No. 685,016. Patented Oct. 22, 1901.

F. A. TOWSLEY.

STREAM OR CURRENT MOTOR.

(Application filed Apr. 12, 1899.)

(No Model.) 2 Sheets—Sheet 1.

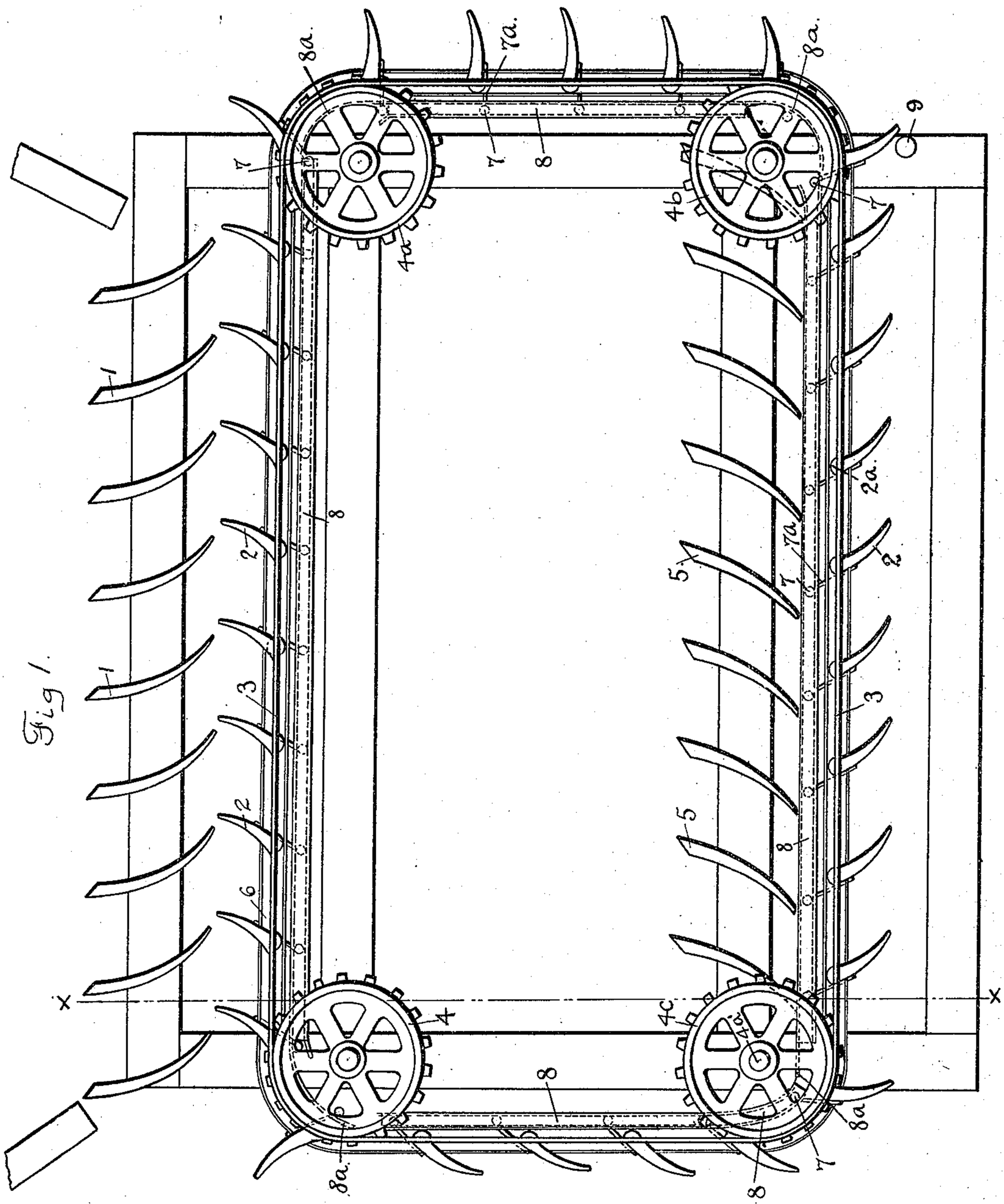


Fig 1.

Witnesses
Fred. P. Beach
W. H. Dwire

Inventor
F. A. Towsley
By his Attorney
Geo. B. Willcox.

No. 685,016. Patented Oct. 22, 1901.

F. A. TOWSLEY.

STREAM OR CURRENT MOTOR.

(Application filed Apr. 12, 1899.)

(No Model.) 2 Sheets—Sheet 2.

Fig 2

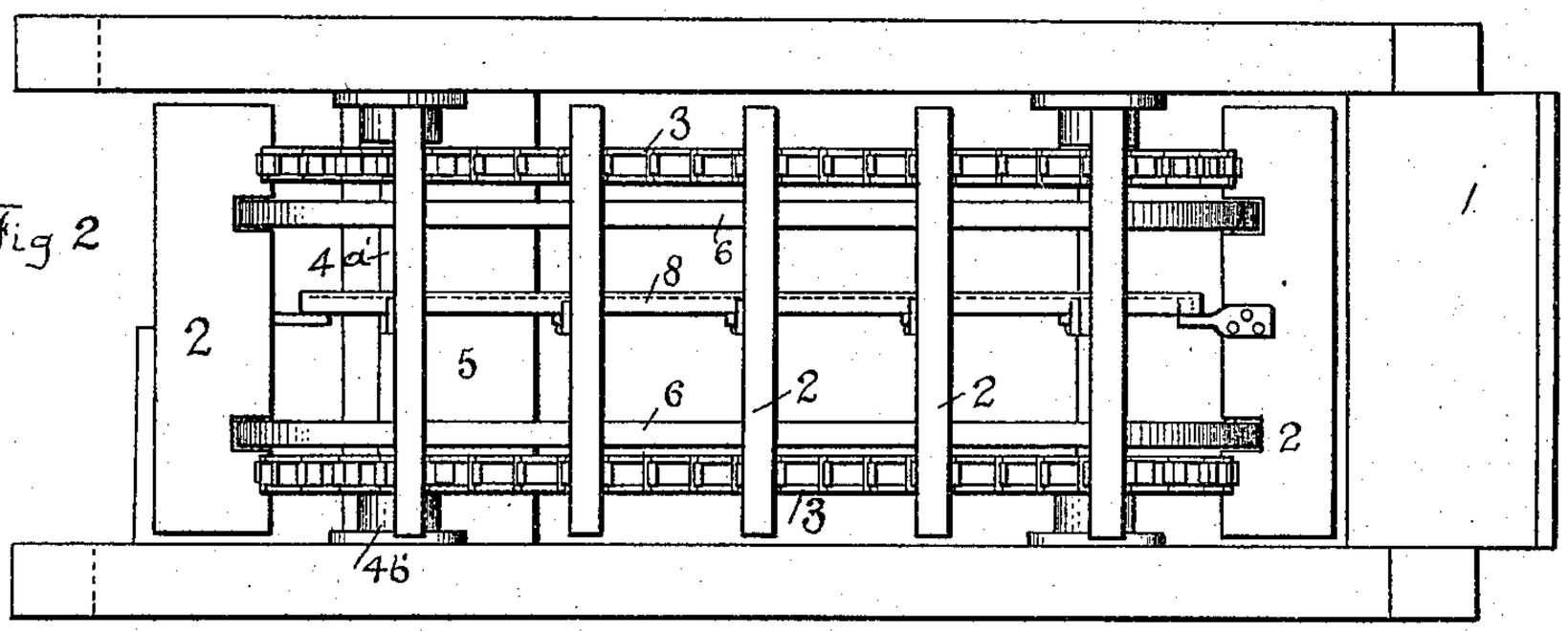
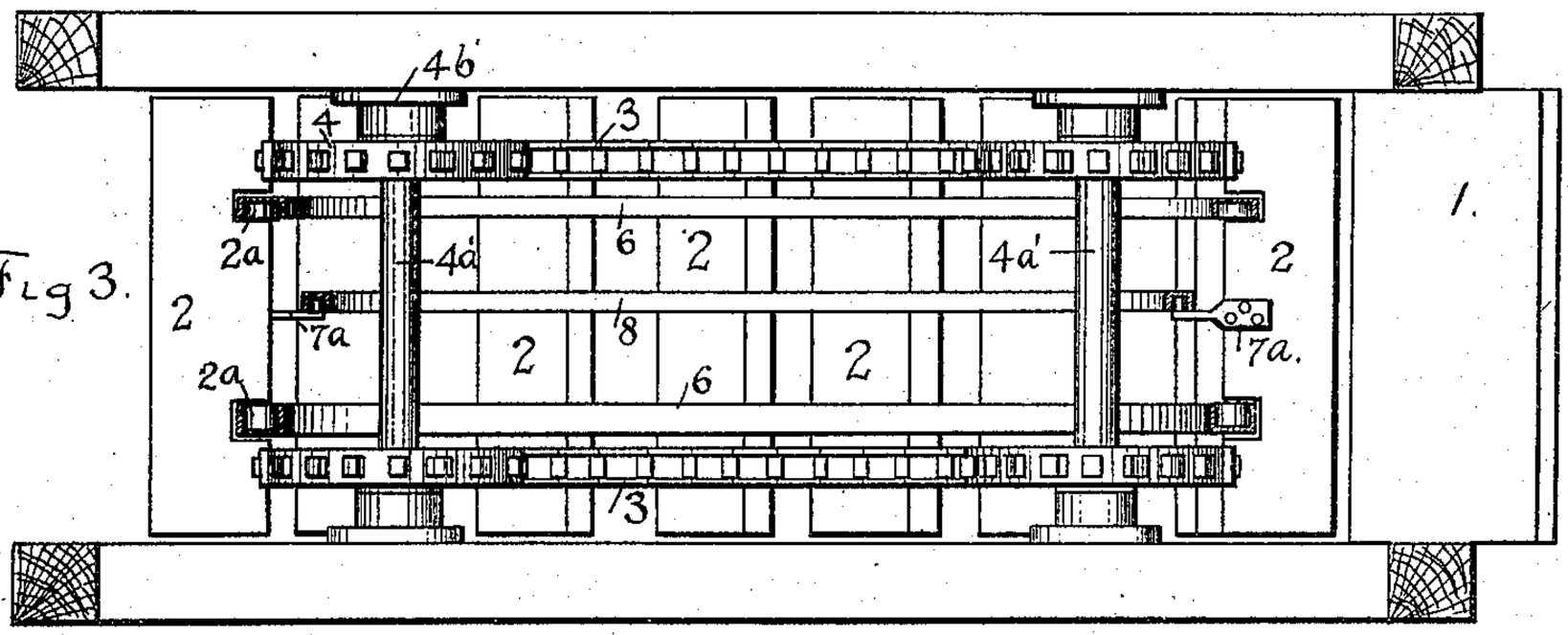


Fig 3.



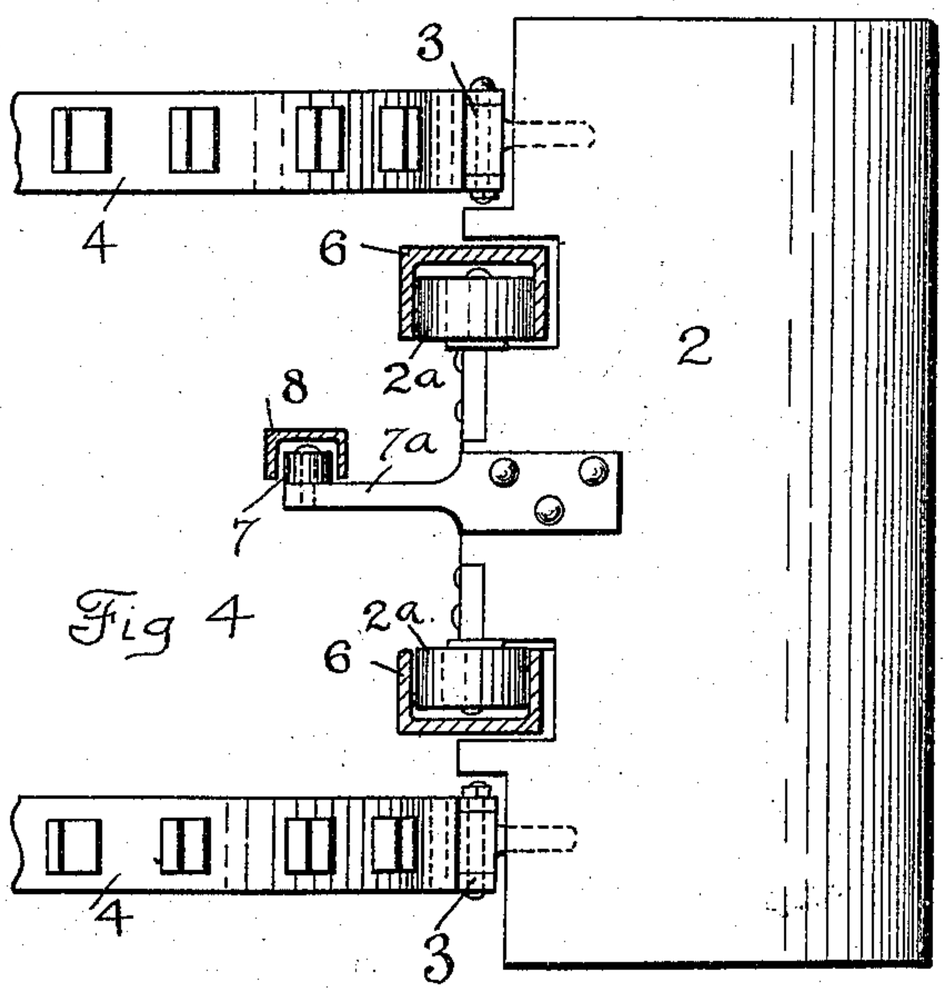


Fig 4

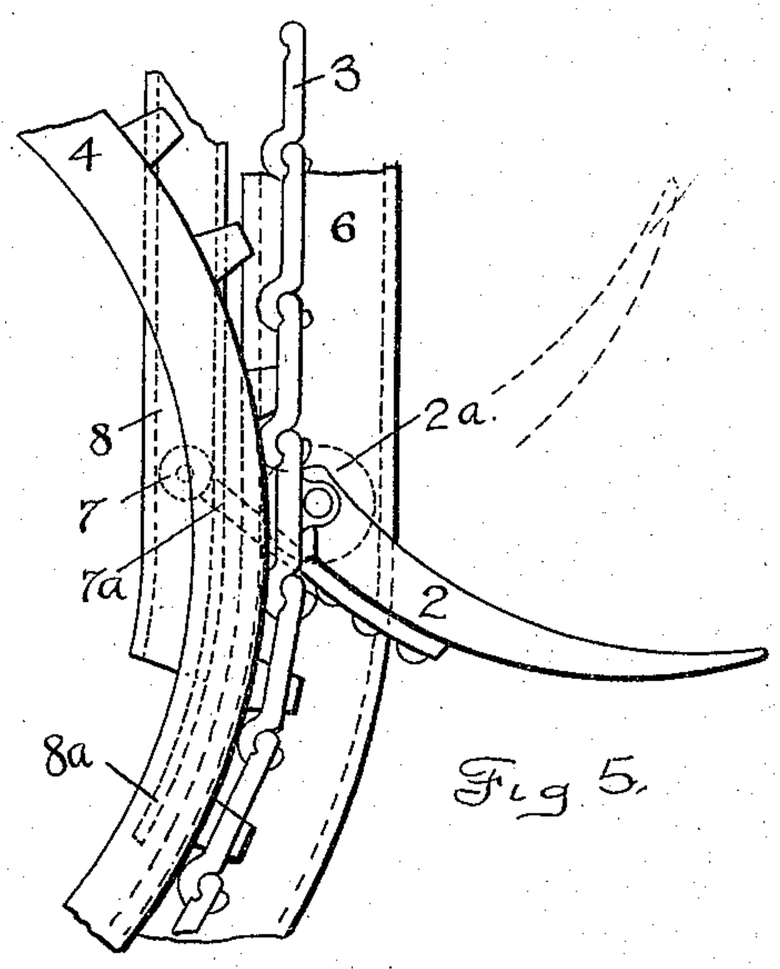


Fig 5.

Witnesses
Fred. P. Beach
M. H. Irwin.

Inventor.
F. A. Towsley
By his Attorney
Geo. B. Willcox.

UNITED STATES PATENT OFFICE.

FRANK A. TOWSLEY, OF MIDLAND, MICHIGAN.

STREAM OR CURRENT MOTOR.

SPECIFICATION forming part of Letters Patent No. 685,016, dated October 22, 1901.

Application filed April 12, 1899. Serial No. 712,786. (No model.)

To all whom it may concern:

Be it known that I, FRANK A. TOWSLEY, a citizen of the United States, residing at Midland, in the county of Midland and State of Michigan, have invented certain new and useful Improvements in Stream or Current Motors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to water-motors, and more particularly to that class of water-motors known as "stream" or "current" motors; and the improvement consists in certain constructions and arrangements of the parts of a stream-motor, as hereinafter set forth and for the purposes which will be explained in detail in this specification.

My invention is illustrated in the accompanying drawings, throughout the several views of which similar characters of reference are used to designate similar parts and devices.

In the drawings, Figure 1 is a plan view of the working parts of my invention, the upper beams of the frame being omitted. Fig. 2 is a side elevation of the same. Fig. 3 is a sectional elevation taken on the line $x\ x$ of Fig. 1. Fig. 4 is a detail in elevation of the vane and its attachments. Fig. 5 is a plan of the parts shown in Fig. 4.

As is plainly shown in the drawings, the improvement consists in providing across a part or the entire width of the stream a row of vertical guide-vanes 1 on the upstream side of the motor. These vanes are preferably fixed at their upper and lower ends to the upper and lower beams of the frame by mortising the ends of the vanes into the beams or by bolts or other suitable means and are set at a small angle with the direction of the current, being suitably curved to properly deflect the current against the moving or motor vanes 2. The motor-vanes 2 are suitably curved to receive the water as it leaves the guide-vanes and are attached vertically at regular intervals along a flexible moving band 3, that is carried by the four pairs of revolving wheels 4, 4^a, 4^b, and 4^c. This band is preferably made of a pair of continuous conveyer-chains placed one above the other and carried by the upper and lower sets of sprocket-wheels, as is shown in Fig. 2, the motor-vanes being attached to the chains at the top and bottom.

On the downstream side of the motor and within the rectangle described by the conveyer-chains is a second row of guide-vanes 5, similar to the row 1 on the upstream side, but having an opposite inclination, as is shown in Fig. 1, and arranged to discharge against the vanes on the downstream side of the motor.

In order to cause the motor-vanes to present their working or water-deflecting faces to the current on both sides, upstream and downstream, of the motor, it is essential that the vane be turned relatively to the band or chain 3 as the vane commences to cross the downstream side and also when it commences to cross the upstream side. This I accomplish by the means shown in Figs. 4 and 5. The upper and lower sprockets 4 are mounted on a vertical shaft 4^a, which is supported by suitable bearings 4^b, mounted on the framework of the motor. The conveyer-chains 3, to which the vanes 2 are attached, impart motion to the sprocket-shaft, from which the power may be taken.

The vanes 2 are secured to the conveyer-chains by bolts passing through hinge-bearings formed in the chain-links, as shown in Fig. 4. Rollers or wheels 2^a are pivotally mounted upon the rear edges of the vanes and run in channel-shaped guides 6, extending parallel with the conveyer-chains 3. These rollers 2^a take the thrust due to the pressure of the water upon the vanes and preserve their alinement with the chains 3. The channel-guides 6 may be supported by straps or brackets fastened to a suitable series of braces secured to the frame. These braces and brackets are omitted from the drawings for the sake of clearness and for the reason that their particular construction and arrangement are immaterial to the essential features of my invention. A vertical roller 7, mounted upon an arm 7^a, projecting from the back of the vane, moves in a groove 8, of channel or other suitable section, which extends parallel with the chains 3 and placed closer to the vane 2 than the length of the arm 7, so that the vane must assume a position at an angle greater or less than a right

angle to the direction of the chain, as is shown in Fig. 5.

To permit the vane to change from one position which is suited to its proper action on the upstream side of the motor to the position suited to its action on the downstream side, I extend the channels 8, in which the guide-roller runs, from wheel to wheel only, not bending them around the corners. This arrangement leaves the guide-roller 7 free of the channel 8 while the vane is passing around the sprocket-wheel. To guide the roller 7 into the next section of the channel 8, I provide curved wings or guides 8^a at each wheel. The roller by coming into contact with the guide 8^a is directed into the next channel-guide. The curved guides 8^a are preferably made by removing the web and one flange from the end of the channel 8 and curving the remaining flange to form the guide 8^a.

Near one of the wheels 4^b and mounted on the frame of the motor is a stop-pin or other suitable projection 9, against which the tips of the vanes impinge, and being retarded while the vane moves forward the vane is turned so as to direct the guide-roller 7 into the next channel-guide 8. At wheel 4, which is diagonally opposite the wheel 4^b, the guide 8^a is of somewhat different shape from the corresponding guides at the other wheels. It will be noticed on referring to Fig. 1 that the guide 8^a at wheel 4 is not bent concentric with the axis of the wheel, the middle part of the curve being nearer the center of the wheel than the end part. It is obvious that the pivotal center of the vanes must travel around the wheel 4 in the arc of a circle, whereas the guide-rollers 7 upon issuing from the side channel 8 engage the guide 8^a near its extremity and are retarded by the flattened curve forming the middle part of the guide 8^a. The difference in curvature between the circle of the sprocket-wheel and that of the guide 8^a serves to retard the guide-roller 7, while the vane continues to move at uniform speed. The effect upon the vane is to turn it from its downstream position first radially with the wheel and then into position for crossing the stream. When the vane is in this position, the guide-roller leaves the guide 8^a and enters the channel-guide 8.

The operation of my invention is as follows: Water entering the vertical guides 1, which are immersed in the stream, is deflected slightly from its course and is deflected against the curved vane 2, attached to the conveyer-chain. By this means the vanes are set in motion and pass successively across the bed of the stream, carrying with them the sprocket-chain, to which they are attached and by which the power is transferred to the wheel. The reaction or ineffectual thrust of the water being transmitted to the guides 6 by the rollers 2^a, the vane is held at the proper angle relatively to the stream by the guide-roller 7 running in its guide 8. When a vane reaches a pair of sprockets, as at 4^a, the guide-roller 7 leaves the groove 8, and during its passage around the sprocket the vane assumes a substantially radial position. As it moves downstream the vane is held practically normal to the direction of the current by the guide-roller 7, which now runs in the guiding-channel 8 (shown at the right hand of Fig. 1) and is so placed relatively to the vane as to hold the arm 7^a in a position normal to the channel 8. When the vane reaches the sprocket 4^b and is released from the right-hand channel-guide, the tip of the vane is tripped by the projecting pin 9 and is thus turned so as to engage the guide-roller 7 in the downstream guide, thus holding the vanes at a constant angle to the current as they pass back across the stream. The stationary vanes 5 receive the water that has passed through the upstream side of the motor and deflects it at an opposite inclination into the downstream row of moving vanes. Upon reaching the sprocket 4^c the roller 7 is deflected into the left-hand guide 8, which is so placed relatively to the vane as to hold the latter turned back upon the chain while moving against the stream, as is shown in Fig. 1.

While I have shown and described my invention as employing four sets of conveyer-sprockets, two sets of wheels of large diameter placed one on each side of the stream might be employed without departing from the spirit of my invention.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a submerged current-motor the combination of a series of vanes vertically arranged on horizontally-movable endless chains and extending outwardly therefrom, of pairs of sprocket-wheels rotatable in a horizontal plane for carrying the endless chains, said wheels being located on opposite sides of the stream; of series of vertical guiding-vanes arranged in rows that extend transversely to the direction of the stream, said vanes being adapted to deflect the current through a small angle and deliver it against the moving vanes; of thrust-rollers carried by the moving vanes, and thrust-resisting guides for said rollers arranged parallel to the direction of motion of the vanes; of guide-rollers attached to the moving vanes, and horizontal guides for directing the guide-rollers; said guide-rollers and horizontal guides being arranged to retain the moving vanes at a suitable angle to the direction of flow while crossing the current, substantially as set forth.

2. In a submerged current-motor the combination of a series of vanes vertically arranged on horizontally-movable endless chains and extending outwardly therefrom; of pairs of sprocket-wheels rotatable in a horizontal plane for carrying the endless chains, said wheels being located on opposite sides of the stream; of series of vertical guiding-vanes arranged in rows that extend transversely to