No. 701,430. Patented June 3, 1902.

W. L. WALTER.

CURRENT MOTOR.

(Application filed July 1, 1901.)

(No Model.) 6 Sheets—Sheet 1.

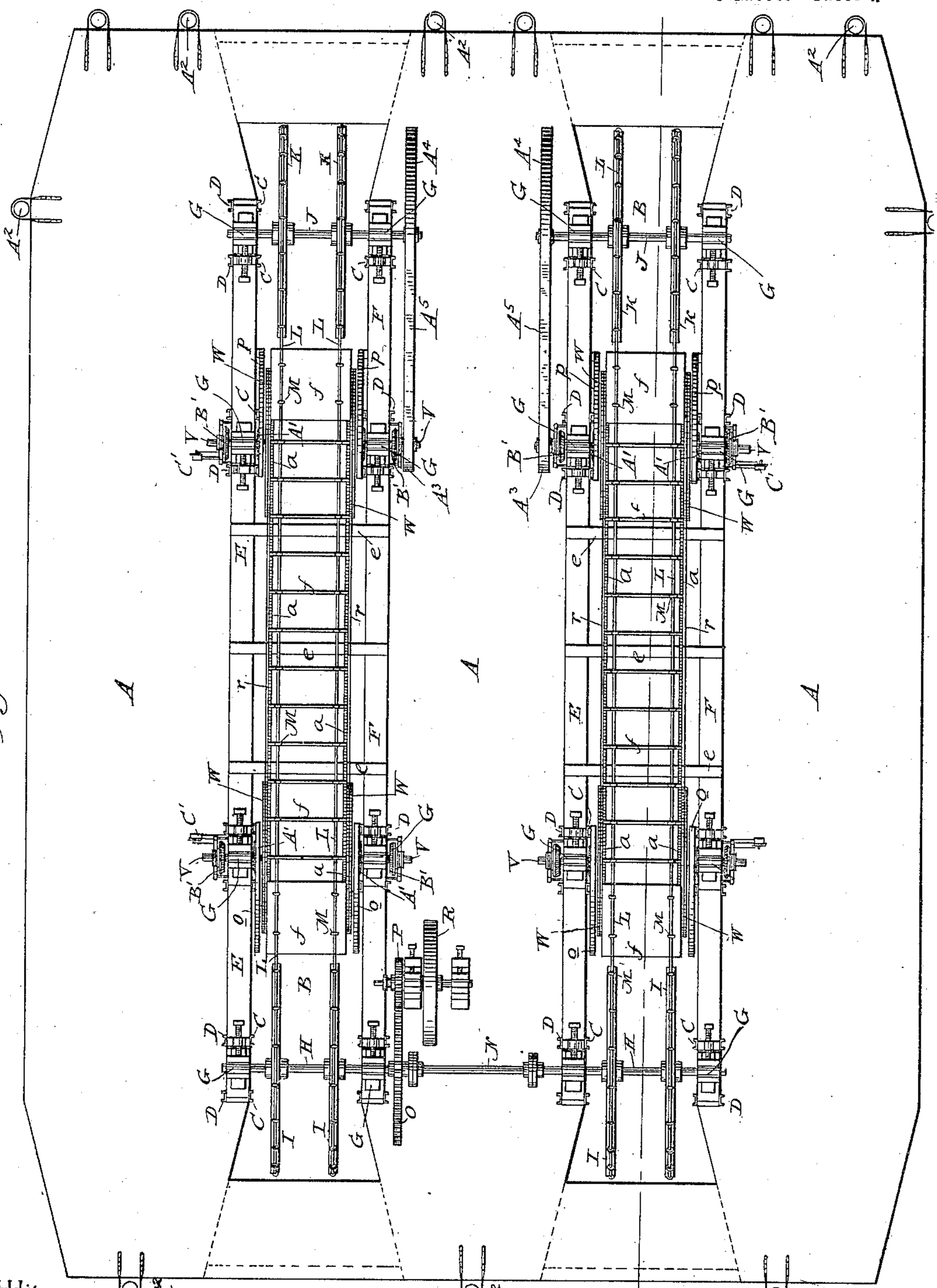

Fig. 1.

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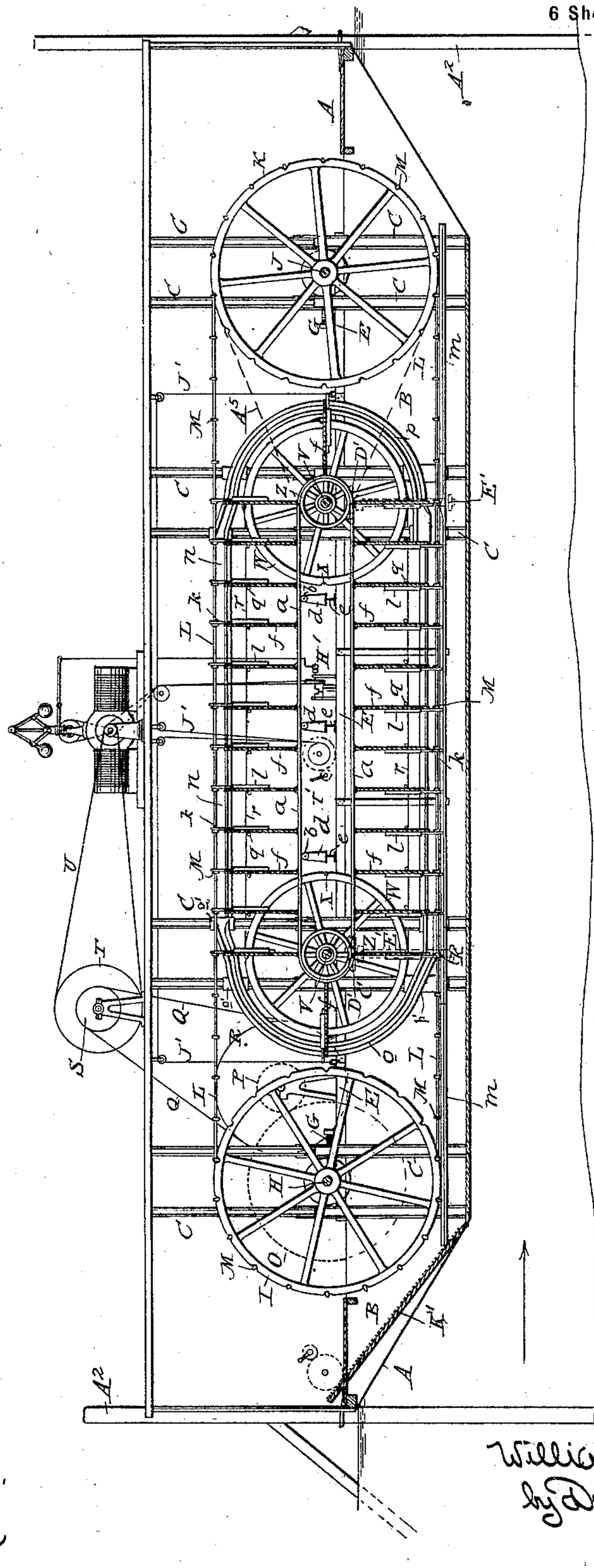
(No Model.) 6 Sheets—Sheet 2.

Fig. 2.



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No. 701,430. Patented June 3, 1902.

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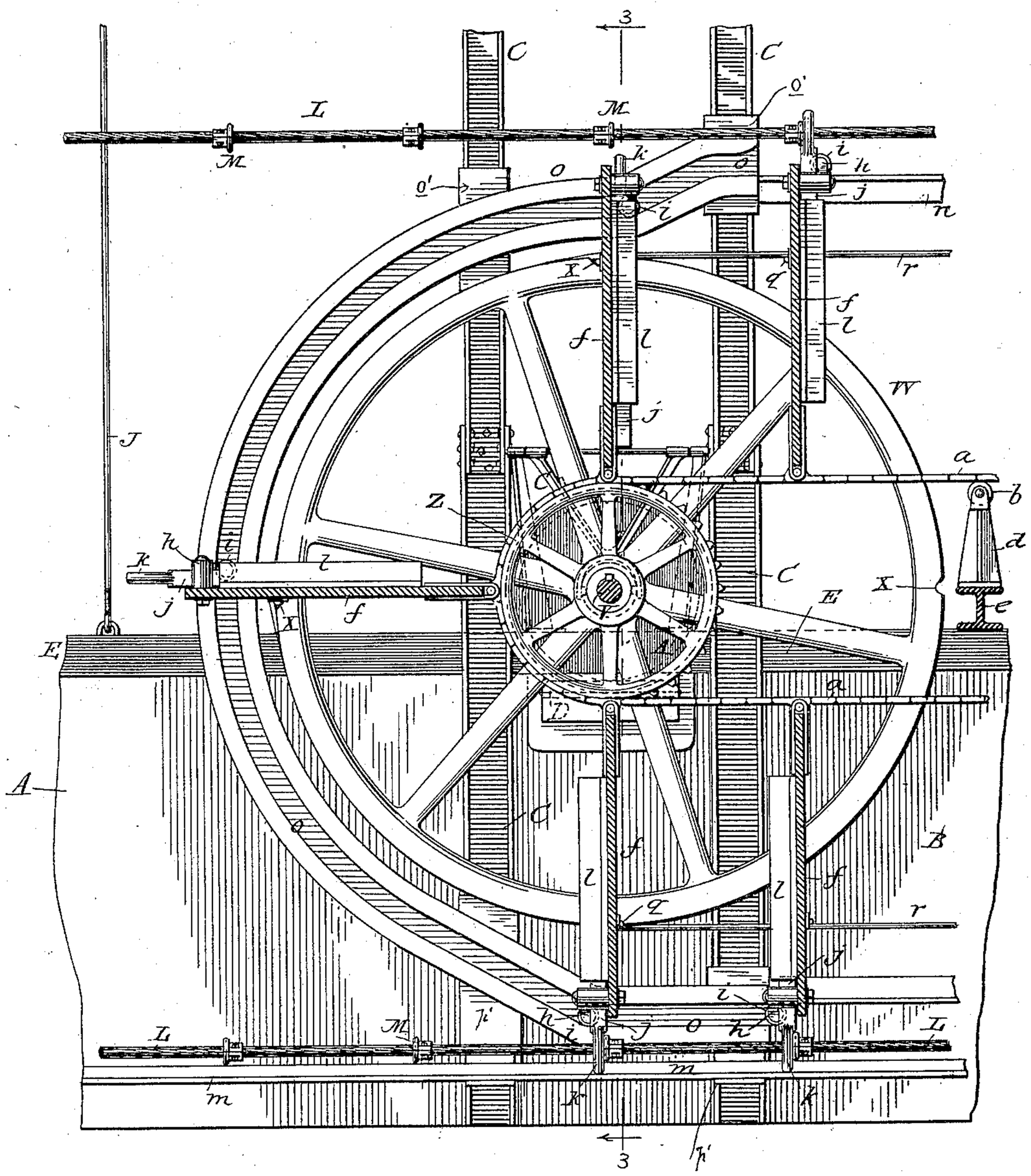
(No Model.) 6 Sheets—Sheet 3.

Fig. 3.



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(No Model.) 6 Sheets—Sheet 4.

Fig. 4.

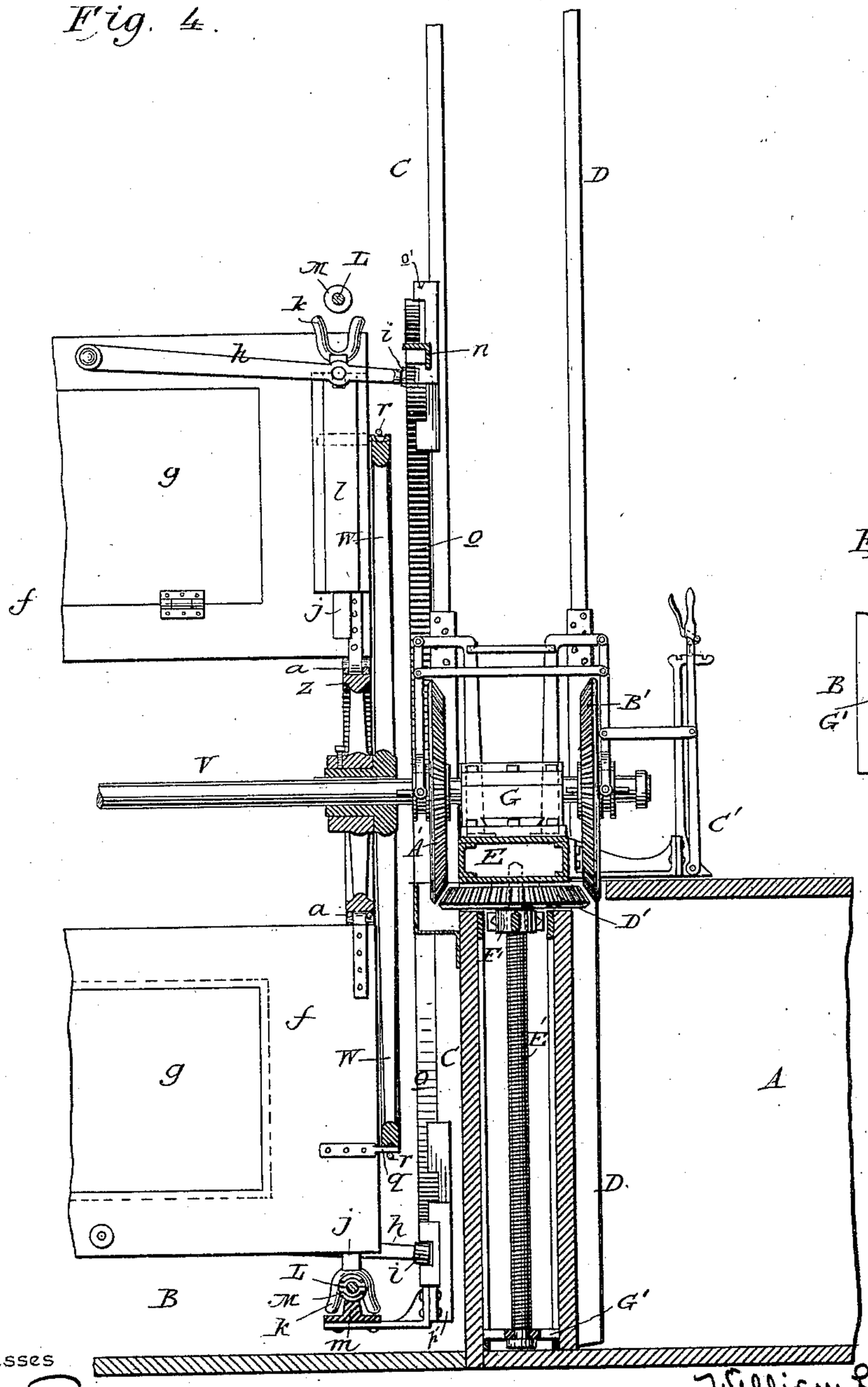
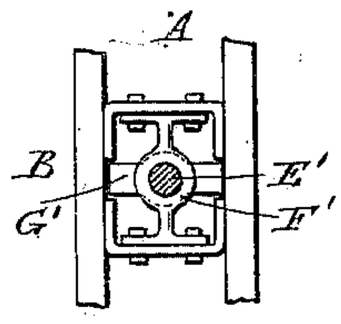


Fig. 5.



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CURRENT MOTOR.

(Application filed July 1, 1901.)

(No Model.) 6 Sheets—Sheet 5.

Fig. 6.

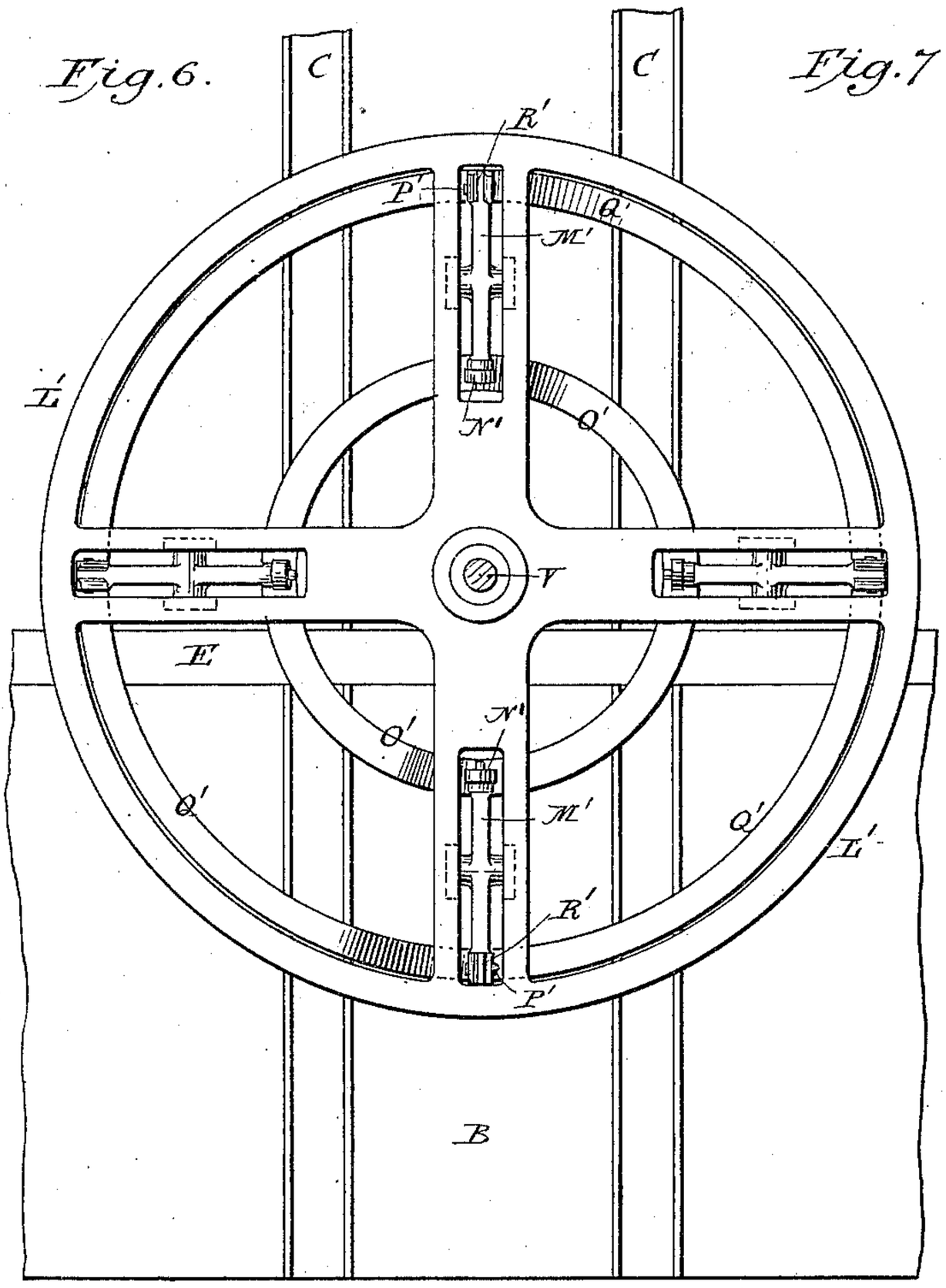


Fig. 7.

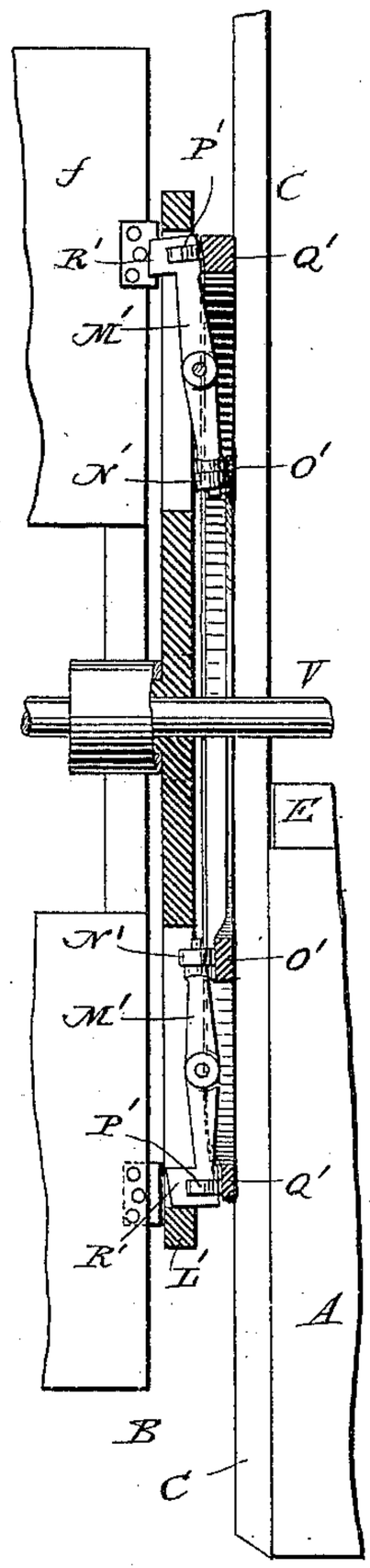


Fig. 8.

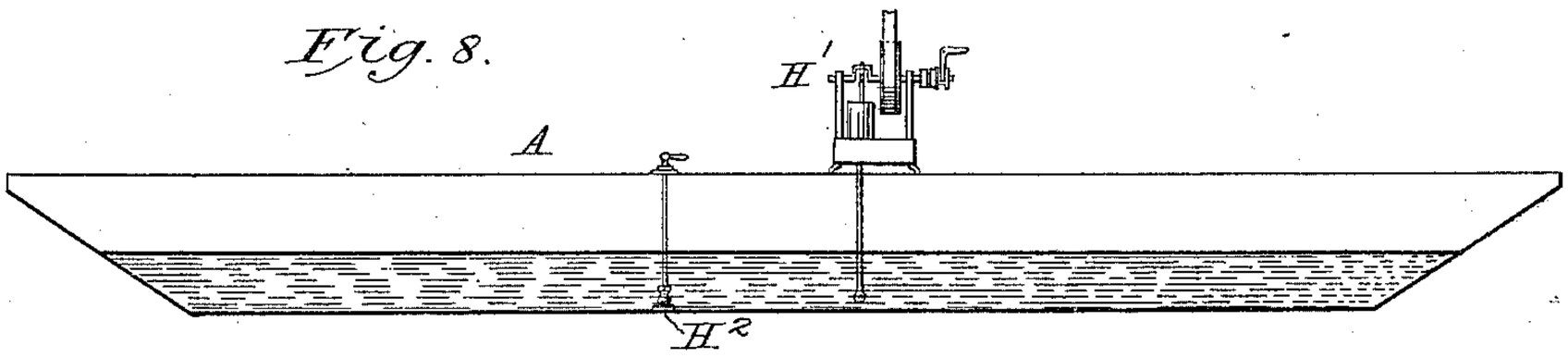
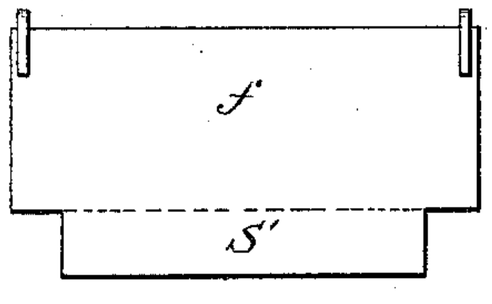


Fig. 9.



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No. 701,430. Patented June 3, 1902.

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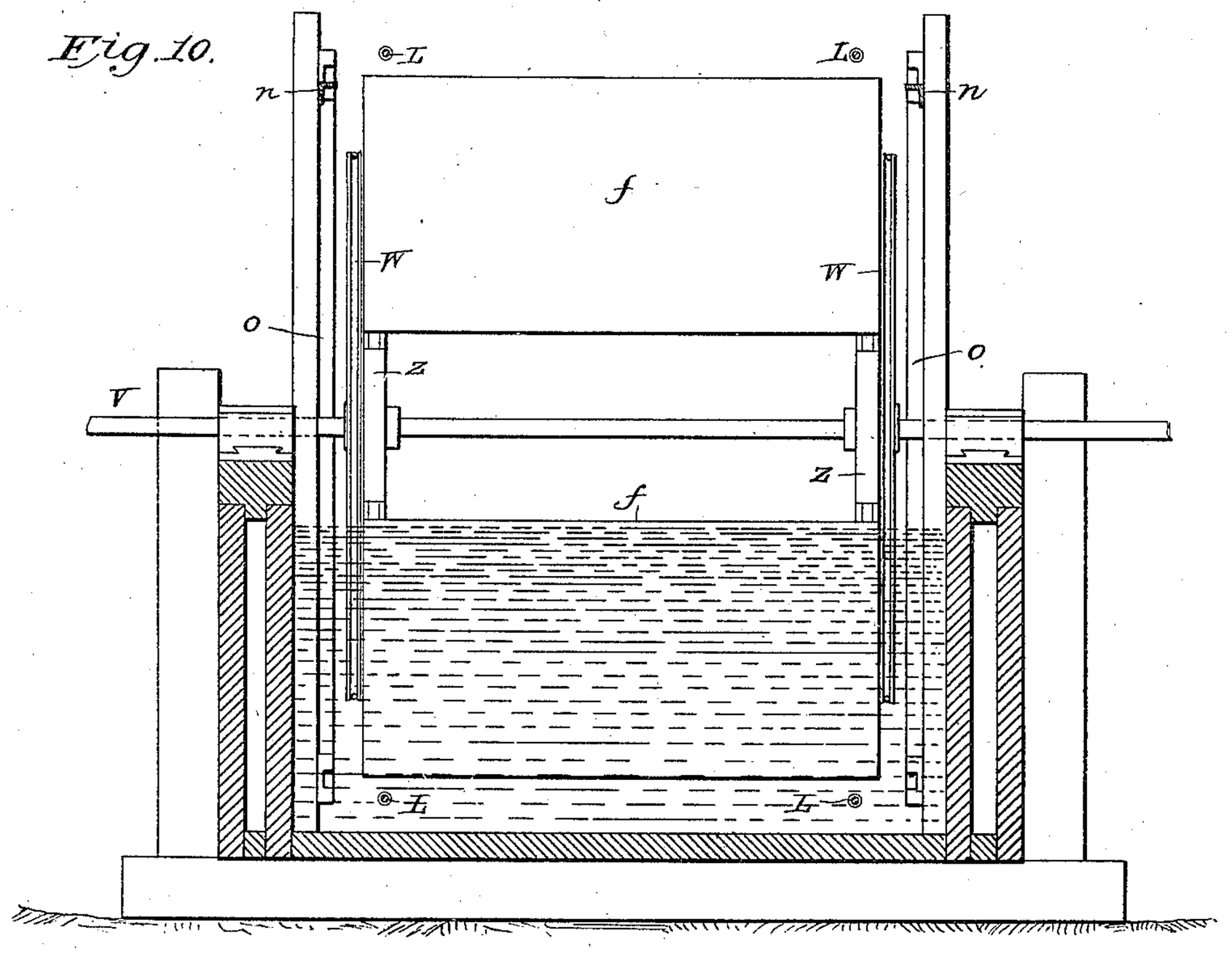
CURRENT MOTOR.

(Application filed July 1, 1901.)

(No Model.) 6 Sheets—Sheet 6.

Fig. 10.



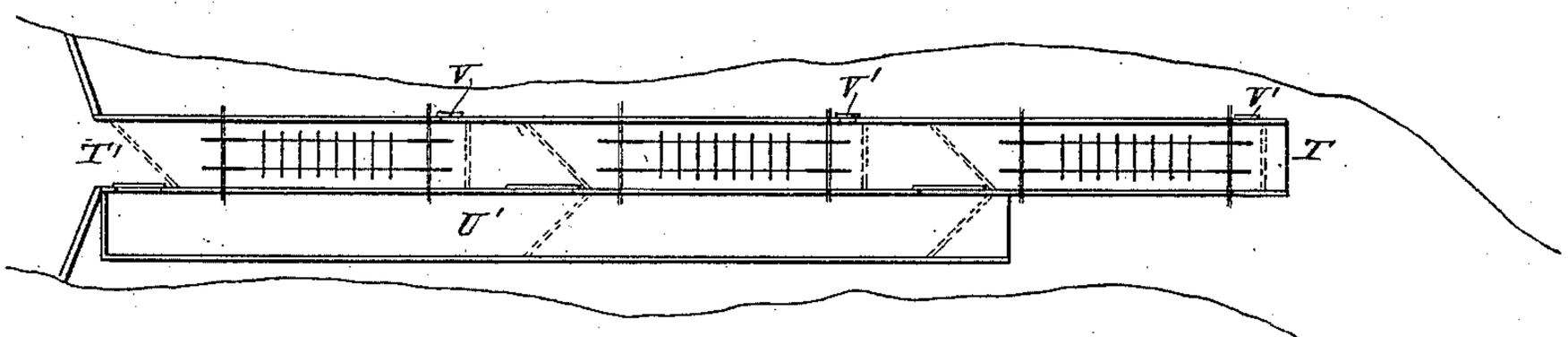


Fig. 11.

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Inventor:
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UNITED STATES PATENT OFFICE.

WILLIAM L. WALTER, OF PORT HURON, MICHIGAN, ASSIGNOR OF ONE-HALF TO SAMUEL W. SMITH, OF PONTIAC, MICHIGAN, AND BERTT H. BROCKWAY, OF WASHINGTON, DISTRICT OF COLUMBIA.

CURRENT-MOTOR.

SPECIFICATION forming part of Letters Patent No. 701,430, dated June 3, 1902.

Application filed July 1, 1901. Serial No. 66,696. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM L. WALTER, a citizen of the United States, residing at Port Huron, in the county of St. Clair and State Michigan, have invented certain new and useful Improvements in Current-Motors, of which the following is a specification.

My present invention pertains to improvements in current-motors, the construction and advantages of which will be hereinafter set forth, reference being had to the accompanying drawings, wherein—

Figure 1 is a top plan view of the apparatus, it being shown in duplicate for the purpose of illustration; Fig. 2, a side elevation, partly in section; Fig. 3, an enlarged detail view of a portion of the apparatus; Fig. 4, a transverse sectional view taken on the line 3 3 of Fig. 3; Fig. 5, a horizontal sectional view of the elevating-screw and the fixed nut; Fig. 6, a side elevation of a modified form of the paddle-sustaining means employed for holding the paddles and properly positioning the same as they pass from the upper stretch to the lower stretch of the outer cables or chains; Fig, 7, a transverse sectional view of the same; Fig. 8, a sectional view of the hull, showing the means employed for admitting thereto and removing therefrom water to vary its buoyancy; Fig. 9, a face view of a modified form of the paddle; Fig. 10, a vertical sectional view of the apparatus shown as applied to a race; and Fig. 11, a diagrammatic view illustrating a series of the motors arranged in a raceway with means for diverting the water from any one or all of the motors, as may be desired.

The object of the present invention is to produce a simple and efficient current-motor wherein a series of paddles may be brought into operative relation with an endless chain or cable to impart a continuous movement thereto, then successively withdrawn from connection therewith, and again brought into operative position when they reach that point in their cycle of travel where they again act with the current, and hence become an active factor in producing motion.

The construction shown in the drawings has many advantages, and these will be pointed out in the following description.

Referring more particularly to Figs. 1 to 4, inclusive, A designates a boat or float of any suitable type provided with wellways or channels B, extending lengthwise thereof. In Fig. 1 two of such ways or channels are illustrated—this merely for the purpose of showing the adaptability of the apparatus—the motor being the same in each channel.

Rigidly secured to the side walls of the wells or ways are guides C, and a second series of guides D extend from the deck of the boat upwardly in line with the guides C. These guides are preferably arranged in pairs, as is best seen upon reference to Fig. 1.

Suitable beams E F, preferably of the box-girder type, as shown in cross-section, Fig. 4, extend along the deck adjacent to the edges of the wellway. Intermediate the guides C D, upon these girders and at point intermediate each pair of guides, there is fixed an adjustable box or bearing G, which extends at right angles to the longitudinal axis of the girder.

Mounted in the bearings G at the forward end of the vessel is a shaft H, upon which are secured two large sprocket-wheels I I, while at the rear or stern of the vessel or float a second shaft J carries a similar pair of wheels K K. Around these wheels pass endless cables L, having secured thereon adjustable buttons or stops M. The forward shaft H is in the form shown in Fig. 1 connected to the corresponding shaft upon the opposite side of the boat by an intermediate section N, and any motion imparted to said shaft is through gears O and P transmitted to an electric generator or other power-translating device through a belt Q, passing from a wheel R to a smaller wheel S, upon whose shaft is mounted a larger wheel T, about which passes a belt U to the generator. A second pair of shafts V is mounted in the adjustable bearings G, carried by the girders E F, intermediate the shafts H and J. Upon each shaft V there is mounted a pair of wheels W, having their rims grooved and also provided with cross notches or channels X. (See Fig. 3.) Each shaft is likewise pro-

vided with a pair of sprocket-wheels Z, about which pass endless chains *a*, which for the sake of clearness are termed the "paddle-carrying chains." Suitable rollers *b*, carried upon brackets or supports *d*, which in turn are supported upon the cross-bars *e*, resting on the main girders, serve to support the paddle-carrying chains and maintain the upper stretch thereof in a practically horizontal or straight line. This is best seen upon reference to Fig. 2.

Pivotally connected to the paddle-carrying chains is a series of paddles or blades *f*, which by preference are provided with hinged doors or flaps *g*, the purpose of which will be hereinafter pointed out. Each paddle is provided at each end with a pivoted bar or lever *h*, the outer end of the bar or lever being provided with a roller *i*. A slide *j*, carrying at its outer end a fork *k*, is slidably mounted in a suitable box *l*, attached to one face of the paddle. This slide has a pivotal connection with the lever *h* and is actuated thereby, as will be presently described, to bring the fork *k* into engagement with the cable L and the buttons M, carried thereby, or to withdraw the same from engagement therewith.

Extending longitudinally of the wellway and upon each side thereof is a track or way *m*. These tracks are immediately below the stretches of the cables L and serve to hold said cables up against or in contact with the forked end *k* of the slides *j*. A second track *n* extends along the wellway, at the upper part thereof, as will be seen upon reference to Fig. 2, and is so positioned as to hold the levers *h* in their elevated position, and consequently hold the forks *k* up against the upper stretches of the cables L, thereby insuring vertical position of the paddles as they pass along in their inverted position from the stern toward the front of the vessel. In order, however, to disengage these forked ends from the cable as the paddles pass downward around the forward wheels W and into the current, there is provided upon each side of the wellway a runway *o* of the form best illustrated in Fig. 3. Upon reference to said figure it will be seen that the mouth of this runway is in direct alinement with the track *n*, but is provided with a downwardly-inclined portion which serves to depress the roller and the lever *h*, and consequently withdraw the forked end from engagement with the cables and the buttons carried thereby. The runway from this point is concentric with the axis of the shaft V until it reaches a point near the track *m*, at which point it is straightened somewhat and finally passes out parallel with said track, thereby again rocking the levers *h*, and consequently forcing the forked ends into engagement with the cables and stops or buttons thereon. A second pair of runways *p* is provided at the rear of the boat and serves in a like manner to disengage the forks from the cables and when the paddles are carried up serves to elevate the levers and again bring the forks into engagement with the upper stretch of the endless cables.

In order to maintain the paddles in their proper position, and consequently have them come into proper relation with the endless cables and the buttons or stops thereon, each paddle is provided with a finger or arm *q* at each end thereof (see Fig. 4) which passes into one of the notches X of the wheel W and is held in said notch by endless bands or cables *r*, which pass about the same. The rim of the wheel W being grooved or channeled insures a proper holding of the paddles as they pass from the upper side of the shaft to their lower vertical position, and the same operation takes place as the paddles are brought from their lowermost position to the upper stretch of the cable L. Thus it will be seen that the paddles are carried along the upper stretch, are then withdrawn from connection with the cables L, and are passed around the guide-wheels and ways to a point where they are again brought into direct engagement with the lower stretches of the cables L. As the paddles pass from the horizontal position into the current the doors G will open or tend to float, thus permitting the paddles to pass down easily from the horizontal to the vertical position. It will be understood, of course, that as soon as the current acts on the upper face of the door it will close the same and the paddle will present a full face, against which the current may act. As the paddles leave the lower stretch of the cables L the rollers *i* enter the runway *p* and withdraw the forked ends from engagement therewith, as has heretofore been explained. Here again the doors tend to open as the paddles pass from the vertical toward the horizontal, thereby preventing undue strain upon the parts.

Upon the shaft V (see Fig. 1) there is mounted a wheel A^3 of a diameter equal to the wheel Z, while upon shaft J there is mounted a wheel A^4 of the same diameter as the chain or cable wheel K. About these wheels A^3 and A^4 passes a chain or band A^5. This connection serves to maintain the speed or travel of the chains or cables in proper relation to each other and to properly position the paddles between the paddle-carrying chains and the stretches of the outer cables or chains. It also serves to equalize and distribute the strains between the parts.

As will be noted, the girders E and F carry the boxes in which the shafts of the various wheels are mounted. The runways *o* and *p* are secured at their upper ends to guide-plates *o'* and at their lower ends to similar plates *p'*, and the tracks *m* and *n* are also connected to said plates, as best shown in Figs. 3 and 4. Said guide-plates or slides *o'* and *p'* work in conjunction with the guides C and D, which permit the plates to move up and down thereon, but prevent movement of the parts in the direction of the length of the boat. The runways *o p* will likewise be connected to the girders E F, so that the girders,

the runways, and the shafts and wheels which are supported by said girders become, in effect, one integral structure and may be moved up and down in the wellways as desired.

It is of course essential to provide means whereby the paddles may be fully immersed or partially or wholly raised out of the current in order to regulate or entirely stop the operation of the machine. To this end each of the shafts V is provided with bevel-gears A′ B′, arranged upon opposite sides of the girders E F, as will be clearly seen upon reference to Fig. 4. A suitable stand or platform C′ extends out from the girder, and upon said platform is mounted a suitable lever system connected with the gears A′ B′ to slide one or the other thereof lengthwise of the shaft and bring it in operative relation with an intermediate gear D′, rigidly affixed to the upper end of a screw-shaft E′. Said shaft passes through a fixed nut F′, (see Fig. 5,) and as a consequence when the screw is rotated it will be raised or lowered, according as one or the other of the gears A′ B′ is brought into relation with the gear or pinion D′. The upper end of the shaft E′ has a socketed bearing in the girder. (See Fig. 4.) Any form of bearing may be employed in this connection which will hold the parts in proper position and place. A suitable guide G′ is connected to the lower end of the screw-shaft E′ in order to maintain it in its proper working position. From this it will be seen that should it be desired to elevate the paddles slightly or to a position where they would be inoperative, the attendants by simultaneously operating the levers and bringing the proper gear into operative position would thereby cause the screws to elevate the girders E F, bodily lifting the working portions of the apparatus in a vertical direction, and as a consequence withdrawing the paddles from the current. It is assumed, of course, that the machine is in operation when this action takes place, and when the paddles are withdrawn to such an extent that the weight and the friction of the parts equal the force of the current as applied to the paddles the operation of the screws will stop. When the power of the machine is utilized for raising or lowering the paddles, gear P must of course be disengaged from gear O.

If it be desired to entirely withdraw the paddles from the current, a pump H′, Fig. 8, is set in motion to lighten the boat by withdrawing water from the hold thereof. When it is again desired to put the machine in operation, power may be applied to the wheels I to rotate the screw-shaft in a direction to lower the whole device, or water may be let into the hold of the vessel through valve H^2, Fig. 8, to such an extent as to cause the boat to sink to that point where the paddles would come into operative relation with the current. As soon as the paddles are caused to travel the screws can be brought into operation by throwing in the proper gear and the vessel again lightened of its charge of water.

In order to relieve the parts of any strain and, if necessary, to assist in their elevation, I provide a winch or hoisting mechanism I′, from which cables J′ pass over suitable pulleys to the main supporting-girders.

At the forward end of each of the wellways there is preferably provided a gate K′, which may be adjusted so as to deflect the current to a greater or less extent from the paddles. By the use of this gate the movement of the paddles up or down may be obviated to a limited extent.

In Figs. 6 and 7 there is illustrated a modified construction for properly positioning the paddles as they pass from the upper to the lower stretch or from the lower to the upper stretch, as the case may be. Upon the main shaft there is mounted a spider-wheel L′, in which are pivotally mounted a series of arms or levers M′. Said levers carry at their inner ends rollers N′, which bear upon a cam O′, while rollers P′, mounted in the outer ends of the levers, work upon a suitable cam Q′. These cams are so formed as to rock or tilt the levers and bring the forked ends R′ thereof into engagement with the ends of the paddles or blades as they are brought around in line with the runways or guides *o* and *p*. The action of these arms is to grasp the paddles as they pass from the upper stretch down toward the lower stretch and properly present the same to the lower stretch of the endless cable and the buttons carried thereby. As the paddles pass from their working position up around toward the upper horizontal stretch the arms or levers M′ engage the same and hold them properly until they reach the upper stretch and are brought into engagement therewith.

The mechanism just described may be used in place of the equivalent devices heretofore mentioned, or the two may, if desired, be used in conjunction with each other.

In Fig. 9 a modified form of the paddle is shown, where instead of employing the door the paddle is provided with a downwardly-extending portion S′. Said downwardly-projecting portion S′ will extend below the stretches of the chains or cables L, thereby exposing a greater surface to the action of the current.

In Fig. 10 the apparatus is shown in connected or in operative position with a sluiceway or flume, this for the purpose merely of showing the adaptability of the apparatus.

In Fig. 11 there is illustrated a flume T′, containing three of the motors, while a discharge flume or channel U′ is placed to one side thereof. The dotted lines show the gates controlling the channels in an open position, while the full lines show the gates in their closed position. From a mere inspection of said figure it will be noted that all three of the motors may be used at one time, or any two or one thereof may be used independently of the others, or the entire series may be thrown out and the water discharged directly

through the flume or wasteway U'. Exhaust-gates V' are preferably placed in each compartment adjacent to each motor, so that when one compartment is closed against the current it may be drained and repairs made to the apparatus, if necessary.

Suitable spuds or piles A^2 are employed for holding the boat in position against the action of the current. By connecting the boat to them through the use of suitable straps it is permitted to rise and fall with the tide or any variation in the height of the water.

The invention, of course, is susceptible of modification in its details of construction and is not to be restricted to the exact arrangement of parts shown and described.

The terms "cables" and "chains" have been employed throughout this specification in an equivalent sense. In the claims, however, in order to avoid confusion the outer members L have been referred to as "cables," while the inner members *a* have been referred to as "chains." The claims are, however, to be read in a broader sense, as the employment of chains or cables in either position is within the scope of my invention.

Having thus described my invention, what I claim is—

1. In a current-motor, the combination of an endless cable; means for supporting said cable with the lower stretch thereof in a submerged position; a series of paddles mounted intermediate the upper and lower stretches of the cable; and means for bringing the paddles successively into operative relation with the lower stretch of the cable.

2. In a current-motor, the combination of an endless cable; means for supporting the same with the lower stretch thereof in a submerged position; a series of paddles mounted intermediate the upper and lower stretches of said cable; means for bringing the paddles successively into operative relation with the lower stretch of the cable; and means for disengaging the paddles successively as they near the end of the lower stretch of the cable and passing them upwardly and back toward the forward end of the lower stretch.

3. In a current-motor, the combination of an endless cable; means for supporting the lower stretch thereof in a submerged position; a series of paddles; means for successively bringing the paddles into operation with the lower stretch of the cable; means for releasing said paddles as they near the end of the lower stretch; and means for elevating said paddles and carrying them forward toward the forward end of the lower stretch of the cable, substantially as described.

4. In a current-motor, the combination of an endless cable; means for supporting the same with the lower stretch thereof in a submerged position; a series of paddles mounted intermediate the upper and lower stretches of said cable; means for traversing said paddles in a circuitous path intermediate the upper and lower stretches of the cable; means for successively bringing said paddles into operative engagement with the lower stretch of the cable; means for disengaging said paddles therefrom as they near the end of said stretch; and means for bringing the paddles into operative relation with the upper stretch of the cable and moving them therewith toward the forward end of the motor.

5. In a current-motor, the combination of a pair of endless cables; means for supporting the same with the lower stretches thereof in a submerged position; a pair of paddle-carrying chains between the upper and lower stretches of the endless cables; a series of paddles pivotally connected to said paddle-carrying chains; means for causing the successive engagement of the paddles with the lower stretches of the cables; means for disengaging the paddles from said lower stretches; means for elevating said paddles and causing them to engage with the upper stretches of the cables; and means for disengaging the paddles from said upper stretches and carrying them around into proper position for engagement with the lower stretches.

6. In a current-motor, the combination of a pair of endless cables; means for supporting the same with their lower stretches in a submerged position; a pair of paddle-carrying chains mounted intermediate the upper and lower stretches of said cables; a series of paddles pivotally connected to said chains; means carried by said paddles to lock them to the upper and lower stretches of the cables; and mechanism for releasing and locking said means and carrying the paddles from one stretch to the other stretch of the cables.

7. In a current-motor, the combination of a pair of endless cables; means for supporting the same with their lower stretches in a submerged position; a series of buttons or stops attached to said cables; a pair of paddle-carrying chains mounted between the upper and lower stretches of said cables; paddles carried by said chains; levers pivotally connected to the paddles; slides mounted upon the paddles and each connected with a lever; a fork carried at the outer end of each slide; and means for operating the levers and causing the forks to engage the cables and the buttons carried thereby, substantially as described.

8. In a current-motor, the combination of a pair of endless cables; means for supporting the same with their lower stretches in a submerged position; a series of buttons or stops attached to said cables; a pair of paddle-carrying chains mounted between the upper and lower stretches of said cables; paddles carried by said chains; levers pivotally connected to the paddles; slides mounted upon the paddles and each connected with a lever; a fork carried at the outer end of each slide; means for operating the levers and causing the forks to engage the cables and the buttons carried thereby, and means for withdrawing the forked ends from engagement with the

cables as the paddles pass from one stretch to the other of the cables.

9. In a current-motor, the combination of a pair of endless cables; means for supporting the same with their lower stretches in a submerged position; a series of buttons or stops attached to said cables; a pair of paddle-carrying chains mounted between the upper and lower stretches of said cables; paddles carried by said chains; levers pivotally connected to the paddles; slides mounted upon the paddles and each connected with a lever; a fork carried at the outer end of each slide; means for operating the levers and causing the forks to engage the cables and the buttons carried thereby; means for withdrawing the forked ends from engagement with the cables as the paddles pass from one stretch to the other of the cables; and means for holding the paddles in their proper position as they pass from one stretch to the other of the cables.

10. In a current-motor, the combination of a pair of endless cables; means for maintaining the lower stretches thereof in a submerged position; a pair of paddle-carrying chains mounted intermediate the upper and lower stretches of the cables; a series of paddles pivotally connected to said chains; pivoted levers carried by the paddles; means connected to said levers for engaging the stretches of the cables; a track located beneath the upper stretches of the cables to hold the outer ends of the levers in a raised position; runways *o*, *p* mounted in line with said track and serving to control the outer ends of the levers; and means for holding the paddles in their proper position as they pass around in line with said runways.

11. In a current-motor, the combination of a pair of endless cables; means for holding the lower stretches thereof in a submerged position; a pair of paddle-carrying chains mounted intermediate the upper and lower stretches of said cables; a series of paddles pivotally connected to said chains; levers pivotally connected to the paddles; means connected to said levers for engaging the stretches of the cables; tracks mounted below the upper stretches of said cables; runways *o*, *p* in line with the ends of said tracks and arranged to control the outer ends of said levers as the paddles near the end of the upper and lower stretches respectively; and means for properly maintaining the paddles as they pass around through said runways.

12. In a current-motor, the combination of a pair of endless cables; means for maintaining said cables with their lower stretches in a submerged position; a pair of paddle-carrying chains mounted intermediate the upper and lower stretches of said cables; a series of paddles pivotally connected to said chains; means for connecting the paddles successively to the upper and lower stretches of the cables; means for withdrawing the connections intermediate said paddles and the cables as the paddles pass from one stretch to the other; arms extending out from the paddles; notched wheels designed to receive said arms; and endless cables passing about said wheels holding the arms in the notches as the paddles pass from one stretch of the cable to the other.

13. In a current-motor, the combination of a pair of endless cables; means for supporting the same with the lower stretch thereof in a submerged position; a pair of paddle-carrying chains mounted between the upper and lower stretches of the endless cables; a series of paddles pivotally connected to said paddle-carrying chains; means for causing the successive engagement of the paddles with the lower stretches of the cables; means for disengaging the paddles from the ends of said lower stretches; and connections intermediate the supports for the cables and the chains.

14. In a current-motor, the combination of a suitable support; a pair of shafts located one at each end thereof; a pair of wheels carried by each shaft; endless chains or cables passing about said shafts; a second pair of shafts mounted on the support intermediate the first pair of shafts; a pair of wheels carried by each of said second pair of shafts; endless chains passing about said wheels; a series of paddles pivotally connected to said chains; means for causing the paddles to successively engage the lower stretches of the cables; and a wheel A^3 carried by one of the intermediate shafts; a wheel A^4 carried by the adjacent shaft of the outer pair; and a driving connection passing about said wheels.

15. In apparatus of the class described, a current-motor comprising a pair of cables, paddles mounted upon one of the cables and having detachable connections with the other cable, and connections between the cables for causing them to move in unison and maintain the paddles in fixed relation thereto while said paddles are connected to both cables.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM L. WALTER.

Witnesses:
HORACE A. DODGE,
BERTT H. BROCKWAY.