Dec. 19, 1922.

1,439,416.

F. W. HESS.

WATER MOTOR.

FILED JUNE 6, 1921.

3 SHEETS—SHEET 1.

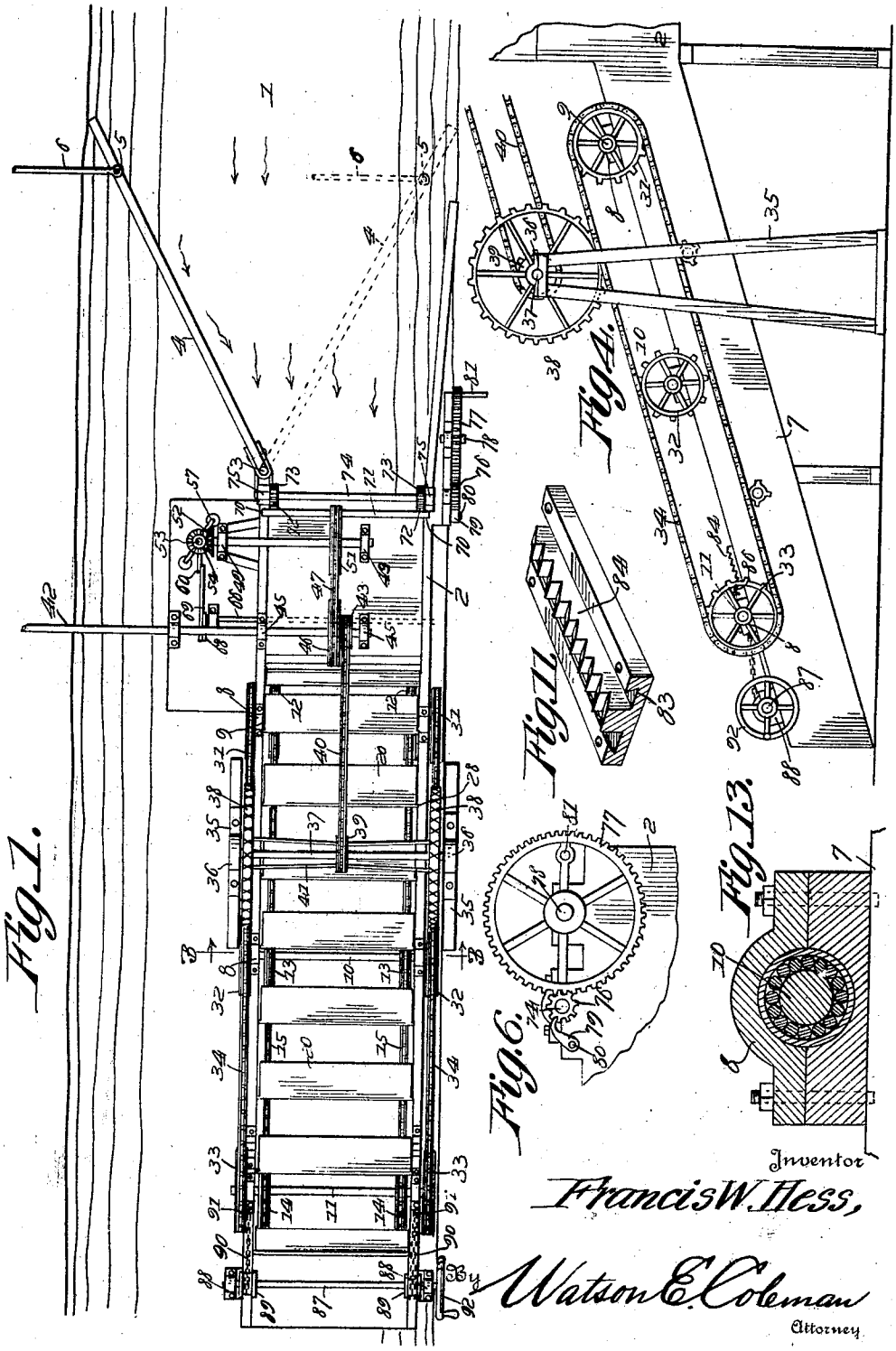


Fig. 1.

Fig. 4.

Fig. 11.

Fig. 6.

Fig. 13.

Inventor

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By Watson E. Coleman

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3 SHEETS—SHEET 2.

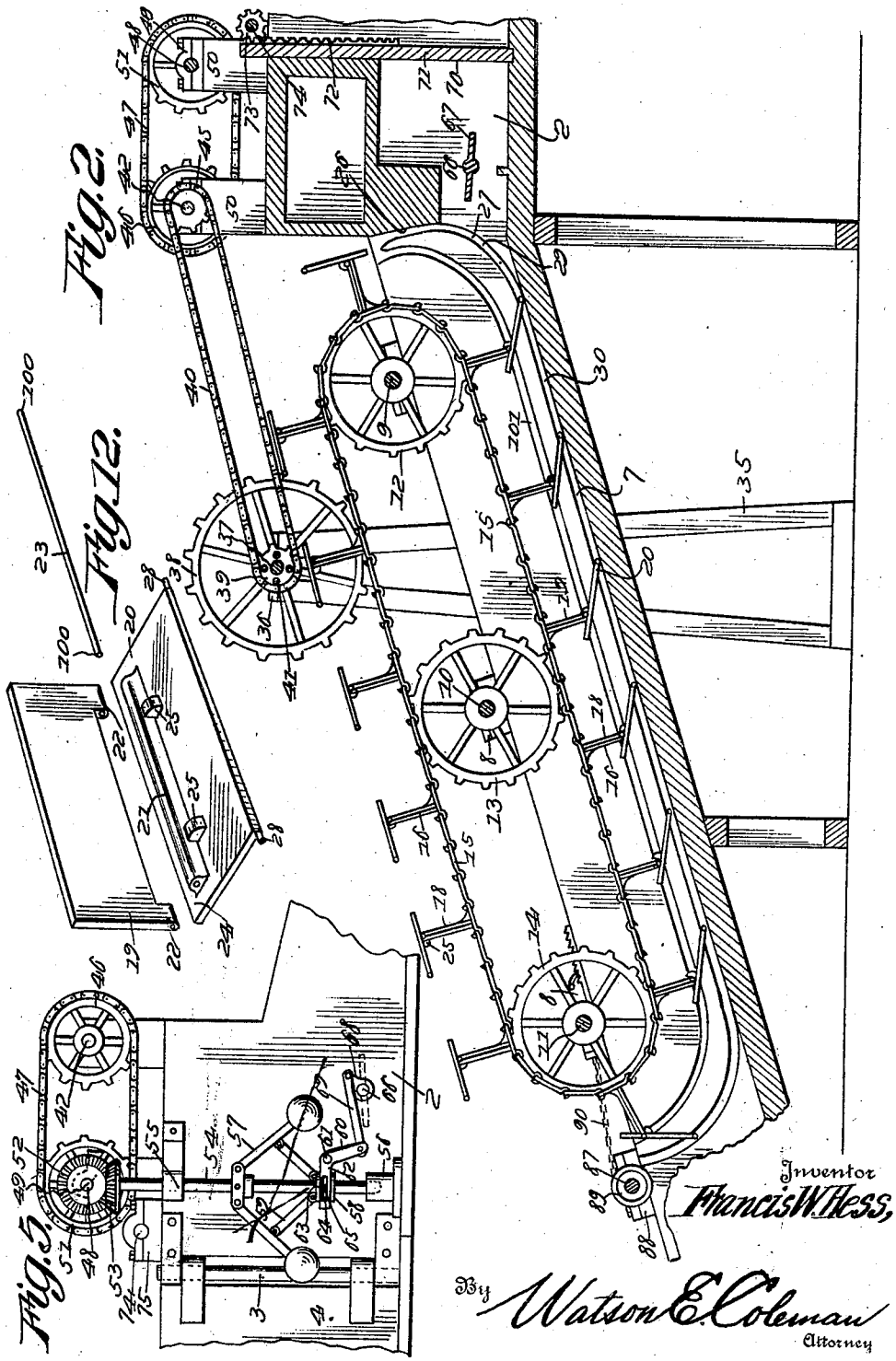


Fig. 2.

Fig. 12.

Fig. 5.

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3 SHEETS—SHEET 3.

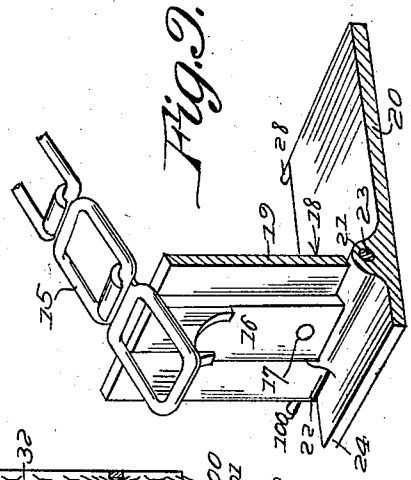


Fig. 9.

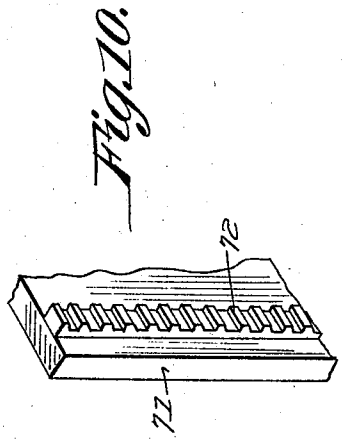


Fig. 10.

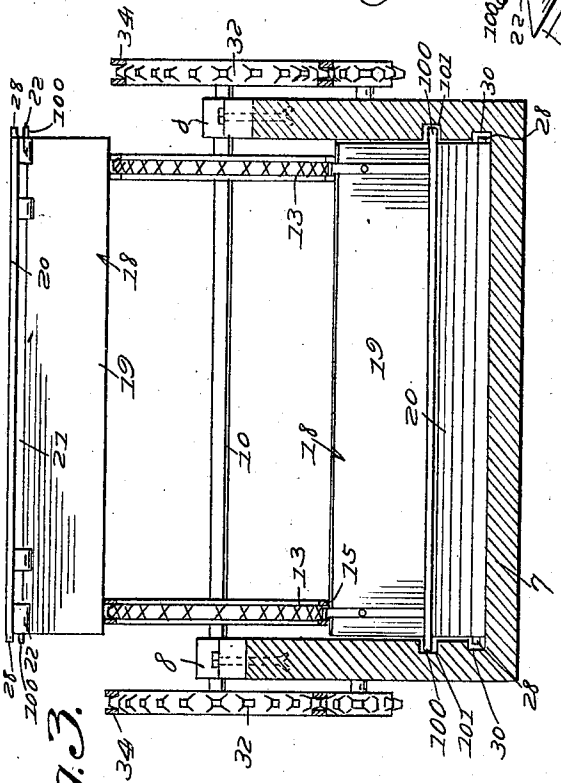


Fig. 3.

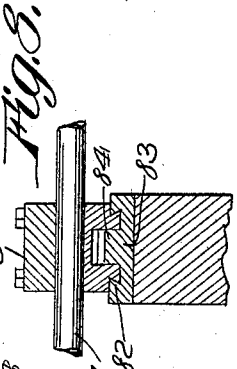


Fig. 8.

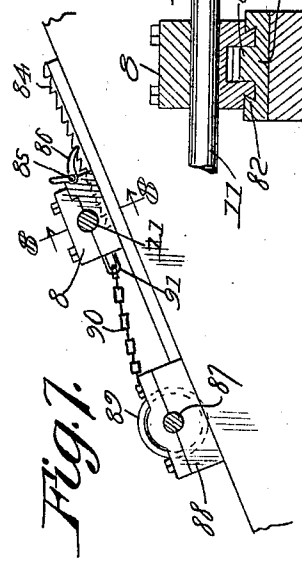


Fig. 7.

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Patented Dec. 19, 1922. 1,439,416

UNITED STATES PATENT OFFICE.

FRANCIS W. HESS, OF KERNSTOWN, VIRGINIA.

WATER MOTOR.

Application filed June 6, 1921. Serial No. 475,317.

To all whom it may concern:

Be it known that I, FRANCIS W. HESS, a citizen of the United States, residing at Kernstown, in the county of Frederick and State of Virginia, have invented certain new and useful Improvements in Water Motors, of which the following is a specification, reference being had to the accompanying drawings.

It is the purpose of the present invention to provide an improved motor of this general character, for the purpose of accumulating power to be derived from various streams, and in accomplishing this purpose it is the aim to utilize a flume and sluiceway constructed in the stream, with power generating means in the sluiceway to be actuated by the water as it passes through the flume and the sluiceway, so that the power may be utilized for operating various machinery, such as mills, generators and the like.

Another purpose embodies the provision of means for diverting a part or substantially the entire volume of water through the flume, in combination with means for controlling the discharge of the water into the sluiceway. In fact the discharge of the water may be mainly controlled by a manually operated water gate, there also being means operatively connected with the motor or power generating means, for automatically controlling the discharge of the water into the sluiceway according to the speed of the motor or generating means.

A still further purpose is to provide an apparatus of this general character, wherein the operative connections between the motor or power generating means and the governor mechanism are centrally located relatively to the motor or power generating means, so as to equalize the strain upon the moving parts of the motor.

A further purpose consists in the provision of an endless traveler with depending buckets including gravity members or parts, which move into operative positions, partially by gravity, and partially by the contact of the water with extensions of said parts or elements, so that said parts or elements may drag or engage the bottom of the sluiceway, so that the full force of the water on the buckets may be available.

A still further purpose embodies guides in the lower portions of the opposite walls of the sluiceway for receiving parts of the buckets, to guide the parts or elements of the buckets, to prevent them from movement upward, thereby avoiding them closing, and losing the effect of the force of the water.

Additionally the invention aims to provide means at the ends of the guides, or rather extensions of the guides, and which are eccentric to the center of the end of the endless traveler, to receive parts of the gravity members of the buckets, to guide said gravity elements into the guides, said extensions acting to limit, in fact to prevent upward movement of the gravity parts or elements of the buckets, particularly at points where the water may have a tendency to close the gravity elements or parts of the buckets.

Also a further purpose embodies the provision of means for regulating the tension of the endless traveler, so as to derive the best results, and to insure holding the endless traveler in position during the operation of the motor.

While the design and construction at present illustrated and set forth is deemed preferable, it is obvious that as a result of a reduction of the invention to a more practical form for commercial purposes, the invention may be susceptible of changes, and the right to these changes is claimed, provided they are comprehended within the scope of what is claimed.

The invention comprises further features and combination of parts, as will be hereinafter set forth, shown in the drawings and claimed.

In the drawings:—

Figure 1 is a plan view of the improved water motor constructed in accordance with the invention, and shown as applied to a flume and sluiceway constructed in a stream.

Figure 2 is a vertical longitudinal sectional view through the motor, thereby disclosing the essential features of construction.

Figure 3 is a transverse sectional view on line 3—3 of Figure 1.

Figure 4 is a view in side elevation of the sluiceway, showing one of the outside connecting chains of the motor, and illustrating sprockets for holding the lower part of the chain in position and preventing sagging.

Figure 5 is a view in side elevation of

a portion of the flume and sluiceway, showing the governor mechanism which controls the discharge of the water from the flume according to the travel of the endless traveler.

Figure 6 is an enlarged detail view of the means for holding the manually operated gate in different positions.

Figure 7 is an enlarged detail view in side elevation of the means for tightening or tensioning the endless traveler.

Figure 8 is a sectional view on line 8—8 of Figure 7.

Figure 9 is an enlarged detail view of one or two of the links of one of the chains of the traveler, showing how the buckets are connected thereto.

Figure 10 is a detail view of a portion of the manually operated gate, showing the rack thereon.

Figure 11 is a detail view of a member of the chain tightener or tensioning device.

Figure 12 is a detail perspective view of the two parts of one of the buckets of the endless traveler, showing the manner of connecting the part 20 to the part of the bucket which is attached to the chains.

Figure 13 is a detail sectional view through one of the roller bearings for one of the shafts 9, 10 and 11.

Referring to the drawings, 1 designates the stream of water, which may be of a character, suitable for operating a motor of the present kind, and 2 denotes a flume, which may be any suitable size, according to the amount of water to be directed thereinto, and yet not of a size to occupy the full width of the stream. In this way a portion or the greater volume of water may be diverted through the flume, in order to derive the greatest amount of power therefrom.

This flume may be constructed of any suitable material, wood or the like, preferably concrete, brick or stone. Hingedly mounted to the side of the flume nearest the center of the stream, as at 3 is the current diverting gate 4. This gate may swing from its dotted line position, to its full line position, and connected to the gate as at 5 is a bar or rod 6, which may be operated by any suitable means (not shown), for the purpose of shifting the gate one way or the other. Obviously when the gate assumes a position as shown in dotted lines, substantially the entire body of the stream is diverted to one side of the flume, allowing the stream to resume substantially its usual course. However when the gate is moved to the full line position, substantially the entire body of the stream is diverted through the flume, and the idea of contracting the water in its flow, insures a greater force of power of the fluid during its travel through the flume and the sluiceway. Obviously the gate 4 may assume positions intermediate the dotted and full line positions, so that parts of the stream may enter the flume, and parts be diverted to one side of the flume, and vice versa.

Extending from the flume and constructed of any suitable material preferably concrete, brick or stone or the like is a sluiceway 7, which may have any suitable inclination relatively to the flume, in order to insure the greatest amount of power, to be derived from the force of the water.

Mounted in suitable anti-frictional roller bearings 8 are shafts 9, 10 and 11, and it is obvious that any number of shafts may be utilized. The anti-frictional roller bearings 8 are mounted on the edges of the sides of the sluiceway, and keyed to the shafts 9, 10 and 11 and operable on the interior of the sluiceway are sprockets 12, 13 and 14. These sprockets are engaged by suitable sprocket chains 15, which have depending brackets 16. Bolted or otherwise suitably fastened to the brackets as at 17 are buckets 18 against which the water operates, for propelling the endless travelers or chains 15. Each bucket comprises the part 19 and the gravity movable part 20. The parts 19 of each bucket are fastened to the brackets of the endless travelers or chains, while the parts 20 drag or travel upon the bottom of the sluiceway. The parts 20 have ribs or beads 21, which engage between the lugs 22 of the parts 19, there being hinge pins 23 hingedly uniting the parts, so that the parts 20 may move by gravity in order to drag upon the bottom of the sluiceway. The hinge pin 23 has its ends extended as shown at 100 beyond the end edges of the buckets, so as to engage the groove 101 so as to hold the endless sprocket chain 15 in position, and thereby keep the link chains in engagement with the under teeth of the intermediate sprockets. The parts 20 of the buckets have extensions 24 and lugs 25. When the buckets are traveling over the sprockets, the parts 20 assume positions substantially at right angles to the parts 19, in view of the fact that the lugs 25 act to limit the parts 20 in such positions. However when the buckets are passing over the sprockets 12, and when they are approaching the lower part or the bottom of the sluiceway, the parts 20 tilt by force of gravity, and engage a wall 26 at a point where the sluiceway adjoins the flume. Adjacent where the sluiceway adjoins the flume a contracted passage 27, substantially corresponding to the space between the lower parts of the chains 15 and the bottom of the sluiceway, is constructed. Therefore when the parts 20 are traveling adjacent the wall 26, the water passing through the passage 27 contacts with the extensions 24 of the parts 20, and the force of the water acts to dispose the parts 20 in their proper positions, for travel through the sluiceway. The opposite edges of the parts 20 of the buckets adjacent

their end edges are provided with lugs or projections 28, which enter the arcuate guides 29 of the guides or grooves 30. The extension guides 29 are eccentric to the shaft 9 of the sprockets 12, thereby holding the parts 20 of the buckets at less obtuse angles to the parts 19 of the buckets, than when the parts 20 are traveling or dragging upon the bottom of the sluiceway. Also owing to the eccentric dispositions of the arcuate extensions 29 with the lugs or projections 28 engaging therein prevents the parts 20 from assuming or approaching the right angle positions, previously assumed by the parts 20 when traveling over the upper parts of the sprockets. Any other suitable connection between the parts 20 and the sides of the sluiceway may be employed, but it is to be remembered that the essential feature is to derive all the power possible from the force of the water in passing through the passage 27. In order to accomplish this result, the buckets should substantially fill the width of the sluiceway, without their end edges having any great amount of frictional contact with the sides of the sluiceway.

The shafts 9, 10 and 11 are of sufficient length to project beyond the roller bearings 8, and fixed to the extremities of these shafts are additional sprockets 31, 32 and 33, which are engaged by the endless sprocket chains 34. By means of these additional endless chains, and their cooperative sprockets, uniform movement of the moving parts of the motor are assured. Furthermore the uniformity of movement is such as to avoid any strain upon the endless propeller traveler, as well as to avoid irregularity in the movement of the chains.

Rising upwardly upon opposite sides of the sluceway are upright supports 35, and mounted in roller bearings 36 at their upper ends is a power transmitting shaft 37. This shaft on its extremities carry sprockets 38, which engage the upper parts of the chains 34.

Centrally disposed upon the shaft 37 is a smaller sprocket 39, about which the sprocket chain 40 engages. The sprockets 38 and 39 are fast to the shaft 37, and since these sprockets are relatively reinforced by the connecting rods 41, uniformity of movement of such parts is assured. Furthermore owing to this particular connection and means of transmitting power, there is no strain, or irregular drag on one side more than the other. In fact the transmission of power is uniform from the chains 34 to the sprockets 38, and from the sprocket 39 to the jack shaft 42 through the medium of the sprocket 43 and the sprocket chain 40.

The jack shaft 42 is mounted in roller bearings 45, which are similar to those in which the shafts 9, 10 and 11 are mounted, and carried by the jack shaft 42 is a sprocket 46, about which a sprocket chain 47 engages. A counter shaft 48 is mounted in roller bearings 49 of the supports 50, and is provided with a sprocket 51 about which the chain 47 engages. A bevel gear 52 is carried by and rotatable with the shaft 48, and is in turn in mesh with the bevel gear 53, which is rotatable with the shaft 54. The shaft 54 is arranged vertically, and is mounted in bearings 55 and 56. A governor 57 is carried by the shaft 54 and includes a vertical sliding sleeve or collar 58, which is connected to the governor arms by the links 59. A bell crank lever 60 is pivotally mounted at 61 on the side of the flume, and one of the arms 62 thereof has forks 63 provided with slots 64, which engage the lateral pins 65. A shaft 66 extends transversely of the passage 27 of the flume, and movable with the shaft is a butterfly valve 67, to control the water in its flow through the passage 27. An arm 68 is carried by one end of the shaft 66, and connected to the arm is a link 69, which in turn connects to the other arm of the bell crank lever 62. Obviously the governor mechanism which is geared to the jack shaft 42, operates to control the butterfly valve, which in turn controls the water in its flow through the passage 27 and into the sluiceway. When the flow of water is rapid, the endless travelers or chains 15 will operate relatively fast, and owing to the operative connections between the motor and the governor mechanism, the butterfly valve may be regulated.

Mounted in guides 70 of the flume is a water controlling gate 71, provided with racks 72, which mesh with the pinion 73 on a counter shaft 74. The shaft 74 is mounted in bearings 75 of the flume walls, and on one of the extremities of the shaft 74 is a pinion 76, which meshes with a gear 77, which is carried by a stub shaft 78 also mounted in bearings of one of the flume walls. A dog 79 is pivoted at 80 to the side of one of the flume walls and engages the pinion 76. The gate 71 may be operated by grasping the handle 81, which will impart movement to the gear 77, and in turn move the pinion 76, causing the shaft 74 to rotate. The pinions 73 will cause the gate 71 to raise and lower, and by means of the dog 79 the gate may be held in different adjusted positions, according to the amount of water to be permitted to enter the flume.

The bearings 8 in which the shaft 11 is mounted are dovetailed in the guides 82 of the bearing supporting plates 83. These plates have ratchet teeth 84, and pivoted upon the bearings, (which are mounted in said guides) as at 85 are dogs 86, which are designed to engage by gravity with the ratchet teeth 84. A shaft 87 is mounted in

bearings 88, which are mounted upon the upper edges of the sluiceway walls, and carried by the shafts are drums 89. Chains 90 are connected to and wound about the drums, and are in turn connected to the eyes 91 of the bearings, which are mounted in said guides 82. A hand wheel 92 is carried by the shaft 87, therefore by imparting a revoluble movement to the shaft 87 causing the chains 90 to wind upon the drums 89, the bearings which carry the shaft 11 may be adjusted in their guides 82, thereby tightening or tensioning the various sprocket chains of the motor, should they loosen, due to the strain thereon.

The jack shaft 42 extends over the side of the bank of the stream, and may be coupled or harnessed in any suitable manner to machinery to be operated, such as mills, generators or the like. In fact the shaft 42 may be belted direct with the operating parts of the mill, or may constitute the rotating shaft of the generator, for the purpose of generating electricity, and if necessary the shaft 42 may be connected to more than one generator, or to more than one mill. However if harnessed or coupled to one or more generators, the generators may operate other electrical apparatus, for the purpose of providing electrical current for some suitable installation. By virtue of an apparatus of this kind, various localities may be furnished with current, for lighting, heating, and furnishing power of any kind, for the welfare of the community.

As previously stated the water of the stream is controlled, so as to either pass to one side of the flume or sluiceway, or the entire volume may be diverted into the flume and sluiceway. In the operation of the motor, the water will impart movement to the endless travelers, such as the chains 15 with the buckets thereon, and since the upper parts of these chains 15 are geared with the jack shaft 42, power may be transmitted to any suitable source.

The invention having been set forth, what is claimed as being useful is:

1. In an apparatus for the purpose indicated, a flume, a sluiceway having a passage of communication therewith, power generating means comprising endless travelers mounted in the sluiceway, said sluiceway having its sides provided with guides, the endless travelers having water impelled buckets provided with gravity bucket elements having means engaging said guides, certain ends of the guides having extensions eccentric with the center of one end of the endless travelers, into which the means on the gravity elements of the buckets engage, to prevent the gravity elements from assuming positions transversely of the water in its flow.

2. In an apparatus for the purpose indicated, the combination, a flume having a sluiceway, endless travelers mounted in the sluiceway and provided with guides, fluid impelled buckets mounted on the endless travelers operable in the lower portions of the sluiceway, a passage communicating the flume and the sluiceway, means in said passage to control the water in its flow therethrough, a power transmitting shaft operatively connecting with the endless travelers, and means connecting with the power transmission shaft and said means in the passage for governing the latter, thereby controlling the water in its flow, means for diverting the water of the stream into the flume, or to one side thereof, and means controlling the water in its flow into the flume.

3. In an apparatus for the purpose indicated, a flume, a sluiceway having a passage of communication therewith, power generating means comprising endless travelers mounted in the sluiceway, said sluiceway having its sides provided with guides, the endless travelers having water impelled buckets provided with gravity bucket elements having means engaging said guides, certain ends of the guides having extensions eccentric with the center of one end of the endless travelers, into which the means on the gravity elements of the buckets engage, to prevent the gravity elements from assuming positions transversely of the water in its flow, and means carried by the gravity elements for causing them to feather the water while the guiding and holding means of the elements are entering the extension guides.

4. In an apparatus for the purpose indicated, a flume, a sluiceway having a passage of communication therewith, power generating means comprising endless travelers mounted in the sluiceway, said sluiceway having its sides provided with guides, the endless travelers having water impelled buckets provided with gravity bucket elements having means engaging said guides, certain ends of the guides having extensions eccentric with the center of one end of the endless travelers, into which the means on the gravity elements of the buckets engage, to prevent the gravity elements from assuming positions transversely of the water in its flow, and means carried by the gravity elements for causing them to feather the water while the guiding and holding means of the elements are entering the extension guides, and means for increasing or decreasing the tension of the endless travelers.

5. In an apparatus as and for the purpose indicated, a sluiceway having an inlet for the water in its flow and provided with guides in its opposite walls, of a motor comprising endless travelers mounted for operation in the sluiceway, said travelers having water impelled buckets provided with gravity bucket elements for operation

on the bottom of the sliuceway, and means for limiting the bucket elements in position at right angles to the buckets when moving with the upper part of the travelers.

6. In an apparatus as and for the purpose indicated, a sluiceway having an inlet for the water in its flow and provided with guides in its opposite walls, of a motor comprising endless travelers mounted for operation in the sluiceway, said travelers having water impelled buckets provided with gravity bucket elements for operation on the bottom of the sluiceway, and means for limiting the bucket elements in position at right angles to the buckets when moving with the upper part of the travelers, said bucket elements when starting to move with the under parts of the travelers adapted to assume obtuse angle positions relatively to the buckets, and means to prevent the bucket elements from resuming their relative right angle positions to the buckets.

7. In an apparatus as and for the purpose indicated, a sluiceway having an inlet for the water in its flow and provided with guides in its opposite walls, of a motor comprising endless travelers mounted for operation in the sluiceway, said travelers having water impelled buckets provided with gravity bucket elements for operation on the bottom of the sluiceway, and means for limiting the bucket elements in position at right angles to the buckets when moving with the upper part of the travelers, said bucket elements when starting to move with the under parts of the travelers adapted to assume obtuse angle positions relatively to the buckets, and means to prevent the bucket elements from resuming their relative right angle positions to the buckets, and means carried by the bucket elements to be acted upon by the water in its flow for causing said last mentioned means to operate.

8. In an apparatus as and for the purpose indicated, a sluiceway having an inlet for the water in its flow and provided with guides in its opposite walls, of a motor comprising endless travelers mounted for operation in the sluiceway, said travelers having water impelled buckets provided with gravity bucket elements for operation on the bottom of the sluiceway, and means for limiting the bucket elements in position at right angles to the buckets when moving with the upper part of the travelers, said bucket elements when starting to move with the under parts of the travelers adapted to assume obtuse angle positions relatively to the buckets, and means to prevent the bucket elements fror resuming their relative right angle positions to the buckets, a flume connected with the inlet, a butterfly valve mounted in the inlet, means operatively connected with the endless travelers and with the butterfly valve to control the latter, and thereby regulate the water in its flow into the inlet and through the flume.

In testimony whereof I hereunto affix my signature.

FRANCIS W. HESS.