(No Model.)

3 Sheets—Sheet 1.

H. RHYN.

STEAM ENGINE OR OTHER MOTOR.

No. 391,860. Patented Oct. 30, 1888.

Fig. 1.

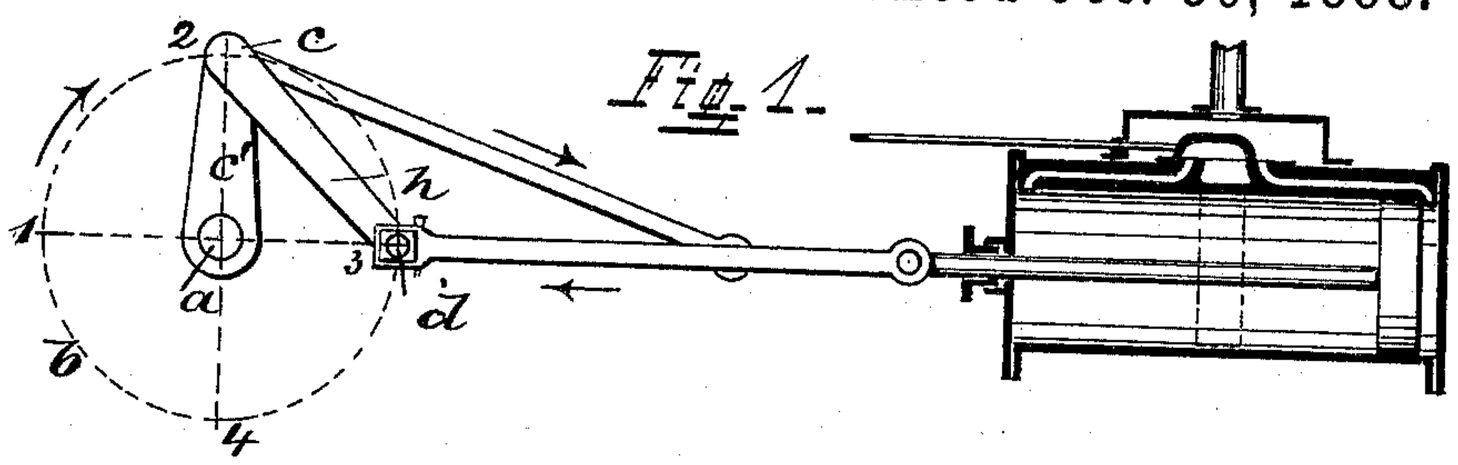


Fig. 2.

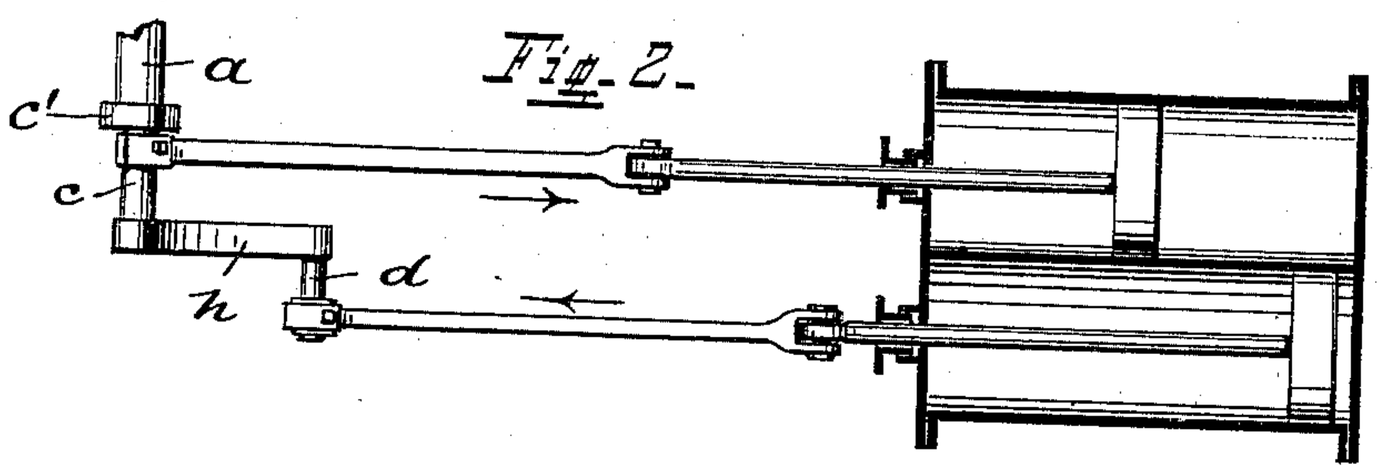


Fig. 3.

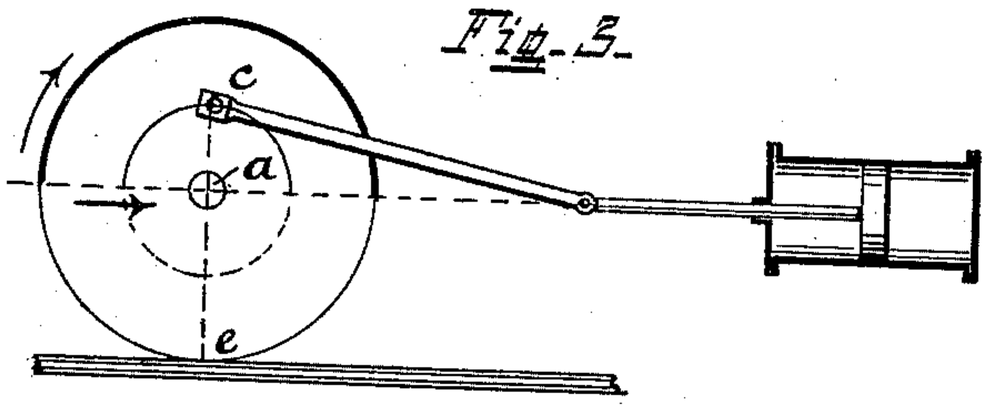


Fig. 4.

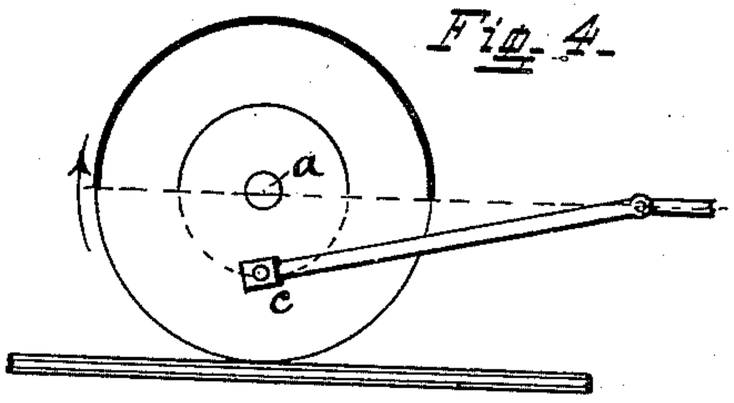


Fig. 5.

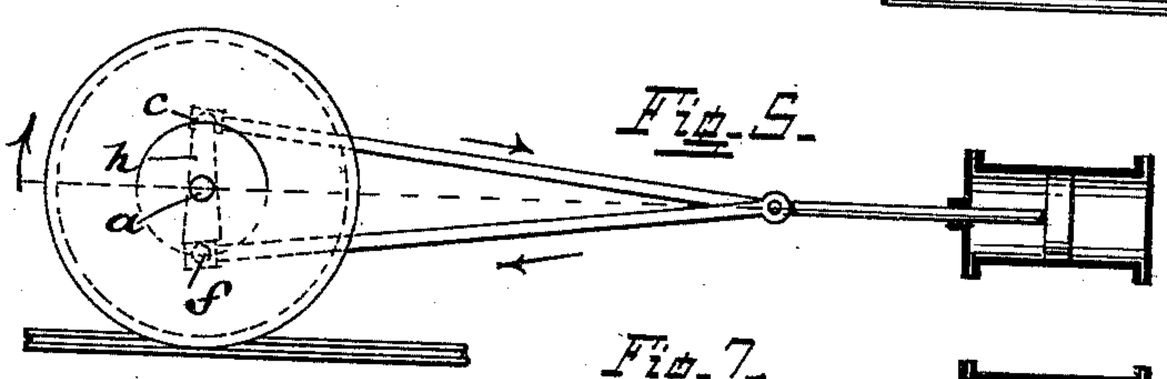


Fig. 7.

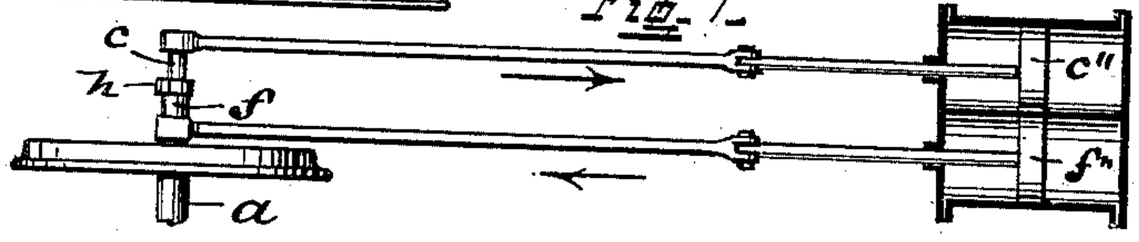


Fig. 6.

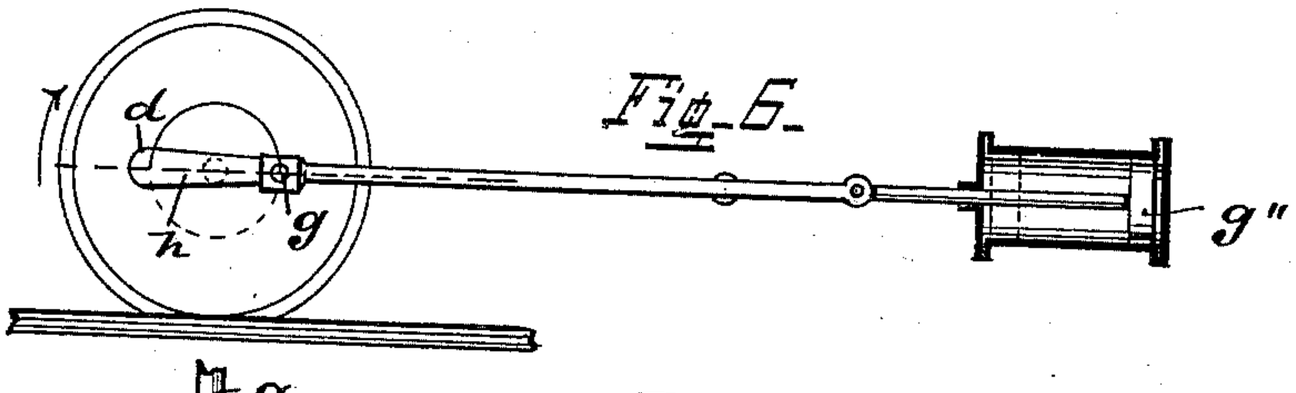
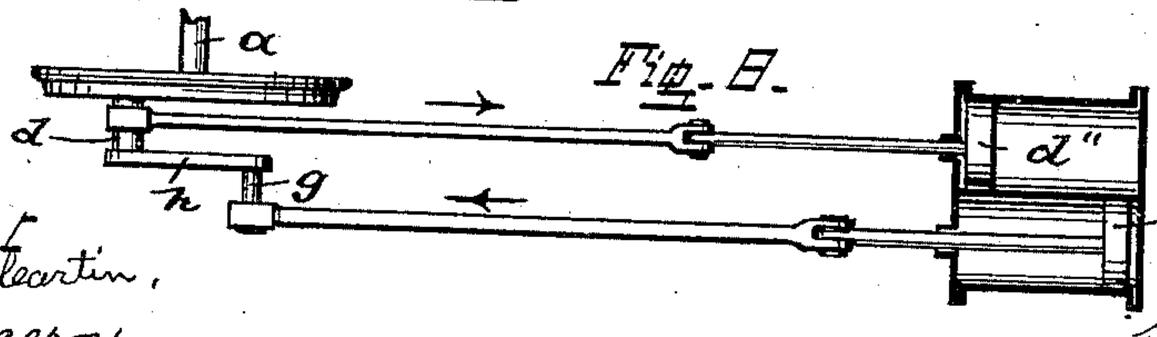


Fig. 8.



Attest
Jas. J. McClearin.
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(No Model.)

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STEAM ENGINE OR OTHER MOTOR.

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Fig. 9.

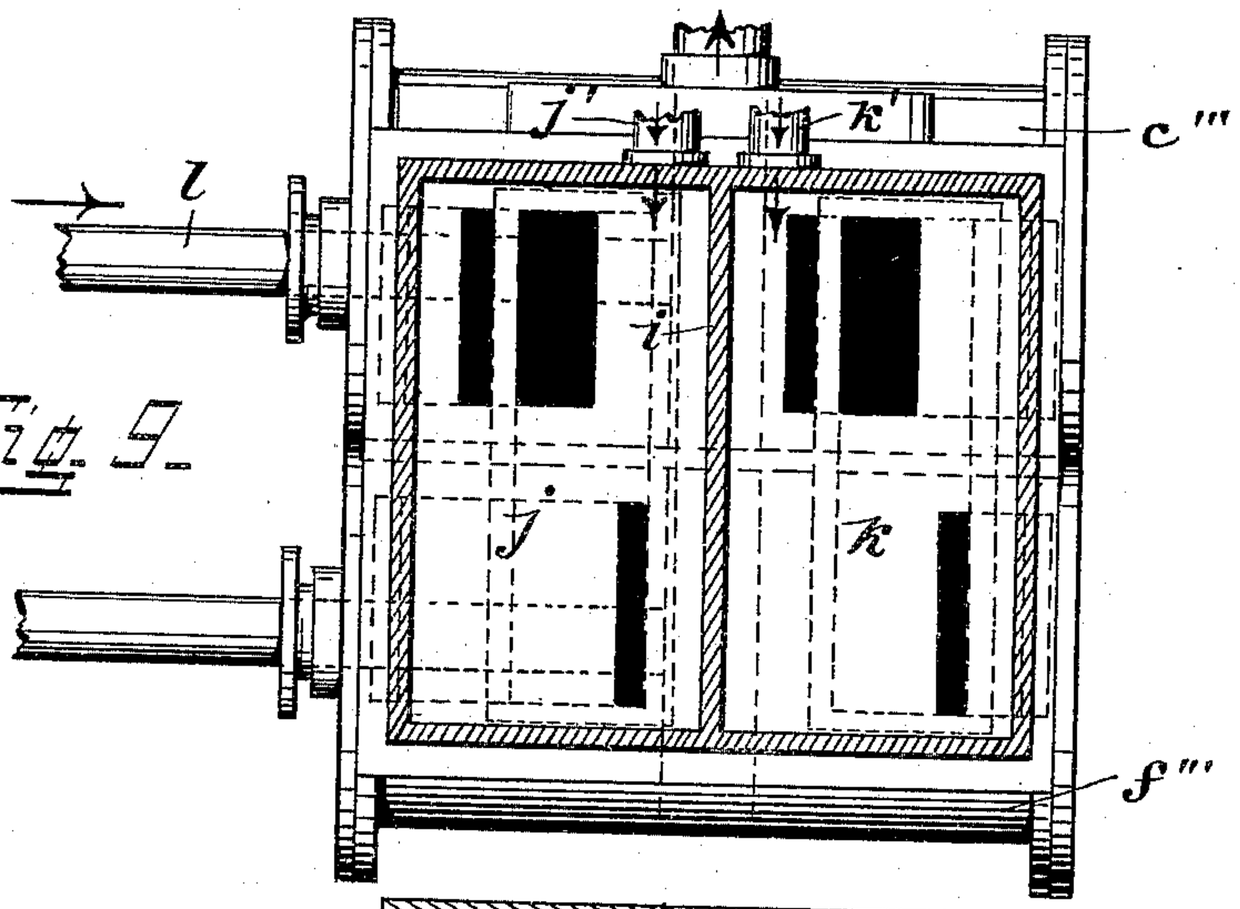


Fig. 10.

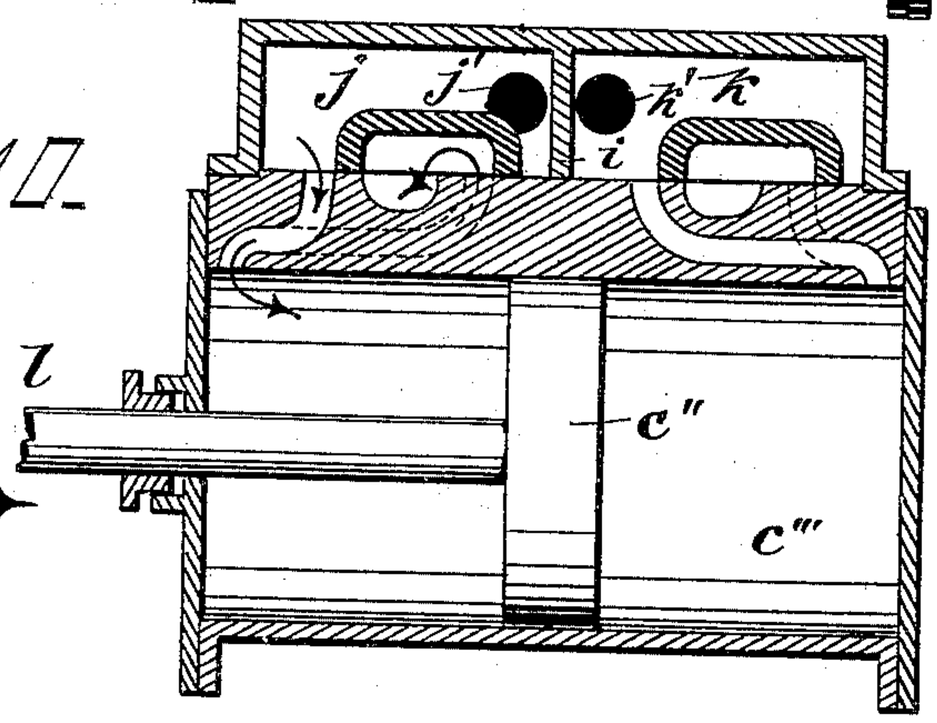
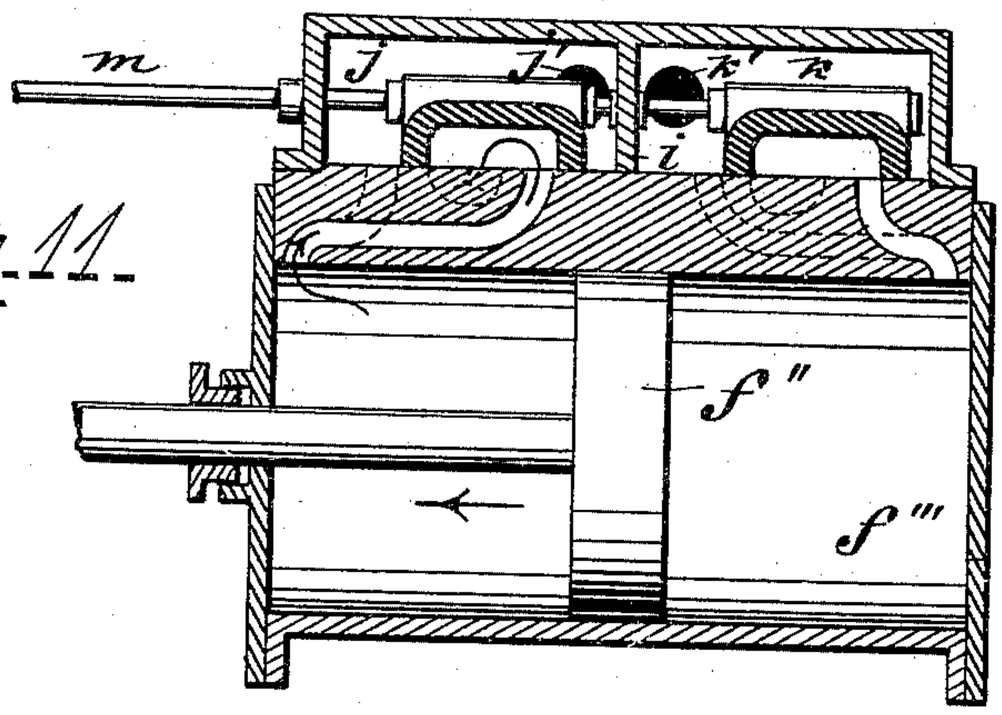


Fig. 11.



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(No Model.) 3 Sheets—Sheet 3.

H. RHYN.

STEAM ENGINE OR OTHER MOTOR.

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Fig. 12.

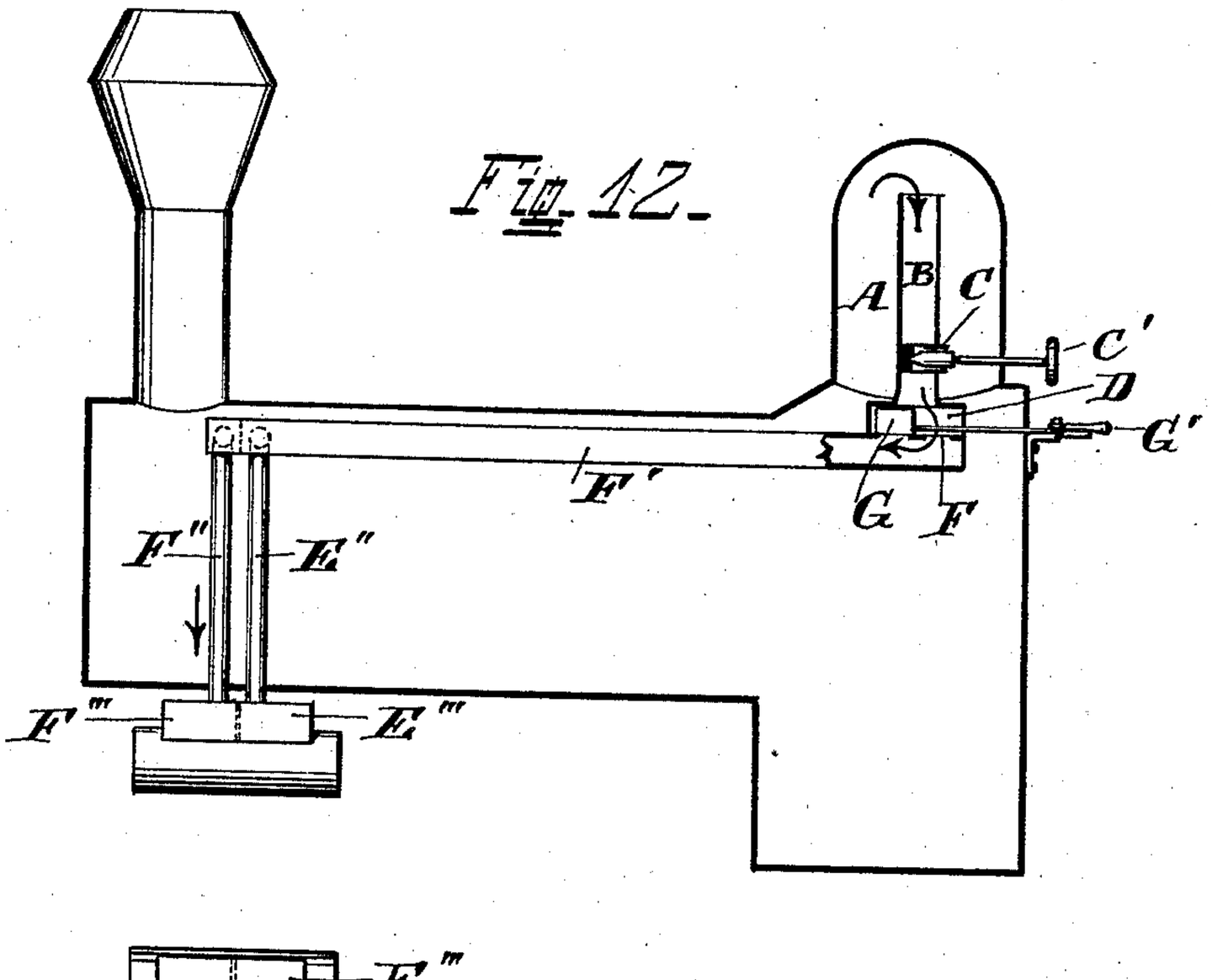


Fig. 13.

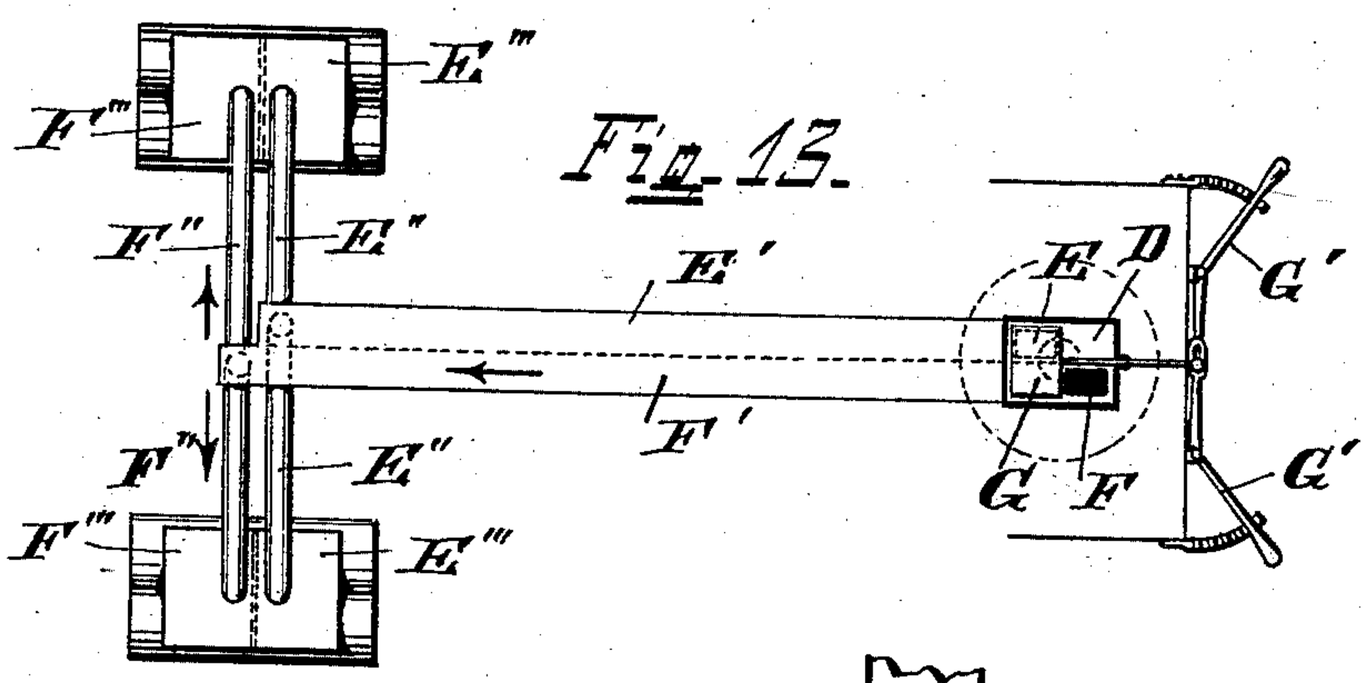


Fig. 15

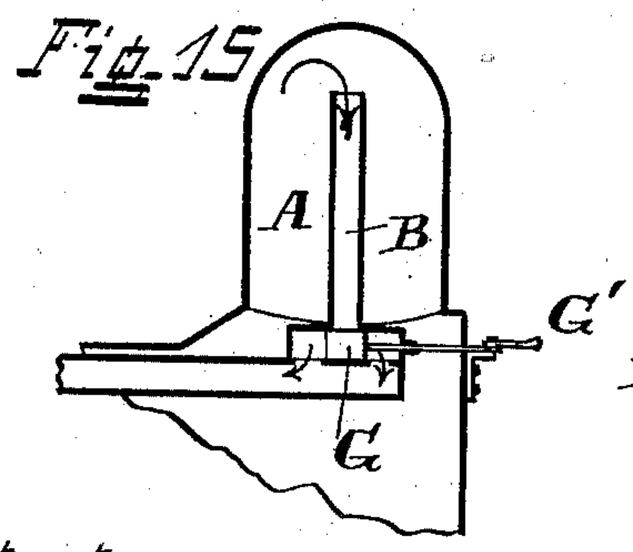
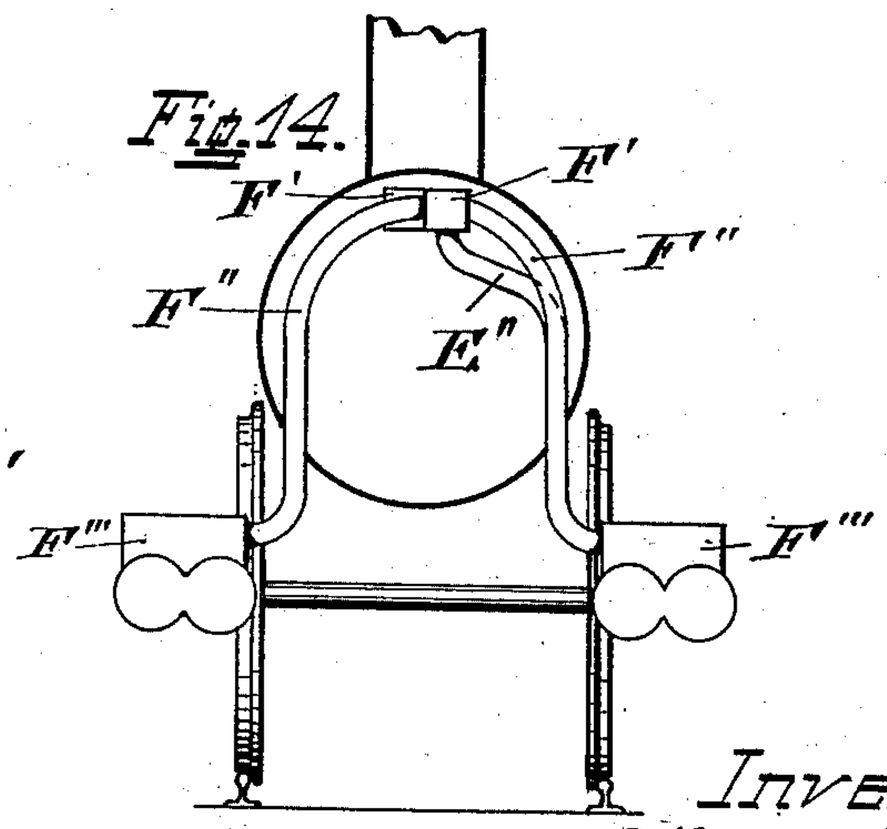


Fig. 14.



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UNITED STATES PATENT OFFICE.

HENRY RHYN, OF PHILADELPHIA, PENNSYLVANIA.

STEAM-ENGINE OR OTHER MOTOR.

SPECIFICATION forming part of Letters Patent No. 391,860, dated October 30, 1888.

Application filed May 17, 1886. Renewed September 12, 1888. Serial No. 285,236. (No model.)

To all whom it may concern:

Be it known that I, HENRY RHYN, a citizen of the United States, residing at Philadelphia, Philadelphia county, State of Pennsylvania, have invented certain new and useful Improvements in Propelling Steam-Engines, of which the following is a specification.

My invention relates principally to locomotive, marine, and traction engines.

In most engines heretofore built the speed of the reciprocating parts varies, the rotating parts gain and lose power at certain points while completing their revolutions. In other words, there are points of maximum and minimum effectiveness (the latter generally called "dead-points") in each revolution. To overcome this inequality of power the fly-wheel has been introduced, which stores up the maximum power and by its momentum distributes it equally during the revolution. In case of locomotives the momentum of the moving train accomplishes this equalization.

In consideration of above-mentioned facts, the object of my invention will be more clearly understood. I propose to do away with such unequal distribution of power, having no points of maximum or minimum power, but having an engine giving out a constant working effect during the entire revolution of its driving parts equal to the highest maximum effect ordinarily obtained in only two points of the crank-circle, or, in other words, having nothing but a succession of points of maximum effectiveness all round in the circle of the crank-pin equal to the effect obtained only in two points of the same circle before.

I attain the object of my invention in the construction illustrated in the accompanying drawings, in which—

Figure 1 shows in a diagram a side view of an engine, and Fig. 2 a top view of same. Figs. 3 and 4 are diagrams of the drivers of a locomotive. Figs. 5 and 6 represent in diagrams the left and right driver of a locomotive; and Figs. 7 and 8 are top views of the same, respectively. Fig. 9 represents one pair of cylinders as I use them on each side of my engine. Fig. 10 is a longitudinal central section through cylinder C‴ of the preceding figure. Fig. 11 is a like section through cylinder *f‴* of Fig. 9. Fig. 12 is a longitudinal section of a locomotive, only those principal parts being shown which indicate the position of my improvements. Fig. 13 shows in a top view the steam supply pipes from their fore end to the steam-cylinders. Fig. 14 is a front view of a locomotive, shown in the same manner as Fig. 12. Fig. 15 is a modification of my reverse-valve.

The first principle of my invention (the employment of two cranks set ninety degrees apart) I have illustrated in the diagrams Figs. 1 and 2, in which *a* is the driving-axle. *b* is the radius described by the two crank-pins. *c d* are the crank-pins. 1 and 3 are the dead-points, and 2 and 4 the points of highest power in ordinary engines.

Supposing, as in the case in those engines, only one crank, *c*, would be used, it would be at its maximum power, as shown. Now, then, it will lose in the same proportion as it approaches point 3, where its working effect will be zero, or nothing. It will gain again as it approaches point 4, and so on. It is obvious that a good deal of the power gained at the points 2 and 4 will be absorbed by the losses at the dead-points 1 and 3. The introduction of a second crank, *d*, changes this at once. Crank *c* is at its full power, crank *d* at its lowest, and as the cranks rotate in the direction of the arrow what crank *c* is losing by approaching point 3 crank *d* is gaining by approaching point 4. Furthermore, by examining Fig. 1, it will be seen that while one crank, *d*, is at its supposed dead-point, the other one's piston is under a full head of steam and pulling the former one over this dead-point. This repeats itself all around at each point of the crank-circle, including the two dead-centers, and in any position of the cranks one always gains power in the same proportion as the other one loses it. In locomotives and traction-engines especially I consider the effect of the crank on the drivers below the line of reciprocating motion like nothing, entirely ineffective, and all steam used for the stroke during this half-revolution wasted.

To make myself better understood, I refer to the diagrams Figs. 3 and 4 of the drawings. Fig. 3 shows the drivers of a locomotive, the

crank being at its most effective point and above the line of reciprocating motion. In this case the diameter, drawn from the crank-pin through the center, (represented by a dotted line,) acts as a lever on the load, which is represented by the axle *a*. *e* is the support produced by the weight of the engine above and the friction on the rails below. *c* is the applied power in the shape of the crank-pin on the other end of this lever, pulling the load forward. In Fig. 4 the crank-pin is below the line of reciprocating motion. Here we have the power *c*, the load *a*, but no support, consequently no leverage. Here it is where the drivers slip every time, but are carried over by the momentum of the running train. For these reasons I abandon this stroke entirely, doing my effective work all above the line of reciprocating motion.

As will be seen, four cranks are employed on one axle to perform one revolution of the drivers. Crank *c* in Fig. 5 and crank *d* of the other driver, Fig. 6, are in the same relation to each other and having the same effect on axle *a*, being both fast with it, as already explained before in diagrams Figs. 1 and 2. Two cranks ninety degrees apart are always effective, one on each side, each in the upper half of the crank-circle, the two half-circles supplementing each other, making a full circle in which each point through which the crank-pin travels is a point of maximum power. Thus I use only the most effective portion of the revolution of the crank-pin, and as I use livesteam for that stroke only I economize consequently in steam and fuel. In other words, steam enters one of the two cylinders on each side only at the forward stroke of the respective piston. For instance, on one side (see Figs. 5 and 7) piston *c''* of crank *c* is moving forward under a full head of steam, while piston *f''* is going back under no pressure and its cylinder is exhausting. At the same time piston *d''* of crank *d* (see Figs. 6 and 8) begins its forward stroke under a full head of steam, and piston *g''* of crank *g* begins to move back, no steam being admitted into its cylinder. In case the locomotive is going backward, the formerly backward stroke is used now, and everything takes place precisely as described, only in opposite directions. The lateral distance of the cranks in this case does not change the general features and principles of my invention, as they are all acting on one main driving-axle and all crank-pins are moving or revolving in the same circle. Of the four cranks and four cylinders only two cranks and cylinders are alternately doing the real work at the time—one on each side; but because I do not count on the lower half of the revolution of the crank-pins (for reasons as explained already) I need this arrangement in order to have always two cranks ninety degrees apart and supplementing each other moving above the line of reciprocating motion.

Having thus explained in general the principles of my invention, I shall show now more particularly some ways how to practically apply my methods to steam-engines.

In locomotives the crank is constructed in a similar way as shown in diagrams Figs. 1 and 2; but the position of piece *h* is different. It is set so that its two ends carrying the crank-pins are one hundred and eighty degrees apart. On the other driver it is the same; but piece *h* is so set as to be at an angle of ninety degrees to the same piece of the former driver. One valve and one eccentric will do for each pair of cylinders, as only one cylinder of a pair performs actual work at a time. Each pair of cylinders is, however, really only a substitute for one cylinder of the pair in an ordinary engine, and they may consequently be smaller. Such arrangement is necessary, because I only use one stroke of each pair (always the stroke in the direction in which the locomotive or propeller is moving) at the time. The reasons for so doing I have already explained above. Thus by using four cylinders I can dispense with the backward stroke of the pistons, during which time the crank-pins move below the line of reciprocating motion, and still have always two pistons—one on each side—under full head of steam, rotating the crank-pins during the most effective portion of the crank-circle—that is, above the line of reciprocating motion.

The cylinders may be considerably smaller than ordinarily used, and their arrangement and location, of course, are left entirely to the constructor and has to suit the engine in consideration of the work it is to be used for. They may be close together or apart. The reversal of such a locomotive makes a different construction of the steam-chest and valves necessary, and is fully shown in the drawings.

The top of the two cylinders is occupied by the live-steam chest, which is divided steam-tight by a partition, *i*, making in reality two steam-chests, *j* and *k*, of which only one is to be used while going in one direction. Each steam-chest has two steam-ports and one exhaust-port. Of the two steam-ports one communicates with one cylinder, the other with the other one, the two being covered by one valve—that is, one port supplies one cylinder with live steam, while the other port exhausts the other cylinder. In the illustrations the locomotive is supposed to move forward, or in the direction the arrow on piston-rod *l* points. In this case steam-chest *j* only supplies alternately the two cylinders, while from steam-chest *k* the steam-supply is cut off. Piston *c''* moves under full live-steam pressure, the arrows, Fig. 10, indicating the directions in which said steam travels, (see Fig. 10,) while piston *f''* moves back, having no steam behind it. By this arrangement, the valve being correspondingly set, steam will always and only enter the cylinders when the pistons are moving forward—that is, in the direction

the locomotive travels—and when the crank-pins are above the line of reciprocating motion.

The reversing of my engine consists merely and only in changing the flow of steam from one steam-chest to the other. In the present case to make the engine go backward steam-pipe j' will be closed, k' opened, and steam-chest k will be filled with live steam. Valve-stem m extends through the steam-tight partition and carries another valve precisely the same shape and set like the other one. The ports are so arranged in relation to this valve (see drawings) that no matter at which point of the stroke the engine is reversed by changing the flow of steam live steam will always enter that cylinder in front of that piston whose crank is moving above the line of reciprocating motion, thus having right away the same order of things as before, only in an opposite direction.

In order to explain more fully the reversal of my engine, I refer to Figs. 12, 13, 14, and 15. From the steam-dome A steam enters tube B, and, if throttle-valve C is open, always fills space D. In space D are two ports, E and F, communicating with steam-pipes E′ and F′. On the forward ends of those steam-pipes each one has two branch pipes, E″ E″ and F″ F″, of which each branch leads to a steam-chest on each side of the engine. Valve G, being actuated by levers G′ from the outside, (the engineer's cab,) covers either one or the other of ports E or F. In the present case steam enters port F, passes through pipe F′, branches F″ F″ to the steam-chests F‴ F‴, and the engine is going backward.

To reverse the engine all that is necessary is to pull valve G out so as to uncover port E and cover port F, and the engine will go forward. The throttle does not need to be touched at all, as is now the case. Valve G might be so arranged and constructed as to take the place of the throttle-valve in the same time, which modification is illustrated in Fig. 15. Valve G is operated, as shown, from either side, being provided with two pivoted levers, G′, whose free ends work in graded segmental racks.

By arranging cylinders and operative parts different many modifications are possible without changing the spirit and meaning of my invention.

Having thus explained my invention, what I claim as new is as follows:

1. A propelling steam-engine with two double cylinders, four steam-chests, and four valves, two valves of a double cylinder being on one valve-rod, but in different steam-chests, one steam-chest of the two on each side only being supplied with live steam while going in one direction.

2. In a propelling steam-engine having four cylinders, two at each side, the cranks of one pair being in one line or one hundred and eighty degrees apart, but set at right angles to the similarly-constructed cranks of the other pair, the corresponding cylinder of each crank only receiving steam while said crank travels through the upper half of its circle.

3. A propelling steam-engine having two cylinders and two steam-chests on each side, each steam chest having its own steam-pipe branch and slide-valve, the two slide-valves of one side connected to and actuated by one valve-rod, one steam-chest on each side only being used while going in one direction, the valve therein so set and the ports so devised as to supply live steam alternately to the two cylinders on same side at their relative forward stroke.

4. In a propelling steam-engine, the combination, as described, of four steam-cylinders, four steam-chests, E‴ F‴ E‴ F‴, four steam-pipe branches, E″ F″ E″ F″, two steam-pipes, E′ F′, having ports E and F, valve G, and hand-lever G′, with steam-dome A, one steam-pipe only with its branches being used to supply the steam-cylinders while going in one direction, the engine being reversed by merely changing the flow of steam from one pipe to the other and its branches.

5. In a propelling steam-engine, the combination, as described, of double steam-pipes E′ F′, and their branches E″, F″, E″, and F″, supplying steam-chests E‴ F‴ E‴ F‴ of double steam-cylinders.

6. In a propelling steam-engine, the combination, as described, of double cylinders and double steam chests, two ports, one from each cylinder and at their same corresponding ends entering one steam-chest, two corresponding ports entering the other steam-chest from the other ends of the two cylinders, thereby (one steam-chest only being supplied with live steam while going in one direction) admitting steam only to one side of the piston.

In testimony of which invention I hereunto set my hand.

HENRY RHYN.

Witnesses:
CARL SPENGEL,
AARON E. MOORE.