(No Model.)

3 Sheets—Sheet 1.

N. YAGN.

HYDRAULIC MOTOR.

No. 273,930. Patented Mar. 13, 1883.

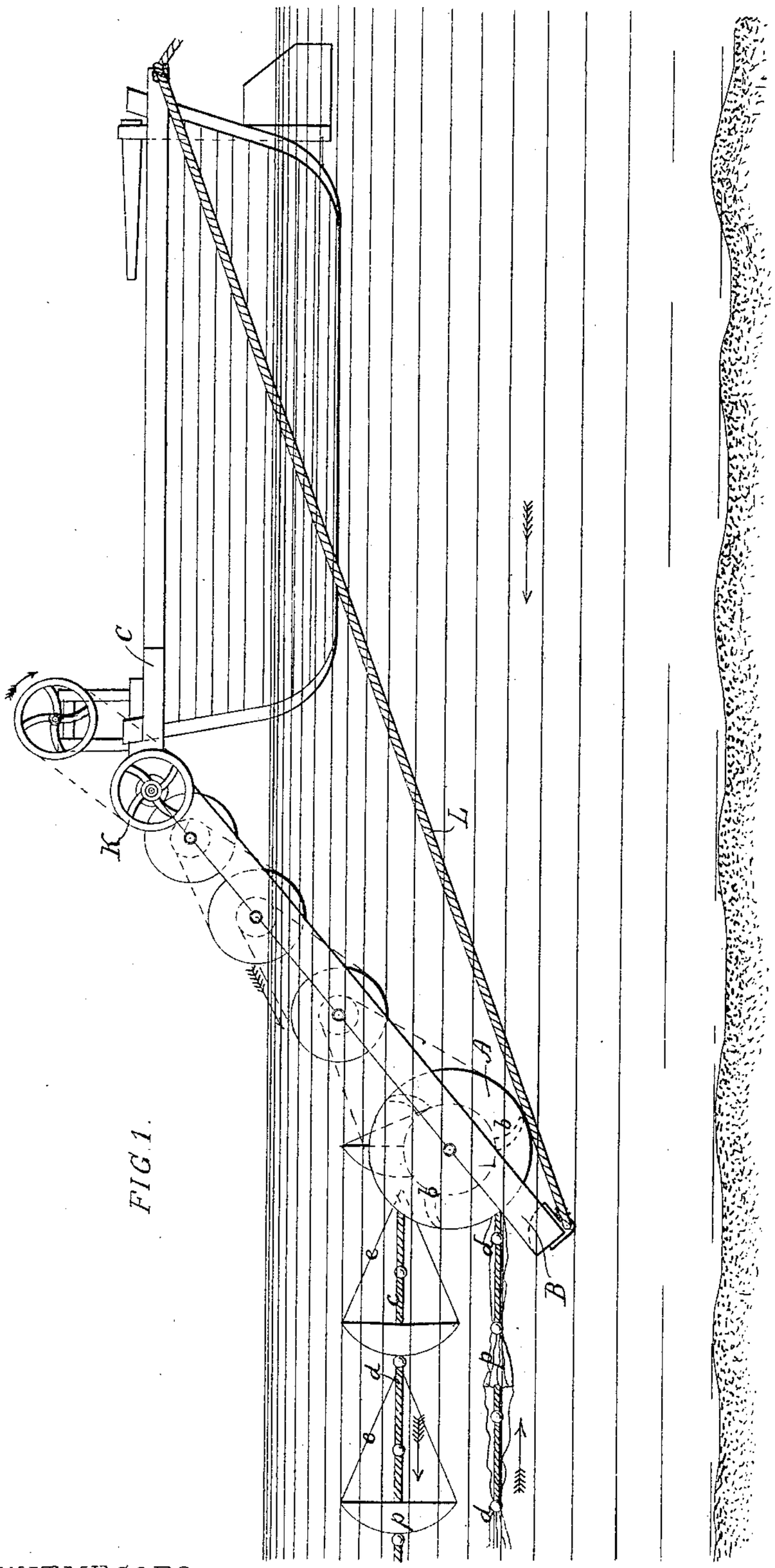

FIG. 1.

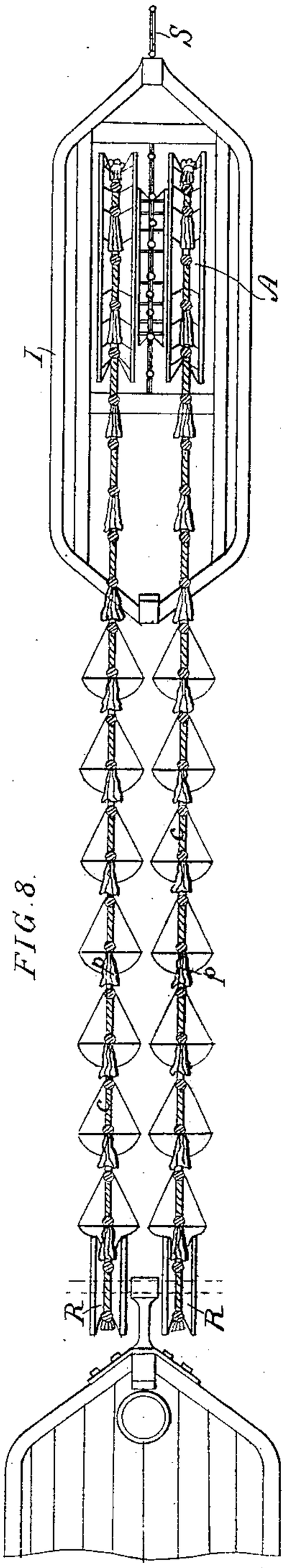

FIG. 8.

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by his Attorneys

Howson & Sons

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3 Sheets—Sheet 2.

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FIG. 2.

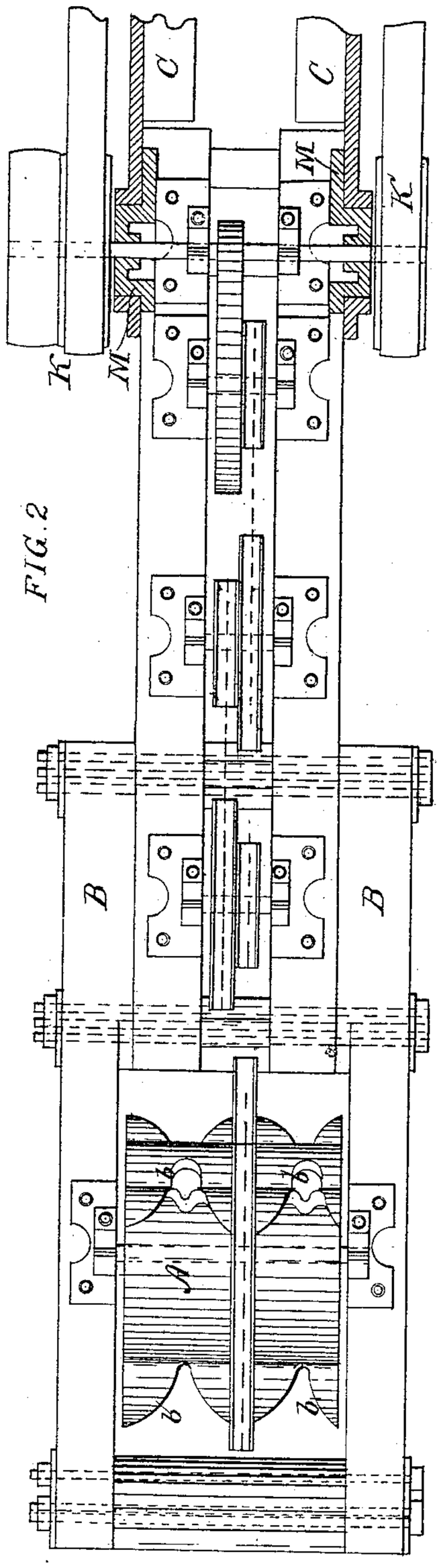
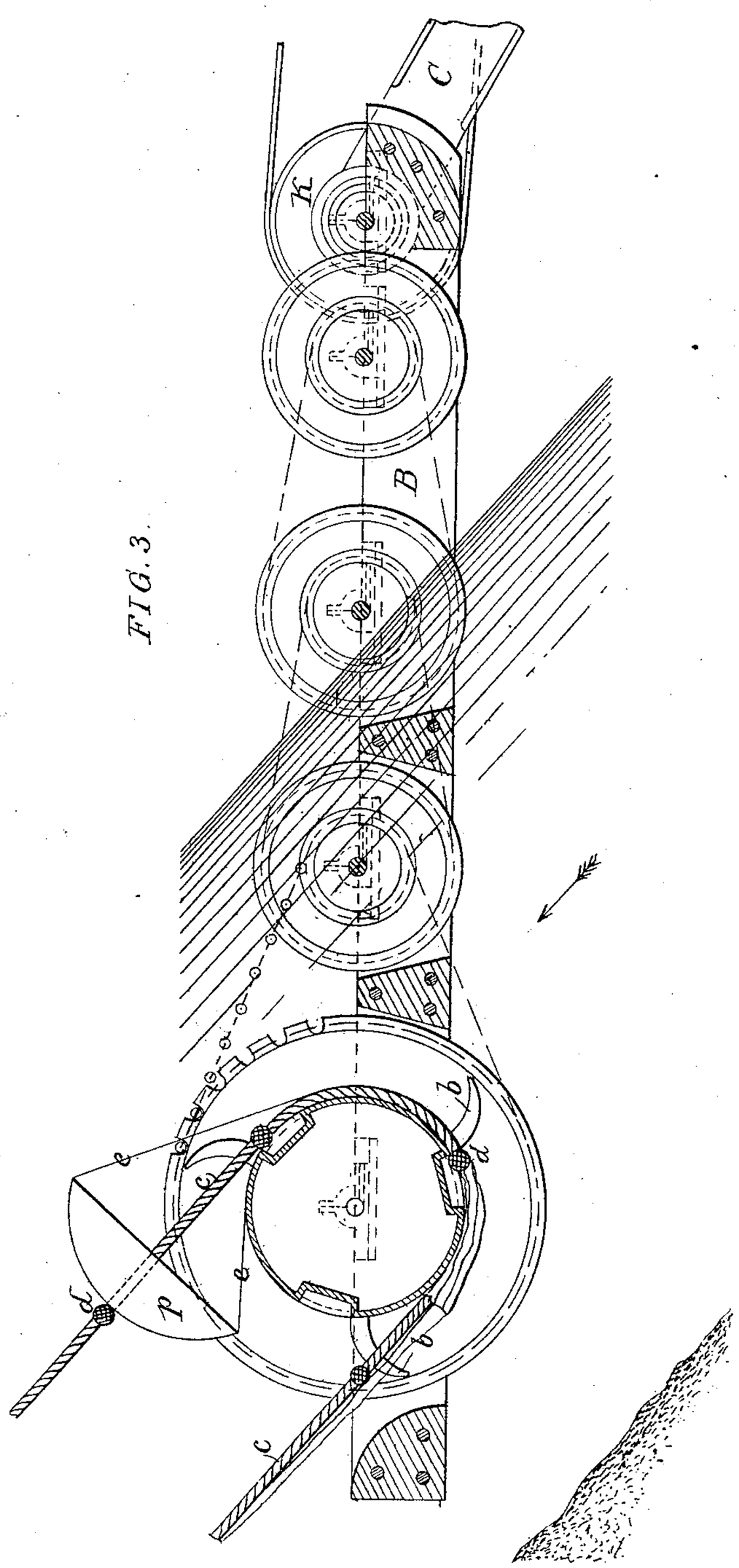


FIG. 3.



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(No Model.)

3 Sheets—Sheet 3.

N. YAGN.

HYDRAULIC MOTOR.

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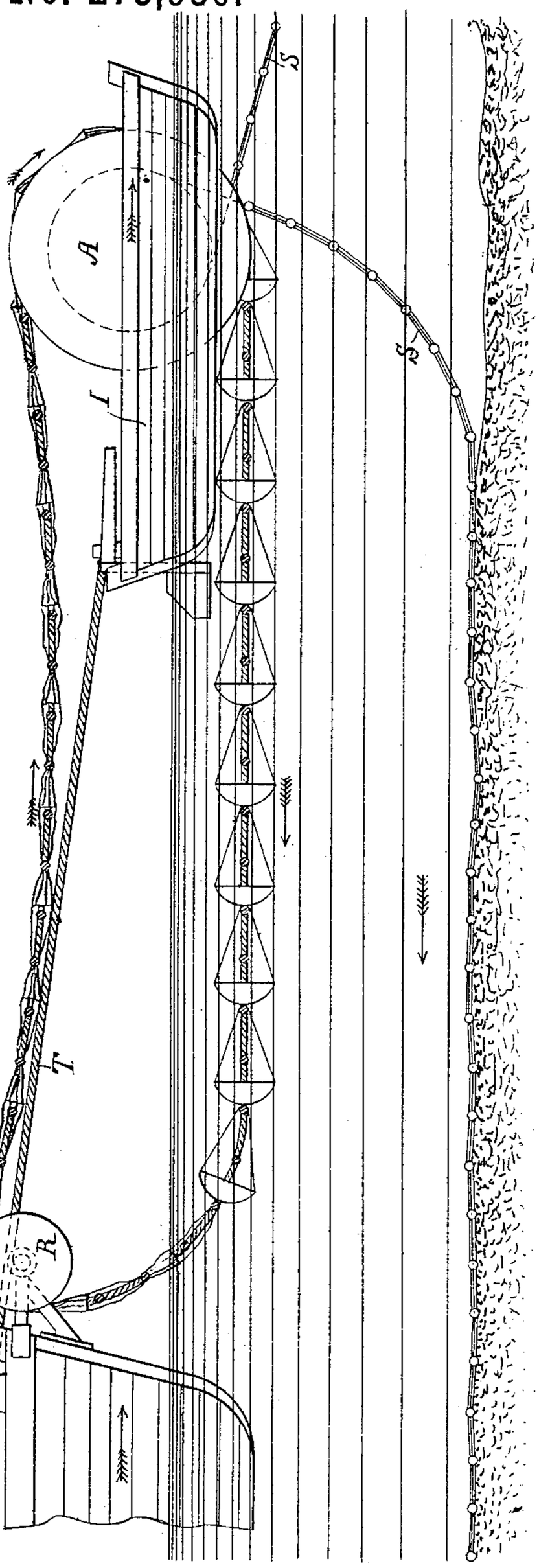

FIG. 7.

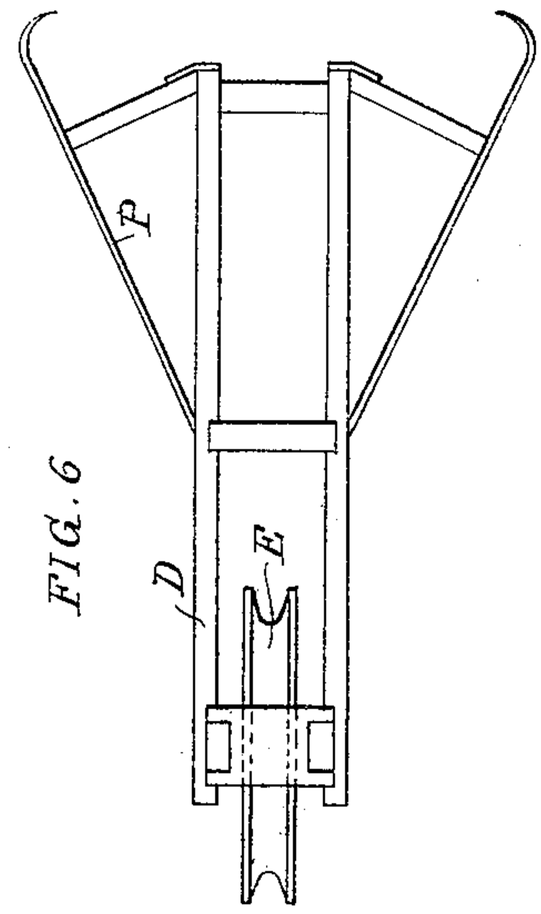

FIG. 6

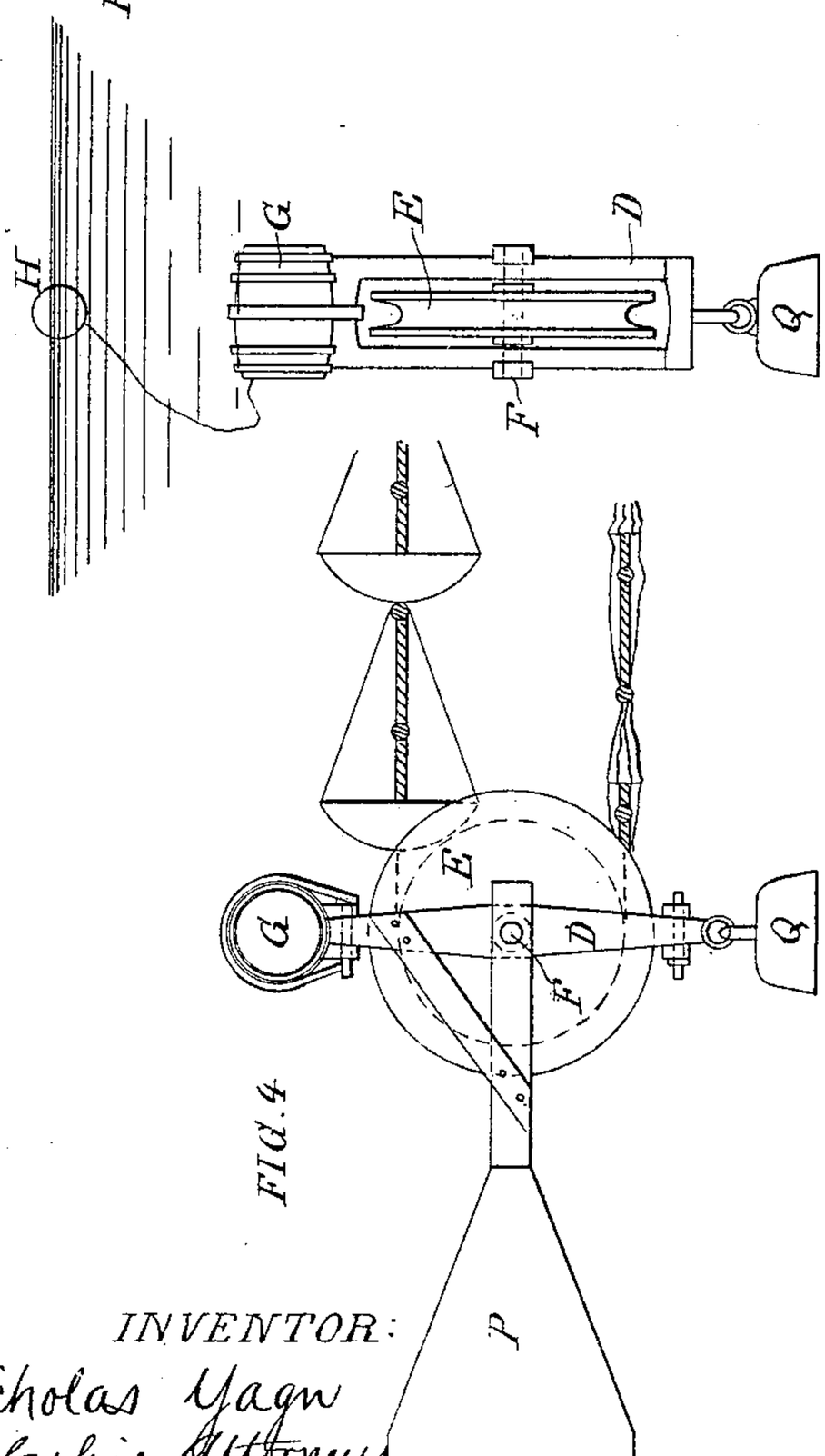

FIG. 5

FIG. 4

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by his Attorneys

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UNITED STATES PATENT OFFICE.

NICHOLAS YAGN, OF ST. PETERSBURG, RUSSIA.

HYDRAULIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 273,930, dated March 13, 1883.

Application filed August 14, 1882. (No model.)

To all whom it may concern:

Be it known that I, NICHOLAS YAGN, a subject of the Czar of Russia, and a resident of St. Petersburg, Russia, have invented certain Improvements in Hydraulic Motors, of which the following is a specification.

The object of my invention is to construct a simple and strong apparatus for utilizing the power of the currents of rivers for mechanical purposes; and this object I attain as hereinafter more fully set forth.

In the accompanying drawings, Figure 1, Sheet 1, is a side view of sufficient of my improved motive-power apparatus in position for use to illustrate my invention. Fig. 2, Sheet 2, is a enlarged plan, partly in section, of a portion of the apparatus; Fig. 3, a vertical section of the same; Figs. 4, 5, and 6, Sheet 3, views of a device which may be employed in connection with the foregoing. Fig. 7 is a side view of my apparatus as applied for utilizing the power of the current for towing barges against the stream; and Fig. 8, Sheet 1, a plan view of the same.

My motive-power apparatus is carried by a boat, vessel, or float, which is to be anchored out in the stream whose current is to be utilized. For this purpose the bow or stern of the boat is provided with a pair of beams, C C, having bearings to which are adapted the journals M M of a frame composed of two parallel beams, B B, which, in practice, may, for instance, be from six to nine meters long. In bearings at the opposite end of these beams is mounted the drum A, over which passes the endless flexible rope or ropes *c*, furnished with flexible and collapsible parachutes or flaps *p*, as hereinafter described, for imparting rotary motion to the drum A. This drum has formed on it a central sprocket-wheel, whereby its motion may be transmitted through chains and chain-wheels and cog-wheels on the frame or beams B B to the shaft which carries the driving-pulleys K K, as shown in Figs. 1 and 2. From these pulleys K the motion may be conveyed to any suitable point where it is needed. The drum A is provided with a number of forked projections, *b b*, where the endless ropes *c* are to pass around it, and on these ropes are formed, at corresponding intervals, knots *d d*, which take into the forks or recesses of the projections, as indicated in Fig. 3. These knots may be produced by intertwining strong cords into the ropes and winding such cords around the ropes. At every knot or at every second knot on the rope is attached a parachute, *p*, of sail-cloth, the rope passing through the center of each parachute, which has its circumference connected at different points to the rope by means of, say, four or six bracing-strings, *e e*, so that when the parachutes are distended by the current, as shown on the upper portion of the rope in Fig. 1, they will not be liable to turn inside out. To give to the distended parachutes a more regular form four, six, or eight wooden ribs or canes can be fixed to them radially from the center where the rope passes through, although this is not necessary, and I prefer generally to dispense with them. The length of the ropes, as well as the strength, number, and size of the parachutes *p*, may be varied, according to the amount of power to be obtained. The end of each rope *c* away from the drum A passes over a grooved pulley, E, mounted in an independent floating frame, D, such as indicated in Figs. 4, 5, and 6.

In motive-power apparatus of this class, as usually constructed, chains with rigid paddles are used, and both drums over which the endless chains pass are mounted in the same frame or in connected frames; but in my apparatus it will be seen that I dispense with this frame, the frames of the drums being unconnected, except through the rope itself, and the parachutes, as well as the ropes, are entirely flexible and adapt themselves to the current and to the pulleys or drums over which they pass. Hence the force of the current will always keep the rope taut and prevent its becoming entangled, while accommodating itself more readily to the direction of the current. At the same time this construction takes up less room and presents fewer obstacles to the motion of passing boats or vessels, because it can be sunk to a suitable depth out of the way by adjusting the angle of the beams B, Fig. 1, by means of the rope L; or, when the rope *c* is left near the surface, it will readily yield to the passage of the vessel. To prevent any liability of the ropes *c* to torsion, it is advisable to make them of several strands twisted in different directions, or to use braided ropes.

The floating frame D, which carries the outer pulley or drum, may be of any suitable con-

struction, but I prefer the form shown in Figs. 4, 5, and 6. The frame is a rectangular frame, having bearings for the axles F of one or more pulleys, E, and to the upper part of the frame may be secured a buoy or other suitable float, G, to increase the buoyancy of the frame, while a weight, Q, secured to the lower end of the frame insures that the frame, will be kept upright and steady, and prevent any capsizing. An indicating-float, H, on the surface of the water, may be connected by a cord or rope to the float G, in order to facilitate the raising of the frame D, when desired, for inspection or removal. The frame may also be provided with fins or wings P, preferably at an angle so as to form a wedge with its faces in vertical planes, thereby contributing to the stability of the frame D, and adding to the tendency to keep the ropes perfectly taut. There should of course be sufficient space between the grooved pulleys E and the cross-bars of the frame D for the free passage of the parachutes.

As one-half of the parachutes on the rope or ropes *c* have their mouths open to the current, they will be distended and driven with considerable force or power in the direction of the current, while the other parachutes, whose mouths are down the river, fold together and return against the stream with little impediment, the parachutes being successively opened out or distended as they pass over the drum A, and closed at the other end as they pass over the pulley E. Thus an uninterrupted rotary motion of the drum A is produced, and this is transmitted from the latter by suitable gearing and belting to the point where desired, either ashore or afloat.

It has been found by actual test that with a rope two hundred and forty meters long, and a speed of current of one meter per second, the described apparatus can develop forty horse-power, after deducting the friction.

My apparatus may also be applied to the towing of barges against the stream, as indicated in Figs. 7 and 8. In this arrangement I employ a small but strong vessel, I, in which is mounted the drum A, provided with three grooves, whereof the two outside ones for the endless ropes with parachutes are of the same diameter, while the intermediate groove is in the form of a chain-wheel of smaller diameter. The outer grooves have the same forked projections for the knots of the ropes as do those on the drum A, Fig. 1. The drum A is mounted in bearings in an open portion of the boat I, so as to project down into the water through the bottom of the vessel, the rest of which is separated from this "well" by water-tight walls. I prefer to sink the drum to about 0.5 meter below the vessel's bottom. The parachute-ropes which pass over the two outside pulleys pass over pulleys R, secured to the bow of the vessel to be towed, and these ropes may also act as towing-ropes between the boat I and the barge; or a separate tow-rope, T, may be employed. Around the chain-wheel portion of the drum A is passed the towing-chain S, which lies on the bottom of the river and is secured by an anchor or other suitable means. The towing-chain, with anchors, can be brought forward, as is done with towing or capstan steamers; or it may be laid along the whole length of the navigation-line.

The action of the apparatus is as follows: One-half of the parachutes of the endless ropes are distended by the current and carried forward with considerable force, as before described. This tends to impart rotary motion to the drum A in the direction of its arrow, Fig. 7, while the action of the current on the towed vessel tends to pull the boat I back and through the chain S to turn the drum A in the reverse direction; but as the diameter of the portions of the drum over which the ropes pass is greater than that over which the chain S passes, the drum A will be turned in the direction of its arrow and wind up the towing-chain.

Instead of having a separate towing-boat, I, the drum A may be mounted on the barge itself; or two drums may be used, one on each side of the barge, the parachute-ropes extending along the side of the barge and passing over floating pulleys, as before described.

I claim as my invention—

1. The combination of the pulleys or drums of a water-motor with an endless flexible cable or rope having secured thereto flexible collapsible parachutes, through the centers of which the rope passes, substantially as set forth.

2. The combination of an endless cable having parachutes with drums or pulleys, over which said cable passes, and independent floating frames for said drums, connected with each other only by said cable, substantially as set forth.

3. The combination of a floating vessel and a frame, B, pivoted thereto and carrying gearing, with a drum, A, mounted on said frame, an endless parachute-rope, *c*, and an independent frame carrying a pulley over which the other end of the rope passes, substantially as described.

4. The combination of a frame, B, a drum, A, and an independent frame, D, carrying a pulley, and wings P, with an endless parachute-rope passing over said drum and pulley.

5. The combination of a frame, a drum, A, and an independent frame, D, having a pulley, a float, G, and a weight, Q, with an endless parachute-rope passing over said drum and pulley, as and for the purpose set forth.

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

NICHOLAS YAGN.

Witnesses:
FREDERICK KAUPE,
LEWIS VOSS.