

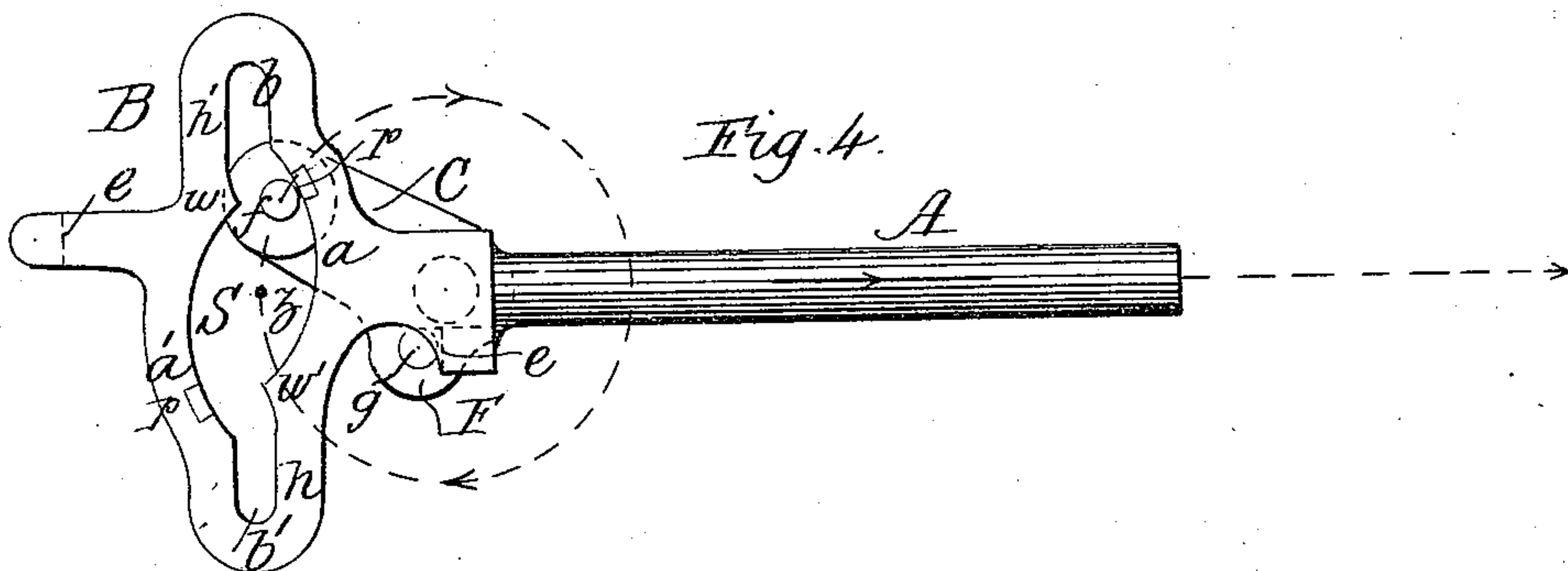
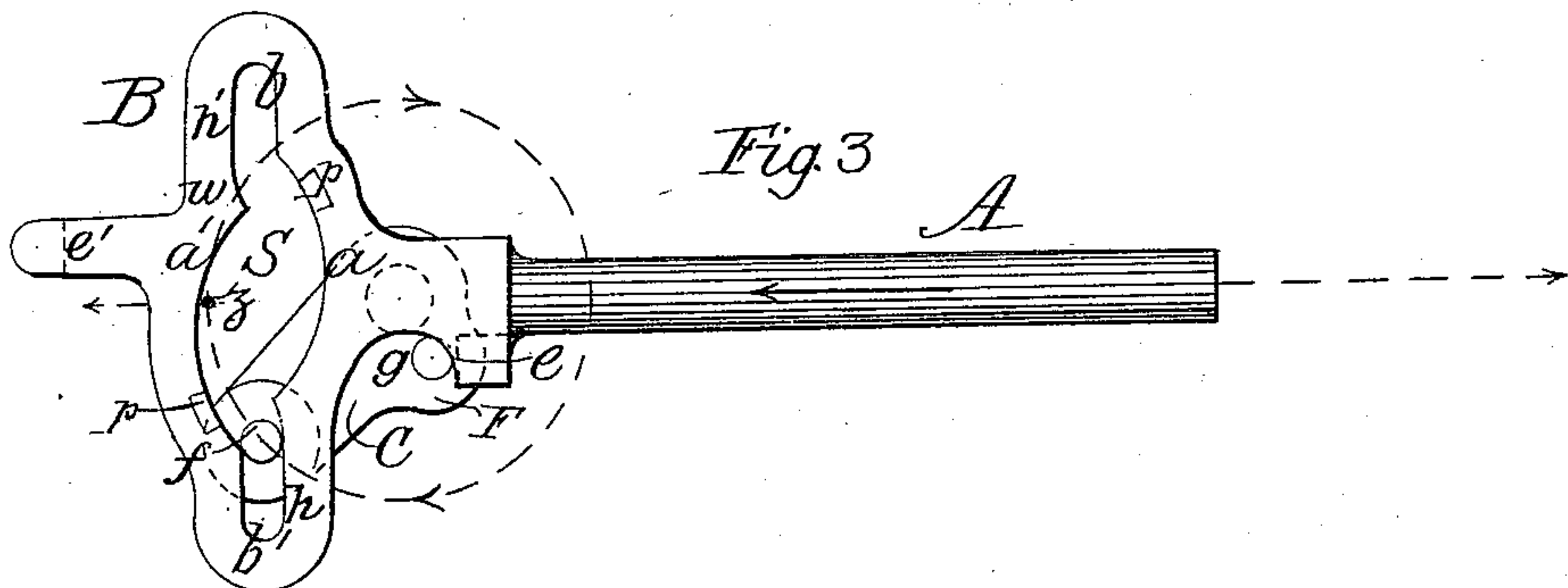
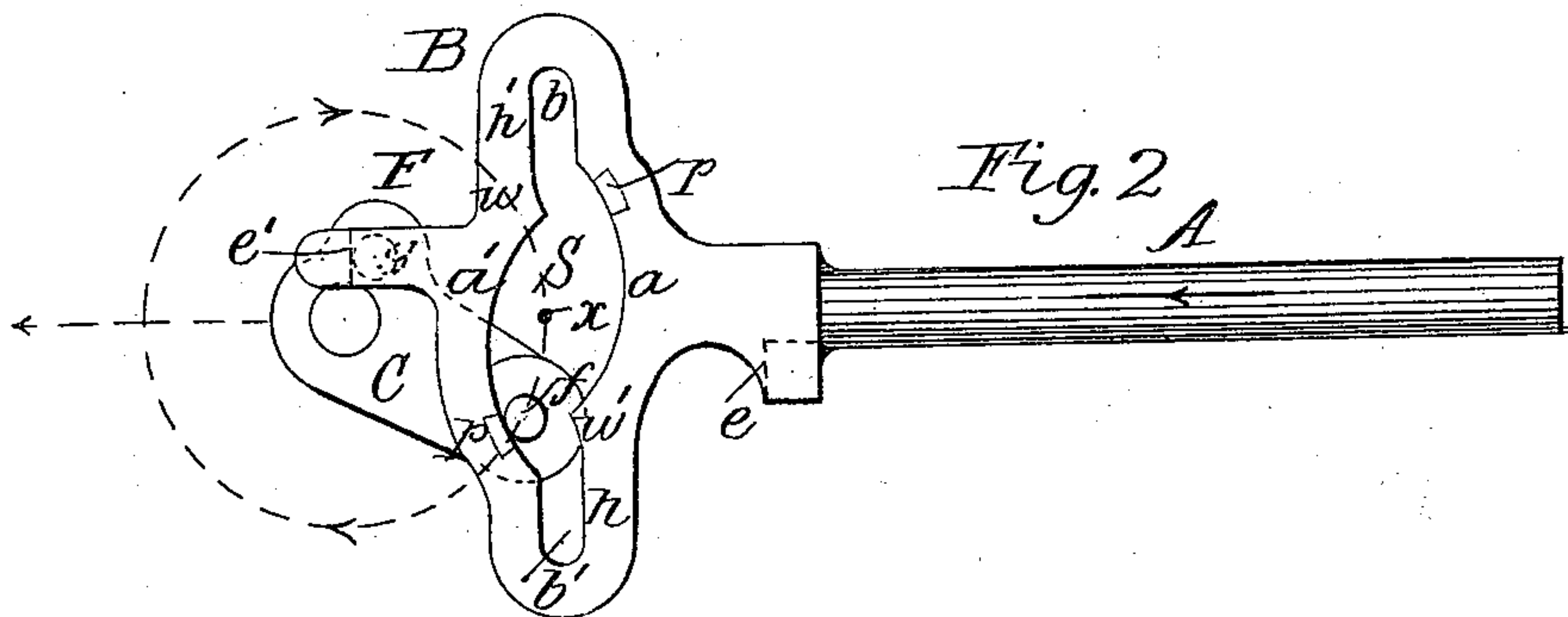
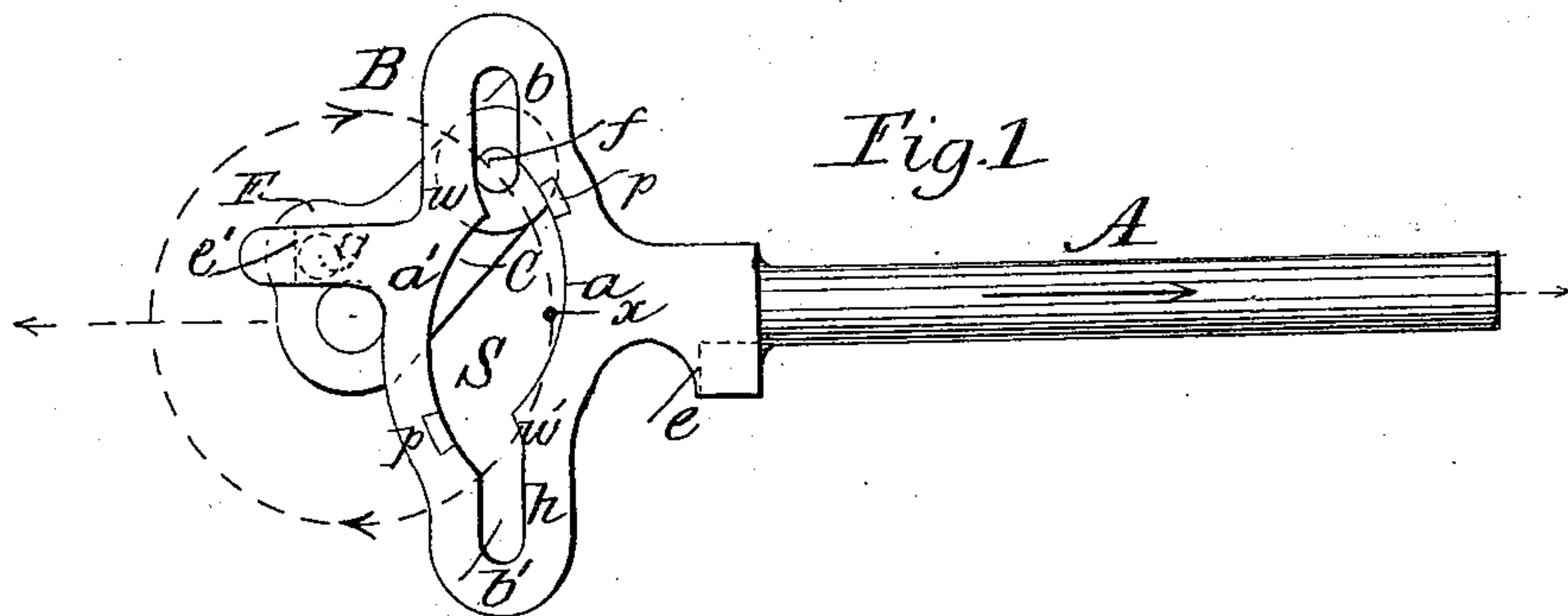
(No Model.)

2 Sheets—Sheet 1.

W. LIVINGSTONE.  
MECHANICAL MOVEMENT.

No. 562,086.

Patented June 16, 1896.



WITNESSES:

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*Alfred Lee*

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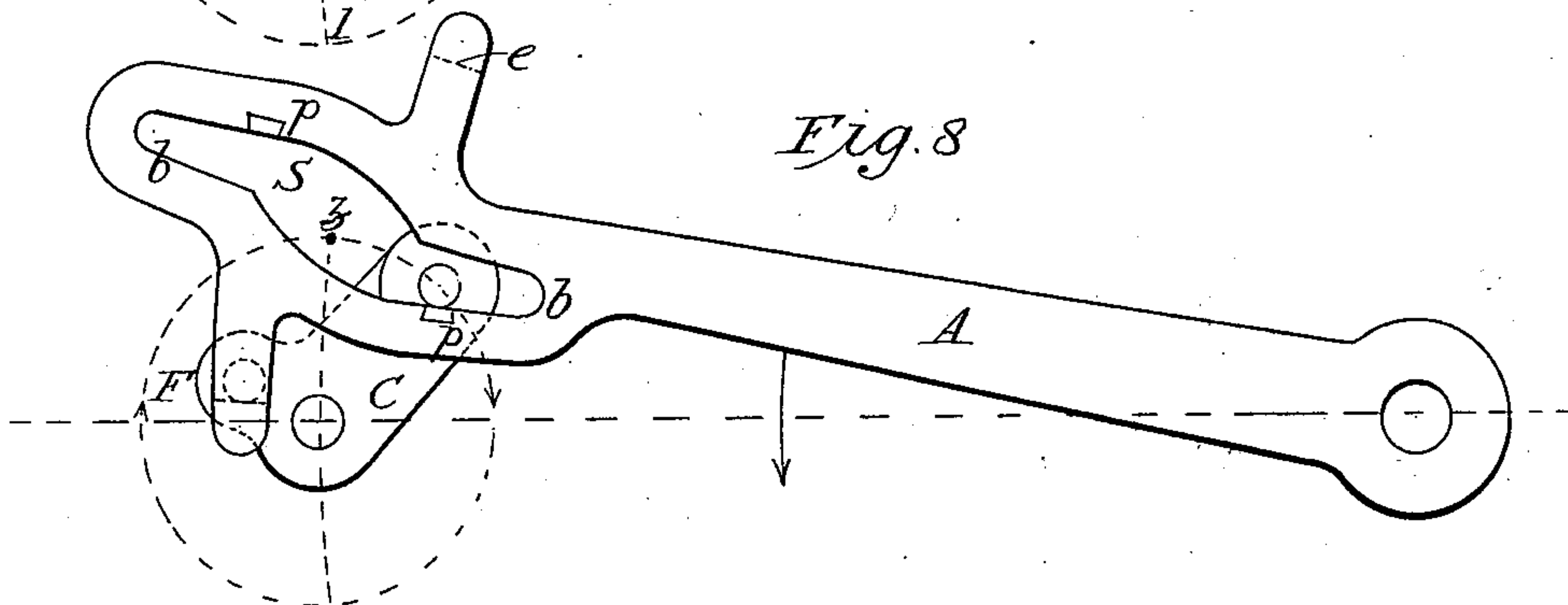
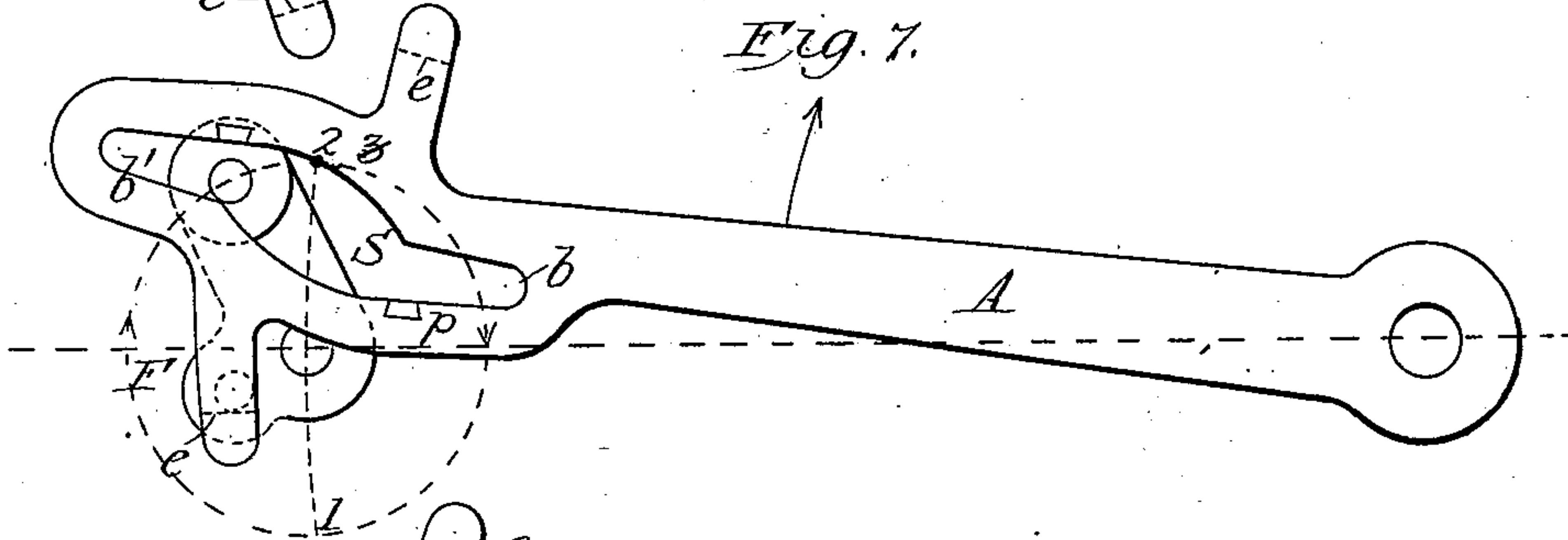
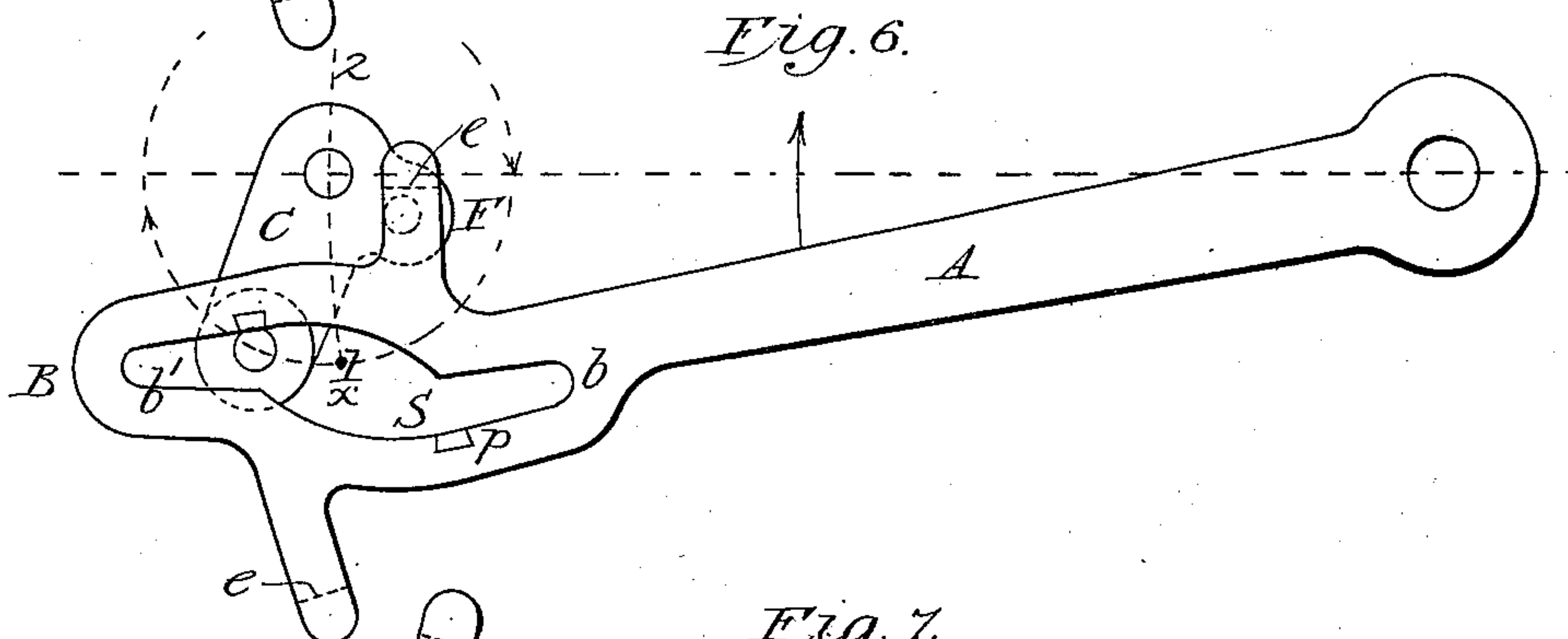
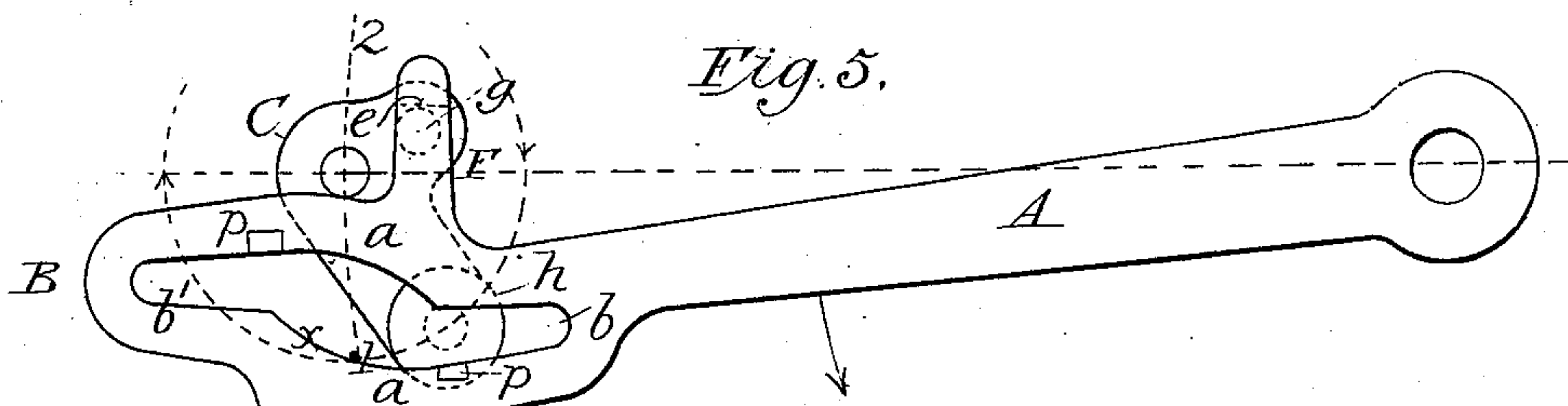
(No Model.)

2 Sheets—Sheet 2.

W. LIVINGSTONE.  
MECHANICAL MOVEMENT.

No. 562,086.

Patented June 16, 1896.



Witnesses  
*W. W. Hollingsworth*  
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# UNITED STATES PATENT OFFICE.

WILLIAM LIVINGSTONE, OF FLUSHING, NEW YORK.

## MECHANICAL MOVEMENT.

SPECIFICATION forming part of Letters Patent No. 562,086, dated June 16, 1896.

Application filed September 10, 1895. Serial No. 562,098. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM LIVINGSTONE, a citizen of the United States, residing at Flushing, in the county of Queens and State of New York, have invented certain new and useful Improvements in Mechanical Movements; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to means of overcoming the dead point or center in machinery where a reciprocating motion or an oscillating motion is to be converted into rotary motion; and the object of my invention is to accomplish this result by positive and direct application of force to the contrivance by which the conversion from one motion to the other is effected.

To this end the invention consists in the application of a differential or auxiliary crank to the main crank of the machine and in the adaptation of the crank-rod to act upon this differential crank as it approaches the dead-points and thereby drive the main crank past these dead-points.

In the accompanying drawings, Figure 1 represents a side view of a crank and a reciprocating crank-rod, with the crank approaching the dead-point and the device for throwing it past that point about to come into action; Fig. 2, the same, and illustrating the result of the action of the device, the crank having been driven past the dead-point. Fig. 3 represents the position of the crank just before reaching the opposite dead-point, and Fig. 4 its position after passing the same. Figs. 5 to 8 represent the invention and the action of passing the dead-point where the crank is actuated by an oscillating bar or lever.

Referring to the drawings, A designates a reciprocating crank-rod which may be coupled directly to a steam piston-rod or any other motor or driving mechanism by which a reciprocating motion can be given to it. This rod carries a head B, in which is a slot S in a position at or about at right angles to the crank-rod.

The slot is peculiarly shaped and consists of an open central part with curved sides and

straight-sided extremities. The crank-pin works in this slot, passing through the open part when the crank is passing the dead-points and traversing the straight extremities twice (up and down) when the crank passes the dead-points. The sides *a a'* of the open part of the slot are oppositely curved; but they are not conterminous, as these sides are so situated as to permit the crank-pin to be driven past the dead-points positively; and to this end their position corresponds to those points of the rotation of the crank where the force the connecting-rod exerts on the crank-pin begins to lessen, say at points where the crank is about at an angle of forty-five degrees to a horizontal line drawn through its axis or to the line of motion of the rod, as shown in Figs. 1 and 3. These points being opposite one another the curves begin at different distances from the axis of the crank, as shown.

The extremities *b b'* of the slot are straight or parallel sided except that opposite to the beginning of the curved sides *a a'*, respectively, the sides of the extremities *b b'* at *w w'*, respectively, are curved slightly toward the opposite curved sides *a a'* for the purpose of easing the movement of the crank-pin from those extremities to the curved sides. The slotted head B is also provided with tappets *e e'* on opposite sides of the head, the former being at a point below the axis of the crank and the latter above the same, their positions being governed by the point where they are to come into action when the crank reaches the position where it is to be moved past the dead-points.

The crank C is constructed in the usual manner, having a wrist-pin *f*, that moves in the slot S and is acted upon by the sides of the slot and rotated thereby as the rod reciprocates. F is a differential or auxiliary crank formed on the arm of the main crank or connected therewith in a suitable rigid manner. The wrist-pin *g* of this differential crank is so placed that when the main crank arrives at its forty-five-degree points it is in position to be struck and actuated by one or the other of the tappets *e e'*, as shown in Figs. 1 and 3.

The circle of rotation of the crank is indicated by broken lines, the arrow-heads indicating the direction of its motion, and the



dead-points by the dots designated  $x$  Z. The crank-rod in Figs. 1 and 4 is supposed to be moving to the right, and in Figs. 2 and 3 to the left, as indicated by the arrows.

5 Taking Fig. 1 as representing the position of the crank at the beginning of its movement to pass the dead-point  $x$ , it will be observed that the crank is at the forty-five-degree point, or thereabout, and the crank-pin  
10 is between the curved side  $w$  and the opposite end of the curved side  $a$ , so that its position is such that any further movement will cause its pin to pass out of the straight part  $b$  and the curved side  $a$  will permit it to pass  
15 without obstruction the dead-point  $x$ . At this point the tappet  $e'$  strikes the differential crank-pin, and the crank-rod in moving to the end of its stroke causes the tappet to act on the differential crank-pin and thereby  
20 drive the main crank from its position in Fig. 1 to the position it occupies in Fig. 2, that is entirely past the dead-point  $x$ . The crank-rod having now completed its movement to the right begins to return, whereupon the  
25 crank-pin enters the lower extremity  $b'$  of the slot and the side  $h$  thereof bears directly against it and moves the crank to the position it occupies in Fig. 3, (the pin passing to the lower end of  $b'$  and then returning again,) where the tappet comes in contact with the  
30 differential crank-pin  $g$ , and the curved side  $a'$  being now in the line of motion of the crank-pin the crank is thrown upward by the tappet to its position in Fig. 4, thereby being carried past the dead-point  $z$ . At this point  
35 the rod again arrives at the end of its movement and commences to return. The crank-pin moves up into and back again in the slot  $b$  and is moved directly by the side  $h'$  to the  
40 position it occupies in Fig. 1, whereupon the operation is repeated.

In Figs. 5 to 8 the invention is shown applied to a lever or treadle and the modification of the slotted head to adapt it to work  
45 the crank by an oscillating motion is illustrated. The slot  $S$ , it will be observed, is in a different position with respect to the crank, being formed in a generally parallel position relative to the length of the lever. The slot  
50 consists of a middle wide part connecting with the two narrower extremities  $b$   $b'$ , the sides of which, however, are not exactly parallel, and the curved sides  $a$   $a'$  of the wider part merging gradually into the adjoining  
55 sides of the extremities  $b$   $b'$ , as clearly shown. The tappets  $e$   $e'$  are formed on arms projecting from opposite sides of the slotted head. The remaining parts of the device are the same in construction as in the preceding figures (1 to 4) and are similarly lettered.  
60

The operation of driving the crank past the dead-points in this application of the invention differs slightly in the action of the parts from that first described, owing to the different motion of the operating device, but the principle of its action is the same. The point  
65 at which the crank arrives when the tappet

$e$  approaches the differential crank-pin  $g$  is at a sharper angle to the line of motion of the lever, (supposing this to be indicated by the  
70 broken line 1 2.) When the lever reaches the position it occupies in Fig. 5, the tappet  $e$  is in position to act on the differential crank-pin, and the further downward motion of the lever to the position shown in Fig. 6 causes  
75 the tappet to throw the crank past the dead-center  $x$  and to the position it occupies in Fig. 6, where the side  $h$  of the part  $b$  of the slot can act on the crank-pin directly and positively, whereby the crank is moved up-  
80 ward, the wrist-pin advancing and retreating in the part  $b$  as the lever rises until it reaches the point where it is shown in Fig. 7, at which time the tappet  $e'$  comes into position against the differential crank-pin, and by the  
85 further movement upward of the lever the tappet drives the crank past the dead-point  $z$  to the position it occupies in Fig. 8, and on the lever reversing its motion and moving downward the wrist-pin advances and re-  
90 treats in the part  $b'$  and the crank finally arrives at the position it occupies in Fig. 5, ready for the operation to be repeated.

Plates of rubber  $p$  may be placed in the sides of the slot and suitably secured at points  
95 where the wrist-pin of the crank strikes when it is thrown past the dead-point to deaden the noise.

It will be observed that the widened part of the slot  $S$  is so situated with respect to the  
100 dead-points of the crank that when the crank-pin arrives at the point where the crank rod or lever ceases to exert its full force on the crank the crank-pin can move independently of the motion of the crank-rod—that is, the  
105 curved sides of the slot permit the crank-pin to move past the dead-center while the slotted head is moving through a space equal to the length of the line connecting the center of the crank-pin from the position the pin occupies  
110 in Fig. 1 to that it occupies in Fig. 2.

I claim—

1. A mechanical movement for overcoming the dead-point in machinery consisting in the combination with a main crank of a differential  
115 or auxiliary crank means for operating the main crank and means for operating the said differential crank independent of the means that operates the main crank whereby the differential crank is brought into action  
120 when the main crank approaches the dead-point, and drives the main crank past the dead-point positively and directly, substantially as specified.

2. The combination of a main crank having  
125 a crank-pin, a differential or auxiliary crank connected therewith, a part provided with a slotted head which engages the main crank-pin, the slot in the sleeve-head at one part of its length adapted to permit the crank-pin to  
130 move independently of the motion of the crank-rod, and tappets disconnected from the slot and adapted to act on the differential crank when the main crank approaches the



dead-point to drive the main crank positively past the dead-point, substantially as specified.

3. The combination of a crank-rod fitted with a sleeve-head provided with a slot S, the  
5 middle part of which is wider than the extremities, and tappets located at a distance from the slot on opposite sides of the axis of the crank, a main crank, and a differential or  
10 auxiliary crank connected with the main crank and adapted to be acted on by the tap-

pets on the crank-rod to throw the main crank past the dead-points, substantially as specified.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

WILLIAM LIVINGSTONE.

Witnesses:

FREDK. HAYNES,  
CHAS. E. PETERS.