No. 786,715. PATENTED APR. 4, 1905.

P. E. M. BASTIOU.

APPARATUS FOR TRANSFORMING MOTION.

APPLICATION FILED MAY 29, 1903.

4 SHEETS—SHEET 1.

Fig. 1.

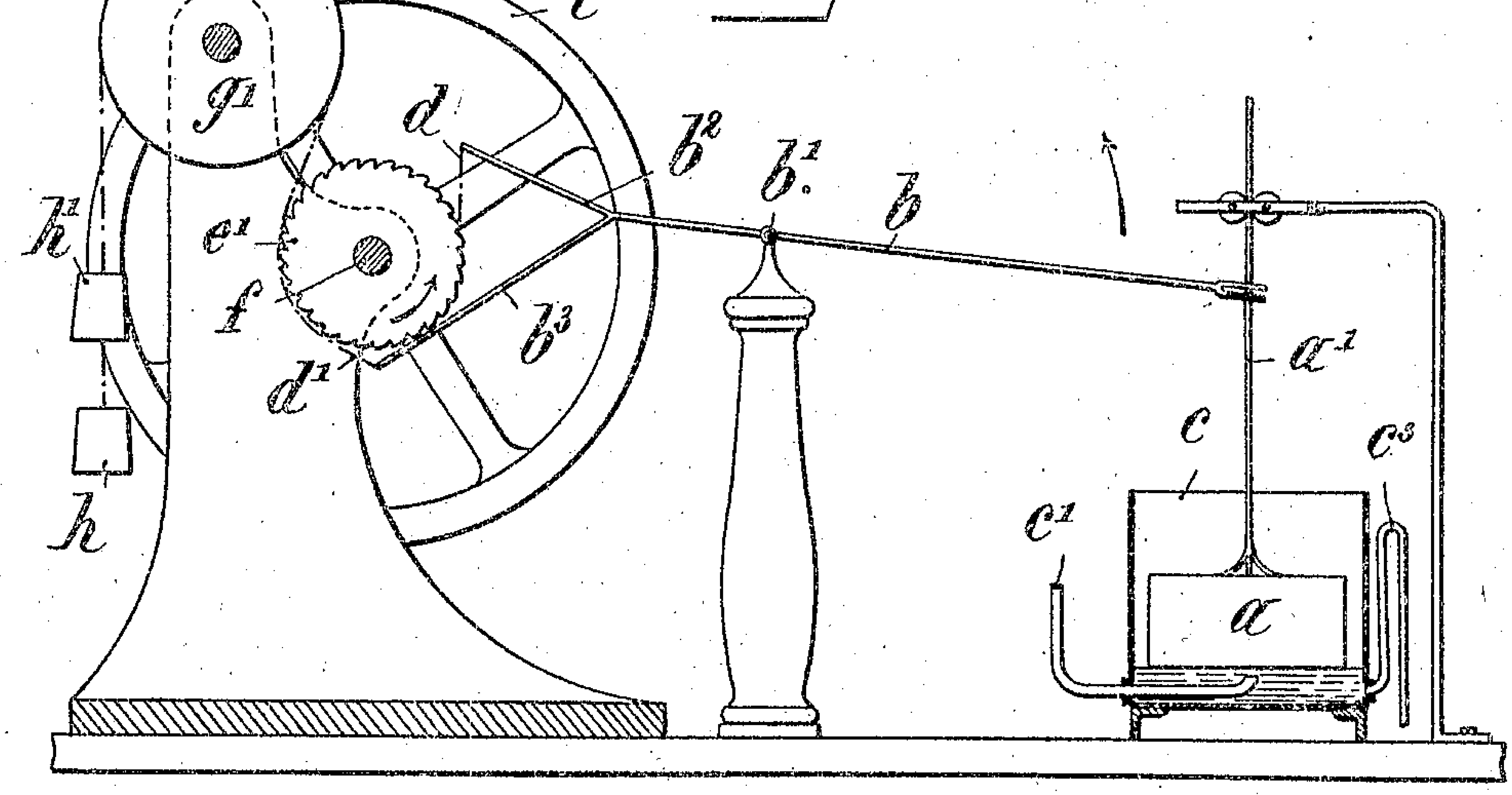


Fig. 2.

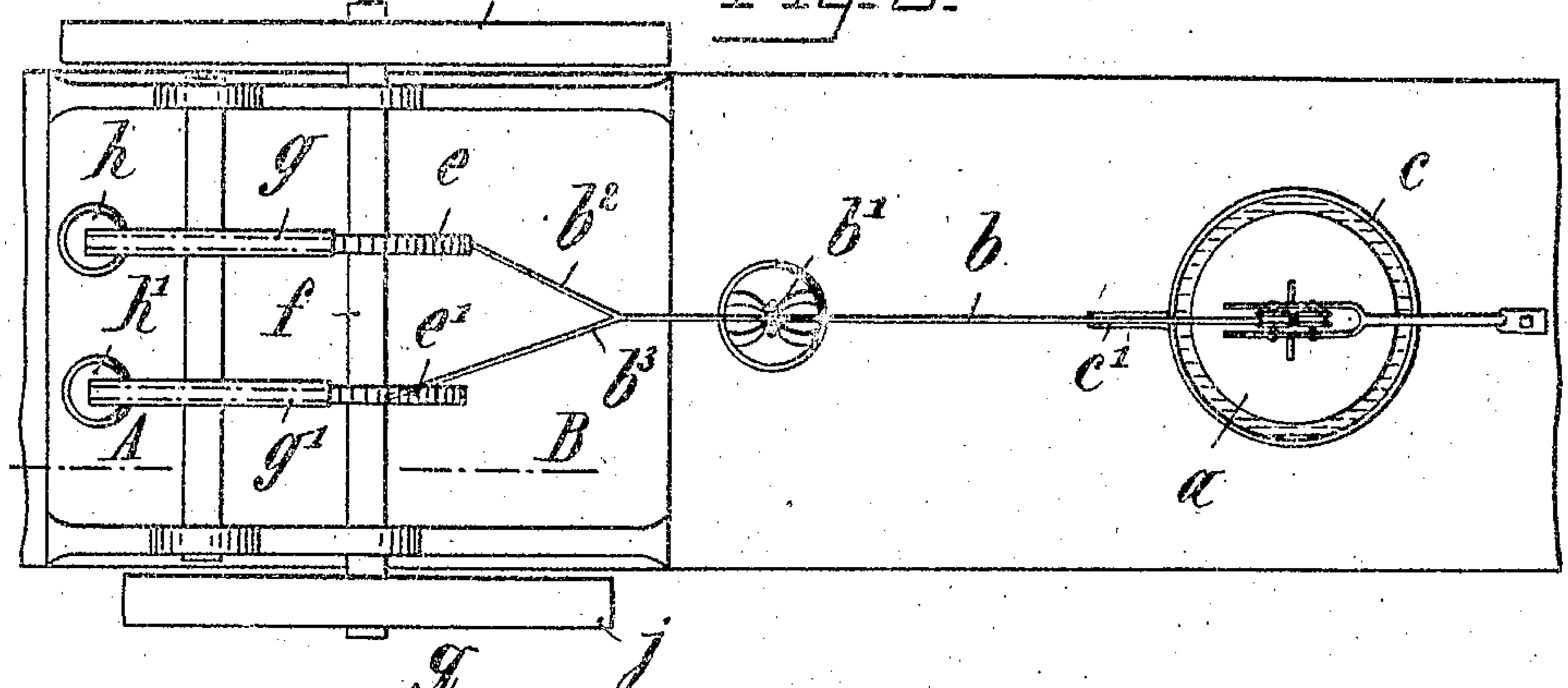
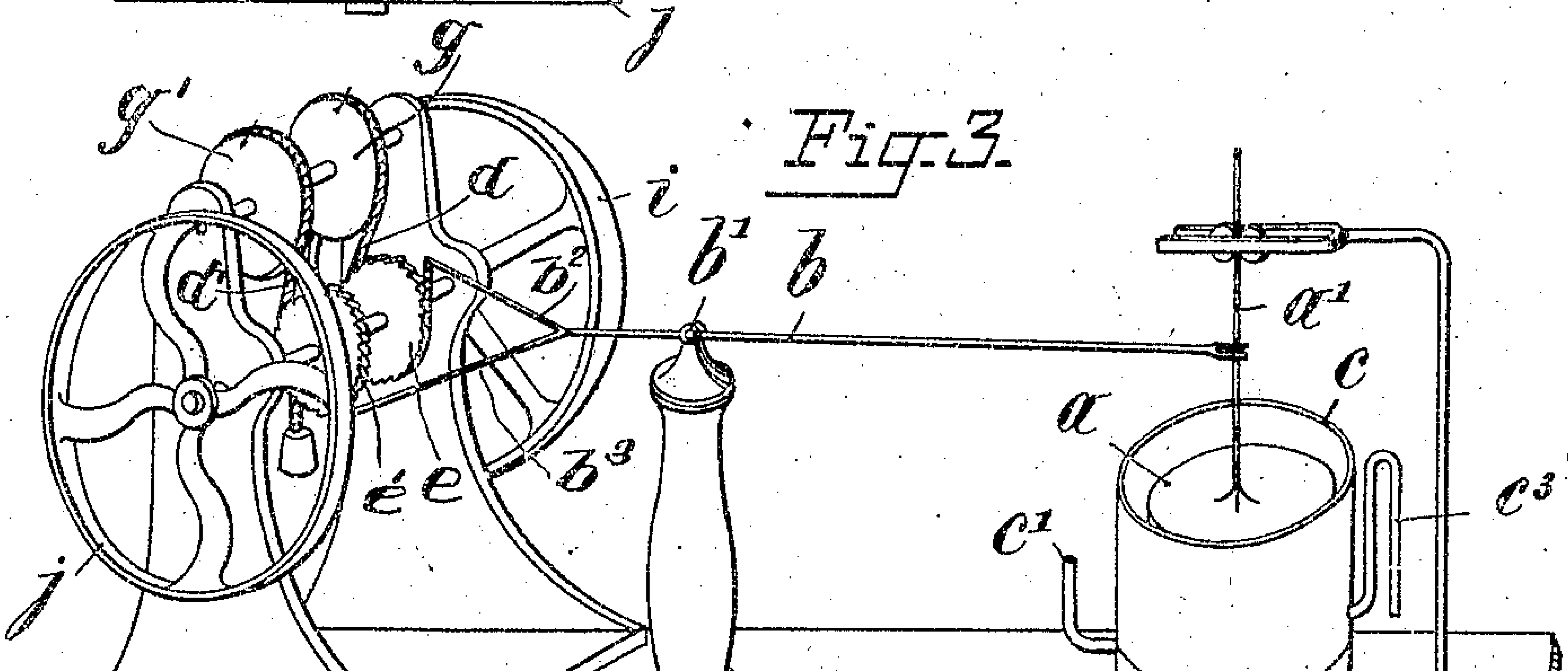


Fig. 3.



WITNESSES:

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4 SHEETS—SHEET 2.

Fig-4.

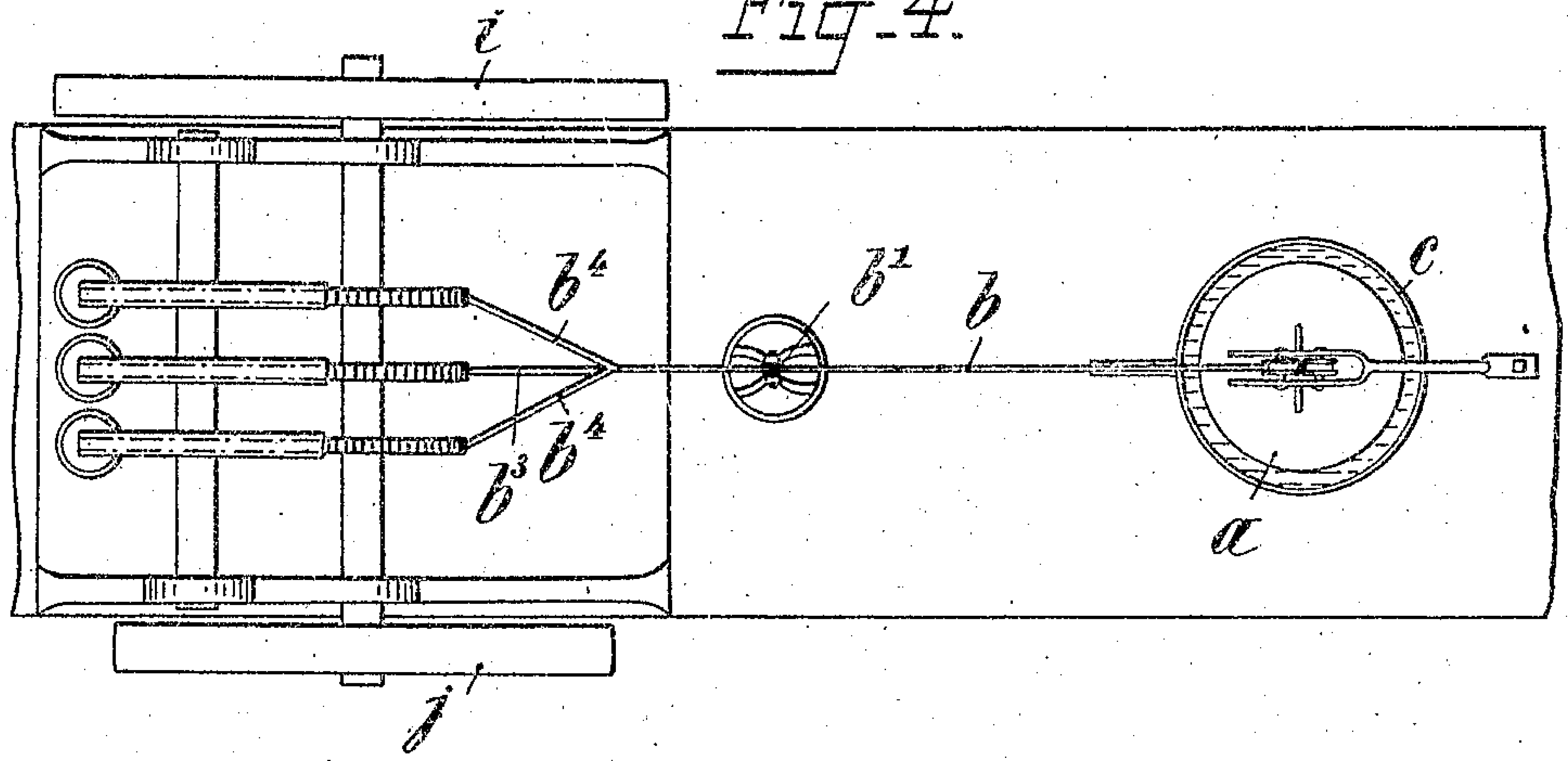


Fig. 5.

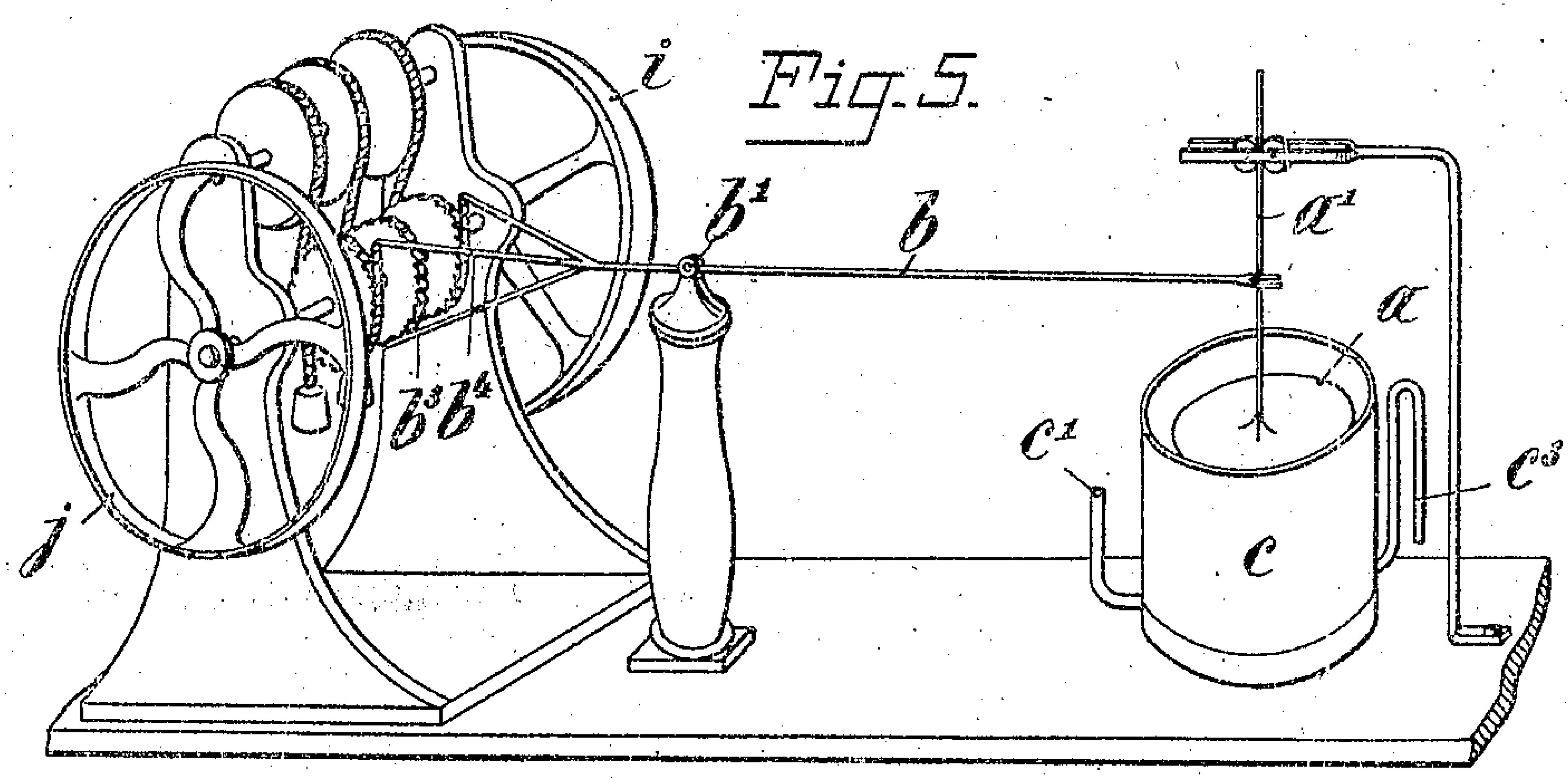
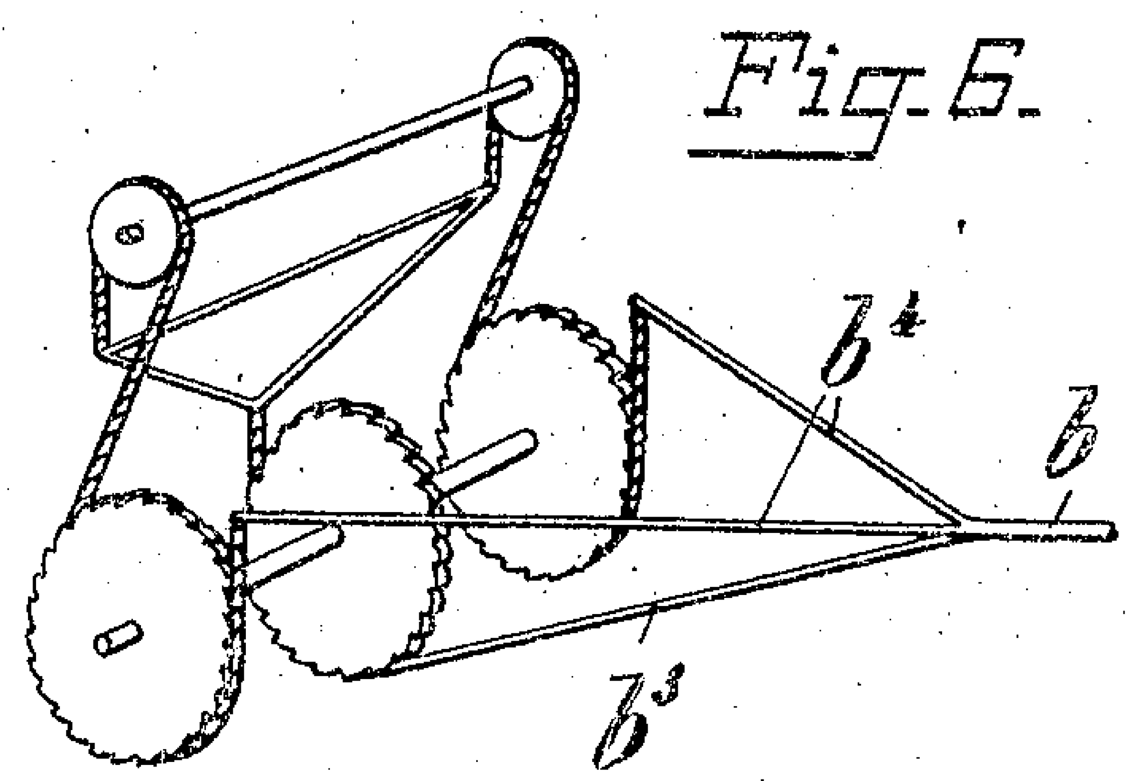


Fig. 6.



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4 SHEETS—SHEET 3.

Fig. 7.

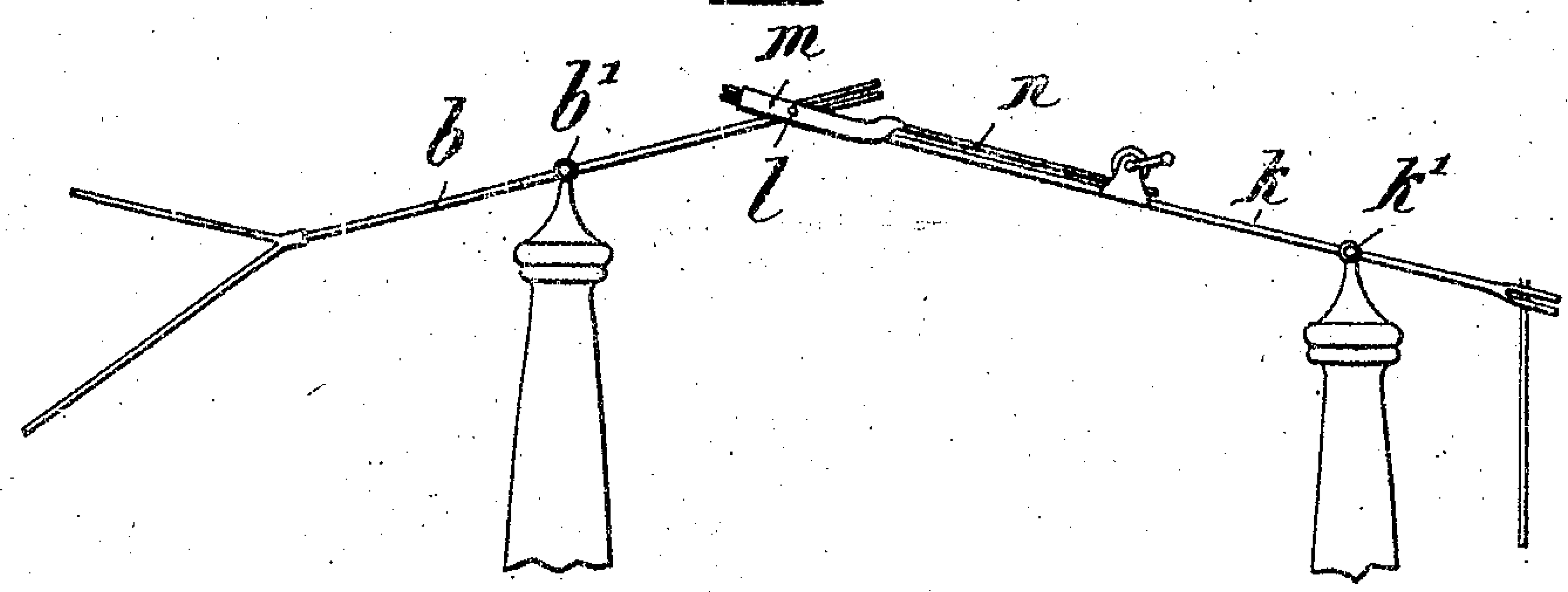


Fig. 8.

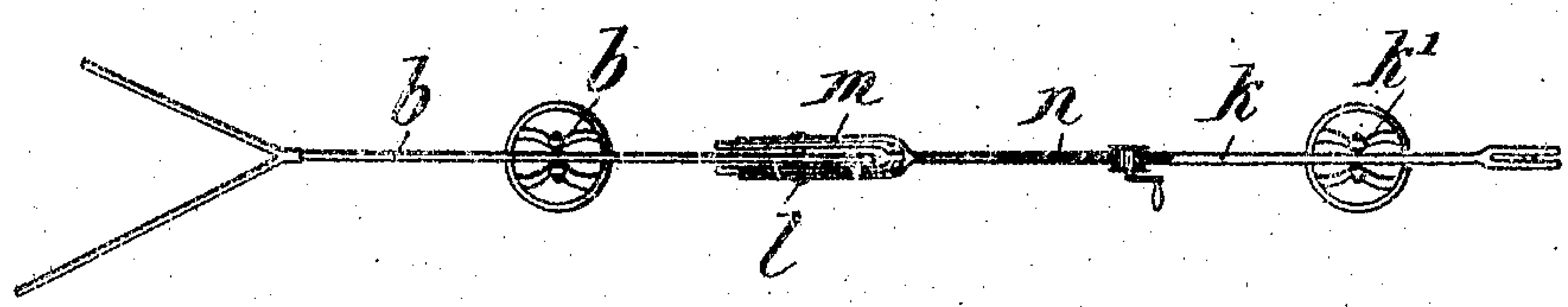


Fig. 9.

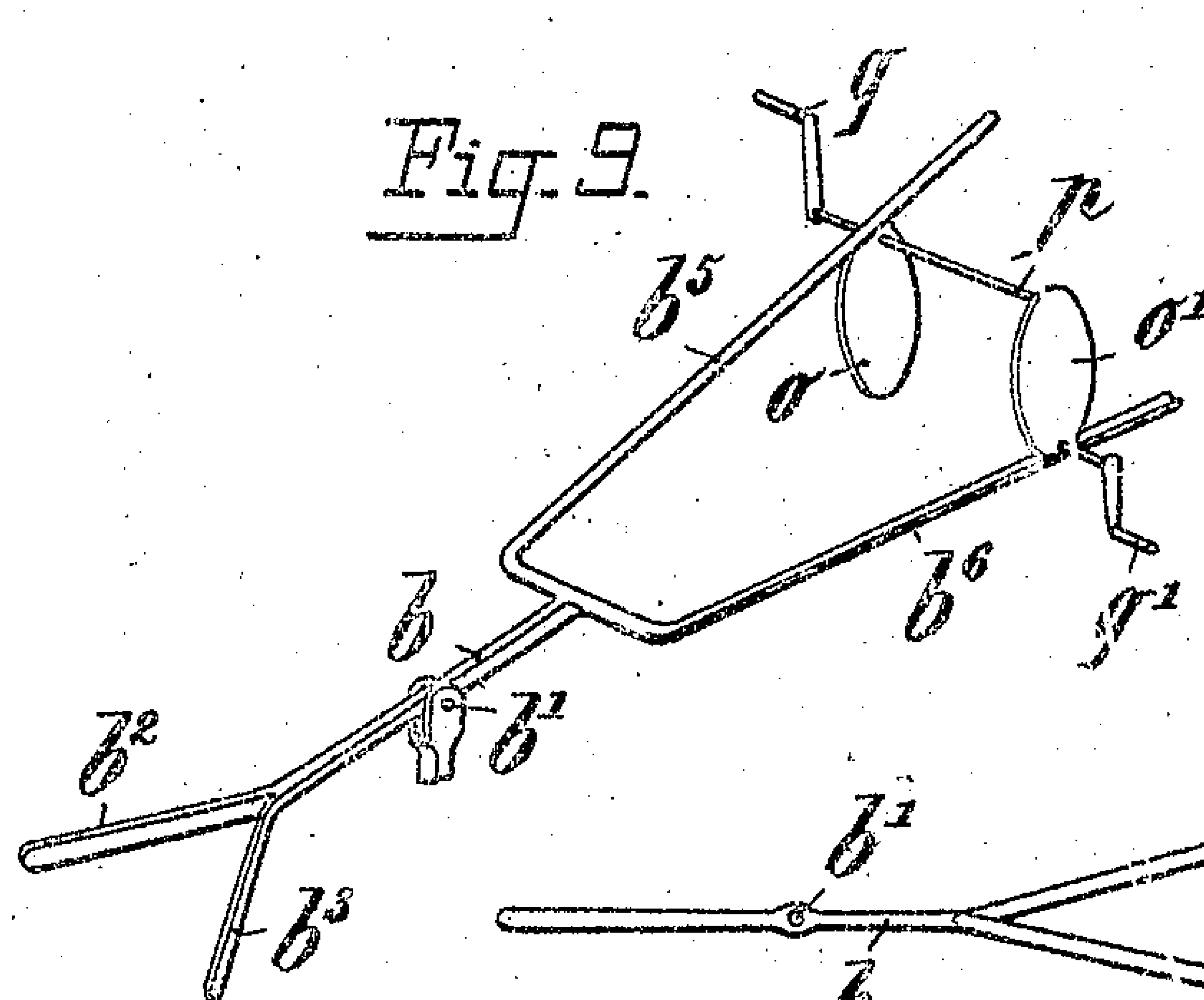
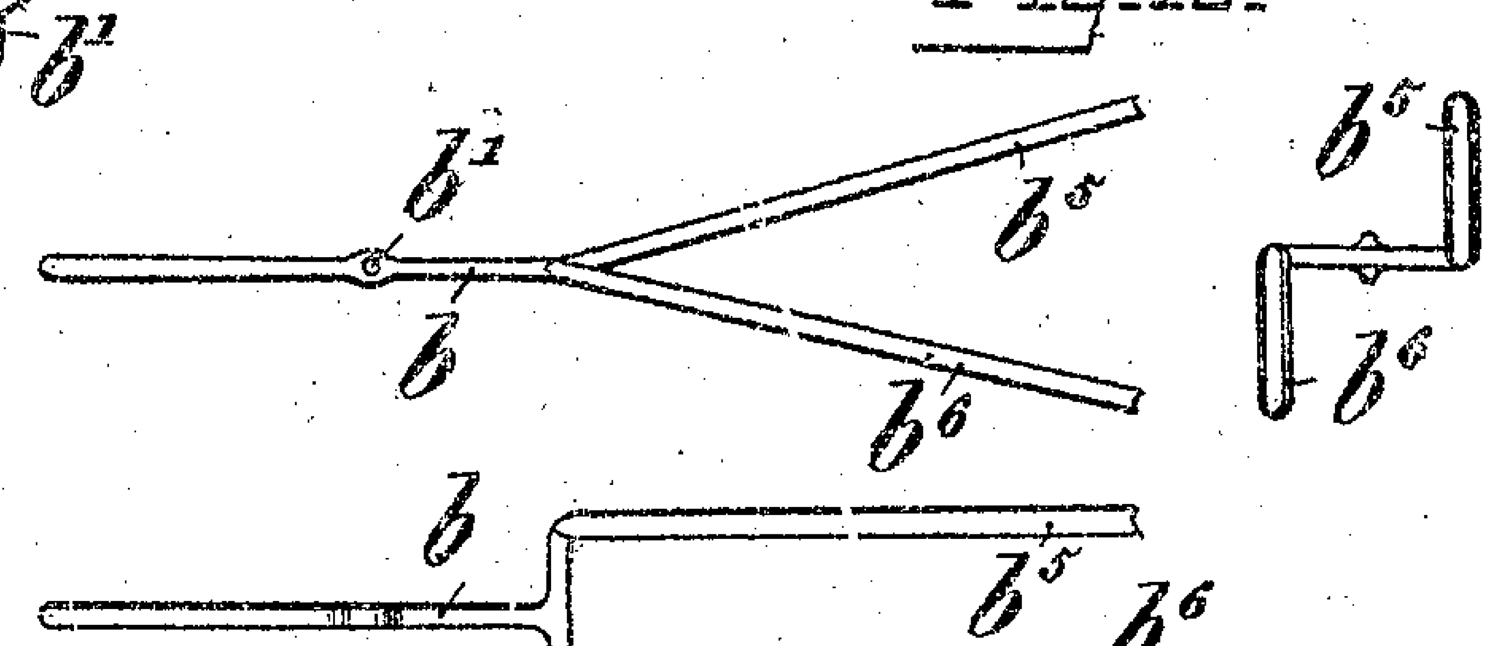


Fig. 10.



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4 SHEETS—SHEET 4.

Fig. 11.

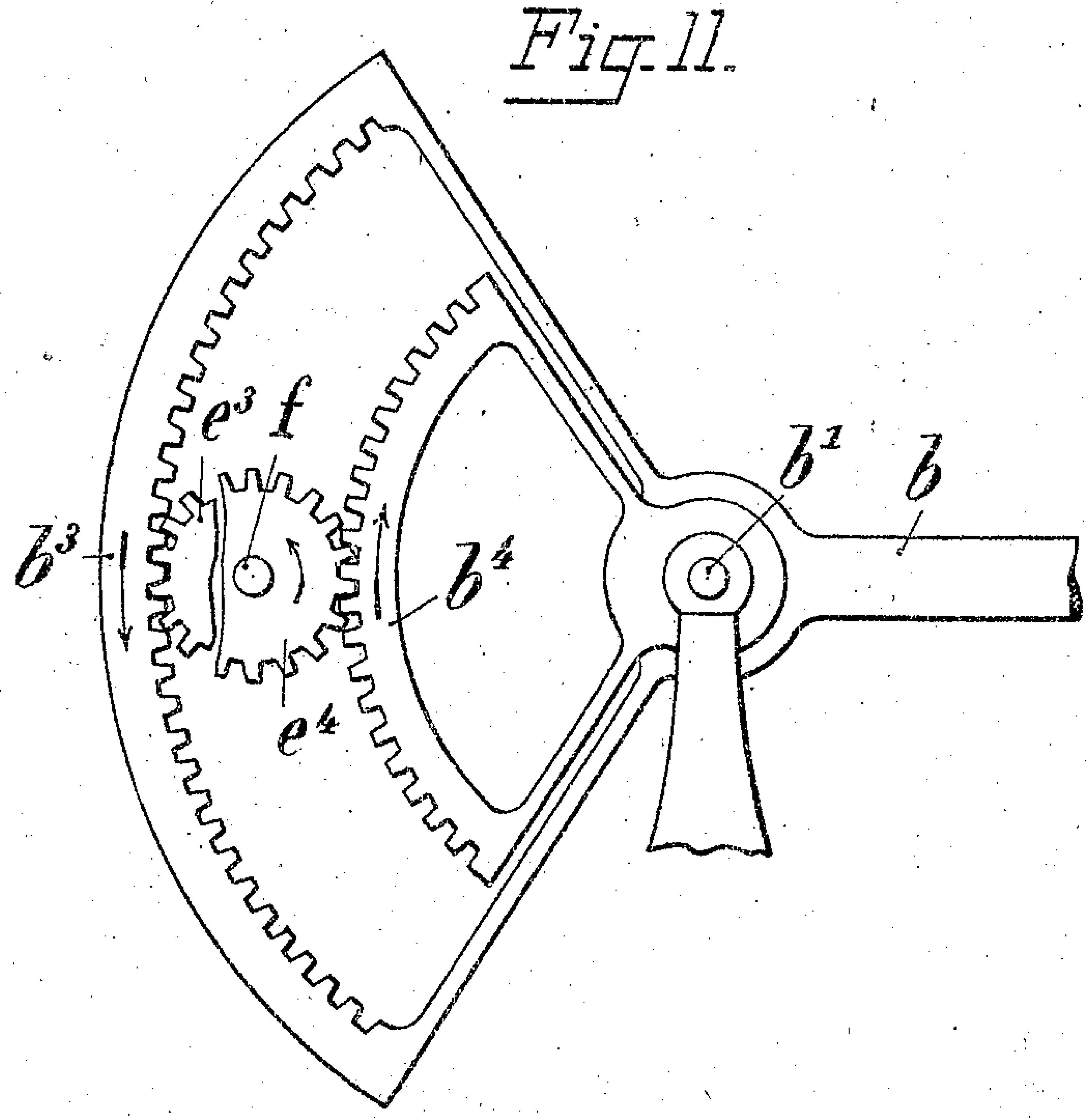
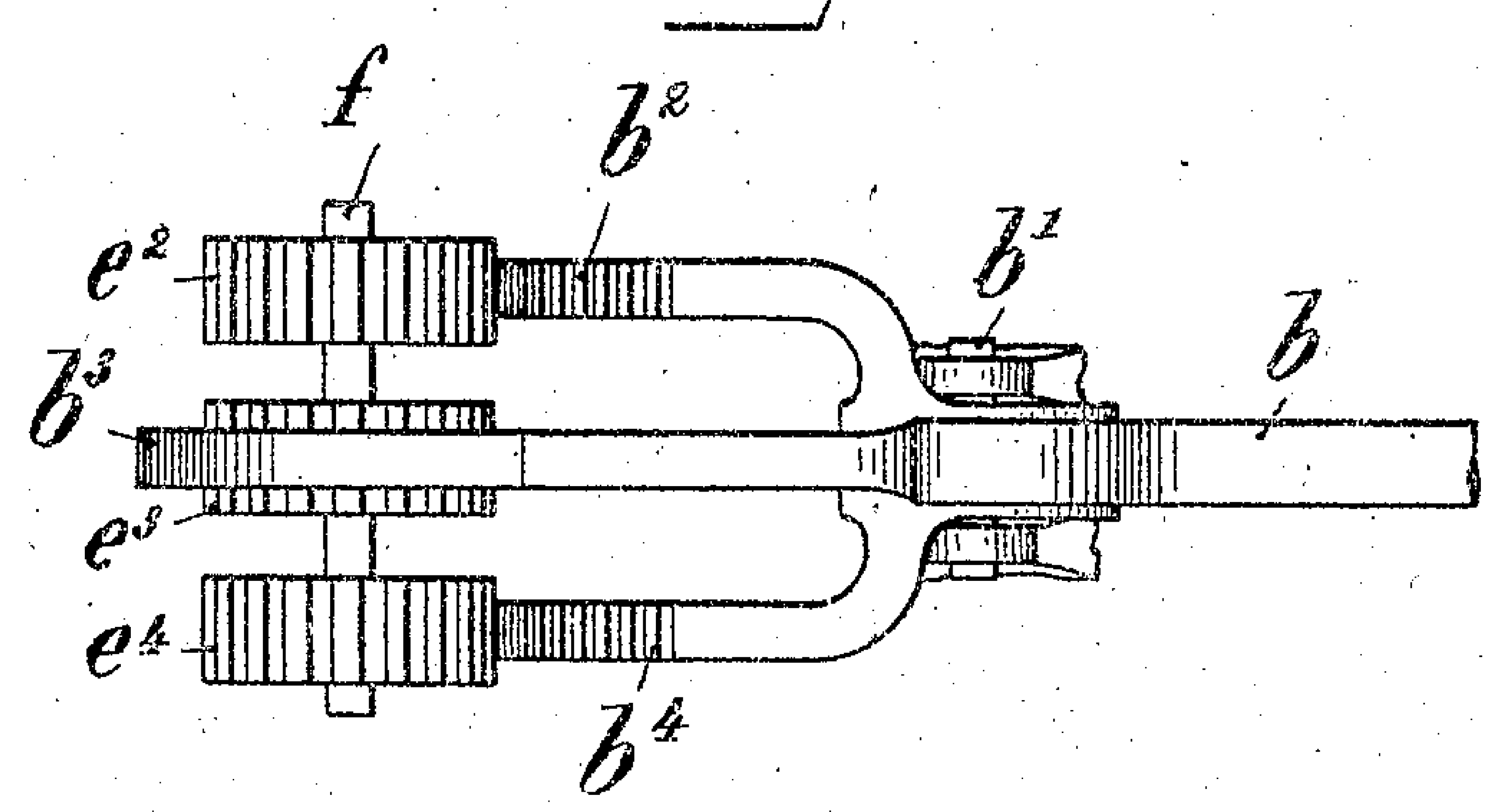


Fig. 12.



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UNITED STATES PATENT OFFICE.

PIERRE EMILE MARIE BASTIOU, OF LANNION, FRANCE.

APPARATUS FOR TRANSFORMING MOTION.

SPECIFICATION forming part of Letters Patent No. 786,715, dated April 4, 1905.

Application filed May 29, 1903. Serial No. 159,314.

To all whom it may concern:

Be it known that I, PIERRE EMILE MARIE BASTIOU, doctor of medicine, of Hotel de Couquedec, Lannion, Côtes-du-Nord, Republic of France, have invented Improvements in Apparatus for Transforming Reciprocating into Continuous Rotary Motion, of which the following is a full, clear, and exact description.

This invention relates to means for transforming a reciprocating movement into a continuous rotary movement.

My device consists, essentially, of a lever of special arrangement, at one of the extremities of which the force to be transmitted acts, while the other extremity presents two arms, one of which is directed upwardly and the other downwardly and acting upon two two ratchet-wheels keyed upon the shaft from which movement is to be transmitted. These two arms drive their respective ratchet-wheels alternately, one in rising and the other in the descent and always in the same direction.

In order that the effort created by the resistance may invariably be exerted upon the lever in the same plane as the power, the lever preferably acts upon the resistance to be overcome by the intermediary of an arm downwardly directed and situated in the same plane as the power with respect to this lever and of two upwardly-directed arms symmetrical with respect to the lever. In this case the three arms act respectively upon three ratchet-wheels mounted upon the same shaft, so that the lower arm will be operative in rising and the two upper arms in the descent, or inversely. The lever can still be terminated by three toothed sectors—a central one with internal teeth and two others with external teeth provided on each side of the central sector—these three sectors meshing, respectively, with three pinions mounted upon the same shaft, but driving the latter in a direction only so that this shaft will be operated alternately by the central sector when the lever moves in a direction and by the two outer sectors when the lever moves in the other direction.

This lever is specially adapted for converting the alternating movement of a float resting in a liquid the level of which rises and falls alternately into rotary movement. This float may, for example, be contained in a reservoir which is automatically emptied and replenished. The float may also be immersed in the sea, the ebb and flow of which will cause it to rise and fall, the rest of the apparatus being on the land or upon a fixed support or upon a vessel, in which latter case it is the swell which will displace the float.

My form of lever is applicable to many other purposes. It may, for example, be employed for transmitting the movement communicated to a shaft by the intermediary of pedals.

In order that the invention may be readily and clearly understood, I have represented the same in the accompanying drawings, but by way of example only.

Figure 1 is an elevation sectional on the line A B of Fig. 2. Fig. 2 is a plan view. Fig. 3 is a perspective view. Figs. 4 and 5 show a modified form of the apparatus in plan and in perspective, respectively. Fig. 6 represents another modification in perspective. Figs. 7 and 8 show in elevation and in plan another modification of the device for transmitting movement. Fig. 9 illustrates another modification showing the application of the lever for transmitting the movement of a shaft operated by means of pedals. Fig. 10 is a detail view showing the lever in elevation and in plan. Figs. 11 and 12 show in elevation and in plan a modified form of lever.

In the figures similar letters of reference are employed to designate like parts.

The transmission device represented in Figs. 1 to 3 comprises a float a, suspended from the extremity of a lever b, rotatably mounted on a shaft b'. This float is immersed in a reservoir c, which is alternately emptied and replenished. The liquid enters the reservoir c through a pipe c' and is discharged therefrom through a siphon c^3, which automatically empties the reservoir c as soon as the level of the liquid in this latter reaches the level of the elbow of this siphon c^3. The diameter of the siphon should be determined with regard to that of the admission-pipe in order that with the liquid continuing to enter through the pipe c' and the discharge taking place through the siphon double the quantity of liquid entering may be discharged, so that the emptying may be effected while permitting the float to descend with the same velocity as that with which it rose. The vertical movement of the float is guided by two pulleys, between which the rod a' of this float is moved, or by rollers rolling upon the internal wall of the reservoir.

The lever b terminates in two arms b^2 b^3, one of which is upwardly directed, while the other extends downward, as shown in Figs. 1, 2, and 3. To these two arms b^2 b^3 are attached two transmission-chains d d' in engagement with ratchet-wheels e e', respectively. These wheels, the teeth of which may be either curved or straight, are keyed upon the shaft f, and, passing over guide-pulleys g g', each of these chains carries at its free extremity a counterweight h h' or a counter-spring. One of the arms (the arm b^2 of the lever b) is directed upward, and the other arm (the arm b^3) is directed downward. The contact of one of the chains, d, with its ratchet-wheel e therefore always takes place upon the same side of this ratchet-wheel with respect to a vertical line passing through its center, while, on the other hand, the other chain, d', is in contact with its ratchet-wheel e' upon the opposite side in such a manner that the two chains are only in engagement with their respective ratchet-wheels in one direction of of the movement—the chain d when the lever b is operated in one direction and the chain d' when this lever b is operated in the opposite direction. In these conditions when the lever b is displaced in the direction indicated by the arrow in the drawings—that is to say, when the two arms b^2 b^3 descend—the chain d' drives the ratchet-wheel e' and imparts to it an angular displacement, while the chain d, acted upon by its counterweight h, slides upon its ratchet-wheel e. On the other hand, when the lever b is displaced in the opposite direction—that is to say, when the two arms b^2 b^3 rise—the chain d', acted upon by its counterweight h', slides upon its ratchet-wheel e', exerting no action on this latter, and the chain d drives its ratchet-wheel e, imparting to it an angular displacement in the same direction as that previously communicated to the ratchet-wheel e' by the chain d'. The shaft f is therefore driven constantly at one time by the ratchet-wheel e and at the other by the ratchet-wheel e'. Upon this shaft f are keyed a fly-wheel i and a pulley j, from which the movement is taken. These two parts may be replaced by a pulley fly-wheel, if desired. The method of transmission by means of ratchet-wheels and chains may be replaced by any suitable transmission.

In order that the driving efforts may always be exerted in the plane in which the lever b is displaced, this latter may advantageously present a single arm b^3, directed downward and situated with respect to this lever in the same plane as the power, and two symmetrical arms b^4, directed upward, as shown in Figs. 4 and 5. Fig. 6 shows another modification, in which the chains corresponding to the two outer upper arms b^4 terminate beyond their guide-pulleys at two of the apices of a triangle, to the third apex of which is attached the chain passing over the intermediate ratchet-wheel and terminating at the single lower arm b^3, in which case this chain does not need a guide-pulley.

The float a should fulfil the two following conditions: First, its weight in air should be sufficient for causing the arm of the lever b, from which it is suspended, to descend; second, its volume should be such that when it floats it displaces, without being completely immersed, a volume of water the weight of which is sufficient for returning this lever to its initial position.

The depth of the reservoir c is determined in such a manner that the float may never encounter its bottom. The reservoir may also comprise an auxiliary admission and discharge aperture for the liquid, cocks being arranged upon these apertures in order that the admission and discharge may be varied according to the pressure of the liquid.

In order that the angular displacement of the arms b^2 b^3 may be maintained constant when the travel of the float varies, I have devised the following arrangement, Figs. 7 and 8: The float a instead of being suspended from the extremity of the lever b acts upon an auxiliary lever k, rotatable upon a shaft k'. One of the arms of this lever k is articulated to the lever b, and from the other arm is suspended the float a. The two arms of these levers b k, articulated one with the other, each present a slot for permitting of the displacement upon each of them of their hinge-pin l when the travel of the float is modified. The displacement of the pin l may be controlled by any appropriate means. The two extremities of this pivot may, for example, be mounted in a fork m, carrying a rod n, adapted to receive a longitudinal displacement controlled by any suitable gearing.

My apparatus operates in the following manner: Assuming the various parts to occupy the position represented in Fig. 1, upon water entering the reservoir c through the pipe c' the float a will rise, the lever b, Fig. 1, is displaced in the direction indicated by the arrow, the arm b^3 descends, carrying with it its chain, the links of which engage with the teeth of its ratchet-wheel e', and consequently imparts a movement of rotation to this ratchet-wheel e' and to its shaft f. The arm b^2 also descending, its chain d, acted upon by its counterweight h, slides over the teeth of its ratchet-wheel e without producing any useful effect, but in no wise impeding the movement of rotation of this ratchet-wheel e, which participates in the rotation of the shaft f. When the level of the water in the reservoir c reaches the elbow of the siphon c^3, this latter becomes primed. The emptying of the reservoir then takes place automatically, although water still continues to enter through the pipe c', because, as previously stated, the diameter of the discharge-pipe is larger than that of the admission-pipe. The discharge therefore takes place while permitting the float to descend under the action of gravity with the same velocity as that with which it rose. The lever is then displaced in the opposite direction, the arm b^3 rising. Again its chain d', acted upon by the counterweight h', slides over the teeth of the ratchet-wheel e' without performing work; but, on the other hand, the chain d engages with the teeth of its ratchet-wheel e and imparts a movement of rotation to this latter and also to the shaft f, upon which it is fixed. The shaft f is thus driven when the float ascends and also when it descends, and the rotation of this shaft is rendered uniform by the action of the fly-wheel i. The float a having reached its lowermost position, the water continuing to enter through the pipe c', the reservoir again becomes filled, the float a rises, and the different operations described above are reproduced in succession.

My apparatus may be made in all forms and of all dimensions and the detail arrangements may be modified in accordance with the various applications.

Fig. 9 illustrates another application of my form of lever for the purpose of transmitting the movement imparted to a shaft by means of pedals. The lever b then presents in addition to the two arms b^2 b^3, arranged in the manner stated above, two other arms, b^5 b^6, arranged as shown in Figs. 9 and 10 and respectively submitted to the action of two cams o o', keyed upon the shaft p, actuated by means of pedals q q'. The cams o o' and the pedals q q' are fixed in such a manner that when the descent of the pedal q takes place the cam o lifts the arm b^5 until the moment at which this pedal begins to rise again. Then the pedal q', which has reached the highest point of its stroke, commences in its turn to descend and the cam o' depresses the arm b^6. The lever b therefore receives an oscillatory movement, being moved in one direction by the action of the cam o upon the arm b^5 and in the other direction by the action of the cam o' upon the arm b^6. I may transmit the movement of the shaft p to the lever b by any other appropriate means.

Figs. 11 and 12 show a modification according to which the lever b terminates at three sectors b^7 b^8 b^9, the two outer sectors b^7 b^9 having external teeth and the central one b^8 having internal teeth. These three sectors gear, respectively, with three pinions e^4 e^5 e^6, mounted upon a shaft f, in order to drive the latter in a direction only. When the lever b moves in the direction of the arrow shown in full line, the shaft f is driven in the direction of the arrow by the outer sectors b^7 b^9 acting upon the pinions e^4 e^6. On the contrary, when the lever is displaced in the reverse direction the shaft f is driven by the action of the central sector b^8 upon the pinion e^5. A continuous rotary motion is thereby imparted to the shaft f.

I claim—

1. Means for transmitting movement permitting of converting a rectilinear reciprocating motion into a movement of continuous rotation, the said means comprising an oscillating lever one of the extremities of which presents three arms directed in opposite directions, the central arm being directed downward and the two others upward, ratchet-wheels keyed upon the part to which the rotary motion is to be imparted, chains gearing with each of the ratchet-wheels and connected with the lever-arms, and pulleys arranged above the ratchet-wheels corresponding to the upward-directed arms.

2. Means for transmitting movement permitting of converting a rectilinear reciprocating motion into a movement of continuous rotation, the said means comprising an oscillating lever one of the extremities of which presents three arms, one arm being directed in one direction and the other two arms in a direction opposite to that of the first arm ratchet-wheels keyed upon the part to which the rotary motion is to be imparted, chains gearing with each of the ratchet-wheels and connected with the lever-arms, and pulleys arranged above the ratchet-wheels, a counterbalance being connected to the end of each chain.

3. A device for converting motion, comprising a pivoted lever having a plurality of oppositely-projecting members at one end, ratchet-wheels on the part to be rotated, guide-pulleys above the ratchet-wheels, and a chain connected with each member of the lever and engaging a ratchet-wheel, each chain passing over a guide-pulley and having a counterpoise at its end.

4. A device for converting motion, comprising a pivoted lever having three arms, the center arm projecting downwardly and the other two arms projecting upwardly, three ratchet-wheels on the part to be rotated, guide-pulleys above the ratchet-wheels, and a chain connected with each arm of the lever and engaging a ratchet-wheel, said chains passing over the guide-pulleys and each having a counterpoise at its end.

The foregoing specification of my improvements in apparatus for transforming reciprocating into continuous rotary motion signed by me this 2d day of April, 1903.

PIERRE EMILE MARIE BASTIOU.

Witnesses:

J. GAUTIER,

TH. SOISBAUTH.