(No Model.) 3 Sheets—Sheet 1.

F. O. RUSLING.

WAVE MOTOR.

No. 541,631. Patented June 25, 1895.

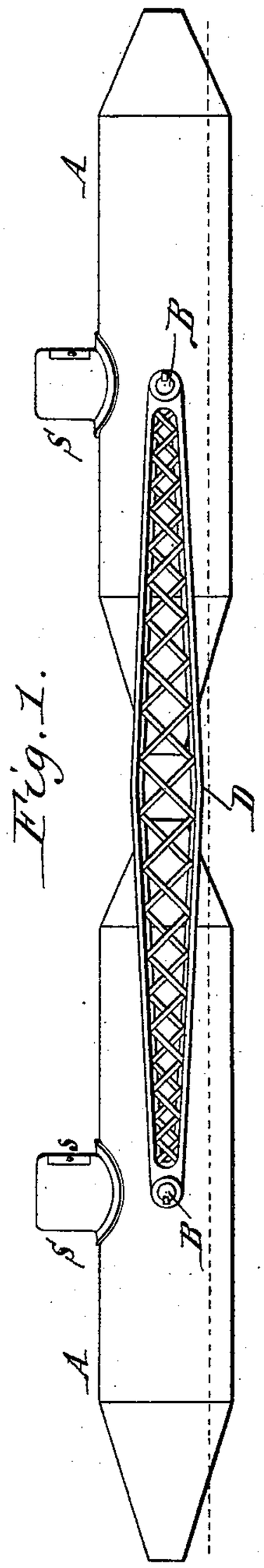

Fig. 1.

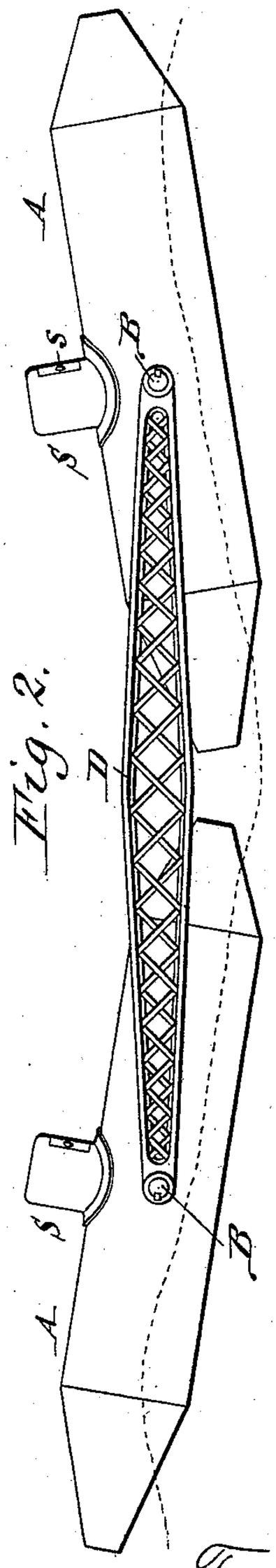

Fig. 2.

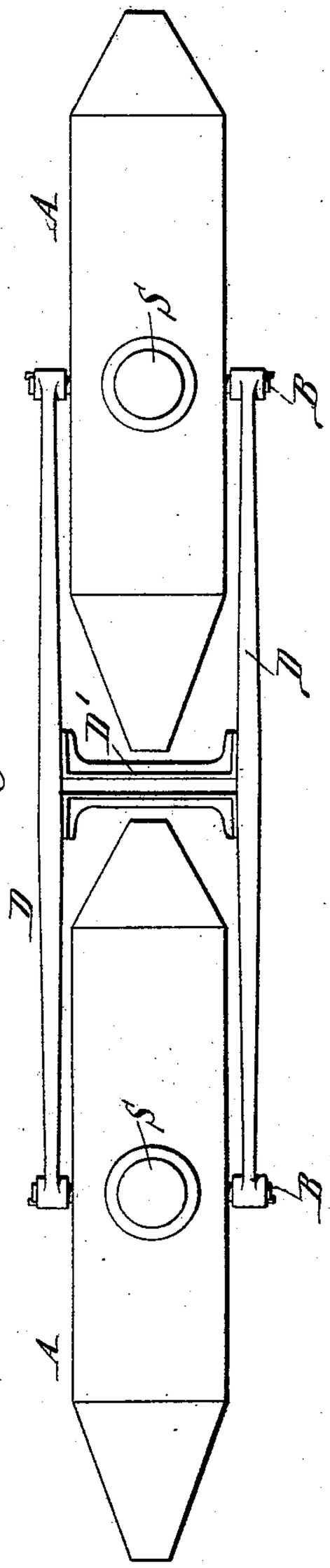

Fig. 3.

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(No Model.) 3 Sheets—Sheet 2.

F. O. RUSLING.

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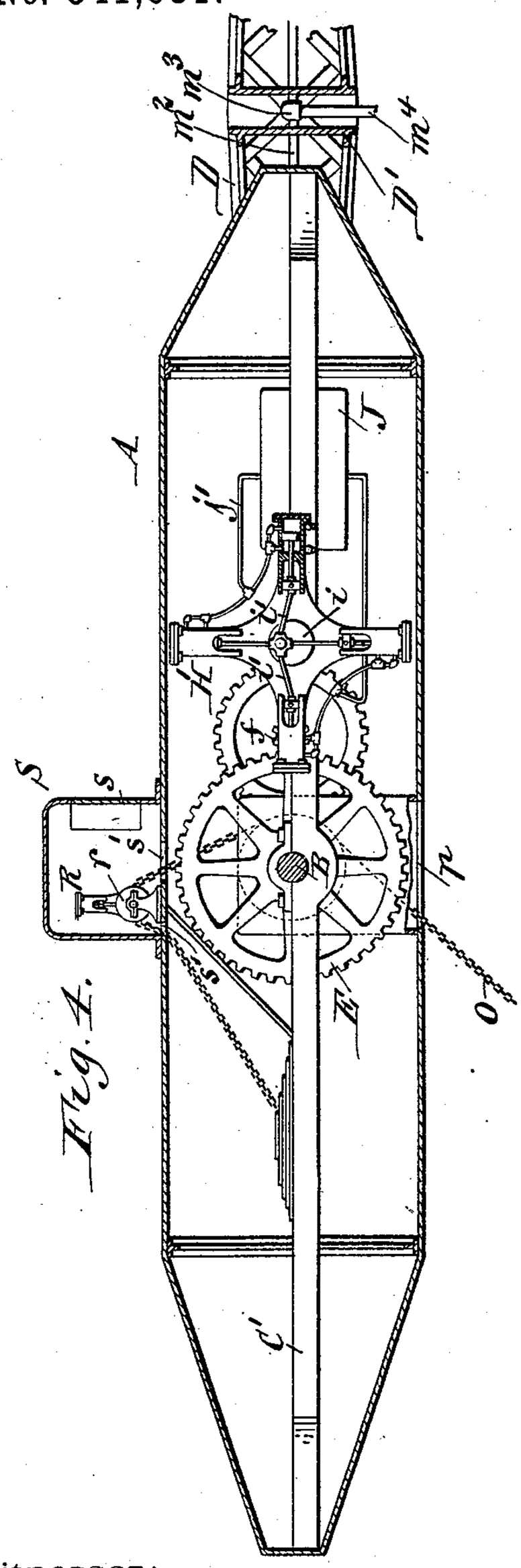

Fig. 4.

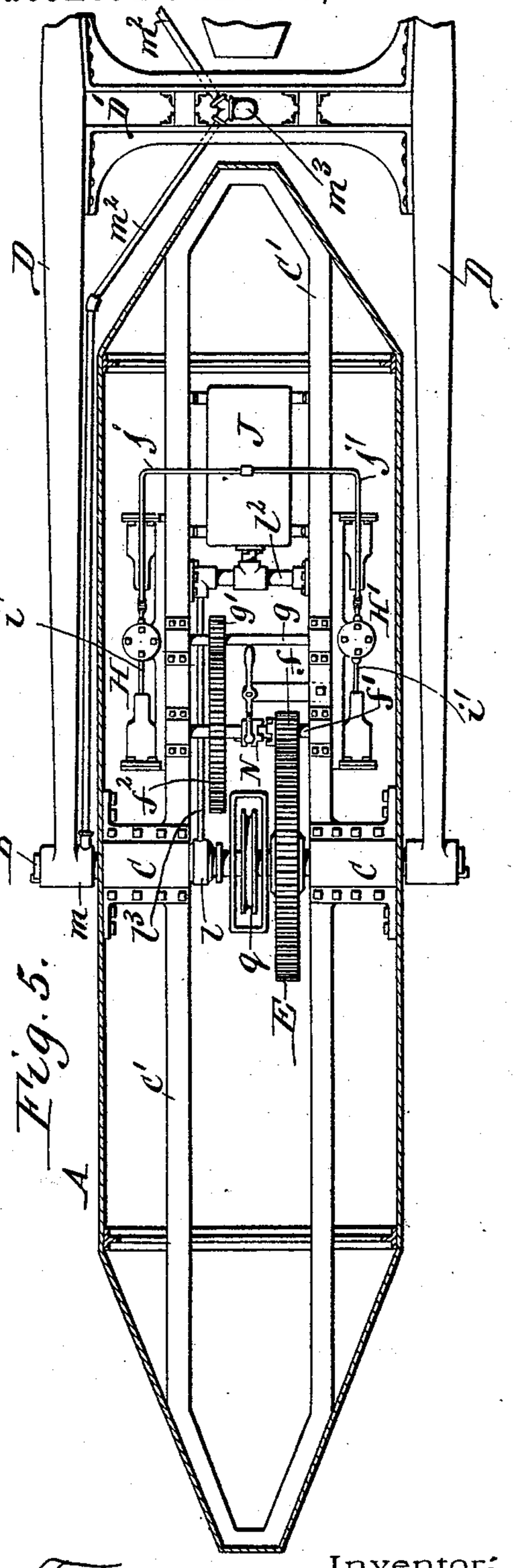

Fig. 5.

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(No Model.) 3 Sheets—Sheet 3.

F. O. RUSLING.

WAVE MOTOR.

No. 541,631. Patented June 25, 1895.

Fig. 7.

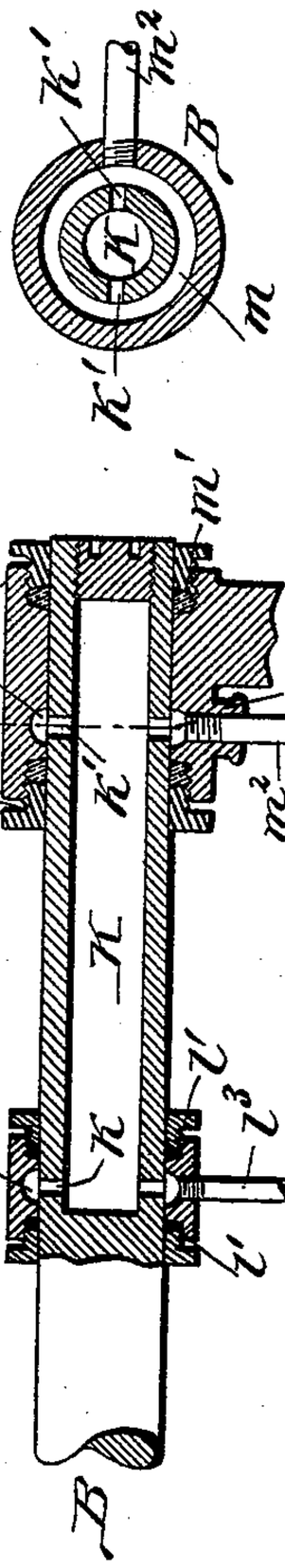
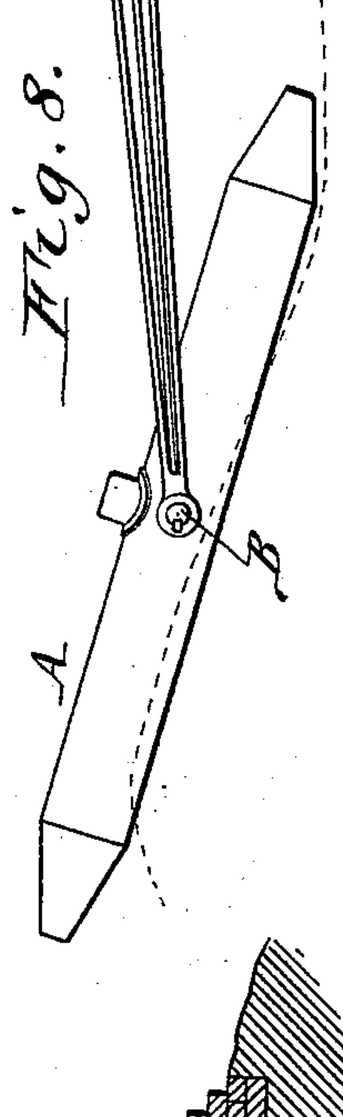


Fig. 6.

Fig. 8.



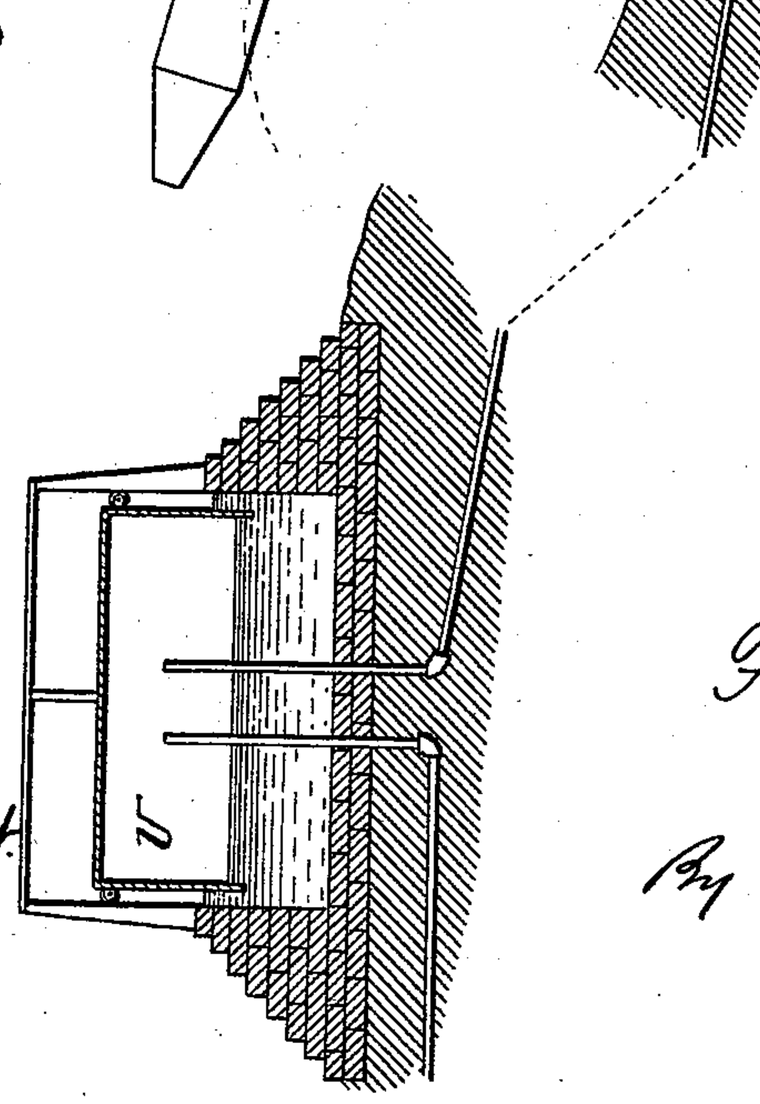
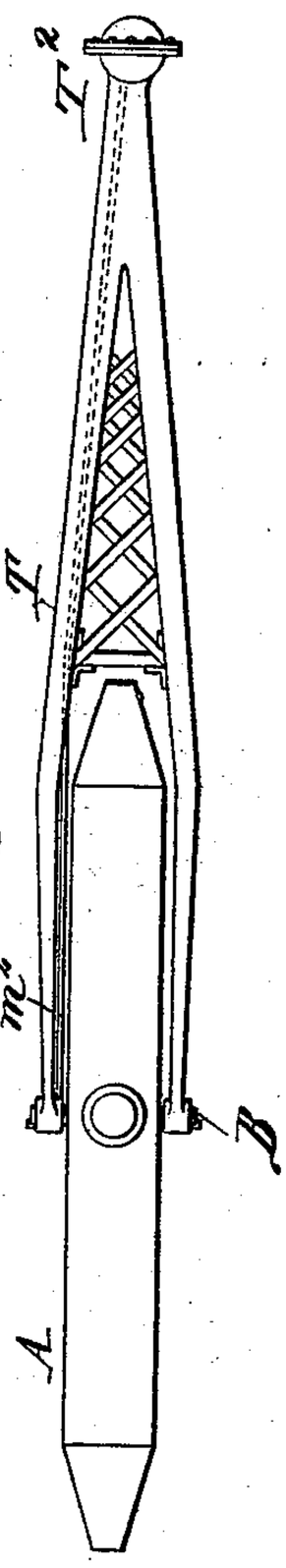


Fig. 9.



Witnesses:
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Theo. L. Popp.

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UNITED STATES PATENT OFFICE.

FORD O. RUSLING, OF BUFFALO, NEW YORK.

WAVE-MOTOR.

SPECIFICATION forming part of Letters Patent No. 541,631, dated June 25, 1895.

Application filed June 29, 1894. Serial No. 516,080. (No model.)

To all whom it may concern:

Be it known that I, FORD O. RUSLING, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Wave-Motors, of which the following is a specification.

This invention relates to that class of wave motors which consist of an oscillating float and more especially to motors of this kind in which a number of floats are connected together.

One of the objects of my invention is to reliably retain the float or floats in position by simple devices which do not interfere with the movements of the floats.

The invention has the further object to improve and simplify the mechanism whereby the power derived from the wave motor is utilized for industrial or other purposes.

In the accompanying drawings consisting of three sheets, Figure 1 is a side elevation showing my invention in connection with a wave-motor having two connected floats, the floats being at rest. Fig. 2 is a similar view showing positions assumed by the floats when in motion. Fig. 3 is a top plan view of the motor. Fig. 4 is a vertical longitudinal section of one of the floats. Fig. 5 is a horizontal section thereof. Fig. 6 is a fragmentary longitudinal section, on an enlarged scale, of one of the float-shafts. Fig. 7 is a cross-section in line 7 7, Fig. 6. Fig. 8 is a sectional elevation of a modified construction of my improved wave-motor. Fig. 9 is a top plan view thereof.

Like letters of reference refer to like parts in the several figures.

Referring to the construction shown in Figs. 1 to 7, A, A represent two oscillating floats, each of which consists preferably of a hollow sheet metal chamber having a body which is oval or cylindrical in cross section and tapering or conical end portions, as shown. Each float is arranged to oscillate on a transvere non-rotary axle or shaft B which passes centrally, or nearly so, through openings formed in the sides of the hollow float, and which is supported in bearings C arranged upon longitudinal beams or timbers C′ extending from end to end of the float and secured to the latter by bolts or rivets. The two floats are arranged tandem or in line with each other and are connected by rigid stay-bars or trusses D arranged on opposite sides of the floats and secured at their ends to the projecting portions of the float-shafts by a key and feather, as shown in the drawings, or by any other suitable means, so as to hold the two shafts against rotation. These stay-bars are connected between the floats by a transverse stay D′ which stiffens said bars. The floats are separated sufficiently to allow them to oscillate without interference. As the power transmitting or translating devices of the two floats are identical, a description of one will suffice for both.

E is a large main gear wheel which is keyed or otherwise secured to the stationary float-shaft so as not to take part in the oscillations of the float, and *f* is a gear pinion meshing with said gear wheel and mounted loosely on a counter shaft *f′* which turns in bearings secured to the longitudinal beams C′. As the main gear wheel E is stationary and the pinion *f* engaging therewith is arranged on one side of the center of oscillation of the float the rocking motion of the latter compels the pinion to ride up and down over the adjacent side of the main gear wheel in the arc of a circle, thereby causing the pinion to rotate to a greater or less extent, according to the amplitude of the float vibrations. This rotation of the pinion is preferably converted into reciprocating motion and utilized for operating the pistons of a number of air compressors or water pumps whereby the power derived from the motor may be applied and stored in a convenient form. When the power of the motor is utilized in this manner, the extent of motion of the primary pinion *f* is preferably multiplied by employing a second counter-shaft and pinion *g* and *g′* respectively motion being transmitted to this counter-shaft by a large gear wheel f^2 mounted on the primary counter-shaft and meshing with the secondary pinion *g′*, as shown in Fig. 5.

H and H′ represent two sets of air compressing cylinders arranged radially around the end portions of the secondary counter-shaft and having the rods of their pistons provided with cross heads which are connected with crank disks *i* secured to the ends of said counter-shaft by pitman rods *i′*, as shown in

Fig. 4. The oscillatory motion of the crank disk thus produces a reciprocating motion of the pistons whereby the air in the cylinders is compressed. The air compressors are supported on base plates which are secured to the longitudinal beams C′. These compressors may be of any approved construction, and they are all preferably connected by pipes *j* and *j′* with a chamber or tank J whence the compressed air may be conducted to a storage tank on shore, or directly to the machinery to be driven. I prefer, however, to utilize the stationary shaft of the float as the source from which the compressed air is conducted to the shore. For this purpose a portion of the shaft is made hollow to form a chamber K, as shown in Figs. 6 and 7, and this hollow portion of the shaft is formed with radial air inlet and outlet openings *k* and *k′*. The portion of the shaft containing the inlet openings is surrounded by an annular inlet chamber *l* which communicates with such air inlet openings and which is free to turn on the shaft, the chamber being provided at its ends with stuffing boxes *l′* to form a tight joint.

l^2 is the outlet pipe of the air tank, and l^3 is a branch pipe leading from said outlet pipe to the annular inlet chamber of the shaft.

m is an annular outlet chamber which surrounds the portion of the hollow shaft containing the outlet openings and communicates with these openings. This outlet chamber is preferably formed in the cylindrical boss at the end of the adjacent stay-bar D and the boss is provided at its ends with stuffing boxes *m′*.

m^2 is a rigid discharge pipe leading from the outlet chamber *m*. The air discharge pipes m^2 of the two floats unite in a coupling m^3, as shown in Fig. 5, and to this coupling may be connected a hose or flexible pipe m^4 for conducting the compressed air to a storage tank on shore.

The primary counter-shaft *f′* is preferably provided with a clutch N of any ordinary construction, as shown in Fig. 5, so that the air compressors can be thrown out of gear for making repairs, or for any other purpose.

By the use of the power transmitting gearing herein shown and described, a continuous operation of the air compressors is effected so long as the floats are oscillated, without the employment of pawls and ratchets or similar devices which have an intermittent action and which must be duplicated in order to produce a continuous action of the driven mechanism.

By pivoting the floats at or near the middle and connecting them by rigid stay-bars, they are reliably retained in their proper relative positions and the float pivots are relieved from twisting or other injurious strains, while the floats are at the same time permitted to oscillate without restraint. As the longitudinal beams C′ support the several shaft bearings and the air compressors they relieve the shell of the float from direct strains, and by extending the beams continuously from end to end of the float, they also serve to stiffen the same.

One of the floats is preferably anchored by a cable or chain O which passes from the anchor upwardly through an opening *p* in the bottom of the float, thence around one side of a guide wheel or pulley *q* journaled upon the float-shaft, and thence around the drum *r* of a "pony" engine or small hoisting machine R. This engine is arranged on the top of the float and inclosed by a dome or housing S having a door *s* for entering the same. The float is formed in its top with openings *s′* for the passage of the anchoring chain. From the drum of the hoisting engine the loose portion of the chain preferably passes back into the float, as shown in Fig. 4. By connecting the anchoring chain with the central portion of the float and giving it a bearing concentric with the shaft of the float, the latter is steadied at the most effective point and at the same time allowed to oscillate with a free and easy motion.

In the modified construction of my improvement, shown in Figs. 8 and 9, a single float is attached by its shaft to the outer end of a rigid bifurcated retaining arm or bar T which is connected at its opposite end to a hollow post or standard T′ rising from the bottom of the body of water and projecting above the surface thereof. The retaining arm is attached to the upper end of this post by a ball and socket joint T^2 which permits the float to assume a position athwart the waves. In this case, the air discharge pipe leading from the hollow float shaft, is connected by a ball and socket joint (not shown in the drawings) with a branch pipe *u* passing through the hollow post and leading to a storage tank U on shore.

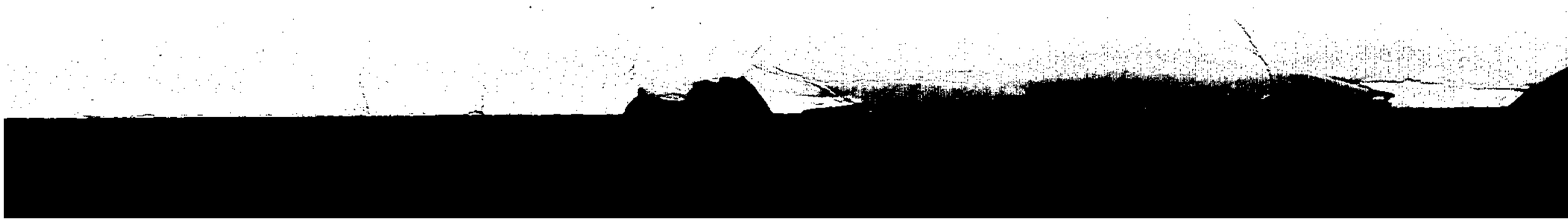
I claim as my invention—

1. In a wave motor, the combination with a float having a non-rotary supporting shaft upon which it is journaled, of a rigid retaining arm or bar secured at one end to the shaft of the float, substantially as set forth.

2. In a wave motor, the combination with a pair of oscillating floats, each having a non-rotary shaft passing centrally through the same, of a longitudinal stay-bar or bars connecting the shafts of the two floats, substantially as set forth.

3. In a wave motor, the combination with a pair of oscillating floats having a shaft passing centrally through the same, of rigid longitudinal stay-bars arranged on opposite sides of the floats and secured at their ends to the shafts of the floats, and a transverse stay connecting said bars between the floats, substantially as set forth.

4. In a wave motor, the combination with an oscillatory float having a non-rotary supporting shaft provided with a fixed gear wheel, of a rotary pinion engaging with said fixed



wheel, and power translating mechanism connected with said pinion, substantially as set forth.

5. In a wave motor, the combination with an oscillatory float having a non-rotary shaft provided with a fixed gear wheel, of a primary counter-shaft having a pinion meshing with said fixed wheel, a secondary counter-shaft geared with the primary counter-shaft, and having crank disks at its ends, and two sets of air compressors having their pistons connected with said crank disks, respectively, substantially as set forth.

6. In a wave motor, the combination with an oscillatory float having a non-rotary hollow shaft forming an air passage or chamber and having air inlet and outlet openings, annular air inlet and outlet chambers arranged on the hollow shaft and communicating with its inlet and outlet openings, and air pipes connected with said annular chambers, substantially as set forth.

7. In a wave motor, the combination with a horizontal shaft, of an oscillatory float journaled centrally on said shaft, a guide wheel mounted on said shaft and an anchoring chain or cable passing over said guide wheel, whereby the float is anchored by means of its shaft and permitted to oscillate without restraint, substantially as set forth.

Witness my hand this 12th day of June, 1894.

FORD O. RUSLING.

Witnesses:
THEO. L. POPP,
ELLA R. DEAN.