Sept. 2, 1958 E. RUTKOVE 2,850,261

WATER WHEEL APPARATUS

Filed Aug. 29, 1956 3 Sheets-Sheet 1

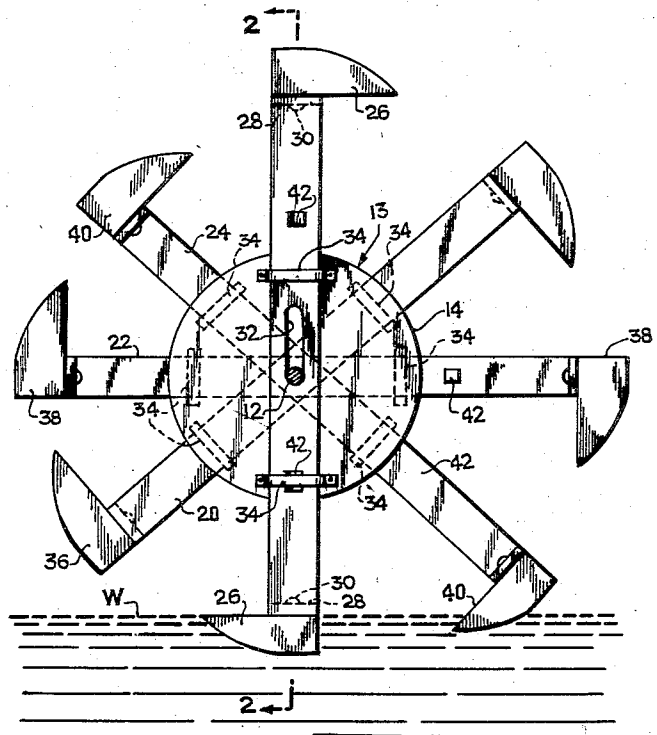

Fig. 1.

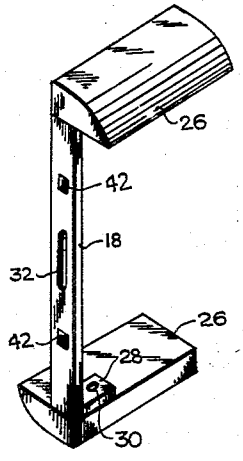

Fig. 3.

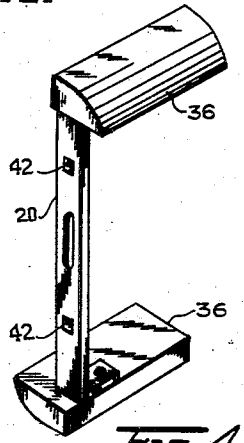

Fig. 4.

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WATER WHEEL APPARATUS

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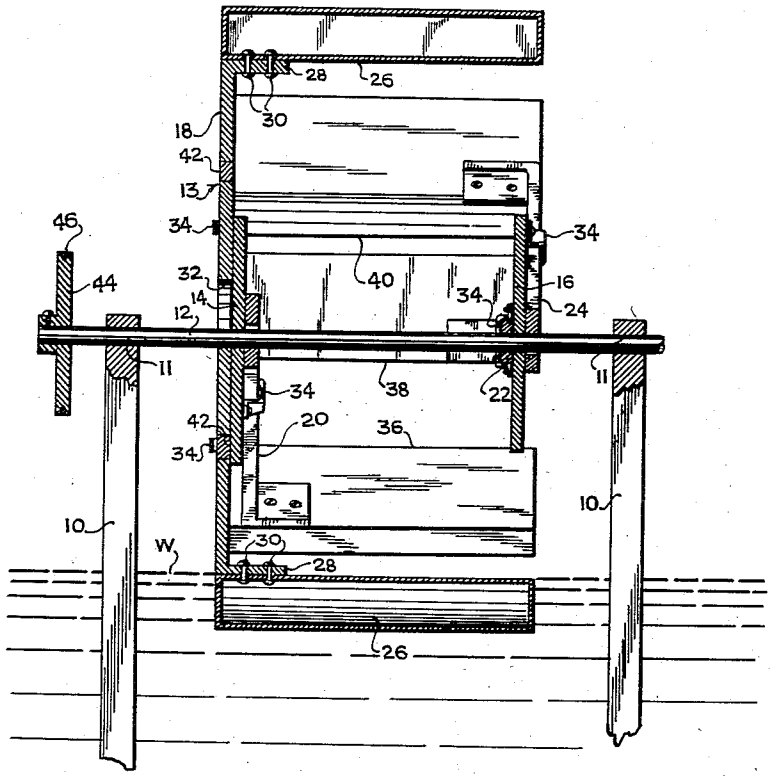

Fig. 2.

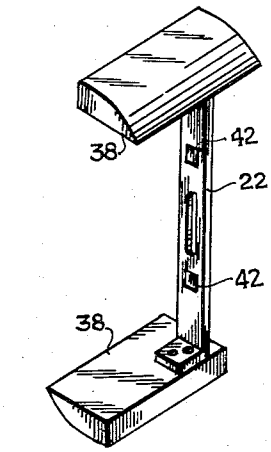

Fig. 5.

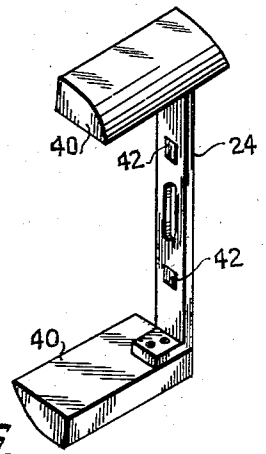

Fig. 6.

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WATER WHEEL APPARATUS

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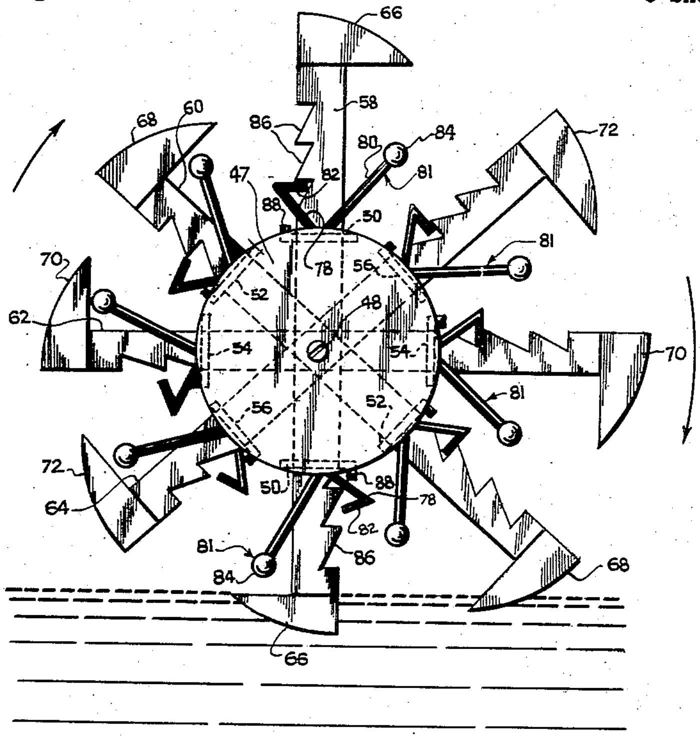

FIG. 7

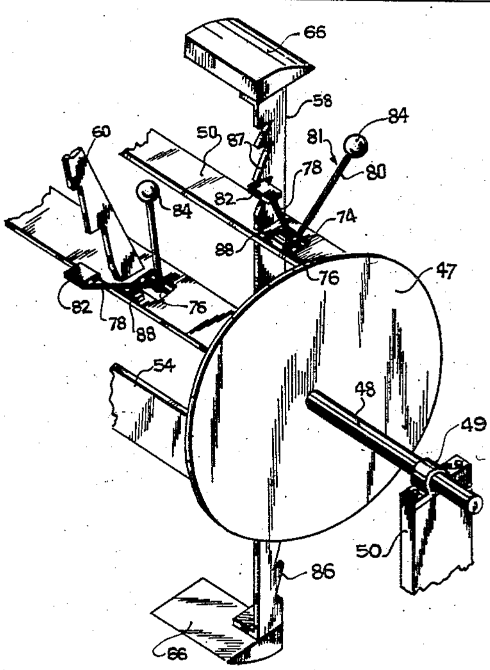

FIG. 8.

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WATER WHEEL APPARATUS

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Application August 29, 1956, Serial No. 606,825

4 Claims. (Cl. 253—26)

This invention relates to water actuated machines or wheels for supplying power, as for example, for the purpose of rotating a shaft with the shaft in turn driving any of various devices including generators, display devices, toys, etc.

The main object of the invention is to provide an improved apparatus of the type described that will be adapted for operation in a body of moving water, the apparatus including floats, carried at the ends of a plurality of arms angularly arranged about the shaft to be turned, and successively moved into the water. In the invention, the pressure of the moving water is adapted to elevate each float as the float moves into the water, and this in turn is adapted to shift the arm carrying the float upwardly, in a path extending diametrically of the axis of the shaft, in such a manner as to overbalance the upper end of the arm. The overbalanced end thereafter tends to travel downwardly toward the water, causing continuous rotation of discs secured to the shaft, on which discs the arms are slidably supported.

A more specific object of the invention is to provide means so designed as to cause the arms, when they are shifted upwardly, to be held against slidable, retrograde movement, during travel of the arm through 180°, said means being designed so as to hold the arm against slidable movement until such time as the water exerts a positive force against a float carried by the arm, tending to slidably move the arm to is opposite extreme position. Said means is then again adapted to hold the arm against retrograde movement for another 180° part of its full cycle of rotation.

Another object is to provide novelly designed float means adapted to aid in the overbalancing of each arm, for the purpose of facilitating the continuous rotation of the discs carried by the arms.

Still another object is to provide apparatus as stated which will be simply designed, so as to minimize frictional losses.

A further object is to provide a device of the type described designed to permit a plurality of the devices to be spaced axially of and be secured to a single shaft.

Another object is to so form the apparatus as to particularly adapt the same for mounting in a river or other body of moving water in which there is a continuous current, so that the force of the current may be employed for imparting continuous rotatable movement to the apparatus.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

Fig. 1 is a view in side elevation of an apparatus formed according to the invention, a shaft rotated thereby being shown in section.

Fig. 2 is a sectional view on line 2—2 of Fig. 1.

Fig. 3 is a perspective view of one of the float-carrying arms per se.

Fig. 4 is a perspective view of a second arm.

Fig. 5 is a perspective view of a third arm.

Fig. 6 is a perspective view of a fourth arm.

Fig. 7 is a view similar to Fig. 1 showing a modified construction.

Fig. 8 is an enlarged, fragmentary perspective view of the modification shown in Fig. 7.

Referring to the drawings in detail, mounted in the path of a body of moving water W are spaced, upstanding bearing posts 10, having bearing openings 11 at their upper ends in which a horizontally disposed shaft 12 is journalled. The body of water may be a river or a running creek or a pond with a falls and the like. The drawing is somewhat diagrammatical in respect to the bearing posts, and in a commercial embodiment, pillow block bearings or the like would be provided at the upper ends of the bearing posts. Further, anti-friction means such as ball or roller bearings can be utilized for the shaft journals, to minimize frictional losses.

The apparatus constituting the present invention has been generally designated at 13. Only one machine is illustrated, by way of example. However, a series or bank of the machines may be utilized in a commercial installation, with all of said machines being drivingly connected to a single shaft 12, the machines of the series being spaced axially of the shaft. In the illustrated example the apparatus includes identically formed first and second discs 14, 16 respectively spaced axially of shaft 12 and having center openings receiving the shaft. The shaft is fixedly secured to the discs, or is otherwise connected to the discs in any manner that will provide for joint rotation of the discs and shaft.

Carried by each disc is a pair of float-supporting arms. Thus there is a first arm 18 in contact with the outer face of the first disc 14; a second arm 20 in contact with the inner face of the first disc 14; a third arm 22 in contact with the inner face of the second disc 16; and a fourth arm 24 in contact with the outer face of the second disc 16. All the arms are disposed diametrically of their associated discs, with the opposite ends of each arm projecting substantial distances beyond the disc periphery. Each arm at its ends carries floats, which can be hollow as shown to impart the desired buoyancy thereto, or alternatively can be filled with a buoyant material such as cork. Considering the floats carried by the ends of first arm 18, these have been designated at 26. Arm 18, at its ends, has laterally projecting extensions 28 and these are secured to the inner surfaces of the floats 26 by screws 30 or equivalent fasteners. The floats 26, viewed in side elevation, project from arm 18 in the direction of rotation of the discs, and the leading portions of the floats taper, viewing the floats in cross section, with the outer surfaces of the floats being curved or bowed in a direction outwardly from the axis of rotation of shaft 12. This arrangement permits each float to enter the water with minimum resistance, thus to further reduce frictional losses.

The arm 18 is secured to its associated floats 26 at one end of the floats, and as shown in Fig. 3 the floats project laterally in one direction from the plane of the arm 18, a substantial distance.

Formed in arm 18 medially between the ends thereof is a longitudinal slot 32 receiving shaft 12. Beyond opposite ends of slot 32 arm 18 is loosely, slidably positioned through guides 34 disposed adjacent the periphery of the first disc 14. Arm 18 is thus mounted on the disc for limited sliding movement in the direction of its length, the arm sliding in a path lying diametrically of the axis of rotation of shaft 12.

All the other arms are similarly formed and mounted

on their associated discs except that the second and third arms **20**, **22** are secured to their associated floats **36**, **38**, respectively, a short distance inwardly from one end of the floats. The fourth arm **24** is secured to its associated floats **40** at the extremities of the floats **40**.

The purpose of this arrangement is to cause all the floats to have their opposite ends in common planes. For example, the left-hand ends of the floats **26**, **36**, **38** and **40**, viewing the same as in Fig. 2, are in a common vertical plane, and also lying in this vertical plane is the arm **18**. The right-hand ends of the several floats, still viewing the same as in Fig. 2, are in a second common vertical plane, the fourth arm **24** also being disposed in the second plane.

Referring now to Fig. 1, the arms are uniformly spaced angularly about the shaft axis, forty-five degrees apart. The number of arms could be increased or decreased, but in each instance there would be uniform angular spacing thereof about the shaft axis.

Further, the second, third and fourth arms are all mounted on their associated discs in the same manner as arm **18**, that is, they have slots receiving shaft **12**, so that they may slide independently of one another upon the discs, and further, they are slidably engaged in guides **34**.

Spaced inwardly from the ends of arm **18** and the ends of the other arms are permanent magnets **42**. The arm **18**, as well as the other arms, is itself made of a non-magnetic material, and the same is true of the discs. However, guides **34** are made of a material adapted to be attracted to the magnets **42**.

In operation, with the parts as shown in Fig. 1, when the gravity wheel is set in motion, either automatically or manually, it will be overbalanced to the right (in Fig. 1) of a vertical line passing through the shaft axis. This is so because the arms at the right of said axis will be so disposed relative to their associated discs as to project beyond the disc peripheries a greater distance at the right of the shaft axis than the distance said arms project, at their other ends, beyond the disc peripheries at the left of said axis.

As the floats move in succession into the water W during rotation of the wheel, the pressure of the running water against the floats forces the floats upwardly due to the buoyancy of the floats. This causes each arm, as it moves into a vertical position such as the position of the arm **18** in Fig. 1, to be bodily shifted upwardly. When the arm is so shifted upwardly, the lower magnet **42** thereof will move into registration with the lower guide **34** through which the arm passes. As a result, a magnetic attraction will be set up, causing the lower guide to be attracted to the lower magnet.

Now, as the disc continues to turn and the lower end of the arm moves out of the water to the position in which arm **20** is shown in Fig. 1, the arm will not slide backwardly within its guides, due to the magnetic attraction of guide **34** to magnet **42**.

In this connection, the magnetic force, while sufficient to cause the arms to remain temporarily in the positions to which they are slidably moved by the pressure of the moving water on the floats, is not so great as to prevent the arms from being slidably moved once again, when the floats at their other ends move into the water. Therefore, when the arms are once again slidably moved, this time in an opposite direction, by the moving water, the magnets which were previously at the upper ends of the arms but are now at the lower ends thereof will move upwardly into registration with their associated guides **34**.

It will be understood that the device, when used in a body of water having a strong current, is adapted to be continuously rotated, for the purpose of turning the shaft. The shaft, when so turned, can be used for any desired purpose. For example, a pulley **44** can be connected thereto and trained about the pulley is a belt **46**. The belt may be trained about another pulley, now shown, for the purpose of driving any of various machines, generators, etc.

In the modified construction shown in Figs. 7 and 8, the device has the same basic operational characteristics as the first form thereof. However, in this instance instead of using magnetic means **42** for releasably holding the several arms in the respective positions to which they are shiftable, locking devices are used comprising angularly shaped, pivoted members weighted at one end and formed with pawls or locking fingers at their other ends.

In this form of the invention, it is preferred that there be thirty-six arms, angularly spaced five degrees apart about the circumference of the rotated shaft.

In the illustrated example shown in Figs. 7 and 8, only four arms, rather than thirty-six, are shown. To provide for thirty-six arms, various structural arrangements could be employed, and it is not desired that the protection for the invention be limited to any particular structural arrangement, except as necessarily required by the scope of the appended claims.

For example, the device could be made in individual units, all connected in coaxial relationship along the length of the driven shaft means, with each unit having the specified number of arms, as for example four arms per unit, as shown in Figs. 7 and 8. In this instance, there would be nine of the units shown in Figs. 7 and 8, spaced axially of the driven shaft, and the arms of the several units so arranged would be so disposed as to provide, considering all the units as a single assembly, for the desired angular spacing of the arms five degrees from one another.

In other words, the principle of the invention is of the main importance, rather than the particular number and spacing of the arms shown on the unit shown by way of example.

In any event, in the modified form (which, it should be noted, may be preferred over the first form) the individual unit illustrated comprises identical discs **47** each of which would be connected to a shaft **48** extending outwardly from the associated disc. Thus, the shafts **48** extending outwardly from a pair of spaced discs **47** would be coaxially arranged, and would be journalled in bearings **49** mounted upon the upper ends of standards **50**.

Connected between the spaced discs **47** are elongated connecting members or braces **50**, **52**, **54**, **56**. As shown in Fig. 7, there is a pair of the braces **50**, with the braces of the pair being diametrically opposed. Similarly, there are two braces **52**, also diametrically opposed, two diametrically opposed braces **54**, and two diametrically opposed braces **56**. The several braces are uniformly spaced about the circumferences of the discs **47**, and since only four arms are shown in the illustrated example, there are only four pairs of braces, one pair for each arm. If thirty-six arms are provided upon a single unit, there would be thirty-six pairs of braces, with the centers of the braces angularly spaced five degrees apart about the circumferences of their associated discs.

The braces of each pair are formed with slot-like guide openings aligned diametrically of the discs **47**. In the openings of the braces **50** an arm **58**, disposed diametrically of disc **47**, is slidable in the direction of its length. In the slot-like openings of braces **52**, a similar arm **60** is slidably mounted. In the braces **54**, arm **62** is mounted and an arm **64** is similarly mounted in the braces **56**, all as shown in Fig. 7.

As shown in Fig. 8, the arm **60** is spaced from disc **47** a slightly greater distance that is the arm **58**. Similarly, arm **62** would be spaced a slightly greater distance from disc **47** than is the arm **60**, while arm **64** would be spaced a slightly greater distance from disc **47** than is the arm **62**. If thirty-six arms are provided in a single unit, the staggered arrangement, longitudinally of the

rotating assembly, would be continued through the entire thirty-six arms.

Mounted upon the outer ends of the several arms are floats, which may be formed and arranged, as shown in Figs. 7 and 8, similarly to the several floats of the arms in the first form of the invention. Thus, there are floats **66, 68, 70, 72** upon the respectively opposite ends of the arms **58, 60, 62, 64**, respectively.

Adjacent the arm sliding in each pair of diametrically opposed brace members, there is an opening **74** (see Fig. 8), and extending longitudinally and centrally of said opening, parallel to the axis of shaft **48**, is a pivot pin **76**, passing loosely through an opening formed in an enlargement provided at the juncture of fixedly connected, angularly related arm members **78, 80** of a locking device generally designated **81**. There is a separate locking device for each arm, and since all the locking devices are identical, the description of one will suffice for all.

The arm **78** is substantially shorter than the arm **80**, and is disposed at an angle of approximately ninety degrees to the arm **80**. Arm **78**, at its outer end, is integral or otherwise made rigid with a plate-like, laterally projecting locking pawl or finger **82**, while on the outer end of the arm **80** of each locking device **81** there is a weight **84**.

The locking device is freely swingable in opposite directions upon the associated pin **76**, with the pawl **82** extending into the plane of the associated arm. In this connection, each arm, adjacent its opposite ends, has a longitudinal series of locking teeth **86**, the series at one end of an arm being formed on one longitudinal edge thereof, with the series at the other end of the same arm being formed upon the opposite longitudinal edge of the arm. Each series of teeth defines notches **87** occurring between the teeth **86**, with each notch **87** having an elongated, sloping surface oblique to the length of the associated arm merging into an end wall of the notch perpendicular to the length of the arm. Thus, the teeth provide ratchet means on the opposite ends of each arm, so that the locking device at a particular end of an arm is arranged to permit movement of the adjacent end of the arm in a direction away from the periphery of disc **47**, while preventing movement of said adjacent end of the arm in a direction toward the disc.

It will be seen, thus, taking arm **58** as an example, that the locking device **81** shown adjacent the upper end of arm **58**, viewing the same as in Fig. 7, is adapted to permit movement of arm **58** upwardly in Fig. 7. On upward movement of arm **58** in Fig. 7, the arm will ratchet along the pawl **82** of the upper locking device **81** seen in this figure.

By reason of this arrangement, and considering the operational characteristics of the form of the device shown in Figs. 7 and 8, the arms have the same movements as the arms in Figs. 1–6. However, the locking devices 81 discharge the functions that are discharged by the magnetic means of the first form of the invention.

Consider, for example, with the device rotating clockwise in Fig. 7, that the lower float of arm **58** has entered the water. The buoyancy of the float in the water causes an upward pressure to be exerted against the lower float **66** of arm **58**, tending to shift the arm **58** upwardly to its Fig. 7 position when arm **58** assumes a fully vertical position.

The upper locking device **81** associated with arm **58** does not prevent said upward movement, because of the ratcheting action previously described herein. This is true even though the weight **84** has caused the upper locking device to pivot clockwise in Fig. 7 to a position in which its pawl **82** is engaged in the upper series of notches of arm **58**.

As to the lower locking device **81** associated with the arm **58**, the weight **84** thereof tends to swing counterclockwise in Fig. 7, to the Fig. 7 position. Movement

of the lower locking device **81** associated with arm **58** in a counterclockwise direction is limited by a stop **88** carried by the associated brace **50**, which stop **88** engages the shorter arm **78** of the lower locking device. When the locking device is engaged against the stop **88**, the pawl **82** of the lower locking device is clear of the series of locking teeth **86** provided at the lower end of arm **58**, viewing the same as in Fig. 7. Therefore, the lower locking device does not prevent the upward movement of arm **58** in Fig. 7.

Accordingly, arm **58** moves upwardly, so that a greater portion of its length projects upwardly from disc **47** than projects downwardly from the disc. Retrograde movement of the arm **58** is prevented by the pawl **82** of the upper locking device, engaging in a notch of the upper series of notches.

The continued movement of the device in a clockwise direction will bring arm **58** to the position in which arm **64** is shown in Fig. 7. The lower locking device **81** is still clear of the arm, and the upper locking device is still engaged in the upper series of notches, due to the weighting of the locking device. Accordingly, the arm is still overbalanced to the right of the axis of shaft **48**, tending to cause continued rotation of disc **47**.

When arm **58** reaches the position in which arm **62** is shown in Fig. 7, the locking devices are still arranged as previously described, with the upper locking device now being at a "3 o'clock" position upon the disc and the lower locking device being at a "9 o'clock" position thereon. This arrangement continues through the next stage, in which the arm 58 would now be in the position shown for the arm **60** in Fig. 7. The arm is still overbalanced at the right of the axis of shaft **48**, and now its other float begins to enter the water so that the arm is once again shifted upwardly as it assumes a vertical position.

This arrangement of course holds true for all the other arms, and as a result, the disc is always overbalanced to the right of the axis of shaft **48**, so that it continues to rotate in a clockwise direction. As previously noted, the device would preferably embody a total of thirty-six arms, angularly spaced five degrees apart about the axis of rotation, so that at all times there is a plurality of the arms entering the water and moved upwardly in rapidly following order, an arm being moved upwardly every five degrees of the rotation cycle of disc **47**.

As noted in connection with the first form, the device will be continuously rotated for the purpose of turning the shaft, and the shaft, when so turned, will be used for any desired purpose. Thus, a pulley and belt such as shown at 44 and 46, respectively, in the illustrations of the first form of the invention may be employed, with the belt being trained about another pulley for the purpose of driving any of various machines, generators, etc.

It is to be understood that any suitable liquid may be used instead of water, and that the rotary arms may be located at varying angular distances from 5° up.

While I have illustrated and described the preferred embodiments of my invention, it is to be understood that I do not limit myself to the precise constructions herein disclosed and that various changes and modifications may be made within the scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent is:

1. A water actuated wheel comprising a shaft, discs secured thereto, guides on the discs, arms extending diametrically of the discs and slidably supported in the guides, said arms being angularly spaced about the shaft axis, floats carried by the arms for slidably shifting the arms in succession upon the discs responsive to pressure of moving water upon entry of the floats in following order into a body of moving water, thus to overbalance the arms at one side of the shaft axis to promote rota-

tional movement of the discs and shaft, and means on the arms for retaining the same in the positions to which they are shifted through travel over 180° of a full cycle of rotation of the arms about the shaft axis, said means being of a strength adapted to be overcome by the lifting force exerted by the pressure of the water against the floats, whereby to free the arms for shifting in an opposite direction at the end of each 180° of travel of the respective arms about the shaft axis, there being two of said discs, spaced axially of the shaft, the arms being arranged in pairs, one pair on each disc, one arm of each pair sliding on one face of its associated disc and the other arm of the same pair sliding on the other face of the associated disc, the arms of each pair being angularly spaced 45° apart about the shaft axis, all of the arms projecting at their opposite ends beyond the disc peripheries, the floats being arranged in pairs, one float of a pair on one end of each arm and the other float of the same pair on the other end of the same arm, said floats tapering when viewed in cross section, and projecting from their associated arms in the direction of rotation of the shaft and discs, the tapered portions of the floats leading in the sense of said direction of rotation.

2. A water actuated wheel comprising a shaft, discs secured thereto, guides on the discs, arms extending diametrically of the discs and slidably supported in the guides, said arms being angularly spaced about the shaft axis, floats carried by the arms for slidably shifting the arms in succession upon the discs responsive to pressure of moving water upon entry of the floats in following order into a body of moving water, thus to overbalance the arms at one side of the shaft axis to promote rotational movement of the discs and shaft, and means on the arms for retaining the same in the positions to which they are shifted through travel over 180° of a full cycle of rotation of the arms about the shaft axis, said means being of a strength adapted to be overcome by the lifting force exerted by the pressure of the water against the floats, whereby to free the arms for shifting in an opposite direction at the end of each 180° of travel of the respective arms about the shaft axis, there being two of said discs, spaced axially of the shaft, the arms being arranged in pairs, one pair on each disc, one arm of each pair sliding on one face of its associated disc and the other arm of the same pair sliding on the other face of the associated disc, each arm having intermediate its ends a longitudinal slot receiving the shaft, for limiting sliding movement of the arms in opposite directions, said guides being formed of a magnetically attractable material, said means comprising permanent magnets mounted on the arms, one magnet of each arm moving into registration with one of the guides receiving said arm, on slidable shifting of the arms, to hold the arms against retroactive movement during their travel over said 180° of a full cycle of rotation.

3. A water actuated wheel comprising a shaft, discs secured thereto, guides on the discs, arms extending diametrically of the discs and slidably supported in the guides, said arms being angularly spaced about the shaft axis, floats carried by the arms for slidably shifting the arms in succession upon the discs responsive to pressure of moving water upon entry of the floats in following order into a body of moving water, thus to overbalance the arms at one side of the shaft axis to promote rotational movement of the discs and shaft, and means on the arms for retaining the same in the positions to which they are shifted through travel over 180° of a full cycle of rotation of the arms about the shaft axis, said means being of a strength adapted to be overcome by the lifting force exerted by the pressure of the water against the floats, whereby to free the arms for shifting in an opposite direction at the end of each 180° of travel of the respective arms about the shaft axis, said means comprising a plurality of locking devices pivoted upon the respective guides adjacent the several arms, said locking devices being weighted to normally maintain a locking device in engagement with each arm, each locking device including a pawl and each arm including a series of notches in which the pawl is adapted to engage to hold the arm against movement in one direction while permitting ratcheting of the arms along the pawl during shifting of the arms in said opposite direction.

4. A water actuated wheel comprising a shaft, a disc secured thereto, guides on the disc, arms extending diametrically of the disc and slidably supported in the guides, said arms being angularly spaced about the shaft axis, floats carried by the arms for slidably shifting the arms in succession upon the disc responsive to pressure of moving water upon entry of the floats in following order into a body of water, thus to overbalance the arms at one side of the shaft axis to promote rotational movement of the disc and shaft, and means associated with the arms for retaining the same in positions to which they are shifted in one direction through part of a full cycle of rotation of the arms about the shaft axis, said means being adapted to release the arms for shifting in an opposite direction at the end of said partial rotation of the respective arms about the shaft axis, said means comprising pairs of angularly formed locking devices each pivoted upon a guide, there being one pair for each arm with one locking device of the pair adjacent one end of the arm and the other adjacent the other end, each locking device being formed at its opposite ends with a weight and with a pawl respectively, the ends of the respective arms having longitudinal series of ratchet teeth engageable by the pawls, said locking devices being so weighted as to shift the pawls into engagement with the adjacent series of notches at the point of highest travel of the locking device, the ratchet teeth associated with each locking device being arranged to permit ratcheting of the arm over the locking device when the locking device is at said point of highest travel, the locking devices being so weighted as to shift out of engagement with the ratchet teeth when the locking devices are at their point of lowest travel, each guide including a stop adjacent each locking device arranged to limit movement of the locking device in a direction out of engagement with the associated arm.

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