(No Model.) 3 Sheets—Sheet 1.

F. W. LINK.

ENGINE FOR CONVERTING MOTION.

No. 273,557. Patented Mar. 6, 1883.

Fig. 1.

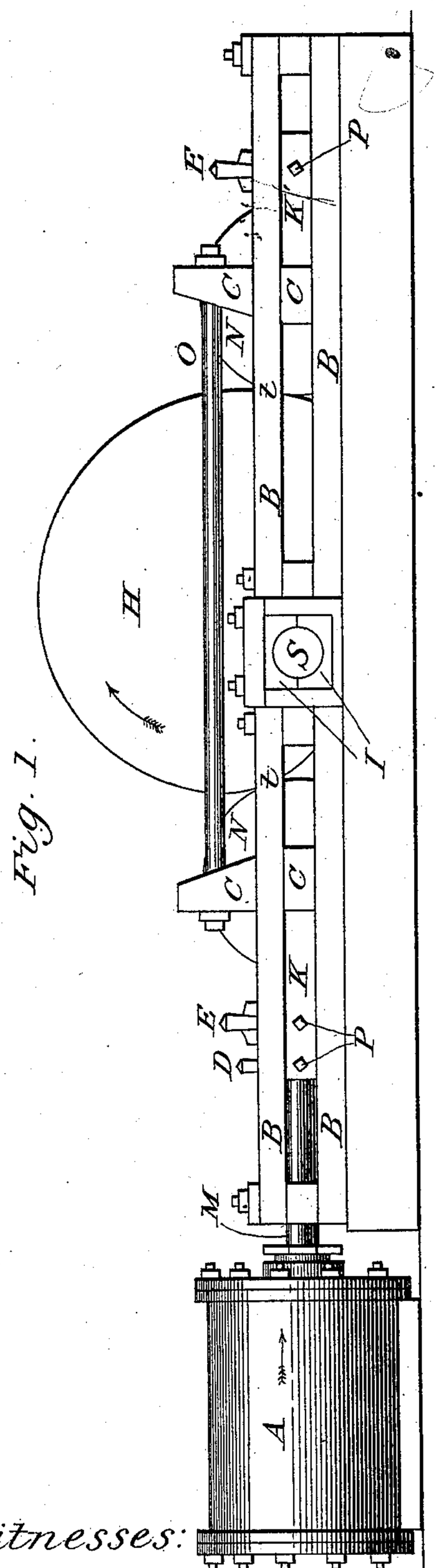


Fig. 5.

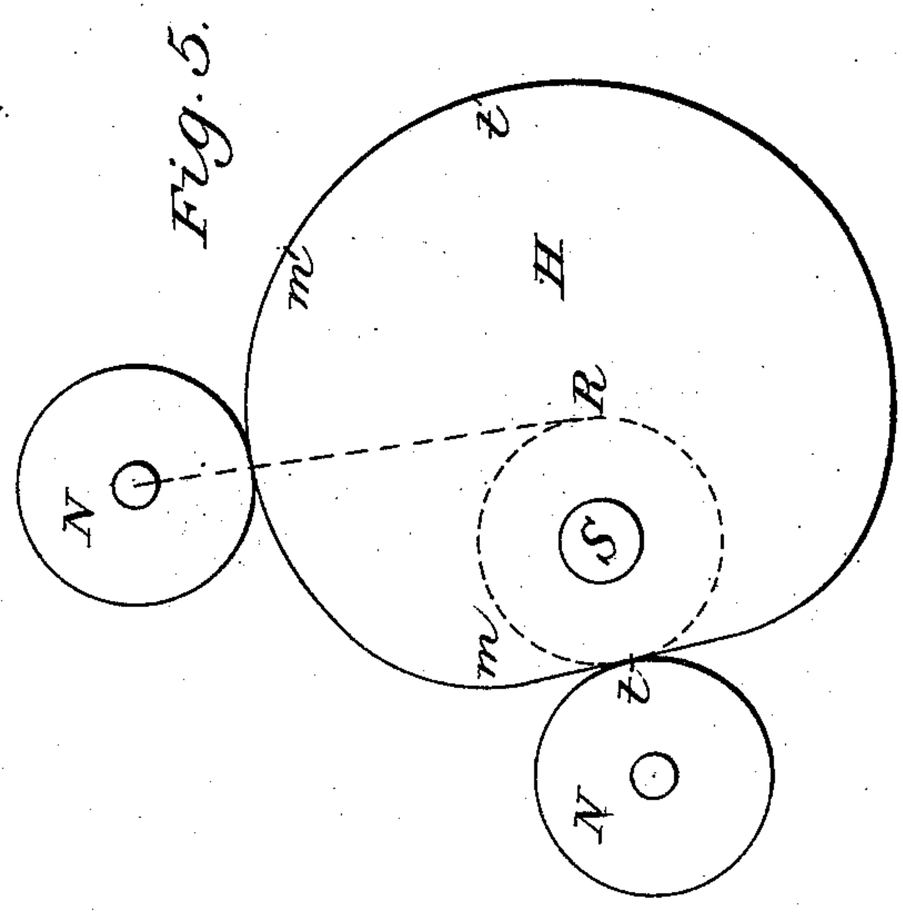


Fig. 3.

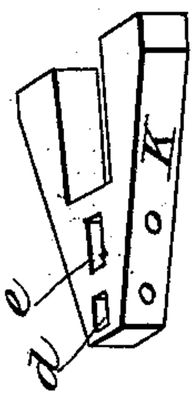


Fig. 4.

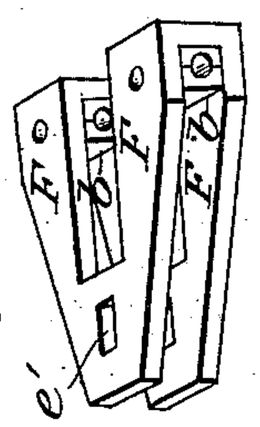
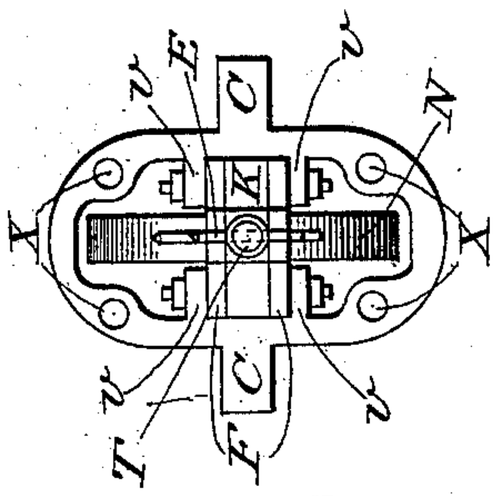


Fig. 2.



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ENGINE FOR CONVERTING MOTION.

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Fig. 7.

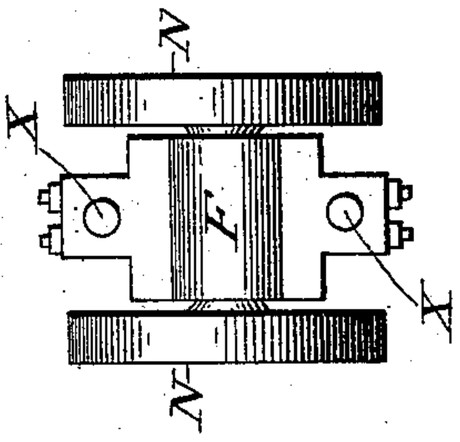
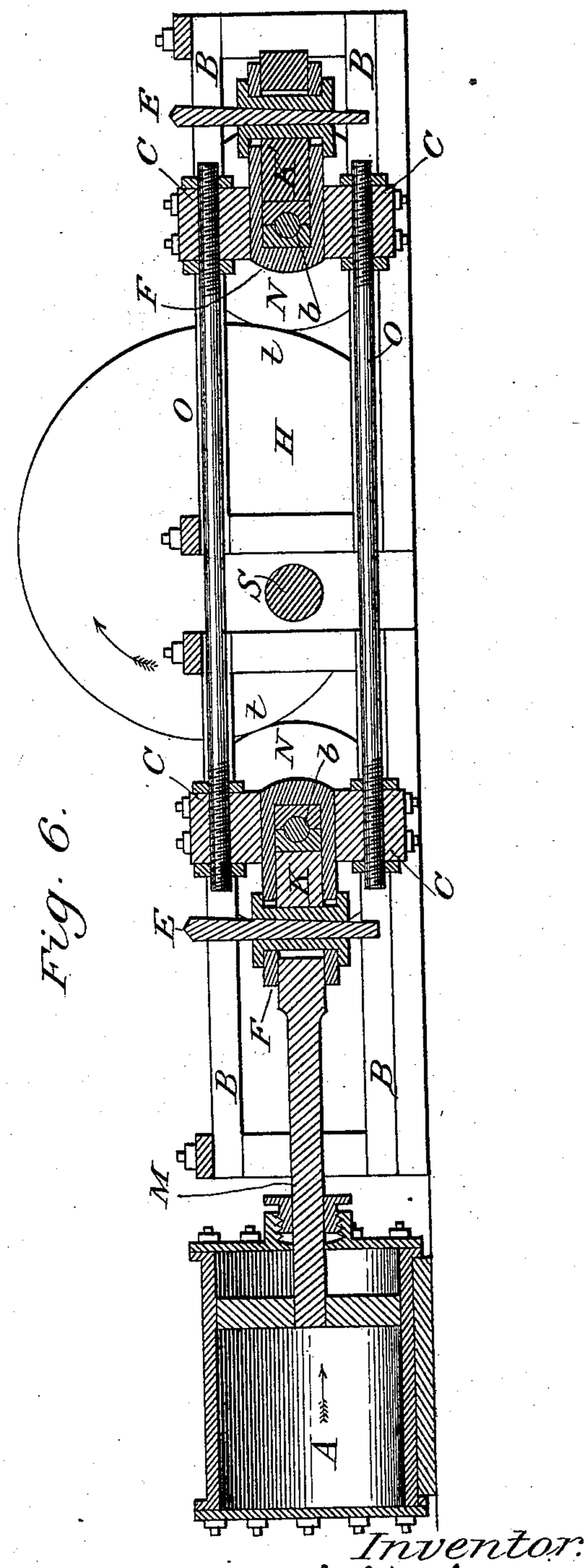


Fig. 6.



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(No Model.) 3 Sheets—Sheet 3.

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ENGINE FOR CONVERTING MOTION.

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Fig. 8.

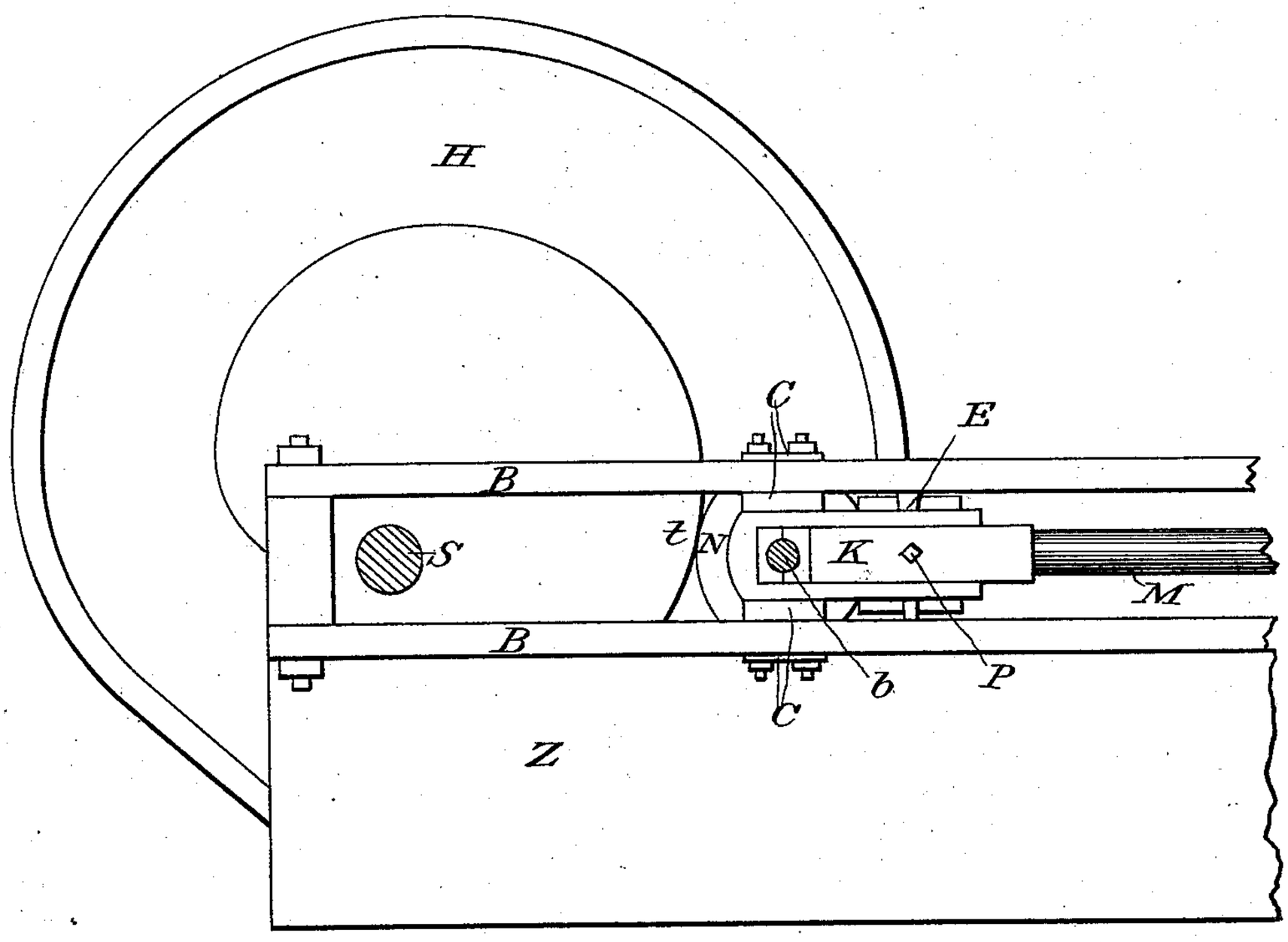
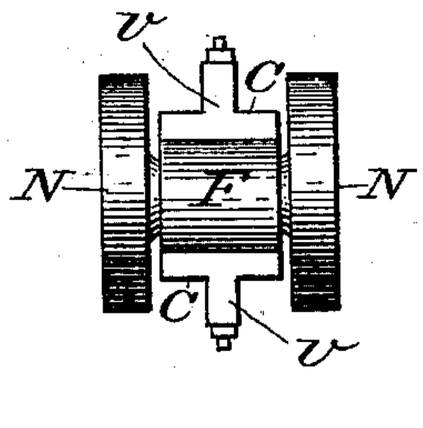


Fig. 9.



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UNITED STATES PATENT OFFICE.

FREDERIC W. LINK, OF MOUNT PLEASANT, OHIO, ASSIGNOR OF ONE-HALF TO NATHAN HOLLOWAY, OF CHICAGO, ILLINOIS.

ENGINE FOR CONVERTING MOTION.

SPECIFICATION forming part of Letters Patent No. 273,557, dated March 6, 1883.

Application filed May 31, 1882. (No model.)

To all whom it may concern:

Be it known that I, FREDERIC W. LINK, of Mount Pleasant, in the county of Jefferson and State of Ohio, have invented a new and useful Improvement in Engines, of which the following is a specification.

The invention relates to a new and improved connection or device for converting alternating forward and backward rectilinear motion and power into rotary motion and power.

The object of my invention is to provide a mechanism that will convert the reciprocating motion and power of a piston and piston-rod or any other similarly moving body into their exact equivalents of rotary motion and power.

The invention consists in a mechanism that is composed essentially of one or more cams fixed to a driving or main shaft, of a novel combined arrangement of one or more pressure-wheels, one or more strap-heads, and one or more cross-heads, whereby the motion and power of the piston and piston-rod are communicated to the cam or cams, and of guide-bars.

It also consists in the new arrangement and combination of these parts; and, finally, it consists in the particular and novel construction of some of the parts.

In the accompanying drawings, in which similar letters of reference indicate like parts, Figures 1, 6, and 8 are different forms of the mechanism that embodies the general plan of my invention. Fig. 1 is a side elevation of an engine having one cam. Fig. 6 is a vertical longitudinal section of an engine having two cams. The section is through the center of the cylinder, one-half of the engine being cut away. Fig. 8 is a vertical longitudinal section of part of an engine having two inside or grooved cams. Here the section cuts away one cam and one pressure-wheel. Fig. 2 is a front elevation of the combined cross-head, strap-head, piston-rod head, and pressure-wheel used in Fig. 1. Fig. 3 is a perspective of the Y-shaped piston-rod head in Fig. 1. Fig. 4 is a perspective of the strap-head used in Fig. 1. Fig. 5 is the cam and the same pressure-wheel in two relative positions. Fig. 7 is a vertical end elevation of the combined cross-head, strap-head, piston-rod head, and pressure-wheels used in Fig. 6. In Fig. 9 is seen an end elevation of the combined cross-head, strap-head, piston-rod head, and pressure-wheels used in Fig. 8.

The cam or cams H are fixed to a driving or main shaft, S, that is properly journaled in boxes I. Against the cam or cams H press the pressure-wheels N. These wheels have their shaft journaled in the brasses *b*. (Seen in Figs. 4, 6, and 8.) The strap F is securely attached to the projections *v* of the cross-head C. This may be done by means of bolts or otherwise. The piston-rod heads K and the butt-heads K′ fit into the space between the upper and lower leaves of the straps F, and are kept in their places and adjusted against the brasses *b* by the gibs and cotters E, and these are secured in their places by the set-screws and jam-nuts P. The slots *e* and *e′* are for the gibs and cotters E. The socket T is for the reception of the piston-rod M. The slot *d* is for the reception of the tapering pin D, which is kept secure in its place by the set-screw and jam-nut P. The piston-rod head may also be attached to the piston-rod by being screwed on or by being solidly continuous with it. The rods O pass through the orifices X in the cross-heads C, and are firmly fixed to the cross-heads by means of nuts and jam-nuts. These rods join the cross-heads together, so as to make one double cross-head. B are guide-bars between which the cross-head or cross-heads move. A is the cylinder. Z is a vertical projection from the bed-plate. When more than one cam is used they are identical and are placed on the same shaft so as to correspond to each other. When more than one cam is used there are as many pressure-wheels on a single pressure-wheel shaft as there are cams. The pressure-wheels are placed on their shafts, so as to correspond with the cam or cams. The pressure-surface of the cam H from the point that is nearest the center of the shaft S to the point that is farthest from the center of the same shaft is an involute curve. The evolute of this curve is a circle of variable radius.

In Fig. 5 the small cross-marks at *t* and *t′* indicate the points referred to. In the engine these points are called "dead" points. At these points the radius of the evolute is zero. Suppose the points of the involute to move away from the dead-point *t* in the direction of *m m′ t′*. The radius of the evolute will increase at

every point until it reaches its maximum at *m*. From *m* to *m'* the radius continues constant at maximum, *m'* being as many degrees from *t'* as *m* is from *t*. From *m'* the radius of the evolute decreases for every point until it reaches zero at *t'*. It is evident that the same is true of the other side of the cam. Since it is the property of the involute that the perpendicular through the point of contact to any tangent of the curve will itself be a tangent to the evolute for that point, and since the line that passes through the center of a circle and the point of contact of the circle and an involute is perpendicular to their common tangent, it follows that it is tangent to the evolute for that point. Hence all pressure by the pressure-wheels N on the cam H is in the direction of a straight line that passes through the center of the pressure-wheel and through the point of contact, and that is tangent to the evolute for that point. The leverage of the pressure is measured by the radius of the evolute; and since the relative length of any two tangents to an evolute is measured by the length of the arc included in their angular divergence, it follows that the motion communicated to the cam by the pressure-wheels is equal in its angular divergence to the distance through which the center of the pressure-wheel moves.

In order to understand the operation of the device, suppose the parts to be in the relative position indicated in Figs. 1 and 6. Suppose a horizontal plane to pass through the main shaft, the pressure-wheels, and the cylinder at their centers. Let us call this the "plane of centers." Let the pressure in the cylinder be in the direction of the dart. Then will the motion communicated by the piston-rod to the pressure-wheel N by its pressure at *t* against the cam H turn it in the direction of the curved dart, since the pressure is above the plane of centers. When the point of contact *t* comes near the dead-point the velocity of the piston-rod gradually diminishes until the point *t* has become the dead-point, when the piston-rod will have come to a stop; but the point *t* is at the dead-point for but an instant, the momentum of the cam or fly-wheel carrying it by, and the power being in the meantime changed into the opposite direction, the other pressure-wheel now begins to press against the cam. The direction of pressure now being below the plane of centers, the cam continues moving in the same direction as before. As the point of contact *t* moves away from the dead-point the piston gradually increases its velocity until it reaches maximum. The cam is so constructed that the distance on the plane of centers between the centers of the pressure-wheels is constant, the pressure-wheels being of equal size and in contact with the cam. I do not confine myself to the cam specially described, as it is evident that other cams can be used in the same way and for the same purpose when grooved or inside cams are used,

What I claim is—

1. An involute cam, H, having an evolute of variable radius at the beginning and at the end of the stroke, varying from zero to maximum at the beginning and from maximum to zero at the end, and an evolute of constant maximum radius between these extremes, substantially as described, and for the purpose set forth.

2. The combined cross-head, strap-head, pressure wheel or wheels, and piston-rod head or butt-head, substantially as described.

3. The piston-rod head K, whereby, in connection with the strap-head F, the brasses *b* are adjusted to the shaft of the pressure wheel or wheels N, substantially as set forth.

4. The strap-head F, whereby, in connection with the piston-rod head K or the butt-head K', the brasses *b* are adjusted to the shaft of the pressure wheel or wheels N, substantially as described.

5. The butt-head K', whereby, in connection with the strap-head F, the brasses *b* are adjusted to the shaft of the pressure wheel or wheels N, as set forth, and for the purpose indicated.

6. The cross-head or cross-heads C, as described, and for the purpose set forth.

7. The compound cross-head C C, the parts being united by connectors O, substantially as described.

8. The shaft S, journals I, bed-plate Z, guide-bars B, cross-heads C, connectors O, strap-heads F, brasses *b*, pressure-wheels and shafts N, butt-head K', piston-rod head K, jibs and cotters E, set-screws and jam-nuts P, piston and piston-rod M, and cylinder A, in combination with the cam or cams H, substantially as set forth.

9. The shaft S, journals I, bed-plate Z, guide-bars B, cross-head C, strap-head F, brasses *b*, pressure-wheels and shaft N, butt-head K', jibs and cotter E, set-screw and jam-nut P, piston and piston-rod M, and cylinder A, in combination with cams H, substantially as described.

10. The pressure-wheel or pressure-wheels N and the cross-head C, in combination with the piston-rod M, (or other similarly-moving body,) whereby the power and motion of the piston are communicated to the cam or cams H, substantially as described.

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