

G. H. Reynolds,
Reciprocating Steam Engine,

No. 37,077,

Patented Dec. 2, 1862.

Fig. 2.

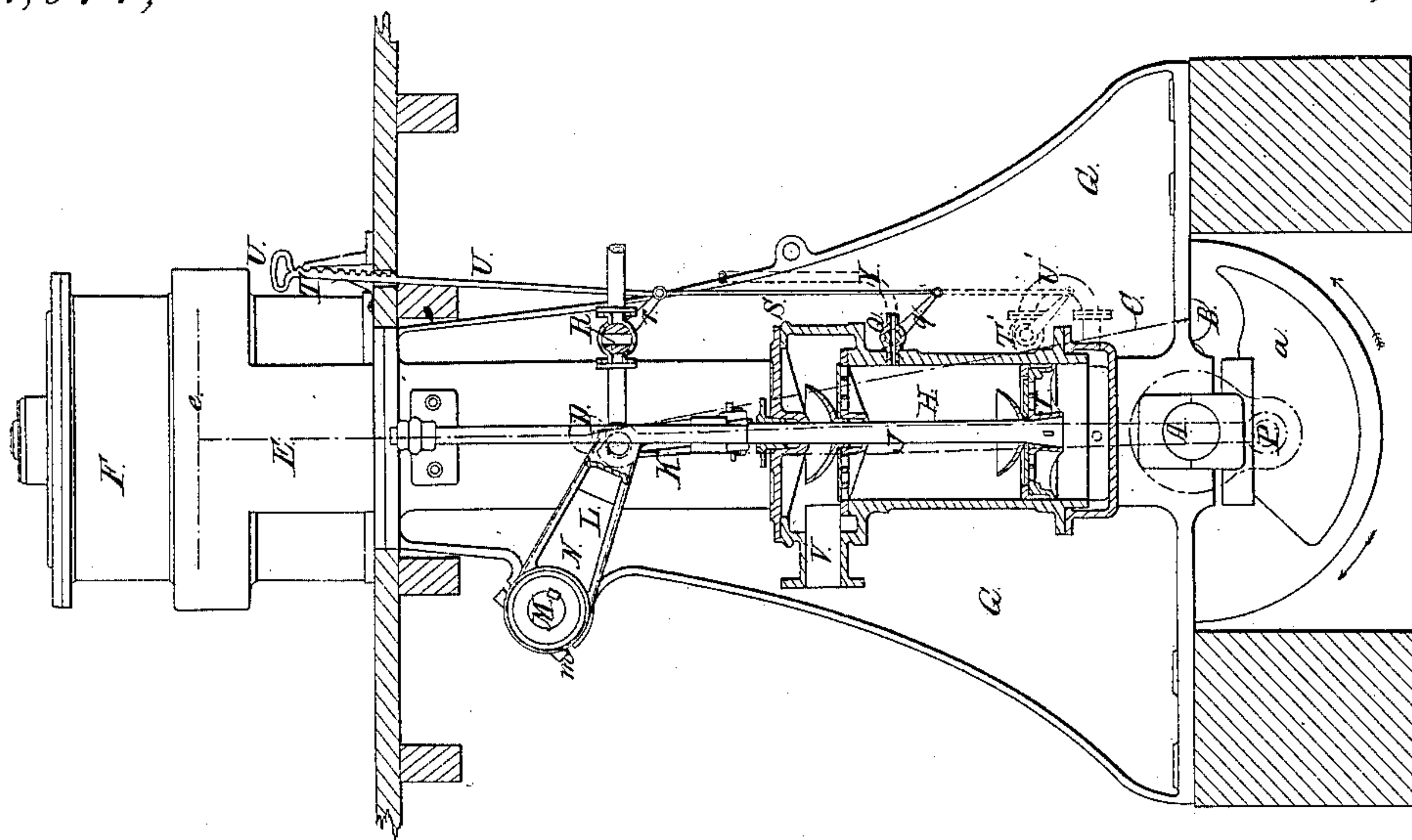
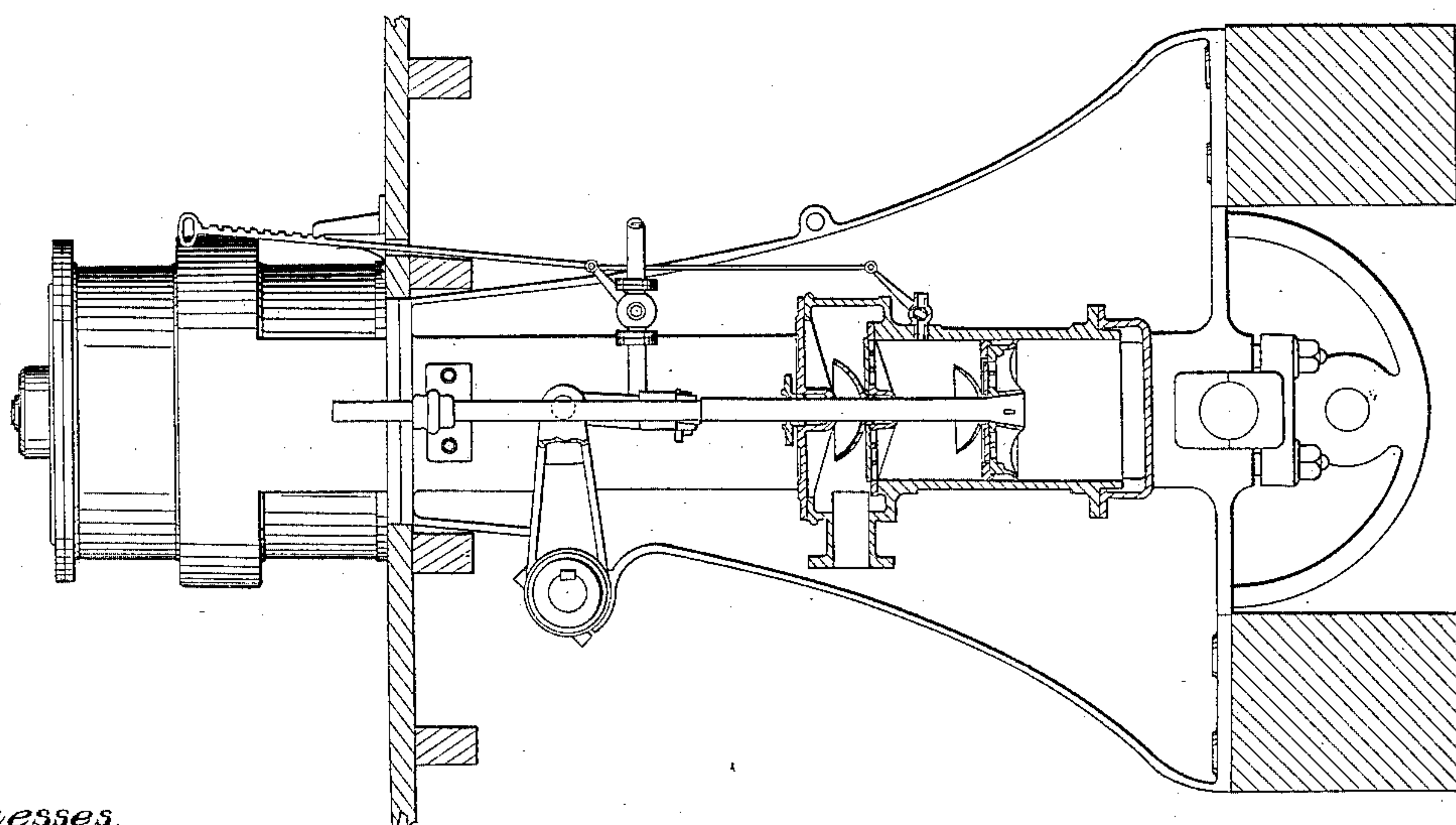


Fig. 1.



Witnesses.

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UNITED STATES PATENT OFFICE.

GEORGE H. REYNOLDS, OF NEW YORK, N. Y., ASSIGNOR TO HIMSELF AND
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IMPROVEMENT IN CONDENSING STEAM-ENGINES.

Specification forming part of Letters Patent No. 37,077, dated December 2, 1862.

To all whom it may concern:

Be it known that I, GEORGE H. REYNOLDS, of the city, county, and State of New York, have invented a new and useful Improvement in Steam-Engines; and I do hereby declare that the following is a full and exact description thereof.

The accompanying drawings form a portion of this specification.

Figures 1 and 2 are views of the principal parts of the engine from the rear or after side, seen partly in section.

Fig. 1 represents the engine on its "lower center," and Fig. 2 represents it on "half-center" or with the piston at half stroke. The parts on the farther or forward part of the engine which are novel in their arrangement and important to appear are indicated in dotted lines. The parts at a middle distance which are not novel in anywise are made to show their position merely by red lines.

Similar letters of reference indicate like parts in all the figures.

My invention is applicable to all single condensing-engines, but is designed more especially for the engines of propellers. It removes the chief objection to the employment of single engines on such—to wit, the liability to stop on the center, so as to involve a considerable amount of time and labor in starting again.

It is well known that the cost of construction, attendance, repairs, &c., is less for the same power with a single than with a double engine; but the difficulty above referred to has been a very great objection to the single engine. My invention makes it easy by very ordinary skill, and with the hand of a single engineer without any assistance from others, to avoid a possibility of stopping on a center under any possible conditions, whether running forward, working in a stationary position, or backing.

To enable others properly skilled to make and use my invention, I will proceed to describe its construction and operation by the aid of the drawings, and of the letters of reference marked thereon.

A is the shaft, and *a* is one of the stout wheels keyed thereon, in which the main crank-pin B is secured in the usual manner.

C is the connecting-rod; D, the cross-head; E, the piston-rod; *e*, the piston; F, the cylinder, and G the stout framing by which the several parts are supported.

So far as the relations of these several parts are alone concerned, the construction and effect is identical with heretofore-known engines, and the shaft A may by the action of the steam through the aid of these parts be rotated either forward, as indicated by the black arrow, or backward, as indicated by the blue arrow.

H is the air-pump; I, the air-pump bucket; J, the air-pump rod; K, the links by which the latter is connected to an arm, L, on the stout rocking shaft M, which is mounted in suitable bearings, *m*, on the frame G, and receives motion through the arm N and connection O from the small secondary crank-pin or air-pump crank P, which is on the farther or front side of the engine. This crank-pin P is carried on what is in effect a continuation of the mainshaft A; but its position in the circle which it describes is novel, and the time at which it causes the air-pump bucket to perform any given part of its reciprocating motion relatively to the motion of the piston F and main crank-pin B is therefore novel. Instead of being on the same side of the main shaft A as the main crank-pin B, or on the opposite side thereof, it is nearly "quartering" thereto. In other words, instead of placing the air-pump crank-pin P in a plane in which the axes of A and of B both lie, (as is usually done where an air-pump is driven by a separate crank, as is mine,) I locate the air-pump crank-pin P in a plane nearly at right angles to said plane. In consequence of this novel arrangement the air-pump is not, as usual, at one end of its stroke at the same time that the engine is at one end of its stroke. Neither is the air-pump and its connections precisely at half-stroke when the engine is on its centers. The precise position which I prefer for the purposes intended will appear directly.

Q is a stop-cock which controls the communication between the interior of the air-pump above the bucket and the external atmosphere.

R is a stop-cock which controls the ad-

mission of cold water into the condenser, the condenser being constructed in the framing G in the well-known manner.

S is a rod connecting the handles *q* and *r* of these two stop-cocks and provided with catches T and a convenient handle, U, within the reach of the engineer, so that its position may be readily changed and the two cocks simultaneously operated at will by the engineer alone. These cocks are so fitted and arranged relatively to their respective handles *q* and *r* and the connection S that when the cock Q is open the cock R is closed, and so long as the injection-cock R is open, whether to a great or small extent, the pressure-cock Q is tightly closed; but the moment the engineer wishes to stop the engine, if he, in addition to giving the rod S a sufficient movement to fully inclose the injection-cock R, gives it a further movement in the same direction, it commences to open the cock Q and to admit air above the bucket I of the air-pump H. The pressure of air upon the upper side of the air-pump bucket forces the latter down to the lowest point in its stroke, if it is not already there, and in doing so turns the shaft A so as to carry the main crank-pin B to near half-way between its highest and lowest position. In this condition the engine comes to rest, ready to start again the moment steam is admitted to the cylinder in the usual manner. It will be observed that if the proper movement of the rod S to close the injection and open the cock Q is made while the engine is still in motion it will insure its stoppage with the air-pump bucket at its lowest, and consequently the piston near its middle, position, and that if by any chance this movement of rod S is delayed until the motion of the engine is stopped it will then, on admitting the air to the air-pump, turn the engine either forward or backward until the bucket I is in its lowest position and the piston ready to impel the engine on receiving steam again. The only position of the parts in which this effect will not result from a proper movement of the rod S (provided there is any considerable vacuum in the condenser) is that in which the air-pump crank-pin P, and consequently the air-pump bucket I, is in its highest position. In such case no effect will be perceived from operating S, because the crank-P being at its highest point or dead-center, the pressure of the air has no leverage to turn the engine so long as the parts remain in this position; but it will be observed that this is an equally desirable condition of the engine to remain stopped in, because the main crank pin B and the piston *e* are in an equally good position for starting the instant steam is let on. If, however, the engineer, for the sake of uniformity or any other cause, wishes to turn the engine out of this condition on stopping, he has only to give the smallest possible opening to the steam into the cylinder, and the steam will induce a sufficient motion to allow the pressure on the air-pump bucket to be ef-

fective, when the engine will then quicken its speed, under the action of the pump, until the normal position of rest is attained.

My air-pump has no foot-valves, and the vacuum in the condenser obtains always on the under side of the air-pump bucket, and continues to obtain during the entire descent of the bucket. In air-pumps having foot-valves the vacuum under the bucket becomes rapidly less as the bucket descends, and it becomes desirable to provide specially in such engines for maintaining the condenser-vacuum in the lower part of the air-pump till the bucket is at its extreme lowest position. This may be effected by opening a cock, T', in a pipe, U', (represented in blue outline,) which may communicate between the air-pump and the condenser, in the manner indicated. The opening of this cock may be done by the same or a separate operation as the opening of the pressure-cock Q. In some styles of air-pump the upper surface of the bucket I, or its equivalent piston, is constantly exposed to the full pressure of the atmosphere. With such it is necessary simply to provide the pipe U' and cock T' alone and to arrange it properly in relation to the cock R and the rod S, or their equivalents, in order to realize all the advantages of my invention, provided always that the air-pump crank-pin is placed nearly quartering to the main crank-pin. It is this quartering or nearly quartering position of the pins P B, with a suitable arrangement of the cocks to make it available as a power to control the position of rest of the engine, which forms a principal feature of my invention. With this and the last-named construction of air-pump the operation is as simple as with the one represented, because on opening the cock T' the vacuum below I becomes equal to that in the condenser, and the pressure of the air all the while upon the top of the bucket I turns the engine or controls its stopping, as already described. I can, if it be considered desirable for any case, either permanently or temporarily, connect the pipe Y to the sea or to a reservoir of any kind, or to the main boiler or boilers, or to a donkey-boiler, or the discharge-nozzle of a steam-pump or other pump working either water or air. In such case a fluid of a higher pressure than ordinary air will be thrown into the air-pump above the bucket on the opening of the pressure-cock Q, and the effect will be obviously more powerful. If a suitable stop-valve (not represented) be provided in the discharge-pipe V, so as to restrain at such period the escape of any fluid from the upper part of the air-pump, the force made available by such a mode of operation may be increased indefinitely; but I do not consider such connections and arrangements for securing other than atmospheric air at ordinary pressure above the air-pump bucket generally necessary.

For all the purposes yet described my air-pump crank-pin P might be placed exactly quartering to or in a plane at right angles to

the main crank-pin B; but I prefer to place it a little behind this position, in order to allow of its performing still another duty, which is not indicated in the drawings, but will be readily understood by engineers. I propose to operate a cut-off valve by a suitable connection from the air-pump motion, and for this purpose it is desirable to make the movements a little later than would result from an exactly quartering position of the pin. The precise amount by which the position shall differ from a quartering position or at a right angle to the plane drawn through the shaft A and the main crank-pin B is not important. I have represented it as exactly quartering. It may be so or be from ten to twenty degrees behind this position without material influence, except on the cut-off. Considering the relation of the latter thereto, I prefer to place it about ten degrees behind the quartering position.

Having now fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The so combining and arranging the air-pump bucket relatively to the steam-piston that the latter shall by the pressure upon the former be caused to come to or near the condition of half-stroke, substantially in the manner and for the purpose herein set forth.

2. Operating the pressure-cock Q, or its equivalent, by the movements of the injection-cock, substantially in the manner and for the purpose herein set forth.

3. The so arranging the parts of the pressure cock or valve and of the injection cock or valve and their several connections that the injection-orifice may be increased and diminished without affecting the pressure-orifice, and yet so that by an additional movement of the same controlling means after the injection-orifice is closed the pressure-orifice may be opened, with the effect herein set forth.

GEORGE H. REYNOLDS.

Witnesses:

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