

March 14, 1944.

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2,344,446

APPARATUS FOR DEPOSITING MATERIAL UNDER WATER

Filed June 24, 1943

4 Sheets-Sheet 1

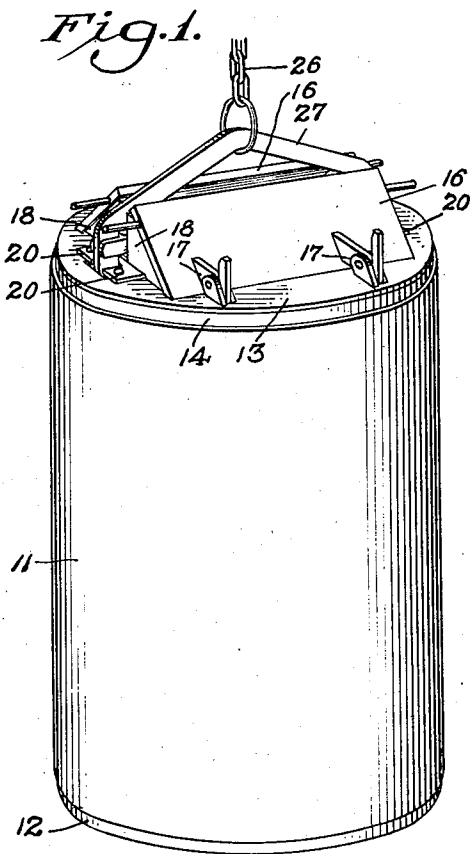
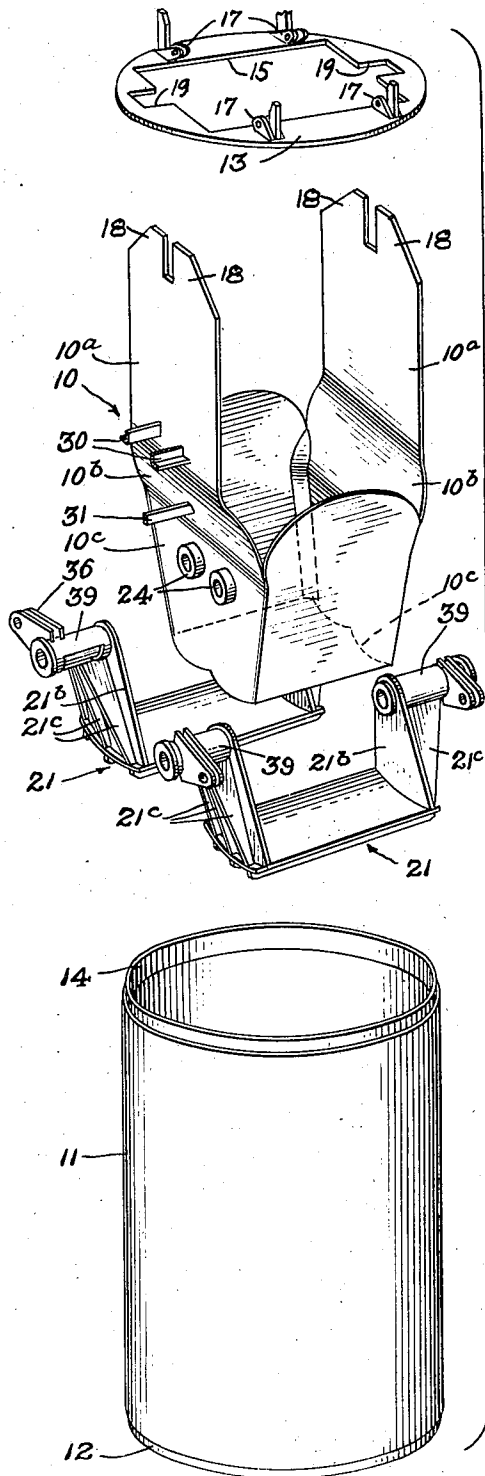


Fig. 2.

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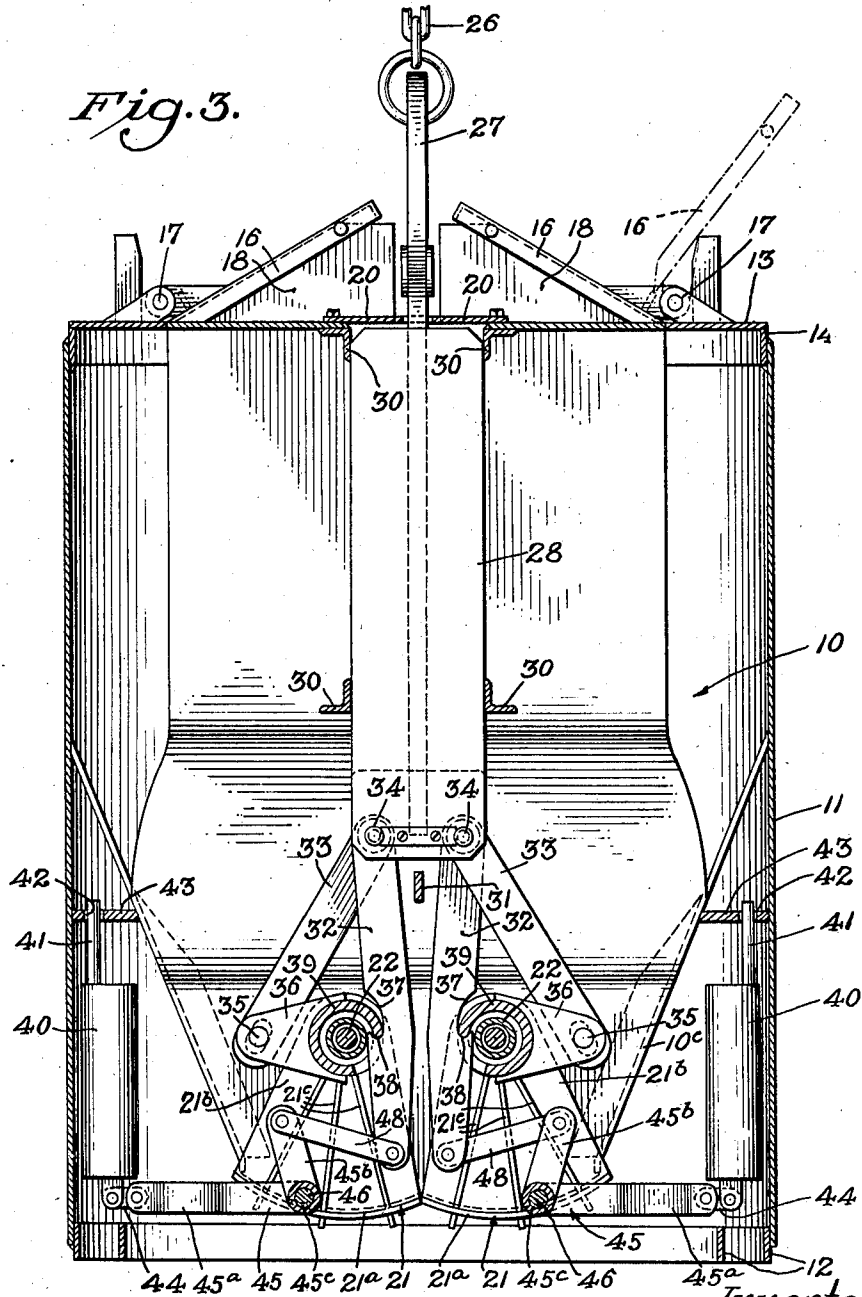
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4 Sheets-Sheet 2



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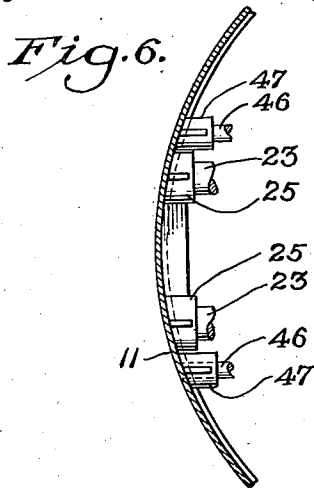
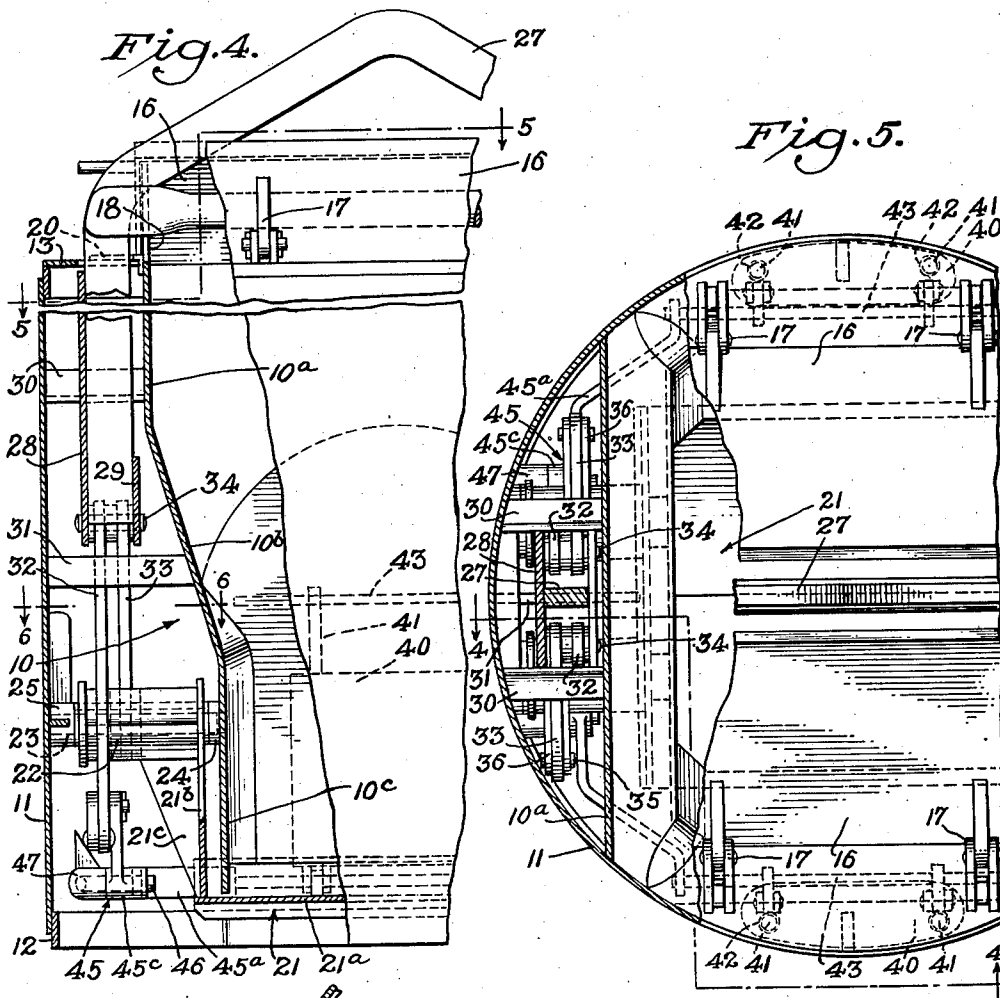
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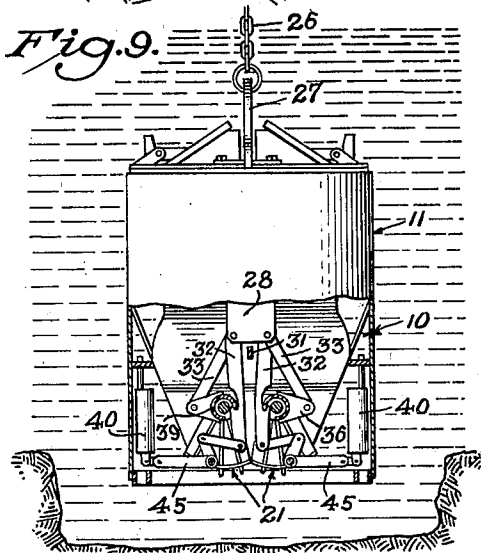
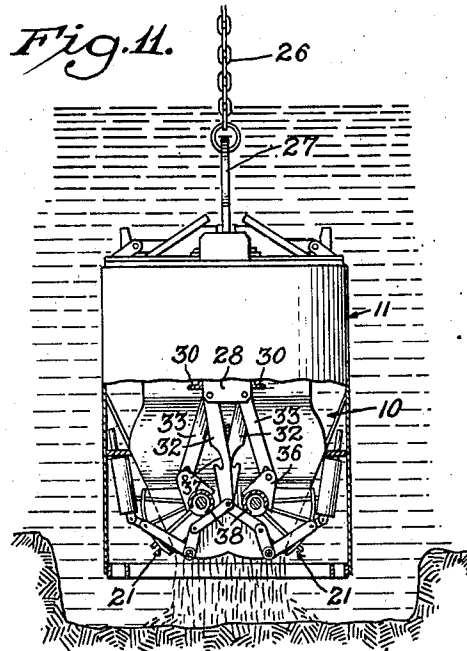
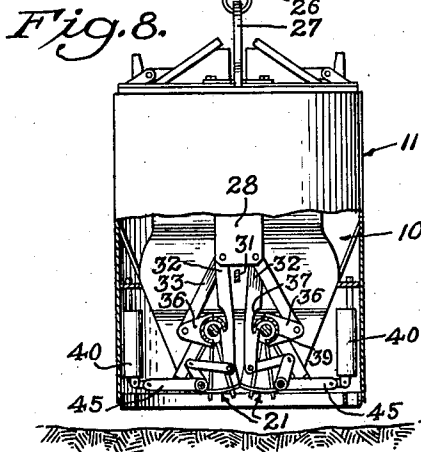
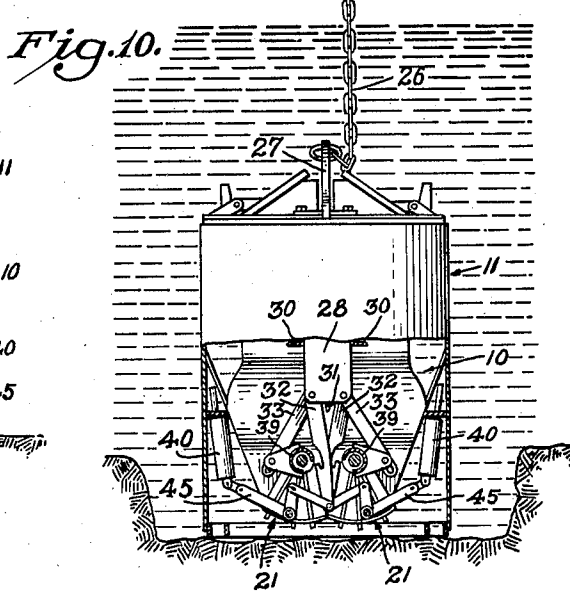
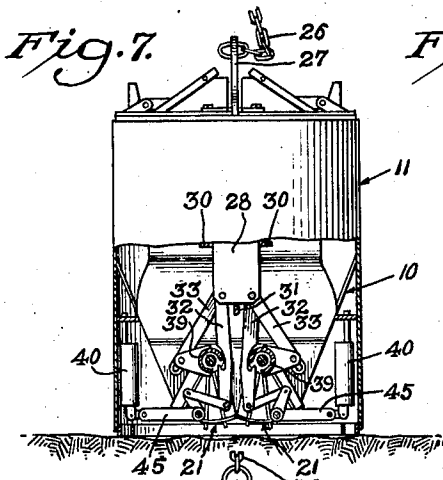
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

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APPARATUS FOR DEPOSITING MATERIAL UNDER WATER

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Application June 24, 1943, Serial No. 492,048

13 Claims. (Cl. 294-71)

The present invention pertains to improvements in apparatus for depositing material under water, that is, to what are commonly known in the art as tremie buckets. Such apparatus is usually employed for depositing mixed concrete at a desired point under water as, for example, in building the poured concrete footings for a dam, bridge pier or the like.

Generally stated, the object of the invention is to provide such a bucket which will dump its contents upon being hoisted up after having been bottomed under water but which will not, on the other hand, dump when the same sequence of setting it down and then hoisting it is performed out of water.

More particularly, I have provided a bucket adapted to be suspended from a single line or cable and having a novel operating mechanism such that when the bucket is rested on bottom when immersed and then pulled up again it will automatically discharge its contents, but if, on the other hand, it is set down at some point out of water and then hoisted the dumping of its contents is automatically and positively prevented. Such characteristic greatly facilitates its handling in that it may be loaded with mixed concrete or other material, set down on a flatcar for transportation to the water site, and hoisted from the flatcar preparatory to lowering it into the water, all without danger of its dumping or necessity of manual setting or holding-in of latches. Yet when the bucket is thereafter lowered into the water all that need be done to dump it is to let it come to rest on the bottom of the lake or river and then hoist away again, whereupon it automatically dumps. In carrying out the invention I provide, as will hereinafter appear in greater detail, means for unlatching though not opening the bucket closure whenever the bucket is set down, together with immersion-responsive means, in the form of a float-operated linkage, which compels relatching of the bucket closure whenever the bucket is hoisted in non-immersed condition, and thereby preventing dumping, but permitting hoisting without relatching, and thus compelling dumping, when the bucket is immersed.

Further objects and advantages of the invention will become apparent as the following description proceeds, taken in connection with the accompanying drawings in which:

Figure 1 is a perspective view of a bucket embodying the present invention.

Fig. 2 is an exploded perspective view of the bucket structure as such, that is, minus its operating mechanism.

Fig. 3 is an enlarged side elevation of the bucket of Fig. 1 with the outer casing broken away to expose the interior arrangement of the parts.

Fig. 4 is a fragmentary front elevation of the

bucket partially in section along the line 4-4 in Fig. 5.

Fig. 5 is a fragmentary plan view of the bucket, partially in section, along the line 5-5 in Fig. 4.

Fig. 6 is a fragmentary detail sectional view taken along the line 6-6 in Fig. 4.

Figs. 7 to 11, inclusive, are stop motion views of the bucket with a portion of the casing broken away to show the respective positions of the operating linkage, and illustrating the bucket respectively at rest out of water (Fig. 7), suspended out of water (Fig. 8), suspended under water (Fig. 9), bottomed under water (Fig. 10), and re-elevated under water after bottoming, thus dumping its contents (Fig. 11).

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring more particularly to the exemplary construction, the bucket, that is, the actual receptacle for the mixed concrete or the like which is to be transported by the device, is illustrated as comprising an inner shell 10 and an outer shell or casing 11 (see Fig. 2). The inner shell 10 is fabricated from plates welded together to form a box-like lower portion 10, terminating in an open bottom at 10c for gravity discharge of the bucket's contents. The two side plates have out-turned central portions 10b and vertically extending upper portions 10a. The latter extend as chords across the circular interior of the outer casing 11, forming clearance spaces at opposite sides of the inner shell, between the two shells, for the reception of the operating mechanism (see Fig. 5). The side edges of the portions 10a and 10b, as well as the curved upper edges of the front and rear plates of the inner shell, are seamed to the outer casing so that a receptacle is formed, the upper portion of which is defined by the two shells and the smaller lower portion by the inner shell alone.

The outer shell or casing 11 (Figs. 1 and 2) is cylindrical in shape and serves not only to coact with the inner shell in forming the receptacle or bucket proper but also forms a protective housing for the operating mechanism of the bucket hereinafter detailed. An annular reinforcing frame 12 at the bottom of the casing 11 allows it to carry the weight of the entire apparatus and contents when bottomed, i. e., rested on the ground, and a disk-shaped cover plate 13 is fixed to a reinforcing ring 14 at the top of the casing 11. A generally rectangular opening 15 in the

cover 13 affords access to the interior of the bucket for filling the same. Doors 16, carried by hinges 17 at the side edges of the openings 15 are arranged to swing inward to closed positions in which they rest on the inclined edges of vertical extensions 18 on the inner shell 10 which project above the cover 13 at opposite ends of the openings 15. The open position of one of the doors 16 is indicated in dot-dash lines in Fig. 3. Notches 19 at opposite ends of the opening 15 afford clearance for the suspension mechanism hereinafter described. Removable cover plates 20 close the portions of the notches 19 not occupied by the suspension mechanism.

A pair of closures or valves, designated generally as 21 (see Figs. 2 and 3) are arranged to close the discharge opening 10c in the bottom of the bucket's inner shell 10. Each of these valves comprises a main closure plate 21a of transversely curved configuration and with a pair of upstanding triangular end plates 21b rigidly fixed to its opposite ends. Reinforcing webs 21c are fixed to the outer faces of the end plates (see also Fig. 4). The valves 21 are pivotally supported by means of hubs 22 fixed to, and projecting outward from, the respective end plates 21b. These hubs are journaled on shafts 23 received in socket members 24, 25 fixed, respectively, to the opposed side walls of the inner shell 10 and outer casing 11. The valves 21 are thus adapted to swing about respective parallel horizontal axes between the closed position therefor illustrated, for example, in Fig. 10, and the open position thereof shown in Fig. 11.

The bucket is suspended by a line 26 attached to a bail 27. The bail is mounted for limited movement in a vertical direction relative to the bucket proper to effect unlatching and opening of the valves 21 upon, respectively, slackening and tensioning of the line in a manner hereinafter detailed. As to the mounting of the bail 27 itself, it will be observed upon reference to Figs. 3, 4 and 5 that the legs of the bail project downward between the inner and outer shells 10, 11 and each such leg has rigidly attached thereto a pair of vertical plates 28, 29. Two pairs of angle irons 30 are located at diametrically opposite sides of the inner shell 10 and are fixed in position between it and the outer casing 11 in position to guide the bail 27 for vertical movement by sliding engagement with the edges of the plate 28 fixed to the latter. Stiffener or tie bars 31 extend transversely between the inner and outer shells 10, 11 at suitably located points beneath the respective ends of the downwardly projecting bail legs.

When the line 26 is under tension the bail 27 is pulled up either to its intermediate position shown, for example, in Figs. 3 and 8, or to its uppermost position shown in Fig. 11, depending upon whether or not the latch mechanism hereinafter described is engaged. The upward movement of the bail to its intermediate position is limited by such latch mechanism, while its movement into its extreme upper position shown in Fig. 11, in which the valves 21 are open, is limited by the engagement of the open valves with the exterior of the inner shell 10. On the other hand, when the line 26 is slacked off, the bail 27 is free to descend, relative to the bucket, to its lowermost position shown, for example, in Fig. 7.

Attached to the reinforcing plates 28, 29 on the lower ends of each of the depending arms of the bail 27 are sets of latching and opening links 32, 33, respectively, for each of the valves 21. Since

the linkages (see Figs. 3, 4 and 5) on each of the two depending bail arms, or, in other words, at each end of the valves 21, are identical, a description of one will suffice for both. The opening links 33 are pivotally mounted at their upper ends on pins 34 extending between the plates 28, 29 on the depending leg of the bail 27, as are also the upper ends of the latching links 32. For clearance purposes the latching link 32 for each valve is mounted opposite the opening link 33 for the other valve, rather than opposite the other latching link. When the latching links are swung to their non-latching position shown in Fig. 11 they are thus able to overlap each other.

The lower ends of the opening links 33 are attached by pin-and-slot type lost motion connections indicated at 35 (Fig. 3) with the outer ends of arms 36 which are rigidly attached to the hubs 22 on the valves 21. When the bail 27 is pulled upward to its extreme upper position shown in Fig. 11, the opening links 33 thus swing the valves 21 outward away from each other into their open positions. On the other hand, downward movement of the bail 27 is limited by the pins at 35 abutting against the upper ends of the slots in the links 33 which receive them.

The latching links 32 are provided with notches 37 in their outer edges engageable with coating latch shoulders at 38. Such shoulders 38 are formed by the edges of longitudinally extending slots formed in cylindrical sleeves 39 rigidly attached to the end plates 21b of the respective valves 21. The sleeves 39 encircle the valve hubs 22 in spaced relation to the same and turn with them since both the hubs and sleeves are rigidly attached to the valve end plates. When the latch links 32 are engaged with the coating sleeves 39 as shown in Fig. 3, further upward movement of the bail 27 is prevented so that the valves 21 are retained in their closed position. Slackening off the tension in the hoist line 26 permits the bail 27 to drop, thus moving the latch links 32 downward out of engagement with the sleeves 39 (compare Figs. 8 and 7 for these respective positions).

As so far described, the valve-controlled linkage is such that when the bucket is bottomed, that is, set down, the slackening off of the line 26 drops the bail 27 and thus results in unlatching of the valves 21. In the event that the latching links 32 were not only moved downward for such unlatching, but also swung inward toward each other into non-latching position to clear the shoulders 38 on the sleeves 39, then the valves 21 would be opened by subsequent hoisting of the bucket since the accompanying raising of the bail 27 would pull the opening links 33 upward, thereby swinging the unlatched valves 21 to their open positions for gravity discharge of the bucket's contents. Without else there would be no distinction in operation between instances in which the bucket was bottomed above water as compared to being bottomed while immersed. In many cases, however, it is just as necessary that the bucket be retained closed when bottomed above water and subsequently hoisted, as it is that it automatically open when these operations are performed with the bucket immersed. For example, in the ordinary use of such bucket it is loaded with mixed concrete at a mixing plant and then has to be swung on to a flatcar for transport to the point of use. In such case the bucket must not dump its contents upon being hoisted from the flatcar but must, on the other hand, automatically dump its contents after being lowered to the bottom of a river or the like and subsequently raised. In ac-

cordance with the present invention a mechanism is provided such that the apparatus automatically distinguishes between instances in which the bucket is bottomed without immersion and bottomed while immersed.

Immersion-responsive means in the form of floats 40 (Figs. 3, 4 and 5) are arranged to operate, through suitable linkages, to compel re-engagement of the latch members 32, 39 upon hoisting of the bucket after it has been bottomed, except when it is immersed, in order to accomplish the automatic distinction between conditions noted above. Two floats 40 are provided, located at diametrically opposed sides of the inner shell 10, between the lower portion of the latter and the outer casing 11. The floats are in the form of tanks sealed for buoyancy and are generally oval in horizontal cross section (see Fig. 5). Guide rods 41 rigidly attached to the upper ends of the floats 40 pass through registering holes 42 in plates 43 fixed between the inner and outer shells, thus confining the floats to movement in a vertical direction. Each of the floats is connected to the linkages at the opposite ends of the corresponding ones of the valves 21. Thus at the opposite extremities of their lower ends the floats 40 are pivotally connected by short intermediate links 44 to the outer ends of arms 45a of bell cranks 45. Such bell cranks have hub portions 45c with which arms 45a are rigid and which are journaled on pins 46 mounted in sockets 47 attached to the inner side walls of the casing 11 (see also Fig. 6). The other arms 45b of the bell cranks 45, also rigid with hubs 45c, extend upwardly at an acute angle with respect to the arms 45a and are pivotally connected at their upper ends by links 43 with the lower ends of the latching links 32.

With the floats 40 connected to the latching links 32 through the linkage systems 44, 45, 43 described, when the bucket is out of water the floats 40 remain in their lowered position shown in Fig. 3 so that the bell cranks 45 are thus urged by the weight of the floats to turn outward away from each other. As a consequence, the latching links 32 are constantly urged to swing away from each other and into engagement with the cooperating latching sleeves 39. Vertical movement of the bail 27 will thus cause the latching links 32 to move up and down with simply a substantially straight line motion so that although the latch members 32, 39 disengage when the bucket is bottomed with the floats 40 down, nevertheless, the latch members re-engaged upon subsequent lifting of the bail 27 and opening of the valves 21 is thus prevented. When the bucket is immersed, however, the floats 40 tend to rise, that is, they tend to pivot the bell cranks 45 toward each other and thus tend to swing the latching links 32 toward each other and out of position for engagement with the respective latching sleeves 39. Consequently, whenever the bucket is bottomed while immersed, the descent of the bail 27 will not only move the latching links 32 downward out of engagement with the sleeves 39, but in addition the floats 40 will compel the latching links 32 to swing inward to a non-latching or non-relatching position out of alignment with the shoulders 38 on the sleeves 39, wherefore upon subsequent lifting of the bail 27 the latching links 32 pass freely by the sleeves 39 and the opening links 33 are thus free to pull the lever arms 36 upward for opening of the valves 21.

The operation of the apparatus herein disclosed will, in general, be clear from the foregoing. By way of brief resume, reference may be made to the series of stop motion views comprising Figs. 7 to 11. For loading or transport purposes above water, the bucket is set down as shown in Fig. 7. In such case the slack line 26 permits the bail 27 to descend so that the latching links 32 move downward to the position illustrated. They are, however, retained in operative relation with respect to the cooperating latching sleeves 39 by the floats 40. Accordingly, when the bucket is picked up again (see Fig. 8) the latching links 32 move upward again, thus relatching the sleeves 39. The bucket, either loaded or empty, can thus be picked up and set down any number of times above water and the valves 21 will remain closed, thereby preventing dumping of the bucket's contents. Upon arrival of the bucket at the point of use, it is lowered through the water as indicated in Fig. 9. Although the floats 40 tend to rise in the latter condition, they are prevented from doing so by the latched linkage attached to them and the valves 21 remain latched in their closed position during the descent of the bucket under water. When the bucket is finally bottomed under water, as shown in Fig. 10, the slack line 26 permits the bail 27 to descend so that the latching links 32 move downward. Compare this Fig. 10 with Fig. 7 as to the positions of the linkages when the bucket is bottomed in and out of water, respectively. The floats 40, being freed by the unlatching of the linkages, rise due to their buoyancy and the bell cranks 45 thrust the latching links 32 inward toward each other and out of operative relation with the cooperating latching sleeves 39. The latching mechanism is at that point completely free. As soon as the hoist line 26 is tensioned again, the bail 27 is pulled upward, this time to its full extent of upward movement, and the unlatched valves 21 are thereupon swung outward to open position by the opening links 33. This permits free gravity discharge of the contents of the bucket at the desired point of use.

I claim as my invention:

1. Apparatus for depositing material under water comprising, in combination, a bucket, means for suspending the same, said bucket having an opening in its bottom for gravity discharge of its contents and a closure for such opening, means for releasably latching said closure in closed position, means operable in response to relief of tension in said suspension means upon setting down the bucket for releasing said latching means and operable alternatively upon retensioning of said suspension means for either relatching said latching means or opening said closure, and immersion-responsive means for conditioning the last-mentioned means for its opening operation when the bucket is immersed and for conditioning the same for its alternatively available relatching operation when the bucket is not immersed.

2. In an apparatus of the type described, the combination of a bucket having a closure, means for opening said closure while the bucket is immersed, and means rendering the first-mentioned means operative to open said closure only when said bucket is immersed.

3. Apparatus for depositing material under water comprising, in combination, a bucket having a closure, means operable in response to sequential setting down and raising of the bucket

for opening said closure, and means for preventing operation of said last-named means to open said closure except when the bucket is immersed.

4. Apparatus for depositing material under water comprising, in combination, a bucket, means for suspending the same, said bucket having an opening in its bottom for gravity discharge of its contents and a closure for such opening, means for releasably latching said closure in closed position, means operable in response to relief of tension in said suspension means upon setting down the bucket for releasing said latching means, and operable alternatively upon retensioning of said suspension means for either relatching said latching means or opening said closure and means including a float movably mounted on the bucket for conditioning the last-mentioned means for its opening operation when the bucket is immersed and for conditioning the same for its alternatively available relatching operation when the bucket is not immersed.

5. Apparatus for depositing material under water comprising, in combination, a bucket having means for suspending the same, said bucket having an opening in its bottom for gravity discharge of its contents and a closure for such opening, a mating pair of latch members for releasably holding said closure in closed position, means operable in response to the application of tension to said suspension means for effecting relative movement of said latch members in a direction generally toward each other, and immersion-responsive means for effecting a relative shift of said latch members to cause them to pass by each other rather than re-engage upon movement thereof resulting from subsequent application of tension to said suspension means.

6. Apparatus for depositing material under water comprising, in combination, a bucket having means for suspending the same, said bucket having an opening in its bottom for gravity discharge of its contents and a closure for such opening, a mating pair of latch members for releasably holding said closure in closed position, means operable in response to the application of tension to said suspension means for moving one of said latch members generally vertically upward, means connecting the other latch member to said closure, and means including a float movably mounted on the bucket for shifting said one latch member laterally out of alignment with said other latch member to thereby prevent their re-engagement upon movement thereof resulting from subsequent application of tension to said suspension means.

7. In an apparatus of the type described, the combination of a bucket having a bail mounted thereon for limited vertical movement relative to the bucket, said bucket having a gravity discharge opening in its bottom and a closure for such opening, a first latch member connected to said closure, a cooperating second latch member movable by said bail generally vertically toward the first latch member, immersion-responsive means for shifting said second latch member into position to engage the first latch member upon elevation of the second latch member by the bail when the bucket is not immersed, to thereby lock the closure by engagement of said latch members and also prevent further upward movement of the bail, said immersion-responsive means also being operable when the

bucket is immersed to position said second latch member to pass freely by the first latch member upon raising of the bail, to thereby prevent engagement of said latch members and permit continued upward movement of the bail, and means operable in response to such continued upward movement of the bail for opening said closure.

8. In an apparatus of the type described, the combination of a bucket having a bail mounted thereon for limited vertical movement relative to the bucket, said bucket having a gravity discharge opening in its bottom, a closure for such opening pivoted on the bucket to swing about a horizontal axis, a latch member fixed to the closure for turning movement about said axis, a latch link pivotally connected to the bail and depending therefrom in proximity to said latch member and shaped for latching engagement with the latter upon upward movement of the bail from its lowermost position relative to the bucket, the engagement of said latch link and latch member serving to limit the upward movement of the bail to an intermediate position therefor, immersion-responsive means for shifting said latch link laterally of said latch member to clear the latter upon upward movement of the bail when the bucket is immersed, and means for shifting said closure to its open position for discharge of the bucket in response to upward movement of the bail past said intermediate position when said latch link is cleared from said latch member by the immersion-responsive means.

9. An apparatus of the type described, comprising a bucket having rigidly joined inner and outer shells spaced apart in at least their lower portions, said inner shell having a discharge opening in its bottom and a movable closure therefor, a bail of inverted U-shape arranged with its legs projecting downward between the side portions of said inner and outer shells, means for releasably latching said closure in closed position, actuating means including an operating linkage protectively housed between said inner and outer shells and operable by said bail for releasing said latching means and opening said closure in response to sequential bottoming and hoisting of the bucket, and means including a float movably mounted between said shells for preventing opening of said closure by said actuating means except when the bucket is immersed.

10. An apparatus of the character described comprising, in combination, a bucket having a bottom opening, a closure for said opening, lifting means for the bucket including a member movable vertically against the action of gravity upon the application of a lifting force, an operating connection between said member and said closure, latch means restraining movement of said closure in an opening direction in response to a lifting force applied to said member, said latch means being releasable in response to a descending movement of said member relative to said bucket, and immersion-responsive means for shifting said latch means whereby to render said lifting member effective to actuate the closure operating means.

11. An apparatus of the character described comprising, in combination, a bucket having a bottom opening, a closure for said opening, lifting means for the bucket including a member movable vertically relative to the bucket and against the action of gravity upon the applica-

tion of a lifting force, an operating connection between said member and said closure, latch means restraining said operating connection against movement for effecting opening of said closure upon application of a lifting force applied to said member, and immersion-responsive means for disabling said latch means when said lifting means is moved upward relative to the bucket while the latter is immersed.

12. An apparatus of the character described comprising, in combination, a bucket having a bottom opening, a closure for said opening, lifting means for the bucket including a member movable vertically against the action of gravity upon the application of a lifting force, an operating connection between said member and said closure, releasable latch means operable when engaged for restraining movement of said closure in an opening direction in response to a lifting force applied to said member, said latch means normally being alternatively releasable and engageable in response respectively to de-

scending and ascending movements of said member relative to said bucket, and means for disabling said latch means against engagement during ascent of said member relative to the bucket.

13. An apparatus of the character described comprising, in combination, a bucket having a bottom opening, a closure for said opening, lifting means for the bucket including a member having an operating connection with said closure and movable relative to the bucket when the latter is bottomed, latch means for preventing operation of said closure by said lifting means, said latch means including an abutment fixed against movement in a vertical direction relative to the bucket and a coacting latch member movable relative to said abutment by said lifting means, and means for shifting said latch member into a position for movement by said lifting means in a path clear of said abutment.

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