

Oct. 18, 1949.

F. H. COTHAY
BUCKET ELEVATOR

2,484,931

Filed March 17, 1947

6 Sheets-Sheet 1

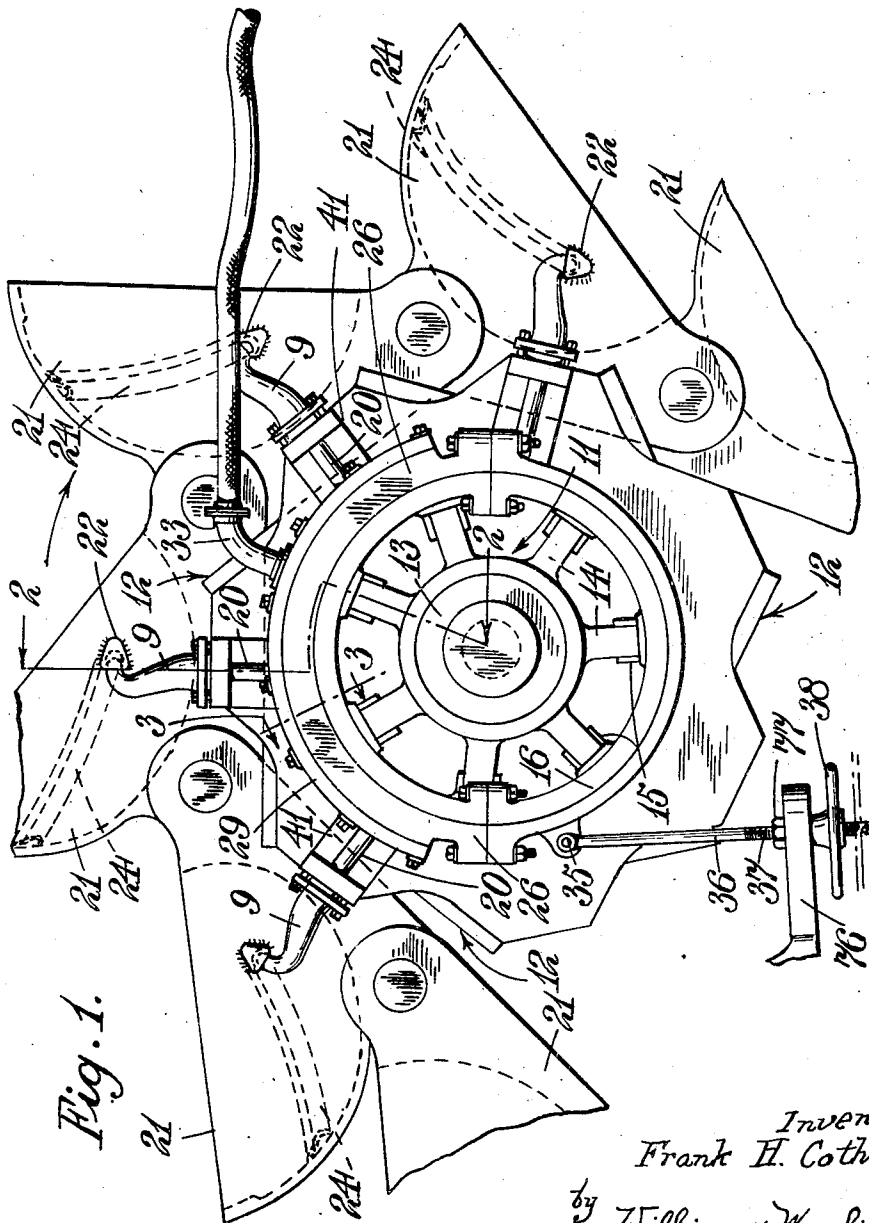


Fig. 1.

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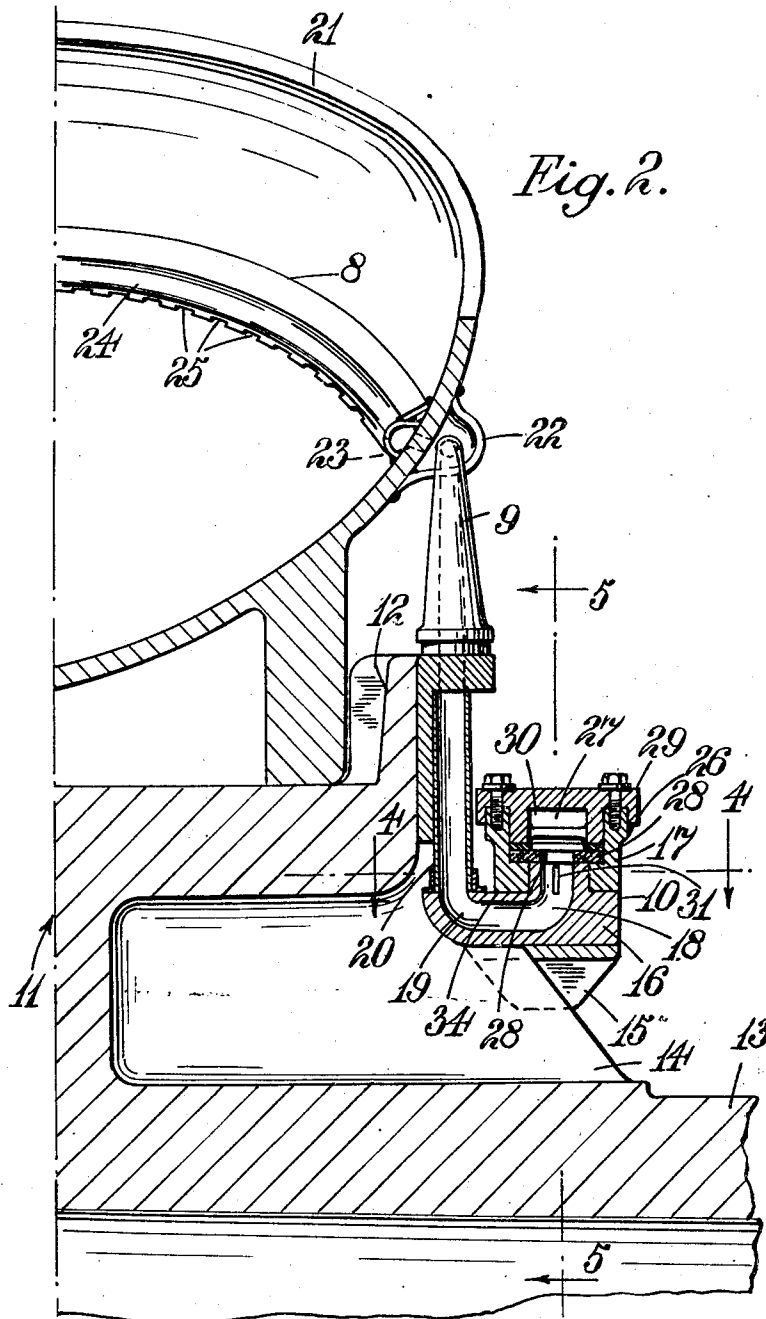
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Fig. 3.

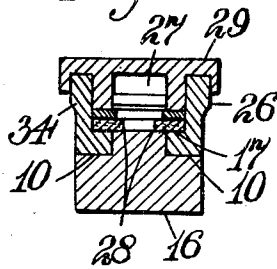


Fig. 4.

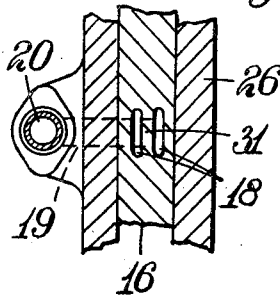


Fig. 6.

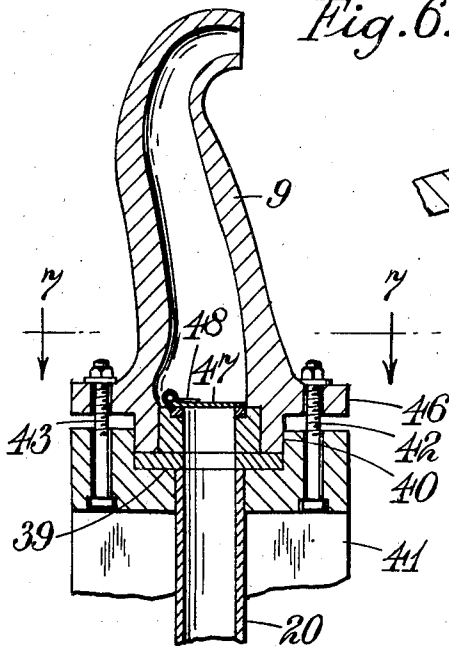


Fig. 8.

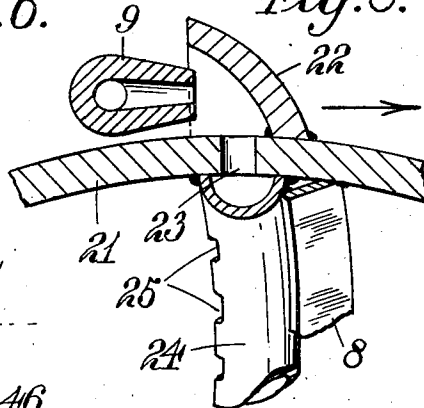


Fig. 11.

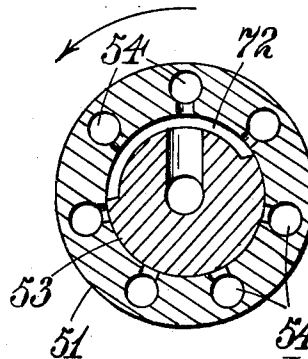
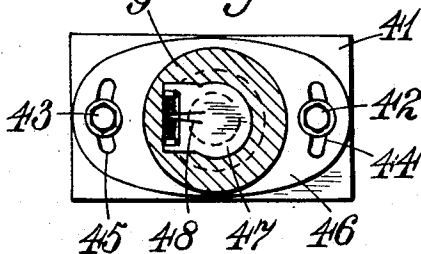


Fig. 7.



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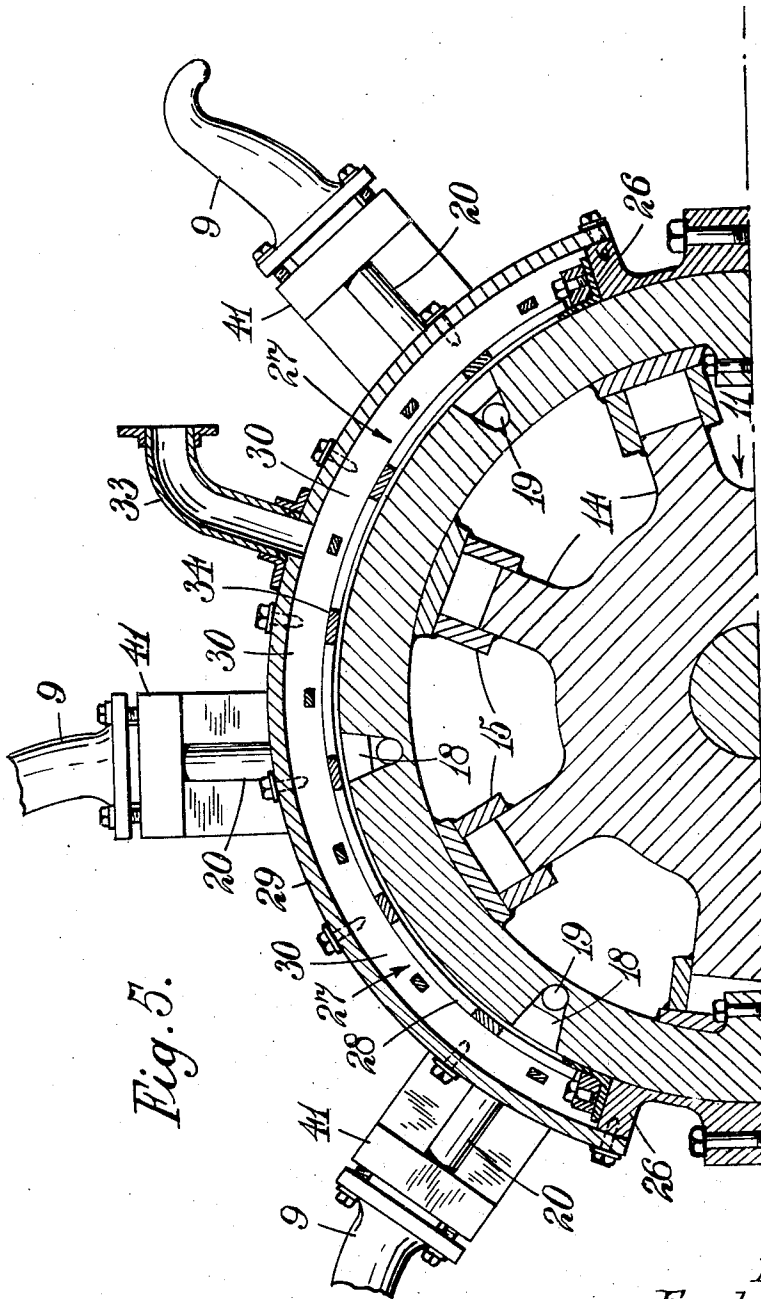


Fig. 5.

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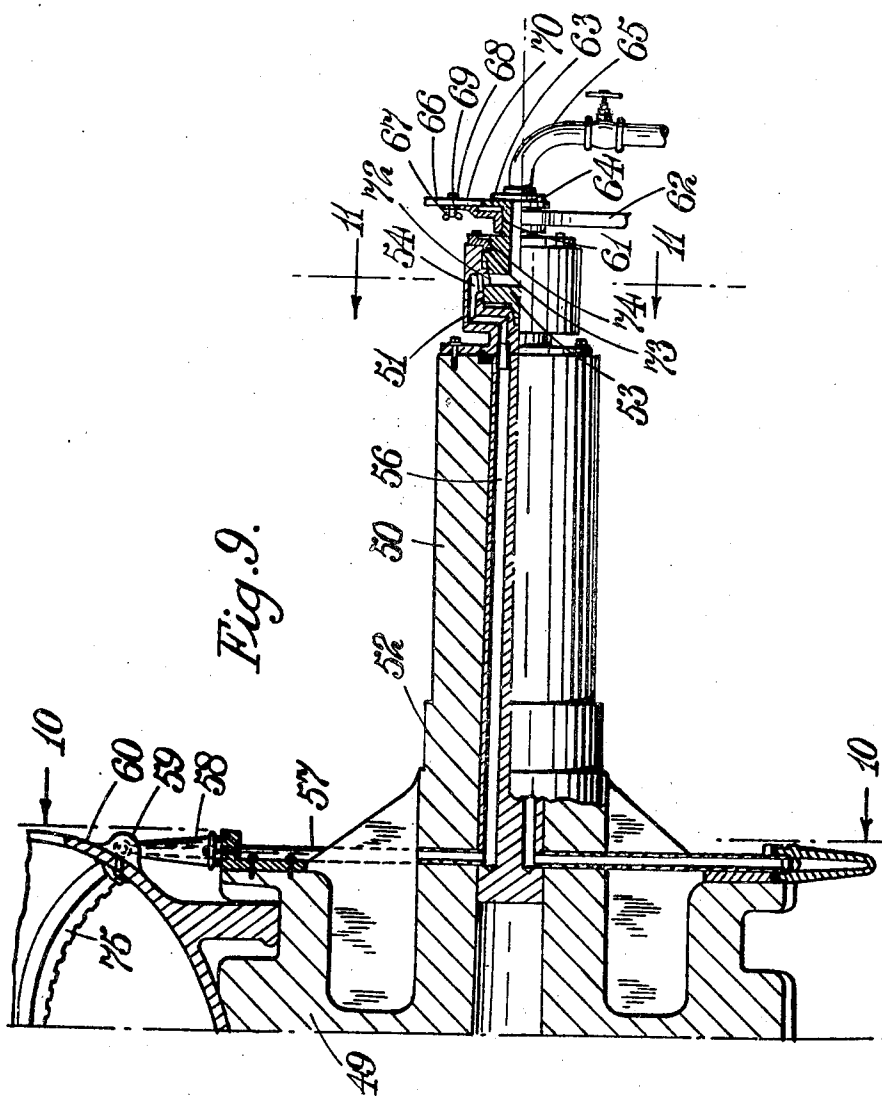
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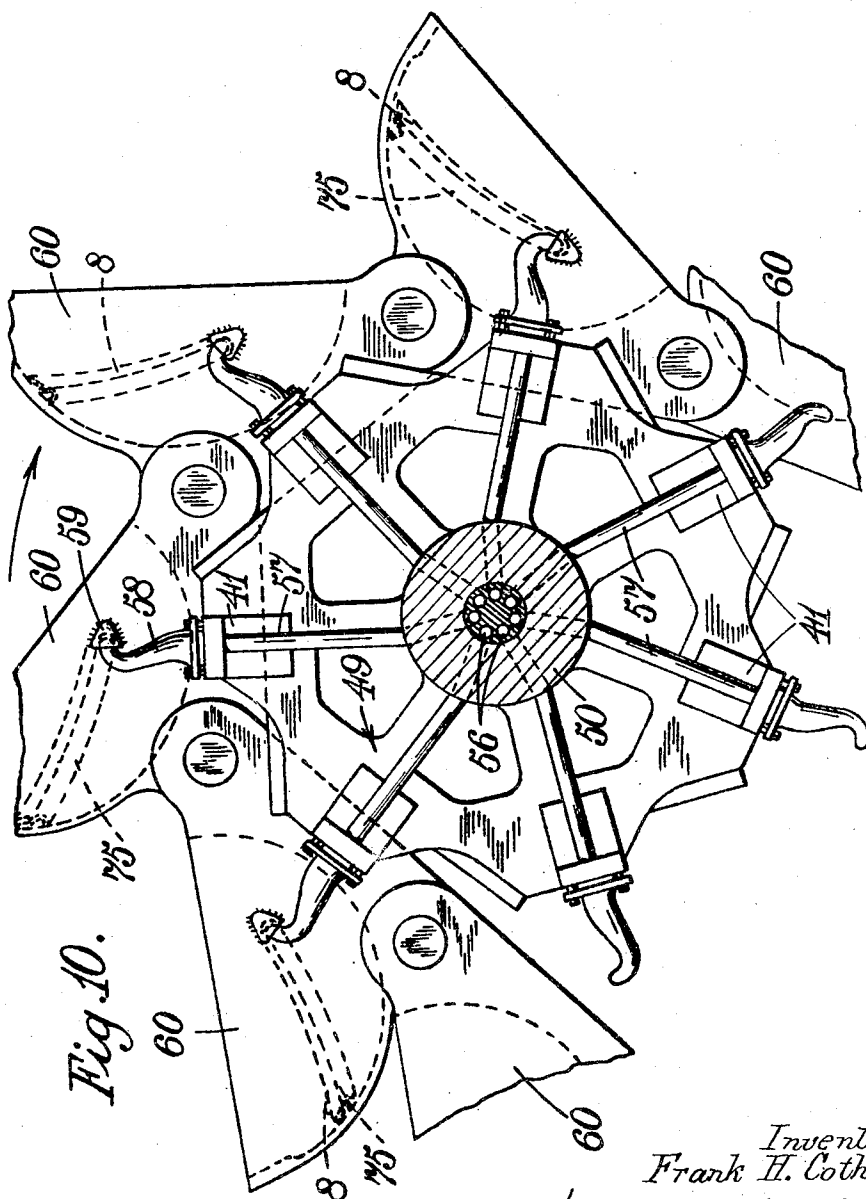


Fig. 10.

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UNITED STATES PATENT OFFICE

2,484,931

BUCKET ELEVATOR

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Application March 17, 1947, Serial No. 735,160
In Great Britain November 13, 1946

11 Claims. (Cl. 198—229)

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This invention comprises improvements in or relating to bucket elevators and bucket dredges.

In the following description and claims, where the term "bucket elevator" is used alone, it is intended to include "bucket dredge" within its meaning.

The invention is concerned with a bucket elevator or dredge of the known type in which a chain of buckets is drawn upwardly and passed over a driving tumbler at the top of its movement. In this elevator or dredge, means are provided for introducing water under pressure to the interior of the bottom of the bucket between that and the material to be removed therefrom with the object of facilitating the discharge from the bucket of sticky or clayey material which otherwise might not fall out of the bucket as it turns over the upper (driving) tumbler. The means for the supply of water to the buckets consisted of a water jet directed into a passage in the bucket which jet was movably mounted and intermittently moved by a cam device so as to follow the movement of each bucket for a short period while passing over the tumbler and then to return to its initial position in readiness to supply water to the next bucket. Under the conditions of operation of a bucket elevator or dredge, cam devices of the kind described are liable to rapid wear and it is an object of the present invention to provide an alternative and improved means of supplying water to the buckets at the top of their travel.

According to the present invention, in a bucket elevator (which term includes, as already explained, a bucket dredge) there is provided apparatus for the supply of water under pressure to the interior and bottom of the buckets to facilitate the discharge of dredged material therefrom, comprising a rotating valve member mounted concentrically with the upper tumbler of the dredge, a plurality of water-delivery pipes mounted to rotate with said valve member and to supply water therefrom to the buckets, a fixed co-operating valve member bearing against the rotating valve member, and ports in the bearing faces of the fixed and rotating valve members to direct water to the water-delivery pipes during that period of their rotation when they are moving in fixed relation with buckets which are turning over on the upper tumbler.

In this connection it will be appreciated that the bucket as it reaches the tumbler at the top of its travel rests during the time when it is turning over to discharge its load in a fixed relationship with the rotating tumbler; advantage is

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taken of this fact according to the present invention to supply water to the buckets during this period.

In one construction the pipes which rotate with the rotating valve member are equal in number to the number of driving faces on the tumbler and are disposed so that the end of each pipe as it falls into relation with one of the buckets during the time of turning over of the bucket, as already described, comes into register with a water-receiving aperture in the side of the bucket and directs water thereinto, the water thence entering a pipe or passage within the bucket itself, the pipe or passage having openings at the interior surface of the bucket so that the water may be introduced between the interior surface of the bucket and the material contained in the bucket.

The rotating valve member is secured concentrically on the upper tumbler for rotation therewith.

In another construction, rotating and non-rotating valve members may be fixed concentrically on the end of the tumbler shaft outside one or both of its journal bearings, and passages in the tumbler shaft connect the ports in the valve members to the water-delivery pipes for supply of water to the buckets.

The following is a description, by way of example, of two constructions in accordance with the invention which are shown in the accompanying drawings, in which:

Figure 1 is an end elevation of the upper tumbler and buckets of a placer dredge with valve members carried on the ribs of the tumbler, some of the delivery pipes being omitted for clearness;

Figure 2 is a section on the line 2—2 of Figure 1 through the top half and one side of the upper tumbler;

Figure 3 is a section through the valve members on the line 3—3 of Figure 1;

Figure 4 is another section through the valve members on the line 4—4 of Figure 2;

Figure 5 is a section through the top half of the tumbler on the line 5—5 of Figure 2 showing the internal construction of the valve members, the buckets and side flanges being omitted;

Figure 6 is a vertical section on an enlarged scale through a water-delivery pipe and its nozzle;

Figure 7 is a section on the line 7—7 of Figure 6;

Figure 8 is a diagrammatic sectional view, drawn to the same scale as Figures 6 and 7, show-

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ing the means whereby water is delivered by the nozzle to a hood on to the bucket and thence through an aperture into a slotted passage within the bucket;

Figure 9 is a section similar to that of Figure 2 showing an alternative construction with the valve members fixed concentrically at the end of the tumbler shaft;

Figure 10 is an end elevation corresponding to Figure 2 of the alternative construction, with the tumbler shaft sectioned on the line 10—10 of Figure 9; and

Figure 11 is a section through the valve members on the line 11—11 of Figure 9.

Referring first to the construction shown in Figures 1 to 8, the upper tumbler 11 of a placer-dredge which is intended for dredging material such as tin or gold-containing soil from alluvial deposits is constructed in the usual way with faces 12 to receive the bucket-chain. In the tumbler construction supporting ribs 14 are formed between the tumbler faces 12 and the tumbler hub. On seatings 15 rigidly attached to these ribs 14 there is secured concentrically a ring-shaped casting 16 which is in two halves bolted together for ease of assembly. The outer face of the casting is machined to provide a smooth circular valve face 17 and to provide on each side of the valve face a portion 10 of somewhat smaller diameter which acts as a guide.

The valve face 17 is provided with ports 18 equal in number to the number of sides of the tumbler, shown as seven in the drawings, and each port leads to a passage 19 which extends within the ring-shaped casting 16 first towards the tumbler faces and then, when the passage has proceeded far enough to be clear of the valve face and its associated guides, radially outwards into communication with a water delivery pipe 20. The various water delivery pipes extend outwardly like the spokes of a wheel and carry forwardly-directed nozzles 9 at their outer ends. Each nozzle is so positioned as to come close to the side of a bucket 21 as the bucket turns over on the tumbler and to deliver water forwardly into a hood 22 leading to an aperture 23 in the side of the bucket.

The apertures 23 in the sides of the buckets are located conveniently at about the centre of the side elevation of the bucket. The hood 22 being in front of the aperture 23 tends to protect it from becoming plugged with clay or mire when the bucket is in its digging position.

The apertures 23 extends through the wall of the bucket and inside the bucket is connected to a passage in the form of a half-pipe 24 which is welded to the inside of the wall behind the digging edge, extending roughly parallel to the base around the wall of the bucket, to a position on the other side of the bucket where there may be a second orifice as described below. This part of the passage is formed with slots 25 on the edge which faces toward the bottom of the bucket and therefore water which is delivered through the slots will be directed down the lower part of the inner wall of the bucket to the bottom thereof. At the other side of the half pipe 24 the angular space between the pipe and the bucket is closed in by an oblique cover strip 8 which acts as a ramp to effect a smooth flow of dredged material over the pipe, and to form on the side of the half pipe facing the bottom a void between the interior surface of the bucket and the dredged material, into which void the water is introduced. As the slots 25 face toward the bottom of the bucket they

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do not tend to be clogged in the digging operation. A second aperture connected to a second internal slotted pipe (or to the first pipe as described above) is formed in the other side wall of the bucket and a second rotating valve-member carrying delivery pipes is mounted on the ribs of the tumbler on the opposite side to the one already described. Thus, each bucket is fed with water from both sides.

Surrounding the rotating valve member 16 already described is a non-rotating valve member 26, also made of a casting in two parts bolted together. This casting is made to fit on the circular guides 10 machined in the rotating valve member 16 at the sides of its valve face. One part of this casting is blank and serves to enclose the valve ports 18. The other part is hollow over a portion of its periphery and contains a long port 27 which overlies the valve face of the rotating valve member. The edges of this port are lined all round with renewable lips of leather 28 which lips of leather form between them a rectangular port opening. The lips of leather resting on the valve face make a water-tight seal. The space above the leather lips 28 is closed in by a removable flanged cover-plate 29 through which water is supplied under pressure from an inlet pipe 33. Circumferential ribs 30 on the cover plate 29 extend inwardly to press on a distance piece 34 and cause it to grip the leather lips so that they effect a water-tight joint at the valve face 17. The ports 18 in the rotating valve member are themselves subdivided by circumferentially-extending ribs 31 which tend to support the ends of the leather lips as the ports in the rotating valve member pass under them.

It will be seen that the period of the rotation during which water is delivered to the rotating valve ports 18 is determined by the length of the non-rotating port 27 in the outer valve member and the timing of the delivery of water is determined by the location of this port. The timing can be adjusted by altering the position of the non-rotating valve member 26 in a circumferential direction. To effect such alteration the non-rotating valve member carries an arm 25 which is connected to a rod 36 screw-threaded over a portion of its length at 37 which passes through a bracket 76 on the dredge structure and is adjusted by a hand-wheel 38 and nut 77.

In operation, the non-rotating valve member 26 is adjusted to cause the time of delivery of water to the rotating valve member 16 to coincide with the time during which each bucket is in its most effective position for discharging its load. Each of the radial water delivery pipes 20 therefore delivers water through the nozzles 9 to the bucket 21 during this time and is cut-off from receiving water at other times and this result is accomplished without the use of any cams or exposed wearing parts. The only wearing parts in this construction in addition to the leather joint, 28 are the guide faces between the rotating and non-rotating valve members 18 and 26, but as these are in constant engagement with each other the entrance of dirt tends to be prevented.

In order to allow for the wear which takes place in all tumblers the nozzles 9 on the outwardly-extending water delivery pipes 20 are preferably made adjustable in length.

As shown in Figures 6 and 7, the inner end of each nozzle seats on a spacing washer 39 in a recess 40 of a supporting bracket 41 on the tumbler side flange 12 which recess communicates with a water delivery pipe 20, and the nozzle is

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secured by two bolts 42, 43 extending from the bracket through curved slots 44, 45 in a flange 46 on the nozzle. When wear takes place so that the bucket seats on the tumbler at a somewhat smaller radius from its centre, the radial position of the nozzle can be adjusted by replacing the washer 39, by another of less thickness, so that water from the nozzle is still directed into the hood 22 on the side of the bucket. Angular adjustment of the nozzles is also provided by the slots 44, 45 for obtaining the best angular setting for delivery of water into the hood. A non-return flap valve 47, loaded by a light spring 48, is incorporated in the nozzle for retaining the water in the pipe and passage system to avoid having to refill the system before it again becomes operative.

It will be appreciated that, if desired, there may be a set of water delivery pipes and associated valve members at one side of the tumbler only, in which case there is an aperture in the corresponding side of the bucket only and the passage inside the bucket is closed at the end remote from the aperture.

In a second construction shown in Figures 9 to 11, instead of locating the rotating and non-rotating valve members on the ribs of the tumbler 49, a rotating valve member 51 is fastened concentrically on the end of the tumbler shaft, outside the journal bearing 52 at one or both sides of the tumbler. This rotating valve member is hollow and receives within it an internal non-rotating valve member 53 with a conical face which fits against an internal conical face on the rotating valve member. The rotating valve member has a number of internal ports 54 (corresponding to the number of driving faces on the tumbler) which open into the valve face and these ports are connected by passages 55 within the rotating member to passages 56 extending longitudinally through the tumbler-shaft and thence at a point near the tumbler radially outwards to delivery pipes 57 with nozzles 58 directed towards the hoods 59 on the sides of the buckets 60 as previously described with reference to the first construction shown in Figures 1 to 8.

The non-rotating internal valve member 53 on the end of the tumbler-shaft has a stem 61 which extends beyond the rotating valve member 51 concentrically with the tumbler and which is supported by a bracket 62 from the framework of the dredge. The stem 61 has a flange 63 which is bolted to the flange 64 of a water supply main 65. The flange connection 63, 64 is such, however, as to permit the non-rotating valve member to be adjusted rotationally to any desired angular position by a radial lever 66 on the flange 63. The lever is locked in its set position by means of a wing nut 67 on a bolt 68 projecting through a curved slot 69 in the cap 70 of the bracket 62.

The non-rotating valve member 53 has a port 72 in the outer face the length of which in a circumferential direction determines the duration of admission of water to the various ports 54 in the rotating valve member. The timing of the admission is determined by the circumferential setting of the non-rotating valve member 53. The joint between the rotating and non-rotating valve members is made watertight by means of a cup leather packing 73 backed up by a flange-plate 74 bolted to the rotating valve member 51.

The forms of the nozzle 58, hood 59, and slotted bucket pipe 75 are similar to those of the corresponding parts 9, 22 and 24 in the first con-

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struction described with reference to Figures 1 to 8.

I claim:

1. In a bucket elevator the combination of a supporting structure, an upper tumbler rotatably mounted thereon, an endless bucket chain passing over the tumbler, a rotary valve member distinct from but rotatable with the tumbler, a fixed valve member coacting with the rotary valve member, a water supply connection on the fixed valve member, delivery pipes secured to the tumbler extending from the rotary valve member to points on the tumbler where they come into coacting proximity to the buckets in the position where the buckets pass over the tumbler, nozzles on the pipes and ports in the buckets to register with the nozzles on the pipes, the valve members having ports so situated that communication with the supply is established throughout the segment of the rotation when the nozzles are in register with the ports in the buckets.

2. A bucket elevator as claimed in claim 1 wherein the nozzles in the pipes are directed tangentially forward considered in relation to the direction of rotation of the tumbler and the buckets have hoods over their ports which are directed rearwardly to coact with the nozzles.

3. Apparatus as claimed in claim 2 wherein the nozzles on the water-delivery pipes are adjustable radially and in direction for the purpose described.

4. A bucket elevator as claimed in claim 1 wherein the rotary valve member is secured to the side of the tumbler and shaped to support the fixed valve member which rides upon it.

5. A bucket elevator as claimed in claim 1 wherein the rotary valve member is secured at the end of the tumbler shaft beyond the journal thereof and is connected to the delivery pipes by separate ducts within the shaft passing through the journal to each delivery pipe.

6. In a bucket elevator the combination of an endless chain of buckets, a supporting structure, a tumbler mounted to rotate upon the supporting structure and over which the bucket chain passes so that there is a position of turning-over of the buckets on the tumbler, a rotary valve member mounted concentrically with the tumbler to rotate therewith and having a ported circular valve face, a fixed co-operating valve member secured to the supporting structure and having a ported circular valve face contiguous with that of the rotary valve member, a duct communicating with the ports of the fixed valve member provided with a connection for a supply of water under pressure, and a plurality of water delivery pipes mounted to rotate with the rotary valve member and secured to the tumbler and having nozzles to coact with the buckets to connect the ports in the valve face of the valve member to ports in the buckets, the valve ports being so situated as to connect the supply to each delivery pipe in that part only of its rotation where it is coacting with a bucket which is in the position of turning over.

7. In a bucket elevator as claimed in claim 6 apertures in the sides of the buckets into which the delivery pipes deliver the water, passages in the buckets extending from the apertures, and openings in the bucket passages for discharging water to the interior of the buckets.

8. In a bucket elevator as claimed in claim 7 the provision of hoods on the sides of the buckets in front of the apertures therein, in combination with nozzles on the water delivery pipes

for delivering water into the apertures behind the hoods.

9. Apparatus as claimed in claim 8 wherein the nozzles on the water delivery pipes are adjustable radially and in direction for the purposes described.

10. In a bucket elevator as claimed in claim 8, a means for angular adjustment of the fixed valve member to adjust the relative timing positions of the ports in the fixed and rotating valve members.

11. In a bucket elevator the combination of an endless chain of buckets, a supporting structure, a polygonal tumbler over which the bucket chain passes so that there is a position of turning over of the buckets on the tumbler, the tumbler having a number of flat faces around its periphery to receive the bucket chain, a rotary valve member secured concentrically to the tumbler shaft for rotation therewith, a fixed valve member coacting with the rotary valve member, a water supply connection on the fixed valve member, a plurality of water delivery pipes equal in number to the number of driving faces on the tumbler, which pipes are secured to the tumbler and extend to points where they come

into coacting proximity to the buckets in the position where the buckets pass over the tumbler, nozzles on the pipes and ports in the buckets to register with the nozzles on the pipes, ports in the bearing surface of the rotating valve member corresponding in number to the water delivery pipes, passages in the tumbler shaft connecting the said ports to the said water delivery pipes and ports in the bearing surface of the fixed valve member so situated that communication between the water supply and each delivery pipe is established throughout the segment of the rotation when the nozzle of said pipe is in register with a port in a bucket.

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