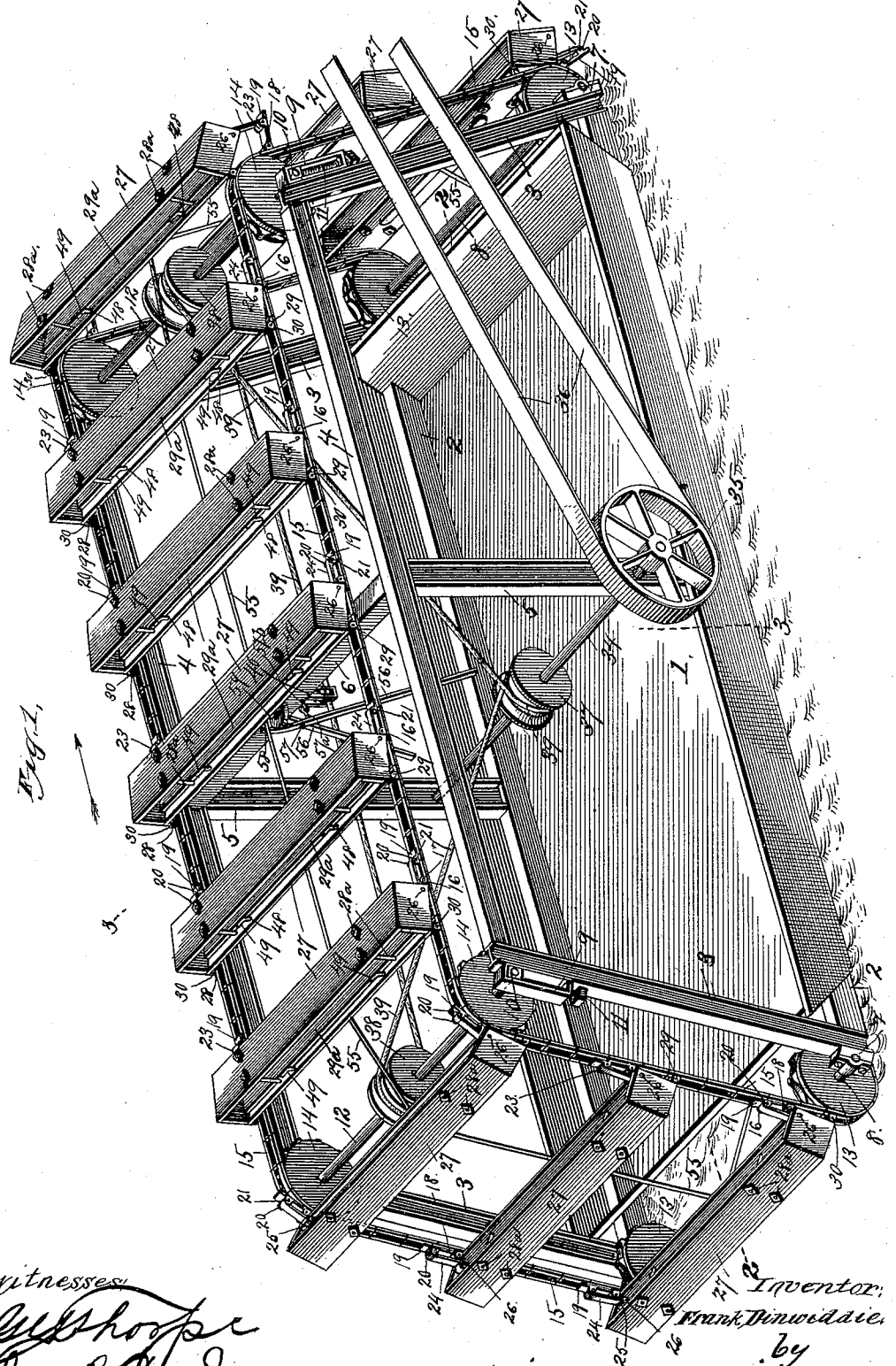
(No Model.) 3 Sheets—Sheet 1.

F. DINWIDDIE.

CURRENT MOTOR.

No. 478,316. Patented July 5, 1892.



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Inventor:
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(No Model.) 3 Sheets—Sheet 2.

F. DINWIDDIE.

CURRENT MOTOR.

No. 478,316. Patented July 5, 1892.

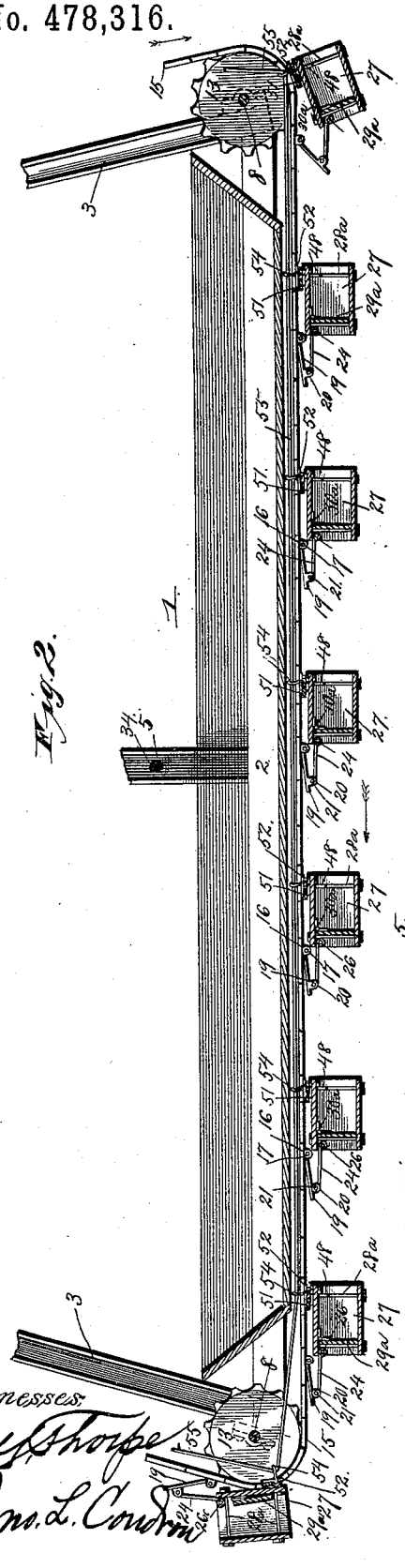

Fig. 2.

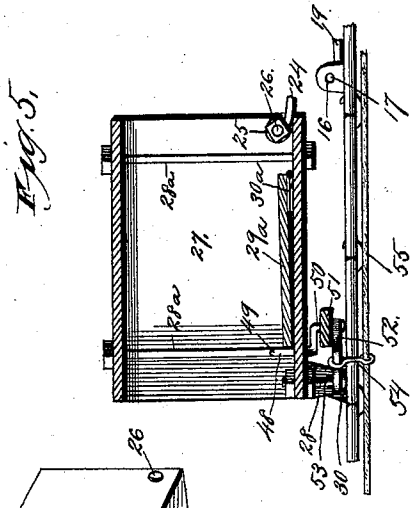

Fig. 5.

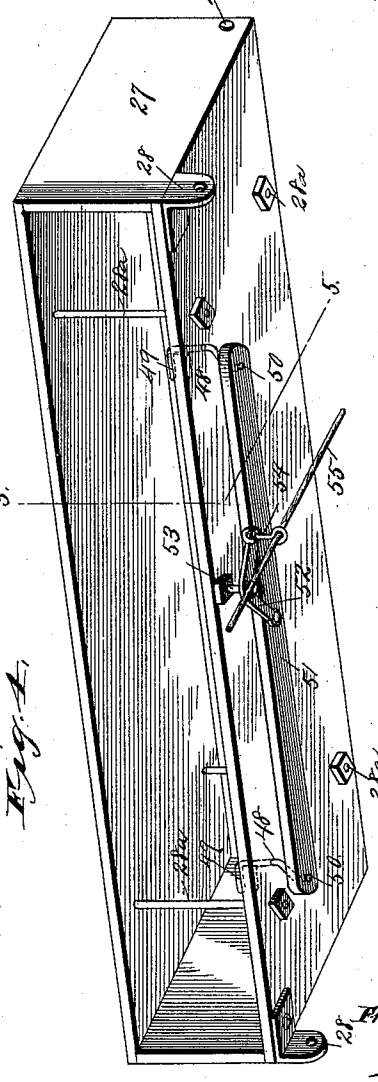

Fig. 4.

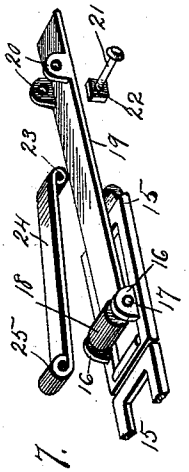

Fig. 7.

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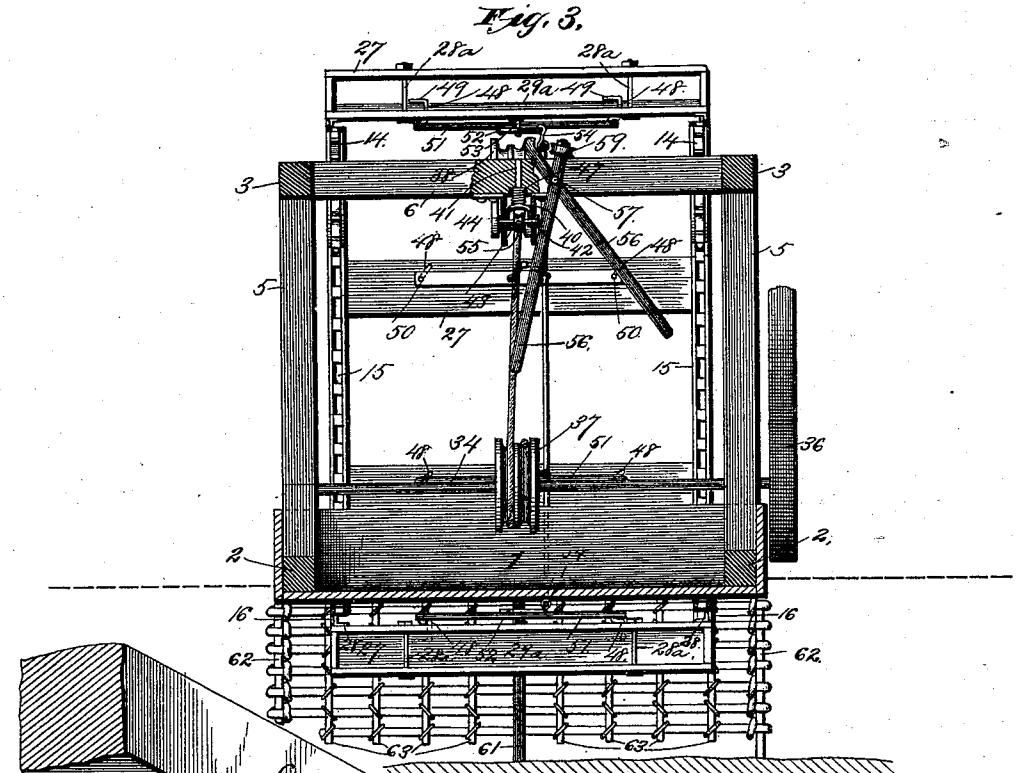
(No Model.) 3 Sheets—Sheet 3.

F. DINWIDDIE.

CURRENT MOTOR.

No. 478,316. Patented July 5, 1892.

Fig. 3.



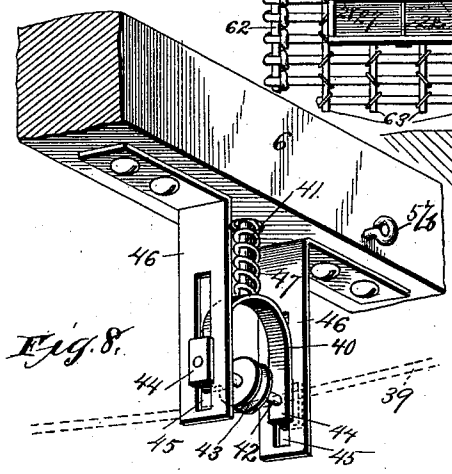


Fig. 8.

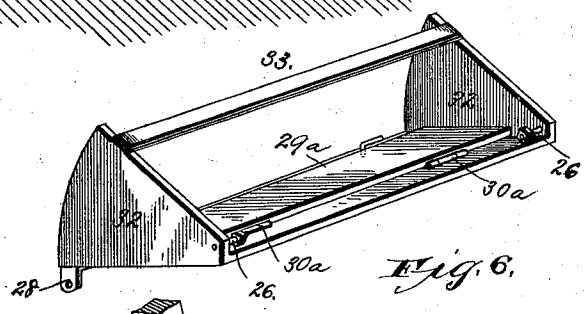


Fig. 6.

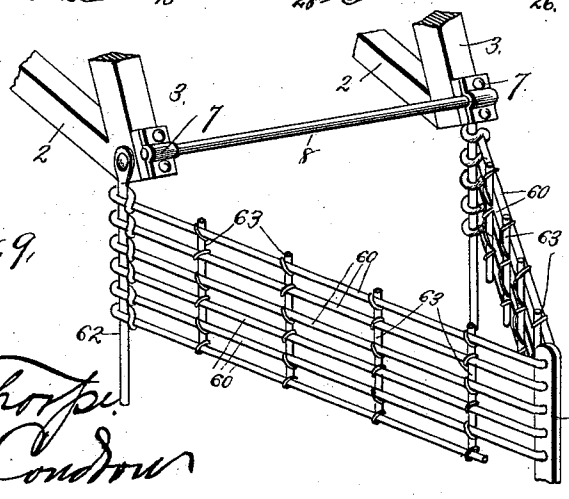


Fig. 9.

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UNITED STATES PATENT OFFICE.

FRANK DINWIDDIE, OF KANSAS CITY, MISSOURI.

CURRENT-MOTOR.

SPECIFICATION forming part of Letters Patent No. 478,316, dated July 5, 1892.

Application filed November 17, 1891. Serial No. 412,171. (No model.)

To all whom it may concern:

Be it known that I, FRANK DINWIDDIE, of Kansas City, Jackson county, Missouri, have invented certain new and useful Improvements in Current-Motors, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates to machines for utilizing the force or power of running water—such as rivers, brooks, and various other running-water courses—and for supplying the power so developed to various forms of machinery; and the objects of my invention are to produce a current-motor which shall be simple, strong, durable, and comparatively inexpensive in construction and which shall utilize the maximum amount of power evolved from the movement of the water; furthermore, to produce a current-motor which shall be direct and positive in its operation and which shall be under complete control of an attendant, so that the latter can stop or start it readily whenever desired.

To the above purposes my invention consists in certain peculiar and novel features of construction and arrangement, as hereinafter described and claimed.

In order that my invention may be fully understood, I will proceed to describe it with reference to the accompanying drawings, in which—

Figure 1 is a perspective view of a current-motor embodying my invention. Fig. 2 is a central vertical longitudinal section of the lower part of the same on the line 2 2 of Fig. 1. Fig. 3 is a transverse vertical section of the same on the line 3 3 of Fig. 1. Fig. 4 is a detached perspective view, on an enlarged scale, of one of the traveling buckets of the motor. Fig. 5 is a transverse vertical section of the same on the line 5 5 of Fig. 4. Fig. 6 is a detached perspective view, on an enlarged scale, of a modified form of the traveling buckets. Fig. 7 is a detached perspective view, on an enlarged scale, of the devices for attaching the buckets to their carrying sprocket-chains. Fig. 8 is a detached perspective view, on an enlarged scale, of the tension mechanism for the power-transmitting cable. Fig. 9 is a detached perspective view, on an enlarged scale, of an ice or other obstruction guard to be applied to the motor.

In said drawings, 1 designates a suitable floating vessel—such as a flat-boat, bateau, scow, or other similar vessel—upon which the supporting frame-work of my improved motor is preferably supported, the said vessel being suitably anchored in the stream or to the bank of the same while the motor is in use. It is to be understood, however, that the motor mechanism and its supporting frame-work may be mounted upon any suitable structure, either fixed or movable, as circumstances may render desirable, without departing from the essential spirit of my invention.

2 designates two horizontal parallel base-pieces or sills, which are laid upon the bottom of the vessel 1 adjacent to its opposite sides and the ends of which protrude beyond the ends of said vessel a suitable distance, as shown. These base-pieces or sills may be either timbers of suitable size and strength, as shown, or they may be metal beams of the I-beam type, if preferred.

3 designates four uprights, each of which is bolted or otherwise strongly secured at its lower end to one end of one of the base-pieces or sills 2. These uprights 3 are thus arranged in two pairs, one pair being at each end of the vessel and the uprights of each pair extending parallel with each other obliquely upward and toward the middle of the vessel. These uprights are also preferably in the form of metal I-beams, as shown, but may be timbers of suitable size and strength, if preferred. The two opposite uprights 3 are connected together by a horizontal tie-beam 4, the ends of which are bolted or otherwise strongly secured to the upper ends of said uprights, and which thus extend parallel with each other above and at each side of the vessel 1. These two tie-beams are also preferably in the form of metal I-beams, as shown, but may, if preferred, be in the form of timbers of suitable size and strength. These tie-beams are shown as each supported about midway of its length by a vertical support 5, the lower end of which is bolted or otherwise strongly secured to the upper side of the corresponding sill or base-piece 2, and the upper end of which is similarly bolted or otherwise strongly

secured to the under side of the corresponding tie-rod 3. These supports are either in the form of metal I-beams, as shown, or of timbers of suitable size and strength, and it is to be understood that while I have shown but one such support for each tie-beam 3 any desired number of such supports may be provided, as circumstances may suggest. The two tie-beams 4 are also braced laterally by a horizontal cross tie-piece 6, the ends of which are bolted or otherwise strongly secured to the inner sides of the tie-pieces 4, the said cross tie-pieces being preferably in the form of metal I-beams, but permissibly timbers of suitable size and strength, and it is to be understood that while I have shown a single cross tie-piece 6 connecting the two tie-pieces 4 about midway of their length any desired number of cross tie-pieces may be used, as circumstances may demand.

Upon the lower ends of the uprights 3, at the outer parts thereof, are secured fixed bearing-boxes 7 of the usual form, as shown, or of any other suitable or preferred form, there being thus four of said bearing-boxes arranged in two pairs, one pair being at each end of the frame-work. In each pair of these bearing-boxes 7 are journaled the ends of a horizontal shaft 8. The said shaft thus extends transversely of the supporting frame-work and beyond the ends of the vessel 1, as shown. Upon the upper ends of the uprights 3, at the outer sides thereof, are secured elongated skeleton or open guides 9, within each of which is movably retained a vertically-adjustable journal-bearing 10, an adjusting-screw 11 being inserted through the lower end of each bearing-guide and supporting the bearing at its upper end, as shown. There are thus two pairs of these adjustable bearings 10, one pair being located at each end of the supporting frame-work, and in each of these pairs of bearings are journaled the ends of a horizontal shaft 12, there being thus two of said shafts, each extending transversely of the upper part of the supporting frame-work and at the ends thereof. Upon each of the lower shafts 8 are mounted two sprocket-wheels 13, which are located adjacent to the ends of the shafts, and upon each of the upper shafts 12 are mounted two similar sprocket-wheels 14, which are located also adjacent to the ends of said shafts, there being thus two pairs of lower and two pairs of upper sprocket-wheels, and the two pairs of sprocket-wheels being located at one end of the supporting frame-work. Over these sprocket-wheels run two endless sprocket or drive chains 15, one of the said sprocket or drive chains being thus located at each side of the supporting frame-work of the machine and within the uprights 3 and supports 5.

Certain of the links of the drive or sprocket chains 15 are each formed with an oppositely-disposed pair of ears 16, through which pass transverse pivot-pins 17, each of said pivot-pins being surrounded between the ears 16 by the turned end 18 of one of a number of connecting-bars 19. (See, also, Fig. 7.) It will thus be seen that at intervals of each sprocket-chain 15 are attached these arms 19 and that each arm 19 of one chain is located directly opposite one of the arms 19 of the companion sprocket-chain. At the end opposite from the ears 16 each bar or arm 19 is formed with an oppositely-disposed pair of similar ears 20, transversely through which extends a pivot-pin 21, which is retained in position by a nut 22, (a like nut being preferably provided for each of the pivot-pins 17.) Each of the pivot-pins 21 is surrounded between the ears 20 by the turned end 23 of a bar 24, and the opposite end 25 of said bar 24 is likewise turned to surround a transverse pivot-pin 26, which passes through the front ends of the traveling buckets 27. On their under sides, at the rear ends thereof, the buckets 27 are formed with two oppositely-disposed ears 28, through which pass pivot-pins 29, which pass also transversely through ears 30 on the corresponding links of the sprocket-chains.

As shown in Figs. 1, 2, 3, 4, and 5, each of the traveling buckets 27 is shown as of oblong rectangular form, without top or bottom, and as having its parts strongly braced together by through-bolts 28^a, and these buckets extend transversely of the machine from one sprocket-chain 15 to the other. Within each of these buckets is placed a gate or abutment 29^a, which is connected by one or any number of hinges 30^a to the inner surface of that side of the bucket which is uppermost when said buckets are submerged. These hinges are secured to the front margins of the gates or abutments 29^a, and are also secured to the inner surfaces of the said sides of the buckets at points near the front margins of said sides. By reference to Fig. 2 it will be seen that when the buckets descend (the movement of the sprocket-chains being in the direction indicated by the arrow) the gates or abutments 29^a will close automatically by gravity and will remain in closed position during the entire submergence of the buckets. It will also be seen that as soon as the buckets emerge from the water the gates or abutments 29^a will likewise automatically open by gravity.

In Fig. 6 I have shown a slightly-modified form of the buckets, but one of which embodies the same essential mode of operation as that of the buckets 27 just described. In this instance the buckets, instead of being rectangular, are triangular in form—that is to say, each of these buckets is composed of one closed side or bottom 31, to the ends of which are secured triangular end pieces 32. The closed pottion 31 is lowermost when the bucket is submerged and the gate or abutment 29^a is secured to its inner surface by hinges 30^a, as before. The opposite side of the bucket is provided with a longitudinal strip 33, against which the free edge of the gate or abutment comes when the latter is in closed position. It will thus be seen that the gate or abutment

29ª in this instance operates precisely as before to close the bucket, and thus actuates the drive-chains when the buckets are submerged. The end pieces 32 of this bucket are also provided with the ears 28, as before, said ears serving the same purpose as that of the ears of the bucket 27. When the gates or abutments 29ª of the buckets 27 are in closed position, they are supported against the pressure of the water by the two front pairs of through-bolts 28ª, and it will be seen that when the buckets are submerged they move beneath the front end of the vessel longitudinally to its rear end, and thence upward over the rear end. By this means the full force or power of the current is utilized and no back-pressure whatever has to be overcome.

I will now proceed to describe the device for transmitting the power generated by the movement of the buckets and sprocket-chains to the mechanism which is to be driven by the motor.

34 designates a horizontal shaft, which extends transversely of the machine and which at its ends is journaled in suitable bearings in or mounted upon the lower parts of the supports 5. At one or both ends of the shaft 34 is mounted a belt-pulley 35, over which is led a suitable belt 36, which runs over a belt-wheel upon the machine or shafting to be driven by the motor. Midway of the length of the shaft 34 is mounted a double-grooved pulley 37, and midway of the length of each of the shafts 12 is mounted a similar double-grooved pulley 38. An endless belt or rope 39 is laid around the pulleys 37 and 38, as shown, and it will be seen that as the moving sprocket-chains 15 revolve the shafts 12 and pulleys 38 the belt 39 will revolve the pulley 37 and the shaft 34 and impart corresponding motion to the belt 36, and thence to the machinery or shafting to be driven by the motor. In order to insure the required tension of the belt or band 39 necessary to prevent slipping of the same and consequent loss of power and movement, I have provided a presser or tension bar 40, which is of inverted-**U** form, and the bend of which is provided with a stem or rod 41, which extends vertically upward from the bend of the bar 40 and which works vertically through a transverse opening in the cross tie-piece 6 before described. Through the lower ends of the arms of this presser or tension bar 40 extends a short shaft 42, which carries midway of its length a peripherally-grooved roller or wheel 43. The ends of the shaft 42 are journaled in two bearing-blocks 44, which work vertically in two vertical guide-slots 45, which are formed in the vertical arms of two oppositely-disposed inverted-**L**-shaped hangers 46, the upper horizontal arms of said hangers being bolted or otherwise strongly secured to the under side of the cross-tie piece 6. A stout spiral spring 47 surrounds the rod 41 and is interposed between the upper side of the bend of the bar 40 and the under side of the tie-piece 6. Thus it will be seen that the spring 47 by its expansive action presses the roller or wheel 43 downward upon the rope or belt 39 and maintains the required tension of the same for the purposes before explained.

In order to provide for the ready starting and stopping of the motor, as desired, I have provided the following attachment: Each of the buckets above described is provided with two short rock-shafts 48, which pass through that side of the bucket which is lowest when the bucket is moving horizontally over the top of the machine, said rock-shafts being located near the front margins of said sides. At their inner ends these rock-shafts are provided with rock-arms 49 and at their outer ends with rock-arms 50. The rock-arms 50 are inserted into the opposite ends of a link-bar 51, and to each of these link-bars, about midway of the length of the same, is pivotally connected one end of a bell-crank lever 52. At its bend each of these bell-crank levers is connected by a pivot bolt or pin 53 with the adjacent side of the bucket, and at its free end said bell-crank carries an eye-bar 54. The lower eyes of these eye-bars embrace an endless cord 55, as shown. The said cord thus extends longitudinally beneath and above the machine and also upward at its ends and is supported by said eye-bars. A pair of levers 56 are pivoted together at 57, and one of said levers is connected by a link 57ª and eye 57ᵇ to the cross tie-piece 6, and the upper end 56 of one of said levers is bent to partially surround the cord 55, while the upper end of the companion lever carries a roller 59, which presses at times against the opposite side of the cord. Now when the lower ends of the two levers 56 are moved toward each other the cord 55 is closely embraced by the bent end 58 and roller 59 of the levers. The continued movements of the buckets now instantly bring one of the eye-bars 54 into contact with the parts 58 and 59, and this tilts the bell-cranks 52, throws the link-bars 51 longitudinally, and moves the rock-arms 49 of the buckets at the top of the machine over the free edge of the gates 29, thus holding said gates open and stopping the machine. The levers 56 are now moved laterally a sufficient distance to cause the rope 55 to move longitudinally, and thus release the crank-arms 49 from the gates in the submerged buckets, allowing said gates to drop. The levers 56 are now separated, and the pressure of water against the gates 49 of the submerged buckets will again start the machine.

In order to prevent floating ice or other floating débris from injuring the buckets or other parts of the machine, I provide a guard at either or both ends of the same. This guard is of substantially **V** form and is composed of two horizontal parallel sets of cables 60, which are connected at their front ends to a stake 61, driven into the bottom of the stream, and at their rear ends to two pendent rods 62, secured to the meeting ends of the

frame-pieces 2 and 3, the two sets of cables being held separated by any suitable number of vertical spreader bars or rods 63. Thus ice or other floating débris will be thrown away from either side of the guard and will not be allowed to strike and injure the buckets or other parts of the motor.

The peculiar operation of the several parts of the motor have been explained in connection with the description of their construction and arrangement, and consequently it is believed that a description of the general operation of the machine is not necessary. It will be seen that the machine is simple, strong, and inexpensive in construction, that it utilizes the full power of the current, and that it is under complete control of the attendant.

It is to be understood that, while I have shown and described but two of the sprocket or drive chains 15 and a corresponding number of sprocket-wheels upon the shafts 8 and 12, I propose to employ as many more of said chains and wheels as I may find desirable, the immediate connections between the buckets and chains and the other described operative connections being correspondingly duplicated.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. A current-motor comprising a suitable supporting frame-work, a number of shafts journaled thereon, a number of sprocket-wheels carried by said shafts, a number of endless sprocket-chains running over said sprocket-wheels, a number of buckets carried by said chains and each provided with an automatically opening and closing abutment or gate hinged within the bucket, a number of rock-shafts carried by the buckets and having rock-arms to engage the margins of the open abutments, a link-bar connected to said arms, bell-crank levers carried by each bucket and connected to the link-bars, and an endless flexible connection connected to said bell-cranks, substantially as set forth.

2. A current-motor comprising a suitable frame-work, a number of shafts journaled thereon, a number of sprocket-wheels carried by said shafts, a number of endless sprocket-chains running over said wheels, a number of buckets carried by said sprocket-chains and each provided with an automatically opening and closing abutment, a number of rock-shafts carried by the buckets and having rock-arms to engage the margins of the open abutments, a number of link-bars connecting said rock-shafts, bell-crank levers carried by said buckets and engaging the link-bars, eye-bars carried by the bell-cranks, an endless flexible connection embraced by said eye-bars, and a pair of gripping-levers pivoted upon the frame-work and arranged to surround the flexible connection for engaging the eye-bars, substantially as set forth.

3. A current-motor comprising a suitable float, a suitable supporting frame-work mounted upon and extending longitudinally of said float, a number of endless sprocket-chains running over said shafts and beneath the float, a number of elongated buckets extending transversely of the frame-work and each connected to the sprocket-chains by two pairs of arms, one arm of each pair being pivotally connected at one end to the bucket and its opposite end to the corresponding end of the companion arm, and the opposite end of the companion arm being pivotally connected to the sprocket-chain, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

FRANK DINWIDDIE.

Witnesses:
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JNO. L. CONDRON.