(No Model.)

4 Sheets—Sheet 1.

A. DE SOUZA.

SYSTEM FOR UTILIZING WAVE POWER.

No. 335,113. Patented Feb. 2, 1886.

FIG. 1.

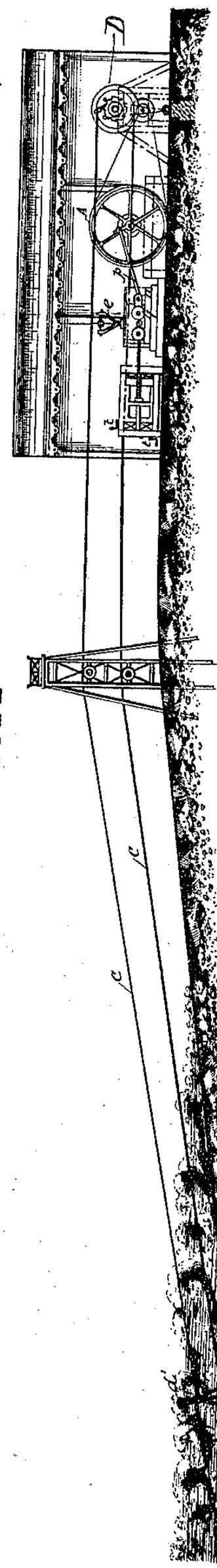

FIG. 2.

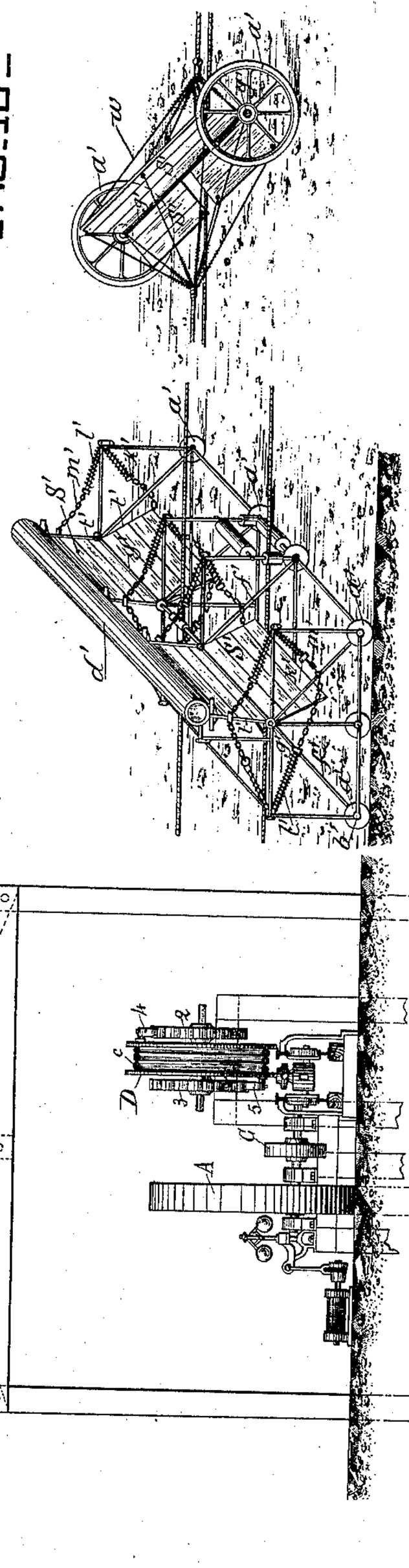

FIG. 5.

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Inventor:

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SYSTEM FOR UTILIZING WAVE POWER.

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FIG. 3.

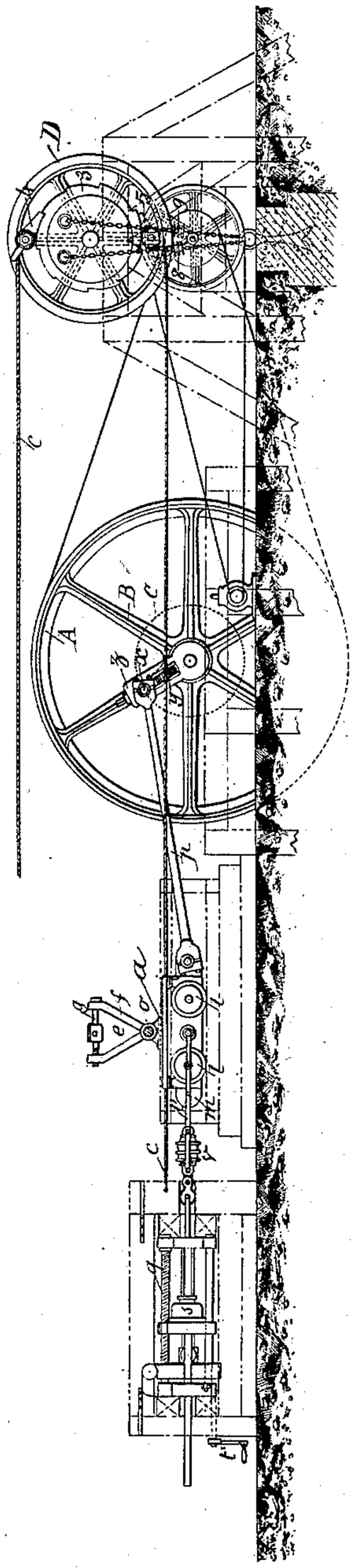
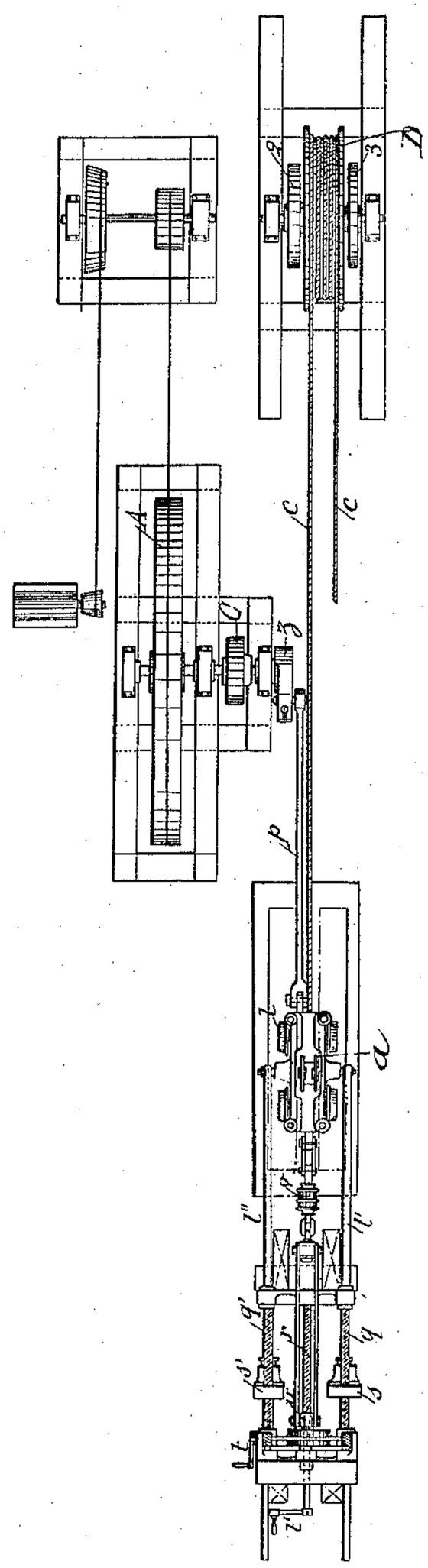


FIG. 4.



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SYSTEM FOR UTILIZING WAVE POWER.

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FIG. 6.

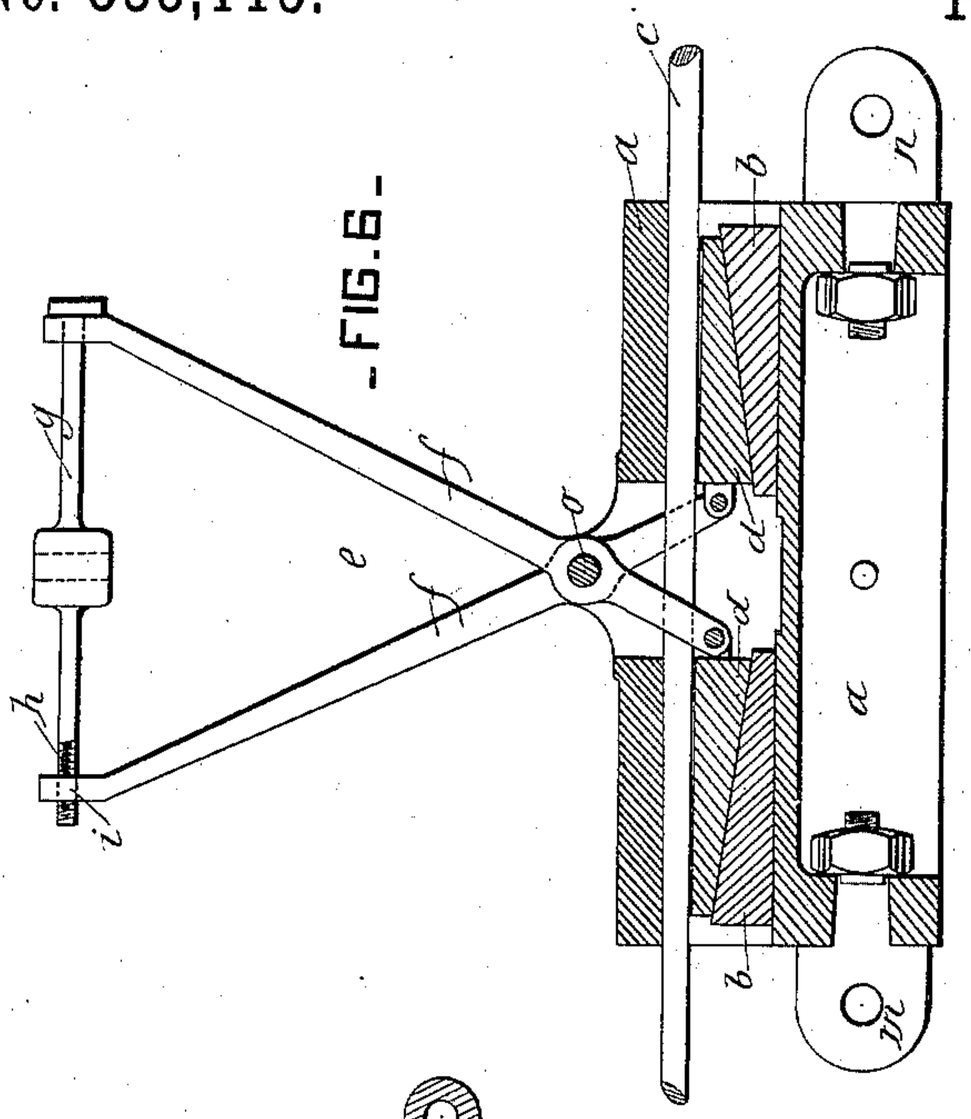


FIG. 7.

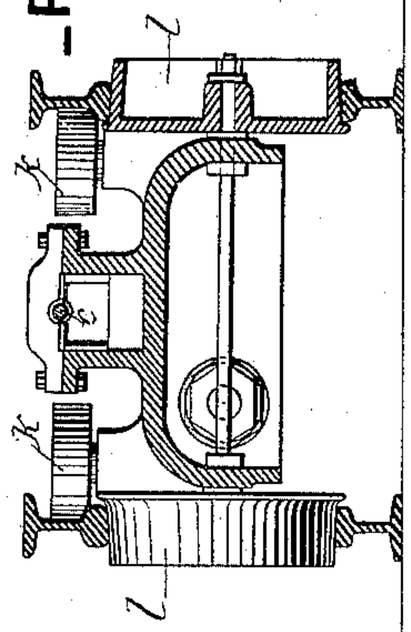


FIG. 9.

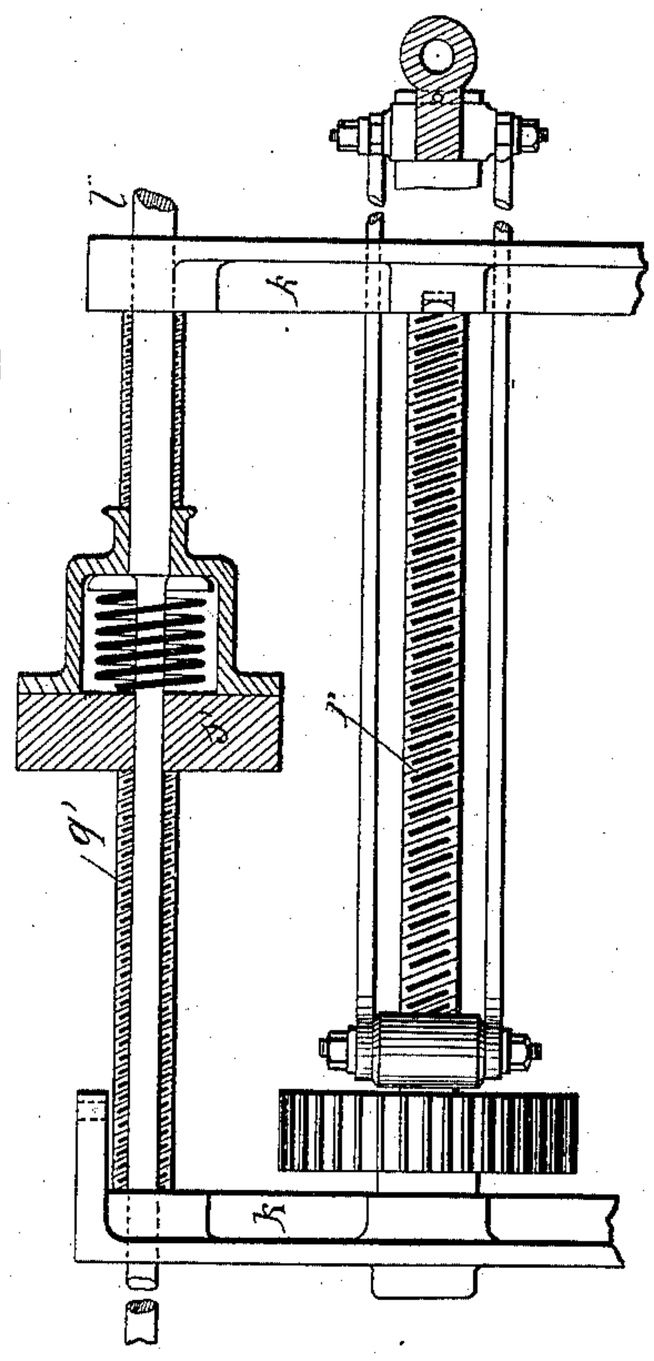
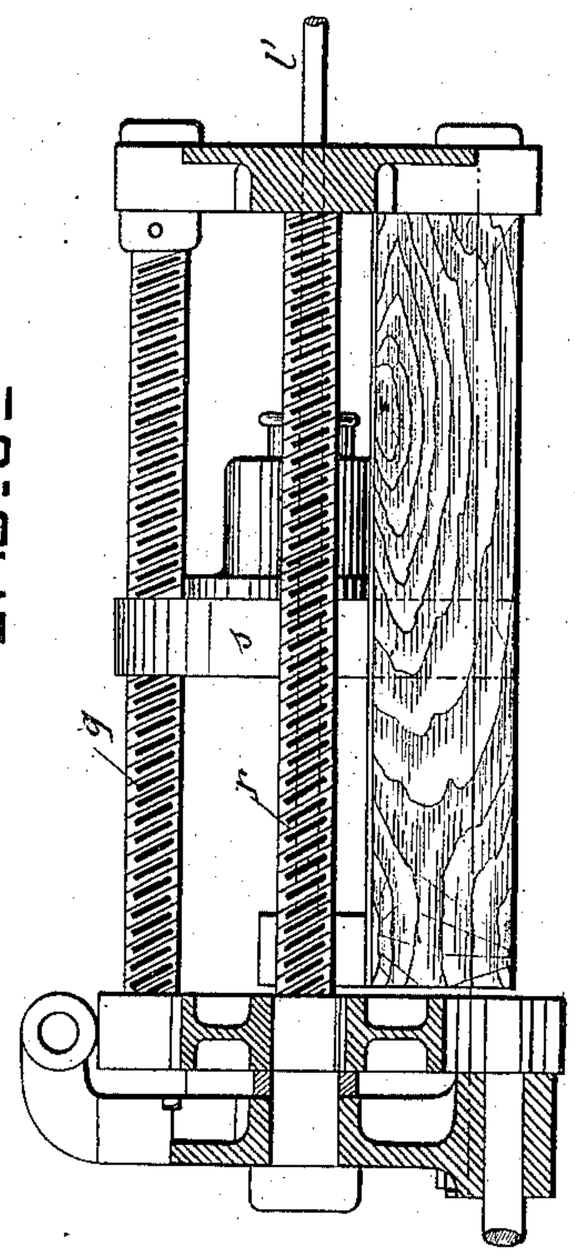


FIG. 8.



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SYSTEM FOR UTILIZING WAVE POWER.

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FIG. 13.

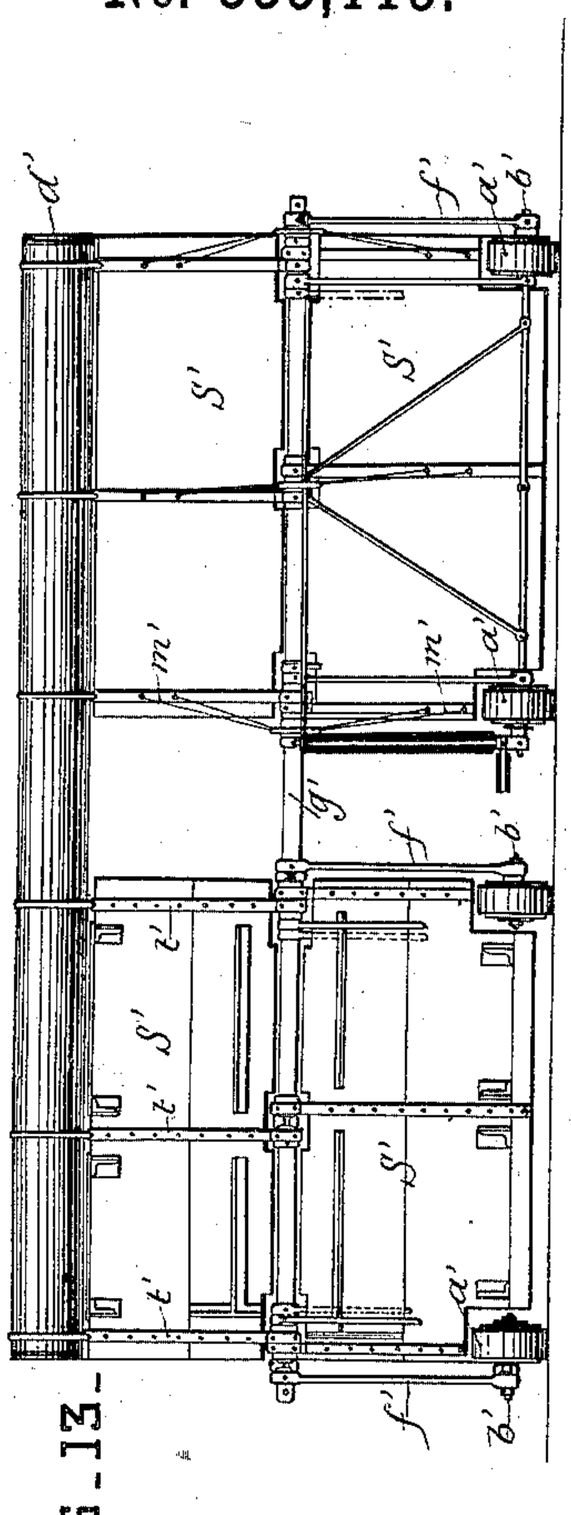


FIG. 14.

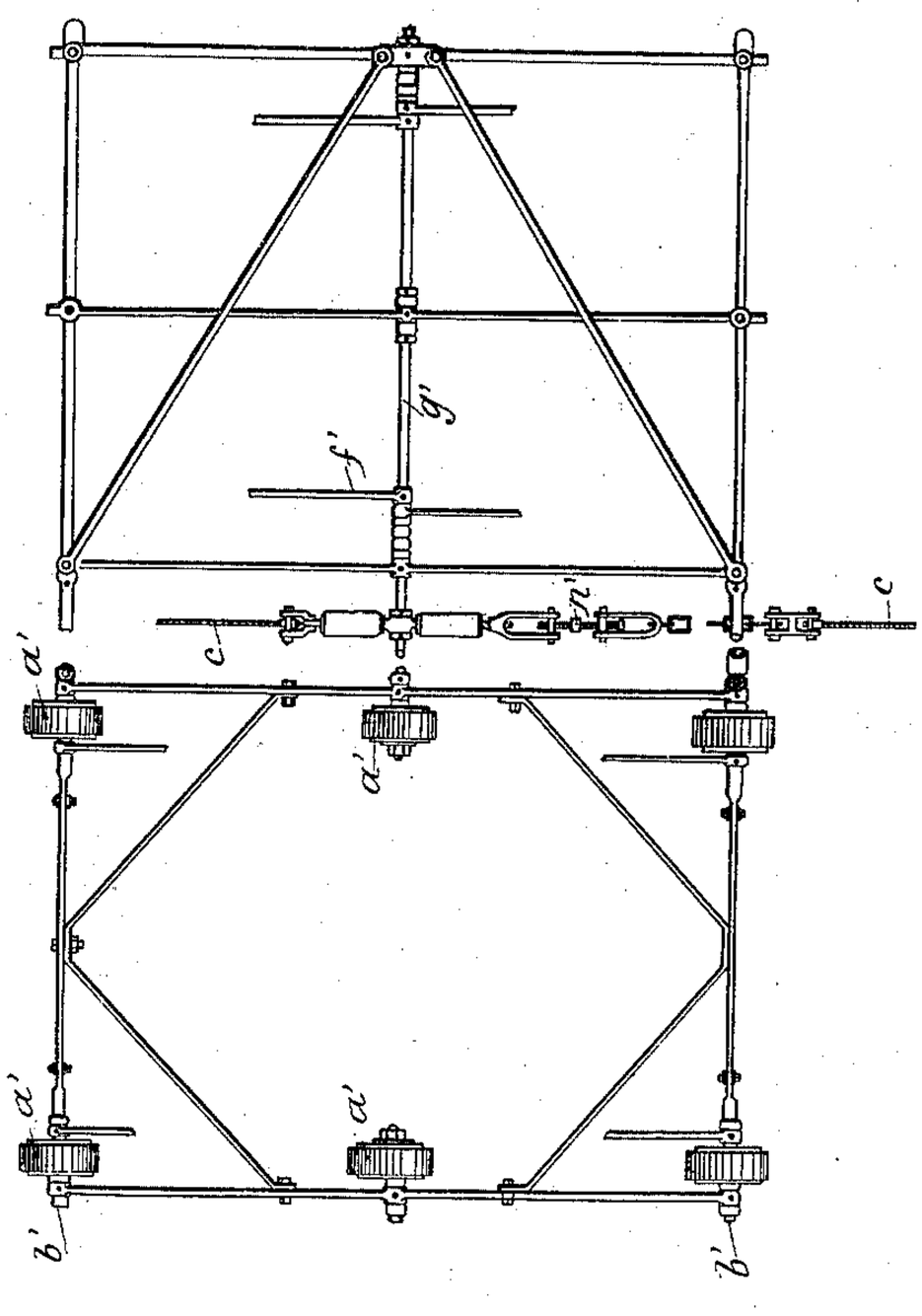


FIG. 12.

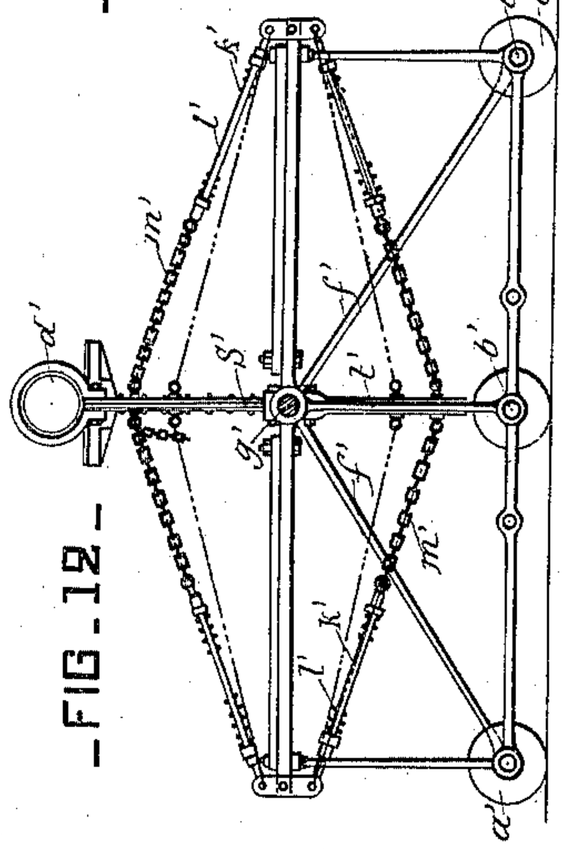
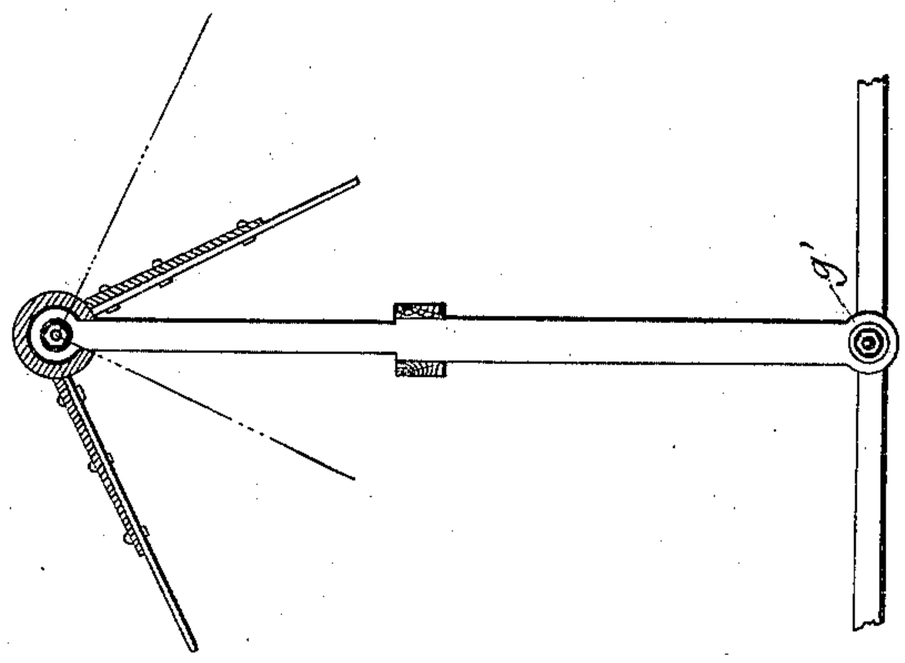


FIG. 11.



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UNITED STATES PATENT OFFICE.

ANTOINE DE SOUZA, OF PARIS, FRANCE.

SYSTEM FOR UTILIZING WAVE-POWER.

SPECIFICATION forming part of Letters Patent No. 335,113, dated February 2, 1886.

Application filed November 7, 1885. Serial No. 182,101. (No model.) Patented in France August 17, 1882, No. 150,661; in England November 4, 1882, No. 5,276, and in Belgium November 6, 1882, No. 59,446.

To all whom it may concern:

Be it known that I, ANTOINE DE SOUZA, of the city of Paris, France, have invented a new and useful improved system for utilizing wave-power and applying the same to electrical and other purposes, of which the following is a full, clear, and exact description, and for which I have obtained Letters Patent in France for fifteen years, dated August 17, 1882, No. 150,661; in Belgium for twenty years, dated November 6, 1882, No. 59,446; in England for fourteen years, dated November 4, 1882, No. 5,276, of which the following is a specification.

My invention relates to the utilization of wave-power more particularly for the production and storage of electricity.

According to this invention the ever varying to-and-fro movements of the waves are applied for the production of power, which may be stored by any suitable mechanical means, or in other manner.

My invention is based on the following, viz: first, reception by suitable apparatus of the power produced by the movements of the waves both backward and forward; second, action of these apparatus which perform the part of pistons upon machines connected therewith by any suitable means of transmission capable of adapting itself to the irregular movements of the waves and tides; third, application of the motive power produced for actuating powerful electrical accumulators or for performing any other work desired.

Before describing the apparatus by which the invention is carried out in practice I would remark that I intend to limit myself to a description of the principle involved and of some essential arrangements independent of the main conditions on which the apparatus would be established, which would vary according to the position of the apparatus, &c. The construction of the apparatus would also necessarily vary to suit each particular application, the degree of strength of the tides, and the kind or amount of power to be produced.

The principle on which the apparatus is constructed will be readily understood by reference to the accompanying drawings, which, however, are given by way of example only.

Figure 1 represents a side view of the apparatus placed on a nearly flat shore. Fig. 2 is a perspective view of the carriage and surfaces on which the waves act. Fig. 3 is a side view of the transmission apparatus. Fig. 4 is a plan, and Fig. 5 an end view, of the same. Fig. 6 is a detail longitudinal section of part of the same, the section being taken along the center line of the cable *c*. Fig. 7 is a detail cross-section through the center of a pair of wheels, *l*. Fig. 8 is an elevation, and Fig. 9 a plan, of part of a regulating apparatus. Fig. 10 shows in perspective the means for attaching the cable and a modified construction of the carriage-framing. Fig. 11 illustrates the mode whereby extra flaps or wings can be mounted upon the last one of the main flaps. Fig. 12 is an end view of the apparatus against which the waves act, and Fig. 13 a side elevation of the same. Fig. 14 is a plan showing the two upper and lower frames.

The same letters of reference represent the same parts in all these figures.

The waves act against the vertical surfaces hereinafter described, the same being mounted upon a carriage, and the motion produced is transmitted to the machinery by a cable, the one part of which is attached to the carriage while the other passes freely between friction-rollers. The carriage, Figs. 12, 13, and 14, is furnished with rollers *a'*, which travel either upon the ground or upon rails supported upon the bed of the sea.

The carriage may be constructed of iron, wood, or other material sufficiently light to allow of the weight being counterbalanced by the pressure of the water. For this purpose floats may be added to facilitate the ascent of the carriage up a sloping beach by reducing the dead weight when the carriage is in shallow water. The tension of the cable is sufficient to keep the carriage in line, as there is but little tendency to lateral movement.

Description of the receiver or carriage.—The flaps S', Fig. 2, formed of strips of sheet-iron or wood, are supported between uprights *t'*, and capable of oscillating on their axes *g'*, their motion being limited in both directions by chains *m'* and springs *l'*, mounted on rods *k'*. The springs serve to lessen the shock of the flaps and regulate their action. The axles

b' of the wheels a' carry the diagonal tie-rods f', whose upper ends serve to support the spindle g' of the flaps.

d', Figs. 2, 12, and 13, represents a float.

The flaps S′ may either have smooth faces, as shown, or may be perforated to reduce or suitably corrugated to augment, if desired, the power of the water on the flaps.

Additional flaps may be hinged, as shown in Fig. 11, above the flaps, before described, to increase the surfaces against which the waves act.

n', Fig. 14, represents a screw-coupling for tightening the cable c.

The carriage may be attached to one strand of the cable c by converging tie-rods w, Fig. 10, this arrangement being adopted for the sake of lightness; or the upper strand of the cable may be secured to a sleeve surrounding the spindle g', as in Figs. 2 and 14. On shore the two ends of the cable are wound around a drum, D, and in sea the cable is laid around a wheel, A^2, which is hung in an anchored framing. The carriage being secured to the cable travels with it. The flaps, when struck by the waves, move it, but, being hinged, all shocks are avoided.

The receiving apparatus comprises three distinct parts, viz:

First. An apparatus which follows the movements of the cable and transmits them to mechanism by which the alternate motion of the cable is converted into continuous rotary motion. In this example the conversion of movement is shown as being effected by means of a transmitter or slide actuating a connecting-rod and crank.

Second. An apparatus for limiting and regulating the motion.

Third. An apparatus for enabling the machine, which receives the action of the flaps, to follow the rise and fall of the tide.

I will describe each of these apparatuses separately, and also show the connection existing between them in the normal working of the machine.

Description of transmitter.—The transmitter or slide serves, as above mentioned, to follow the movements of the cable and transmit them to suitable mechanism, and is constructed in such manner as to enable it to release the cable at the desired moment, to allow of the tidal apparatus acting freely on the apparatus which receives the impulse of the waves. For this purpose a, Fig. 6, is a cast-iron frame provided with inclined surfaces b, by which it may be clamped upon the cable c, by means of wedges d, operated by a clutch, e, formed of a pair of levers, f f, jointed together at o and connected at their upper ends by a bolt, g, the screwed end h of which passes through a screw-socket, i, on the end of one of the levers. The position of the clutch e is indicated in Fig. 1 and also in Fig. 3. The lower end of each lever f is jointed to a wedge, d, so that by drawing the long ends of the levers toward each other by means of screw-bolt g the short ends of the lever will be expanded and force the wedges d apart up the inclined surfaces b, and thus firmly clamp the cable c between them and frame a. The frame a is carried on vertical wheels l, (see Figs. 3, 4, and 7,) running on a double line of rails; and it is also provided with horizontal rollers k, which guide it in a transverse direction, running upon the webs of the upper line of rails.

l' l'', Fig. 4, are two rods mounted upon a cross-shaft of frame a, for connecting the transmitting-apparatus to the stop mechanism. m is a lug serving as an additional means of connection, and n is a lug on the opposite end of frame, to which the connecting-rod p is attached.

The special means employed in connection with these apparatus for converting the reciprocating motion into continuous rotary motion will be hereinafter described.

Stop Mechanism.—As before mentioned, the stop mechanism is intended to limit and regulate the action of the transmitter. It is composed of a framing in which are mounted three screws, q q' r, Figs. 3, 4, 8, and 9, upon the two first of which are mounted two spring-boxes, s s', forming nuts. The rods l' l'', which connect the transmitter to the stop mechanism, pass through these boxes and have shoulders formed thereon, which bear against the springs in the boxes s s' and arrest and limit the motion in one direction, while the part v limits the motion in the other.

The position of the spring-boxes s s' may be regulated by the screws q q', which may be operated in any suitable manner, the adjustment being effected in the example shown with the aid of a screw, r, and toothed gear operating both screws simultaneously by means of the winch-handle t. One of these gear-wheels is shown in Figs. 8 and 9. The two others have been omitted from the drawings, but it will be readily understood that each screw q q' carries such a wheel in gear with that on screw r.

Upon the screw r, which is operated by the winch-handle t, is mounted a nut, u, which is rigidly connected by rods to a spring, v, attached to the lug m on transmitter.

It will be readily understood that the parts s s' u being suitably regulated, according to circumstances and the power of the flaps, the extent of the reciprocating motion of the transmitter or carriage a will be limited or cushioned by spring v and the two springs contained in boxes s s'.

Fly-Wheel and Crank.—As before mentioned, the lug n on the transmitter serves for attaching the head of connecting-rod p, the other end of the rod being pivoted on the nut x of a screw, y, which is mounted in a slot in the crank z, said slot forming also a guide for nut x. This arrangement permits of varying the radius of the circle described by the crank-pin, which should be proportionate to the stroke of the transmitter, which is in turn limited by the stop mechanism, the two mo-

tions being similar in extent. The motion of the nut *x* upon screw *y* in both directions may be rendered automatic by placing a star-wheel on the head of the screw or otherwise. The fly-wheel A, which also serves as a band-wheel, is of the ordinary kind, except that the arm B may be provided with weights fitted to slide thereon, in order to increase or reduce the power; but this I do not claim. The band from the fly-wheel transmits the motion to the dynamo-electric machine by means of any suitable arrangement of band gear. The fly-wheel is connected to the crank by a coupling, preferably that known as a "Pouyer-Quertier" coupling, C, so that it will always turn in the same direction, even when, owing to the movement of the waves being of less extent than the regular stroke, the crank would only describe a fraction of a revolution.

Description of Tidal Apparatus.—This apparatus serves, as before mentioned, to enable that part of the system which receives the impulse of the waves to follow the movements of the tide. For this purpose the two wedges *d* must be released by closing together the arms *f* of the clutch before described. The cable, which has both ends secured to and is wound several times around the drum D, is then held by one of two oppositely-toothed ratchets, 2 and 3 and pawls 4 5, the oscillating motion being finally arrested by the buffers 8 9. The parts being thus arranged, in order to lower the apparatus and follow, for example, a falling tide, the pawl 4 is raised to allow the drum upon which the ratchet-wheels are keyed to turn in the desired direction, while it is prevented from turning in the reverse direction by the pawl 5, which is still engaged with its ratchet. When the carriage has arrived at a suitable position, the pawl 4 is again thrown into gear, the clutch of transmitter re-attached to the cable, and the motion of the waves again transmitted through the entire system. If desired, this movement may be gradually assisted by slackening by degrees the screw-springs *s s'* of the stop mechanism, which would bring the slide *a* to a stop at the commencement of this operation.

To follow a rising tide, pawl 4 remains in place and pawl 5 is released, the same operations being repeated, as above described. The cable being attached by one strand to the movable receiving apparatus having the flaps, is, when the latter is moved in shore or toward the sea, moved, and thereby turns the drum D, to which its ends are secured. As the cable connects by one strand with the transmitter or carriage *a*, this is moved with it; but the regulating-springs *s*, *s'*, and *v*, regulate and temper the motion of the said transmitter so as to avoid shocks and starts. The transmitter, by its connection with the crank Z and fly-wheel A, revolves the latter.

The pawls 4 5 of the tidal apparatus control the direction in which the cable is permitted to be unwound from and wound upon the drum D during the motion of the receiving apparatus.

The dynamo-electric machine is provided with a ball or other governor for acting on the driving-band by shifting it on a cone-pulley, in order to maintain as uniform a speed of rotation as possible.

I claim—

1. The combination of a cable, *c*, having its ends secured to and wound upon a drum, D, on shore, with the roller A^2, anchored in the water, with the movable receiving apparatus having flaps S', to which one strand of said cable is secured, the movable transmitting apparatus, which is adapted to clamp one strand of said cable-regulating apparatus, having tension-springs *s s' v*, and with mechanism, substantially as described, for converting the horizontal motion of the transmitting apparatus into rotary motion of a wheel, A, as set forth.

2. The combination of the sliding frame *a*, carrying the inclines *b b*, with the cable *c*, wedges *d d*, levers *f f*, and screw *g*, substantially as herein shown and described.

The foregoing specification of my improved system for utilizing wave-power and applying the same to electrical and other purposes signed by me this 24th day of September, 1885.

ANTOINE DE SOUZA.

Witnesses:

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FERDINAND BARBE.