the manner of fixing the paddles, the box, and the socket of the pivot of the turbine, and in the arms of the lower crosswork. They also refer to the combination of said crosswork with the discharge-pipe and to certain parts of the dome and of the flood-gates, which will be indicated later with reference to the annexed drawings.

Figure 1 is a vertical semisectional view along the axle of the whole of a turbine of the old form. Fig. 2 shows the other half, representing the new turbine—that is, the turbine with the improvements that will be explained later. Figs. 3 to 6 and 7 to 19 show details of the different shapes of the foot of the paddles and the different ways of inserting and fixing the same in the paddle-carrier. Figs. 20 to 23 show detail views of the movable adjustable support of the shaft that carries the gearing movement or movements by endless screw, which must be given to the flood-gate whether the adjustable support be supported itself by a little column, as shown in Fig. 2, or by some other supporting device, as seen in Fig. 2 in dotted lines and also in Figs. 24, 25, and 26. Figs. 25 to 30 show a vertical section and a side and plan view of the pivotal and arched socket which supports and guides the vertical shaft *e'* for supporting and opening the flood-gate when that shaft is arranged at a distance from the dome, and which at its turn is supported by a support fixed flat upon a beam or applied against a wall, as can also be seen in Fig. 2. Figs. 31 to 33 show a sectional and plan detail views of the said dome on the axle of the horizontal shaft. Figs. 34 to 38 show views of the rack-boxes, and more especially of that which carries the projections *s* and *t* when the vertical shaft *e'* for stopping and opening the flood-gate is right against the dome, and that these projections must serve as pivot and guide for the said shaft.

In the old turbines, Fig. 1, each paddle A is fixed to the paddle-carrier B by a button or cylindrical head C, which necessitates an enlargement of the thickness of the paddle at the point where it is fixed to the penetrating and locking head C. A screw penetrates the center of the head, which it draws into place in order to press the paddle against the paddle-carrier. This connection is defective. Not only the enlargement of the paddle below the head is an inconvenience for the running off of the water, but the paddle itself, which is held only by one head, which is cylindrical and short and around which it tends to revolve in all directions by the different action and reaction of the water, offers only little stability, and accidents can sometimes happen.

In the new turbine, Fig. 2, the paddle A' is cast of one piece with the new supporting-piece D in the shape of a circular segment, Figs. 3 and 7. Each fixing-piece is adjusted in a groove of similar shape, Fig. 4, in the paddle-carrier and is retained by at least two screws, the lower extremity of which can be riveted or headed over. When all the paddles are put in their respective plate, the fixing-pieces will form a continuous circular crown, fitting perfectly and rigidly maintained in the groove of the paddle-carrier, as shown in Figs. 3 to 7 and also in Figs. 7 to 19, which show various modifications of the manner of securing the parts. The fastening-piece can vary in its shape according to the manner it is cast with the paddle and attached to the same and in the manner it is fastened to the paddle-carrier, as can be seen, for instance, in Figs. 8 to 12, 13 to 17, or 18 and 19 but the fastening-piece D always is a segment of an annular crown adjusted in a groove of the said paddle-carrier and maintained by at least two screws.

In the old device, Fig. 1, the inferior part of the vertical shaft of the turbine upon the lower part of which the paddle-carrier B is keyed, rests loosely in the socket in which it

is not united in any manner. Besides, the box E of the pivot is prevented from rotating by side screws F, which obstruct the running out of the water, while one lower screw or lower screws G serve to regulate the position of the said box in its elevation. Further than this, the crosswork H, the arms of which have a transverse cross-section of the shape indicated by I, square at the base, and the discharge-tube J are arranged and put together as shown at the lower part of Fig. 1.

In the new turbine, Fig. 2, the upper part of the bottom of the socket is provided with a diametrical projection K, which engages with a groove made in the lower part of the vertical shaft of the turbine. The box E′ of the pivot is also provided at its lower part with a diametrical groove L, in which the screw-heads G′ engage in such a manner that said box is at the same time adjusted in position, as far as its elevation is concerned, and prevented from rotating without the help of side screws. Besides, the arms of the crosswork are rounded, below, as shown at I′, by which the eddy currents or swirls are avoided as the water passes these arms, and, finally, the discharge-tube J′ and the arms of the crosswork H′ are connected by means of the ears M and N and screws O, which shortens considerably the tube J′ and does away with the inconvenience of having to make the outlet-channels so much deeper. The bed of the sluice, Fig. 2, is located higher in proportion to the amount the tube has been shortened as a consequence of the new arrangement M N O.

Important improvements have also been made in the distributer to the flood-gate, the dome, and to the various parts for working the flood-gate.

The upper crown P is thin, hard to mold, requiring enlargements $P^{\times}$, in order to be able to receive the screws which combine the crown with the lower flange Q of the dome R, inside of which the racks S′ move. These racks, the plane backs of which bear against a depending supporting-claw x', Fig. 1, made of one piece with the box, are attached below to the top of the flood-gate T, which slides, by the aid of a slight play, against the lower annular projection U, cast to the bottom of the dome. On top of that projection and of the flood-gate and the one level with the other a crown V, made of two pieces, is fixed by screws, destined to constitute a closure when the flood-gate is at the lowest point of its course and when said flood-gate T forms a closure at its lower part T^2. These arrangements have several inconveniences. The ports or passages under the crown P are too abruptly inflected. The result will be a strong contraction. Moreover, the flood-gate cannot be removed from the bottom of the dome before the crown V has been taken away.

The new devices shown in Fig. 2 make the coming in of the water easier, facilitate the working of the various parts, as well as the putting together and taking to pieces of the same, and at the same time the crown P′ is better attached to the boxes of the distributer. The crown is made rounding about its outer side, past which the water flows to the distributer, and its flat shape underneath enables the insertion, in the way of a slide, of one of the boxes of the distributer, so that if this box is removed the paddle-work can be examined. It has a shouldered or recessed part P^2, in which are supported the ring U′ and the lower flange Q′ of the dome. The closure upon the circular projection U′ when the flood-gate is closed is effected by the flange V′, cast on the top of the flood-gate T′. Thus the new combination of parts P′ Q′ U′ V′, as can be seen in Fig. 2, besides facilitating the running in of the water, enables me to remove first the dome R′ and then immediately the flood-gate T′, notwithstanding it is cast of one piece with its lining. The two pieces of the ring can also be removed as soon as the flood-gate is raised a little, and the sliding box makes it easy to examine the inside of the paddle-work.

If we now consider the parts for working the flood-gate, we see in Fig. 1 (old turbine) that the shaft *a* for stopping and opening the flood-gate is located under the roof or cover of the dome R and of the box *b* of that dome; that the shaft *a* comes out at each side through socket-rundles *c*, one of which is simple and of which the two parts, symmetrical as far as the axle of the shaft is concerned, are similar and equal to the inferior part of the rundle *c*, while the other's top part is shaped in such a manner that it serves as a pivot-bearing and fixed arch *d* for the vertical shaft *e*, that operates the stopping and opening of the flood-gate; that the grooved pulley *f*, to which the lower part of the chain of the counterweight which poises the flood-gate is connected is independent of the cog-wheel *g*, mounted upon the shaft *a*, and which catches into the pinion mounted upon the shaft *e;* that the operating parts for giving a rotary motion to the shaft *e* are mounted upon a fixed support formed by the top of the small column, and that said motion is imparted by an endless screw, the axle of which passes through two fixed bearings fixed on the upper part of the small column, and, finally, that of the top racks of the flood-gate, when the latter is closed, do not penetrate into the lower opening of each rack-box *h*, which requires that the rack be supported by means of a depending claw or bearing x', forming one body with the box. The corresponding arrangements of the new turbine are different. While remaining at the same height, the shaft *a′* for closing and opening the flood-gate is placed either under or, preferably, as shown in Fig. 2, above the roof or cover of said dome and also above the box *b′*, the shaft *a′* being journaled at each side of the axle of the dome between the lower part of each rack-box *h′* and projections *i* at the top of the dome. When the flood-gate is closed, the top of each

rack moves in the opening of the corresponding rack-box and rests with its rear side against the surface *j* of the opening made through the cover of the dome, whereby the rack is perfectly guided when it rises. One of the boxes *h'*, the inferior part of which is arranged as shown in Figs. 34 and 36, is prolonged laterally at *y'* to extend up to the cog-wheel *g'*, Fig. 2, as is also the projection *i* of the top of the cover or roof of the dome. This lateral bearing-section *i* can be seen in Figs. 31 and 33. That prolongation serves as a fixed pillow *i*, and a socket *l* is also cast at the upper part of one of the boxes *h'* and serves as a guide for the vertical shaft *e'*, to which the rotary motion is imparted either by a bevel-pinion engaging with a horizontal beveled wheel or by means of an endless screw *p*, Fig. 2, that can be surrounded by a cap K, forming one body with the two projections K^{10}, Figs. 20 to 23, between which the screw is held, and with a rotary adjustable socket *l*, held in the center of the upper part of the small column l^{10}, through which the shaft *e'* extends, which is provided at the top with the wheel *v*, having helicoidal teeth. The socket is held adjustably by the set-screw l^{12}.

The prolongations *s i t* are omitted when the vertical shaft *e'* for closing and opening the flood-gate is at some distance from the dome, as indicated by dotted lines at the right in Fig. 2. The rack-boxes are then the same and symmetrical—that is, the one at the right and the one at the left.

In Fig. 2 a bearing-piece U^4 is shown, having a bearing-socket *u* for the vertical shaft *e'* and a bearing u^4 for the end of shaft *a'*. The gear *g'* in this instance, as shown in dotted lines, is on shaft *e'* within the yoke portion u^5 of the bearing-piece, and *f'* represents the gear on the shaft *a'*, meshing therewith.

The box *b'*, which depends into the interior of the dome, is covered by a metal hoop *m* of two pieces, in order that it can easily be removed, notwithstanding the shaft *a'* extends over the box, because said shaft is also placed a little on one side, as far as the axis of the box is concerned. Wedges *x*, held by screws *y*, the heads of which rest upon the hoop *m*, press against the wooden pillows that surround the shaft of the turbine.

From what has just been said and shown of the dome R' of the box *b'* and of the other parts constituting the whole of the closing and opening means of the flood-gate, the shaft *a* is, as it were, entirely outside of the dome and can easily be examined and removed; that the racks S', without being longer, bear, when the flood-gate is closed, against one of the surfaces *j* of the lower opening of each of the rack-boxes *h'*; that, in case the shaft *e* is near the dome, one of those boxes carries two projections, cast in one piece with the same, of which the lower one *s* serves as a pivot-bearing for that shaft and the upper one *t* serves as guide for the same; that the wheel *g'* and the pulley *f'* form only one and the same piece; that the upper motion of the vertical shaft, for closing and opening the flood-gate, is adjustable as well as its lower motion when the shaft *e'* is distant from the dome, as can be seen in dotted lines in Fig. 2—that is, the horizontal axle of the endless screw *p* can turn horizontally around the vertical axle of the shaft *e'*, said screw being in a bath of oil in the cup K, and that the support O of the socket, with a pivot *o*, can be placed at any suitable point and at the required height.

The possibility of adjusting the shaft of the screw *p* by the pivotal socket *l*, as indicated in Figs. 20 to 23, pivoting upon the small column shown in Fig. 2, or even upon some flat support, Figs. 24 and 25, or against a wall, Fig. 26, enables me to place the axle of said screw in the most suitable manner for the working and to fix the same then by means of a lateral screw.

The support O of the arch-pivot *u* of the vertical shaft *e'* for closing and opening of the flood-gate being also adjustable it is evident that it will be easy to adjust the position of the shaft *e'* and of that of the screw.

The reversed position of a stuffing-box extending down into the dome, or of a box, as *b'*, placed below the shaft *a'* and arranged as has been said hereinbefore, enables the new turbine to work at a lower level than the old, and as it is important that the box be always under water this is a valuable advantage.

I claim—

1. In combination, the blades, the supporting pieces D of segmental form arranged to form when in place a ring, and a carrier having a groove or recess to receive the segmental pieces, said segmental pieces having their inner and outer edges concentric throughout and their abutting ends forming portions of the radii of the carrier and the screws passing through the carrier into the segments, substantially as described.

2. In combination the crown P' of the distributer having a recessed upper side the turbine working within said distributer, the dome R' above the distributer having the flange Q' resting in the recess of the crown P', the removable ring U' held in the recess between the flange and crown P' and the bearing rib V' on the distributer or flood gate arranged to bear on the said ring U', said interposed ring serving as a bearing for the rib of the distributer and said distributer being movable vertically toward and from said ring and within the dome R', substantially as described.

3. In combination the paddles, the shaft, the flood gate vertically movable, the shaft *a'*, the rack and pinion between the shaft and flood gate, the dome inclosing said parts having a depending stuffing box *b'* for the paddle shaft, bearings *j* for the rack bar and lateral bearings *i* for the shaft *a'* which extends across the top of the said dome and the rack box *h'* forming a continuation of the bearing *j*,

secured upon the dome and having a lateral bearing portion y' for the shaft a', substantially as described.

4. In combination, the paddles, the rotary shaft, the flood gate movable vertically, the shaft a' with elevating means connected to the flood gate, the dome inclosing said means and arranged under the shaft a' and having a bearing for the said shaft extending laterally, the vertical shaft e', the gear on said shaft and the gear g' connected thereto, said gear resting against the outer end of the bearing, substantially as described.

5. In combination, the flood gate, the dome, the rack and pinion, the rack box on the dome and covering the pinion and rack, the shafts a' and e' arranged at right angles to each other, said shaft a' extending over the dome, the said rack box having the bearings t and s for the shaft e', substantially as described.

6. In combination, the flood gate, the shaft a', the dome, the vertical shaft e', the gearing between the same and the shaft a', the support l^{10}, the cap K carried thereby and having the bearings K^{10}, the screw held between the bearings and over the cap which may contain a bath of oil and the wheel v at the upper end of the shaft e' engaging with the said screw, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ALBERT SINGRÜN.

Witnesses:
CLYDE SHROPSHIRE,
CH. CASALONG.