

No. 695,006.

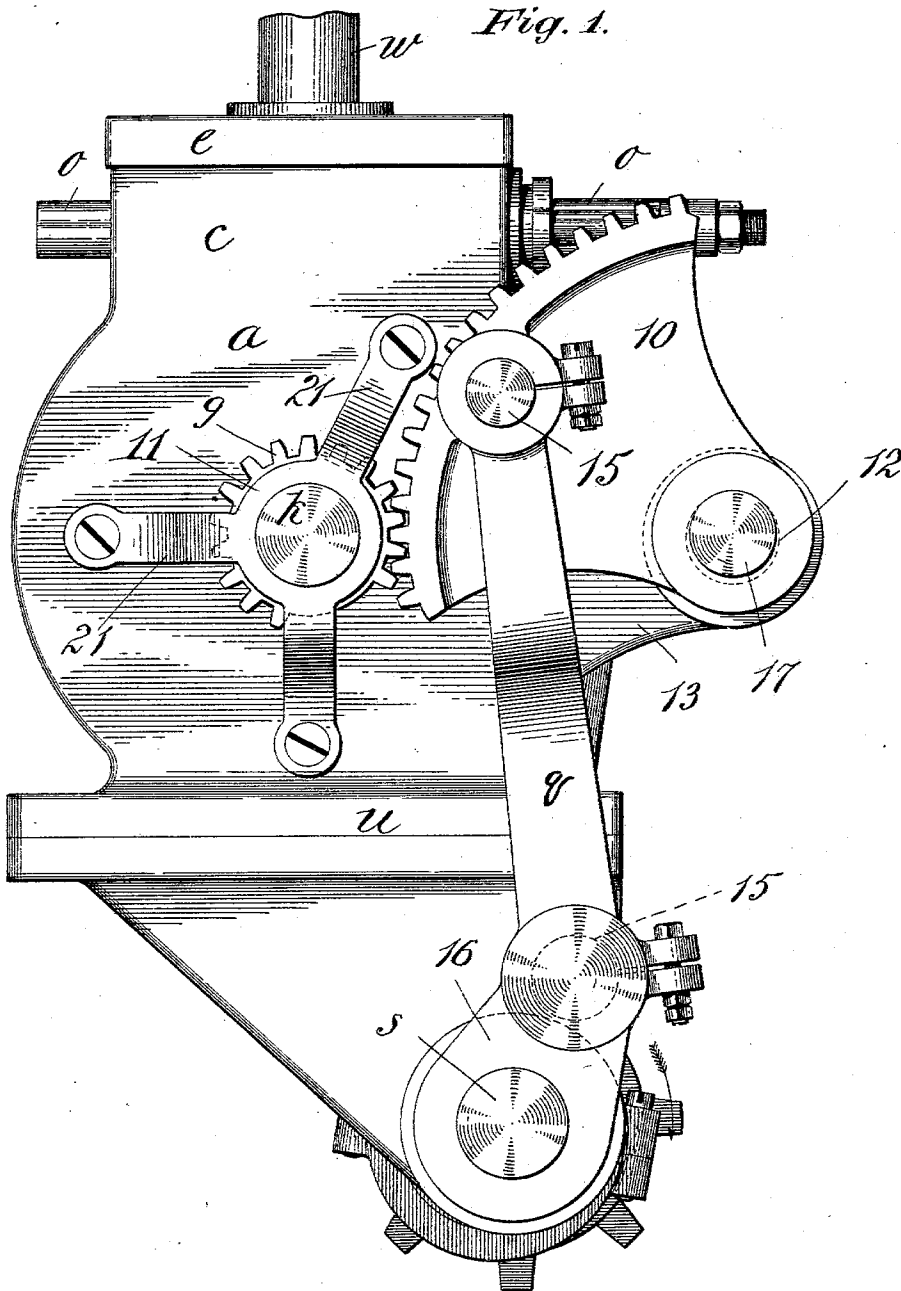
Patented Mar. 11, 1902.

B. F. STOWELL.
STEAM ENGINE.

(Application filed Apr. 2, 1901.)

(No Model.)

4 Sheets—Sheet 1.



Witnesses
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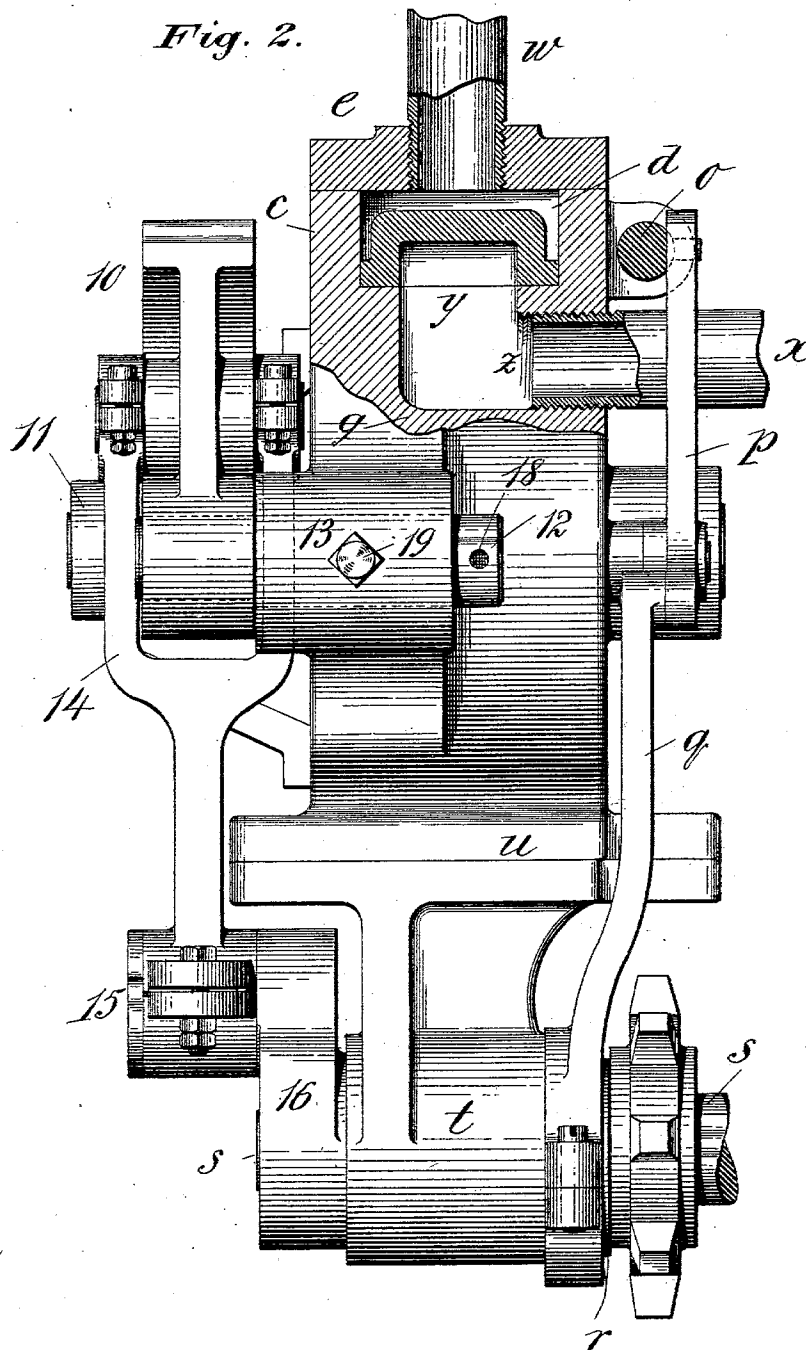
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(Application filed Apr. 2, 1901.)

(No Model.)

4 Sheets—Sheet 2.



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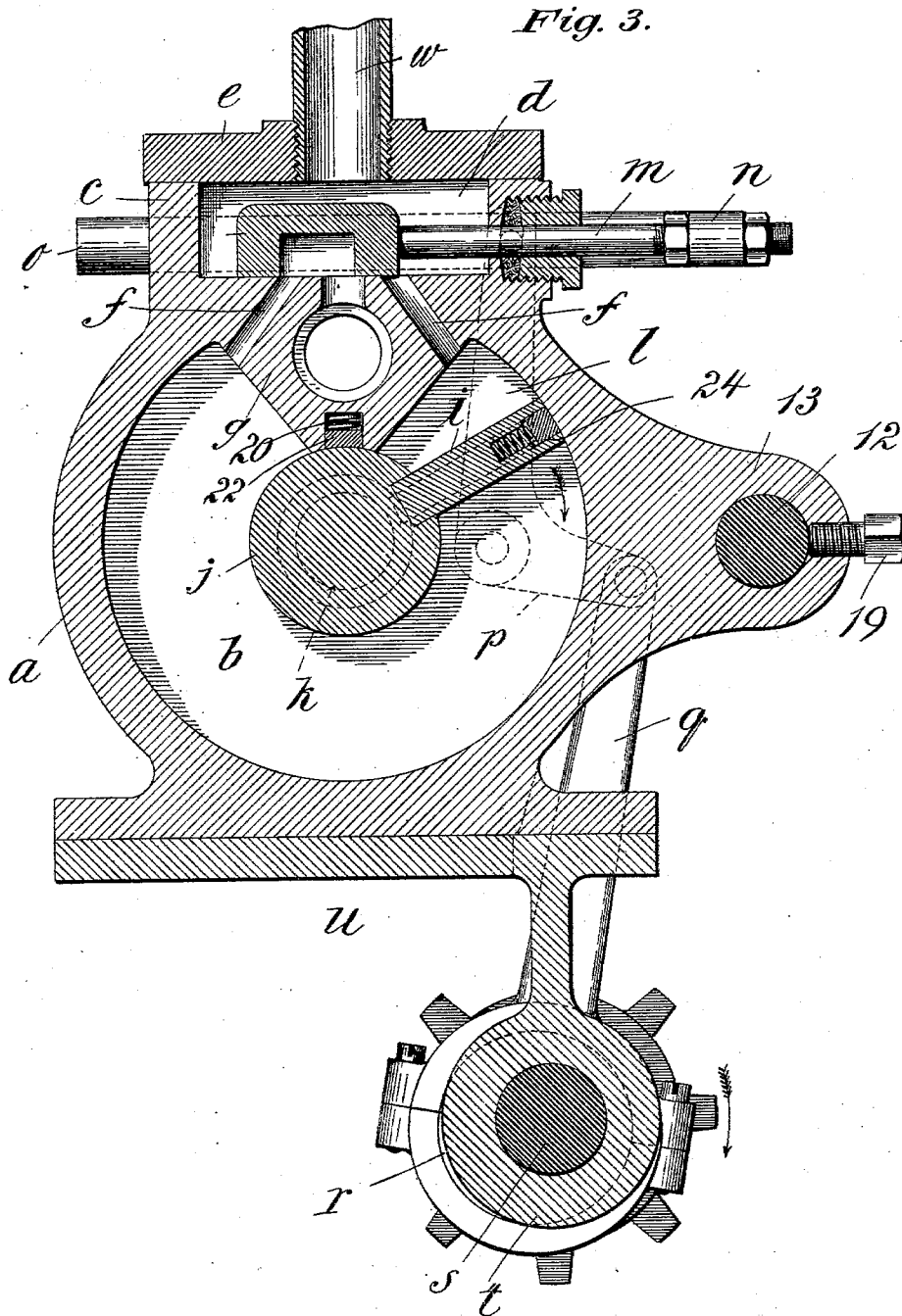
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4 Sheets—Sheet 3.



Witnesses
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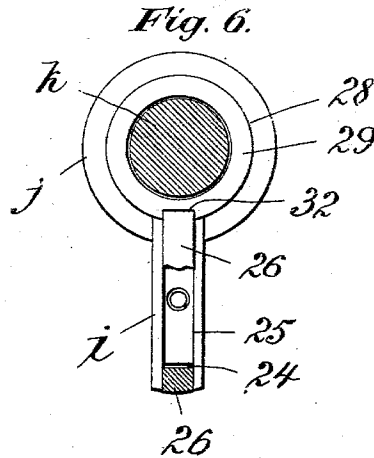
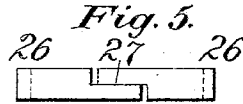
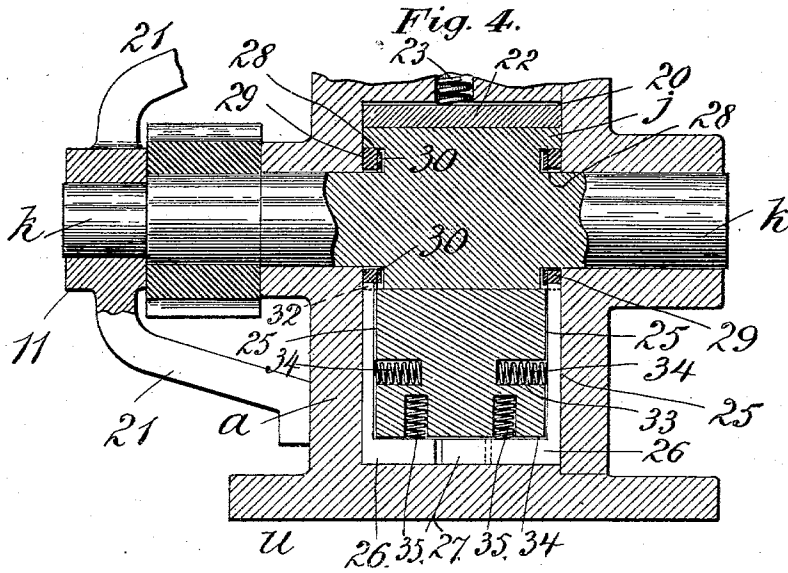
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STEAM ENGINE.

(Application filed Apr. 2, 1901.)

(No Model.)

4 Sheets—Sheet 4.



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UNITED STATES PATENT OFFICE.

BYRON F. STOWELL, OF SPRINGFIELD, MASSACHUSETTS.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 695,006, dated March 11, 1902.

Application filed April 2, 1901. Serial No. 54,061. (No model.)

To all whom it may concern:

Be it known that I, BYRON F. STOWELL, a citizen of the United States of America, and a resident of Springfield, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Steam-Engines, of which the following is a full, clear, and exact description.

This invention relates to improvements in steam-engines of the class or type which comprises a cylindrically-chambered casing having concentrically mounted therein an oscillatory body or shaft provided with a radial piston extending outwardly to the wall of the cylindrical chamber, such chamber having a fixed partition or wall extending to said shaft and provided with steam inlet and outlet passages, a valve, and a medium of connection between the said oscillatory body and the driving or power shaft of the engine, whereby the oscillatory motion of the piston may impart a continuous rotary motion to said driving or power shaft.

The principal object of this invention is to provide, in combination with the shaft or arbor on which the oscillatory piston is carried and with the power or driving shaft of the engine, improved and novel means of driving connection which is of a very simple and durable character and by means of which, from the rotary reciprocatory motion of the piston-shaft a continuous rotary motion to the driving-shaft will be imparted with certainty and with ease and steadiness of running motion.

Another object of the invention is to combine in the mounting for a part of the novel and improved mechanism of driving connection aforementioned means or provisions for taking up wear in the parts as occasion may require after protracted running of the engine.

Another object of the invention is to provide, in combination with the end portion of the shaft of the concentric oscillatory piston, which is extended to the exterior of the cylinder or chambered body of the engine, and with the elements of driving connection therewith provided and coacting, a special arrangement of supplemental journal-support for the extremity of the piston-shaft.

Other objects are to construct the engine of the type hereinabove mentioned with reference to the packings between the internal

fixed and the moving parts in order to acquire increased economy and efficiency.

To these ends the invention consists in the combinations of parts hereinafter described, and set forth in the claims, and in certain particular constructions and combinations or arrangements thereof, as also hereinafter defined and claimed.

The improved engine is fully and clearly illustrated in the accompanying drawings, in which—

Figure 1 is an end elevation. Fig. 2 is a side elevation with the upper portion thereof broken out and shown in vertical sectional view. Fig. 3 is a central vertical cross-sectional view of the engine. Fig. 4 is a partial central section taken through the engine at right angles to the section, Fig. 3, this view being shown with the piston understood as having been turned to its lowermost position and is provided especially for the purpose of illustrating the packings. Fig. 5 is a bottom plan view of the packing for the longitudinal edge and vertical end of the piston. Fig. 6 is a sectional view as seen taken about on the line 6 6, Fig. 4, with some parts broken away inwardly beyond such plane of section for increased clearness of illustration.

Similar characters of reference indicate corresponding parts throughout all of the views.

In the drawings, *a* represents the body or casing of the engine, comprising the chamber *b* of approximately cylindrical form, the casing being provided with the upwardly-extended portion *c*, having within its top the recess constituting the steam-chest chamber *d*, covered by the cap or top plate *e*. From the base of said upper extension *c*, the top of which is flat, downwardly and divergently lead the passages *ff*, Fig. 3, which alternately in the operation of the engine become the steam and exhaust ports, such passages leading from the steam-chest to opposite upper portions of the pressure-chamber *b* at either side of the depending immovable wall *g*, which is formed as a part of or affixed to the engine-casing. This said portion *g* constitutes a partition in the nearly-annular pressure-chamber, which is indicated at *l* as comprised between said partition and the piston-wing and between the internal surface of the chambered casing *a* and the central portion

j of the piston-shaft, and the said pressure-chamber becomes elongated as the piston-wing moves around away from the said wall or partition *g*.

5 In the operation of the engine the one passage *f* is the inlet-passage and the opposite one the exhaust-passage, and then when the piston has its reversed sweep that passage which was previously the exhaust-passage be-
10 comes the inlet and the other one the exhaust, these alternations being repeated constantly and in quick succession during the running, as well known in this description of engine.

h is the valve, which is advantageously the
15 ordinary **D** form of slide-valve, the stem *m* thereof extending through a stuffing-box in the side of the steam-chest wall and has its endwise reciprocatory motion imparted there-
20 to by the connection therewith of an angu-
larly-turned end member *n* of the slide-bar
o, to which the back-and-forth motion is im-
parted by the connection therewith of one
arm of the bell-crank lever *p*, to the other
25 arm of which is connected the arm *q*, formed
as a part of the strap or yoke encircling the
eccentric *r*, which is on the driving or power
shaft *s* of the engine. The said driving-shaft
is supported in the suitably-long journal-
30 bearing *t*, which is cast as a part of and de-
pends below the base *u* of the engine and is
reinforced by integrally-cast webs for great
stability.

w indicates the steam inlet or supply pipe,
and *x* indicates the exhaust-pipe.

35 The steam in the pressure chamber or cyl-
inder *l* at the end of the stroke and after the
slide-valve has moved sufficiently to open the
port *y* to communication with that passage *f*
which had on the terminated working stroke
40 been the inlet-port has free way for exhaust
from the cylinder through the same passages
f which had been the inlet and through port
y to the longitudinal passage *z*, with which
the exhaust-pipe is connected.

45 The organization of so much of the engine
for the general mode of operation which has
been thus far described whereby the rotary
reciprocatory motions to the piston-shaft are
imparted comprises no novelty so far as this
50 application is concerned, and I will now pro-
ceed to describe constructions and arrange-
ments which contribute to the production of
the present invention.

The piston-shaft *k* has a concentrically
55 spur-toothed element—a pinion or a sector-
gear 9, shown as having the teeth thereof ex-
tending throughout the greater portion of its
circumference, as shown in Fig. 1, fixed on
the externally-extended end portion of said
60 shaft.

10 represents a sector-gear pivotally mount-
ed to oscillate on the shaft or stud 12, which
is extended parallel with the piston-shaft and
is held in an immovable position in its sup-
65 port through the bracket or lug 13, which, as
shown, is cast as an integral extension of the

motor body or casing. Said sector 10 is in
mesh with the toothed wheel 9 and has an os-
cillation or rocking reciprocatory motion de-
rived from the similar motion of the said 70
wheel 9. The pitman-rod 14 is pivotally con-
nected at 15 with the sector 10 at a point suit-
ably extended radially from the center of
motion 12 of the sector, and its other end is
pivotally connected at 15 with the fixture 16 75
of the driving-shaft *s*, which fixture is here
shown as a crank, although the same might
be a disk or pulley attached to the driving-
shaft for the same effective crank action. The
rotary reciprocatory motion of the piston- 80
shaft imparted by the back-and-forth sweep-
ings of the piston-wing through the connec-
tions described imparts a continuous easy
and steady rotary motion to the driving or
power shaft. 85

It will be mentioned in appreciation of the
desirability and advantage of the sector 10,
combined with the parts in coöperative rela-
tions, as described, that it is most simply and
cheaply produced and is an element which in 90
the performance of its work is not susceptible
of extensive wear. It obviates the employ-
ment of slides having a rack-bar and cross-
heads, which necessitate planing and other ex-
pensive machine work and fittings and avoids 95
in the operation of the engine racking effects
and noisy running.

The stud or shaft on which the sector is
mounted has its end journal or cylindrical
supporting portion 17 slightly eccentric rela- 100
tively to the axis of the portion of the stud
12 which is fitted through the cylindrical
socket therefor in the bracket 13. The said
sector-supporting stud 12 has at its end por-
105 tion the spanner-holes 18, whereby when the
set-screw 19 is loosened to turn said stud,
and thereby to slightly change the position
of the sector bodily, so that wear between the
teeth of the sector 10 and of the toothed
110 wheel 9 will be compensated for. This pro-
vision materially adds to the working life of
the parts in the engine between which there
is the greatest wear, and even these parts 9
and 10 may be cheaply and quickly replaced
after long use of the engine when the re- 115
placement thereof is rendered desirable or
necessary.

The piston-shaft *k* is extended outwardly
beyond the outer face of the toothed wheel 9
and has provided therefor an additional jour- 120
nal-bearing support 11, the same comprising
the journal-hub and the arms 21 21, extend-
ing in different radial directions therefrom
and suitably offset to straddle over the pin-
ion 9 and having by their extremities con- 125
nections by screwing or bolting to the end or
head of the engine-body. This provides a
stable support for the extremity of the shaft
k and prevents deflection thereof and pre-
vents any tendency of the pinion to run other- 130
wise than perfectly true and even, and the
arrangement shown of this additional jour-

nal and its connected arms is such as in no wise to interfere with or obstruct the meshing relations of the parts 9 and 10.

The packings employed in the engine conducting to the employment of the steam with great economy are illustrated in Figs. 3 to 6.

The lower end of the depending partition or abutment *g* has a longitudinal groove 20 therein, in which is a packing consisting of a bar or blade 22, the lower edge of which has bearing against the cylindrical enlargement of the portion of the piston-shaft comprised within the steam-chamber. This bar or blade is downwardly pressed by the springs 23.

The radial piston-wing has in its outer edge and in its end edges the grooves 24 and 25 25, in which is set the packing, which as a whole is arranged to correspond to the three sides of a rectangle, the same being composed of separable L-shaped members 26 26, matched or halved together, as indicated at 27, Figs. 4 and 5, and adapted for longitudinal distention.

The ends of the intermediate piston-shaft enlargement *j* have formed therewithin the concentric annular grooves or sockets 28, in which are placed the packing-rings 29 29, against which react the springs 30 to crowd the packing-rings outwardly in the direction of their axes for a close bearing against the portions of the heads of the engine-case adjacent the journal-bearings of the piston-shaft.

Each packing-ring 29 has within its outer edge a squared socket or recess 32, in which the inner extremities of the radial members 26 26 of the L-shaped packing are engaged and by means of which engagement the packing-rings turn in unison with the piston-shaft and piston and with the packing-bars for the piston.

The piston has within its opposite ends the sockets 33 for the springs 34 and within its outer radially-extended edge the sockets for the springs 35, the two sets of springs operating to crowd the packing, so that the piston-wing has the blades thereof both at its longitudinal and its radial end edges in close bearing against the inner peripheral surface of the engine-casing.

I have combined with the eccentric and the valve mechanism of this engine the ordinary and well-known link-motion for varying the lead and cut-off and for reversing the running motion of the engine, upon which engine such motion is perfectly and successfully applicable; but I have not deemed it desirable to illustrate it, as it is regarded as a manifest provision.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a steam-engine, in combination, the engine-body having the approximately cylindrical pressure-chamber, the axially-arranged

rotatable body comprised as an intermediate portion of a shaft, provided with the radial piston, the fixed partition extending from the periphery of the cylinder-chamber to contact on the said rotatable body, steam-passages leading into the steam-chamber at opposite sides of the fixed wall, means for alternately opening and closing said passages whereby the radial piston is caused to have an oscillatory movement partially around within said chamber, an element having a series of concentric teeth affixed to the externally-extended end of said shaft, a driving-shaft, a sector-gear pivotally mounted and meshing said toothed element of the piston-shaft, a crank on the driving-shaft, and a pitman-rod pivotally connected to the sector, and to the crank, substantially as described.

2. In a steam-engine, in combination, the engine body having the approximately cylindrical pressure-chamber, the axially-arranged rotatable body comprised as an intermediate portion of the shaft, provided with the radial piston, the fixed partition extending from the periphery of the cylinder-chamber to contact on the said rotatable body, steam-passages leading into the steam-chamber at opposite sides of the fixed wall, the slide-valve for alternately opening and closing said passages whereby the radial piston is caused to have an oscillatory movement around within said chamber, a spur-wheel affixed to the externally-extended end of said shaft, a driving-shaft having a crank and an eccentric, a sector-gear, pivotally mounted, and meshing said spur-wheel, the pitman-rod connecting the sector and the crank, the bell-crank lever, the arm connected to the eccentric, and said bell-crank and the slide-bar engaged by the bell-crank lever and engaging the stem of the slide-valve.

3. In an engine of the character described, the combination with the shaft having the radial piston and the toothed wheel 9 and the driving-shaft having the crank, of the cylindrical stud and a corresponding cylindrical supporting-bearing therefor axially parallel with the piston-shaft, said stud having its end constructed with the cylindrical portion eccentric to the portion thereof supported in the aforesaid bearing, the sector-gear having its cylindrically-apertured hub mounted to oscillate on the said eccentric portion of the stud, provisions for rotationally adjusting said stud, and a pitman-rod pivotally connected to the sector-gear, and to said crank, substantially as and for the purpose described.

4. In an engine of the character described, the combination with the shaft having the radial piston and the toothed wheel 9, and the driving-shaft having the crank, of the cylindrical stud and provisions whereby it may be turned, and a corresponding cylindrical supporting-bearing for said stud axially parallel with the piston-shaft, and said stud having its end constructed with the cylindrical por-

tion eccentric to the portion thereof supported in the aforesaid bearing, the sector-gear having its cylindrically-apertured hub mounted to oscillate on the said eccentric portion of the stud, a set-screw for detachably confining said stud against turning, and a pitman-rod pivotally connected to the sector-gear and to said crank, substantially as and for the purpose described.

5. A steam-engine of the character described comprising an oscillatory piston and piston-shaft having externally of the engine-casing a concentrically-toothed element, and a driving or power shaft combined with a reciprocatory element having teeth in mesh with said toothed element of the piston-shaft and partaking of a reciprocatory motion therefrom, and a medium of connection between said reciprocating element and the driving-shaft for imparting the back-and-forth mo-

tions of the former a continuous rotary motion to the latter.

6. A steam-engine of the character described, comprising an oscillatory piston and piston-shaft having externally of the engine-casing, a concentrically-toothed element, and a driving or power shaft, combined with a reciprocatory element having teeth in mesh with and deriving reciprocatory movement from said toothed element, and a pitman-rod connected pivotally to said reciprocatory element, and having a crank connection with the driving-shaft.

Signed by me at Springfield, Hampden county, Massachusetts, this 30th day of March, 1901.

BYRON F. STOWELL.

Witnesses:

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M. L. WORDEN.