

(No Model.)

2 Sheets—Sheet 1.

W. N. & C. F. CHRISTOPHER.
STEAM ENGINE.

No. 523,761

Patented July 31, 1894.

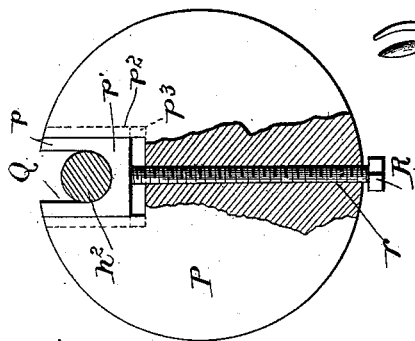


FIG. 5 -

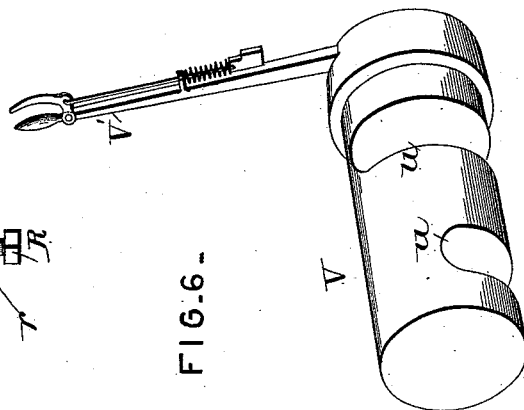


FIG. 6 -

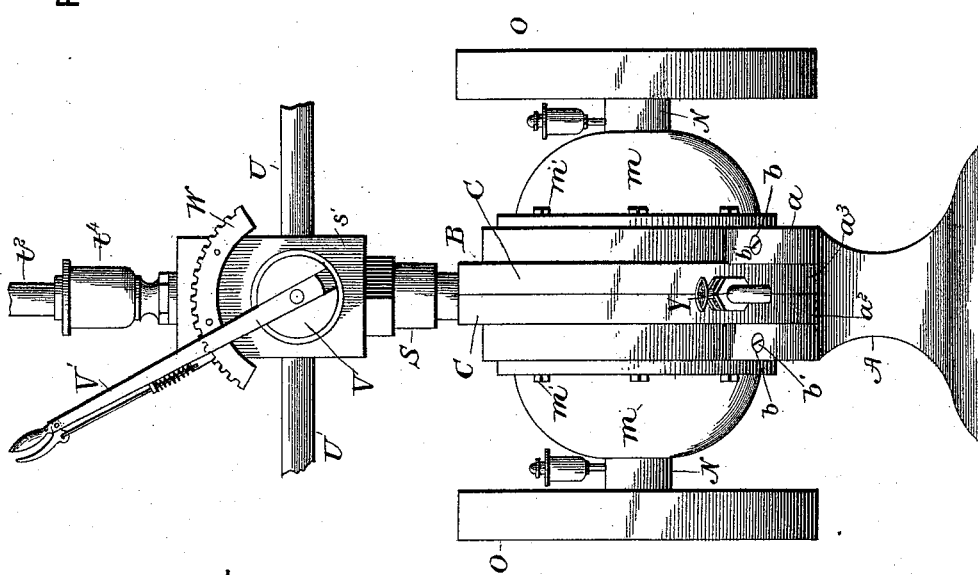


FIG. 1 -

Witnesses

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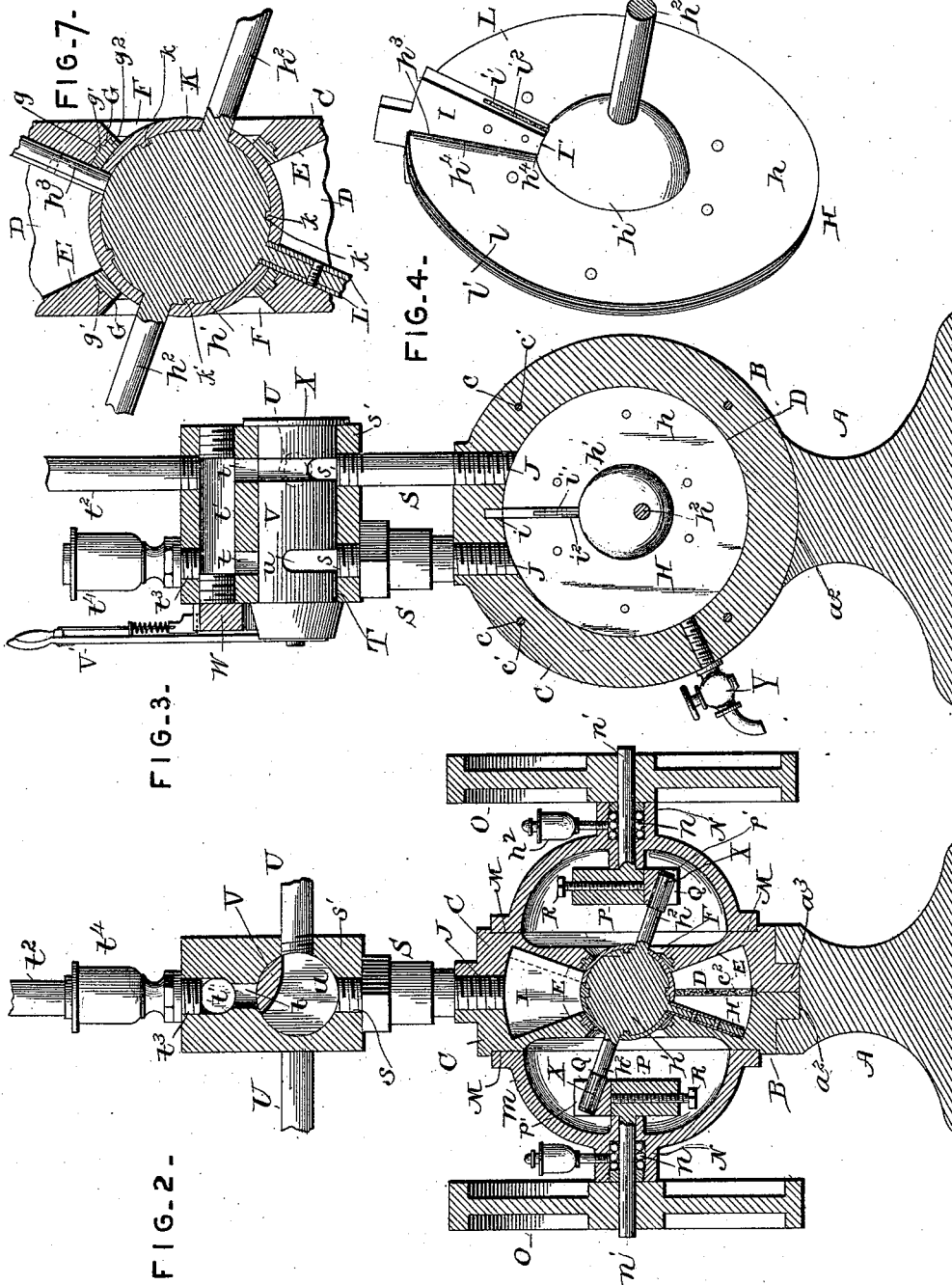
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2 Sheets—Sheet 2.

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Jas. K. McCathran
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UNITED STATES PATENT OFFICE.

WILLIAM N. CHRISTOPHER AND CALVIN F. CHRISTOPHER, OF SPARTANBURG, SOUTH CAROLINA.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 523,761, dated July 31, 1894.

Application filed June 30, 1893. Serial No. 479,270. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM N. CHRISTOPHER and CALVIN F. CHRISTOPHER, citizens of the United States, residing at Spartanburg, in the county of Spartanburg and State of South Carolina, have invented a new and useful Steam-Engine, of which the following is a specification.

This invention relates to steam engines; and it has for its object to provide certain improvements in piston engines whereby the head or pressure of steam will be utilized to its fullest capacity, in order to easily and powerfully transmit motion to the several parts of the engine.

To this end the main and primary object of the present invention is to construct an engine of that type employing a wobbling or gyrating piston, which piston has an unbroken travel in its circuit around the walls of the steam chest, thereby insuring a constant steam tight contact between the faces of the piston and the walls of the steam chest, in order to admit of the full force of the steam being directed against both sides of the piston as it wobbles so as to impart the necessary motion thereto, which is transmitted to the devices to be driven thereby.

Other objects of the invention may be stated to be to provide efficient means for reversing the travel of the engine and to insure a constant lubrication thereof.

With these and other objects in view which will readily appear as the nature of the invention is better understood, the same consists in the novel construction, combination and arrangement of parts hereinafter more fully described, illustrated and claimed.

In the accompanying drawings:—Figure 1 is a side elevation of our improved steam engine. Fig. 2 is a central vertical longitudinal sectional view thereof. Fig. 3 is a vertical transverse sectional view thereof through the center of the steam chest with the piston and abutment in elevation. Fig. 4 is an enlarged detail perspective view of the wobbling or gyrating piston and the abutment shown in its proper relative position thereto. Fig. 5 is an enlarged detail sectional view showing more clearly the connection between the pis-

ton shaft extremities and the rotating shaft heads. Fig. 6 is a detail in perspective of the adjustable steam controlling valve. Fig. 7 is an enlarged detail sectional view of the piston ball bearings.

Referring to the accompanying drawings, A represents a suitable supporting base or casting having at its top the parallel curved securing arms *a*, perforated at their ends and forming there-between a pocket *a*², adapted to receive the central annular flange *a*³, of the cylindrical steam cylinder B.

The cylindrical steam cylinder B, is provided at its bottom side, near its edges, with the threaded openings *b*, adapted to receive the attaching screws *b*¹, passing through the perforated ends of the securing arms *a*, and providing means for removably securing the cylinder to the base, but any other suitable means may be employed to secure this attachment.

The cylindrical steam cylinder B, is sectional and formed of the separate duplicate halves or sections C, having at their meeting edges the screw or bolt openings *c*, adapted to receive the clamping screws or bolts *c*¹, which securely fasten the two halves of the cylinder together, and between the meeting faces of the superposed halves or sections is clamped a packing ring *c*², which serves to make the joint between the cylinder sections perfectly steam tight, and thereby prevent any leakage at this point, and the meeting faces of the cylinder sections form the annular flange *a*², before referred to, and which serves not only to provide for the clamping of the sections together but also for the steadying of the cylinder on its base support.

The sectional steam cylinder B, is interiorly bored to form the interior annular steam chest D, and the opposite sides of the cylinder halves or sections are convexed to form the inwardly pointing conical portions E, the apices of which project in close proximity to each other, thereby providing a construction of steam chest which is wider at its periphery than at its center or inner edge, and the said apices of the inner conical or convexed sides of the cylinder are provided with central bearing openings F, provided with inner beveled

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bearing edges G, which inner beveled bearing edges G, are provided with a series of engagement notches *g*. The engagement notches *g*, in the inner beveled bearing edges G, of the cylinder sides are adapted to receive the prongs or studs *g'*, of the circular beveled metallic wear rings *g*², which wear rings are adapted to be thus removably placed in position on said beveled bearing edges, in order to prevent the wearing away of the metal forming the cylinder sides.

The interior annular steam chest D, of the steam cylinder accommodates therein the wobbling disk piston H. The wobbling disk piston H, is of a size adapting it to loosely fit within the steam chest D, and the same consists of the enlarged flat disk *h*, and the central bearing ball *h'*, the opposite portions of which are located at both sides of the disk *h*, which project beyond the central periphery of the bearing ball *h'*, and said bearing ball is mounted on the piston shaft *h*², the opposite portions of which move in a circle inside of the central bearing openings F, in the opposite cylinder sides. The piston disk *h*, of the wobbling piston is provided in the top portion thereof with the vertical slot or opening *h*³, provided with rounded edges *h*⁴, which are disposed at opposite sides of the centrally disposed vertical abutment partition I. The vertical abutment partition I, is secured at its upper end in the top of the cylinder B, and extends transversely across the same, being adapted to fit firmly at its opposite edges in the side grooves *i*, formed in the inner conical sides of the steam cylinder, in order to make a perfectly steam tight joint, and said abutment partition I, is located between the top steam inlet and outlet ports J, bored into the top of the steam cylinder at both sides of said partition, in order that one side of the steam chest separated off by said abutment is receiving live steam, while the opposite side of the steam chest is exhausting steam.

The upper vertical partition abutment I, is provided with a lower curved edge I', which projects to the upper edge of the aligned bearing openings F, in the opposite sides of the cylinder, and is adapted to fit closely on top of the portion of the central bearing ball at the base of the slot or opening *h*³, and said abutment is provided with a vertical recess or socket *i'*, which accommodates the abutment packing *i*², projecting below the lower curved edge of the abutment in order to make a steam tight joint with the bearing ball of the wobbling piston, and the said bearing ball is itself prevented from wearing in its bearings in the opposite sides of the cylinder by means of the removable metallic wear cups K. The removable metallic wear cups K, fit the opposite portions of the ball *h'*, on both sides of the piston disk, and are provided in their concaved sides with the pins or studs *k*, adapted to engage the notches *k'*, formed in the faces of the opposite ball portion. These wear cups K, have a bearing contact with the metallic

wear rings removably fitting the bearing edges G, of the openings F, and these protecting wear faces not only serve to protect the metal and prevent the same from wearing away, but also act in the capacity of packing to insure a perfectly steam tight connection.

The opposite faces of the wobbling piston are adapted to travel in contact with the opposite inner conical faces or sides of the cylinder, as the piston wobbles therein from side to side, and said opposite faces of the piston are provided with the metallic wear plates L, which take the wearing contact off of the piston, so as to insure a constant unbroken contact between the piston and said conical sides of the steam cylinder, and said piston is also provided with a grooved periphery *l*, adapted to receive the projecting packing ring *l'*, which works in contact with the periphery of the steam chest D, and insures a perfectly steam tight joint between the moving piston and such periphery, whereby the steam has a full effect on both sides of the piston as it rolls from side to side, and always in contact with opposite sides of said cylinder.

As clearly illustrated in the drawings, it will be apparent that the top abutment partition I, which engages the slot or opening *h*³, of the wobbling piston serves to prevent the said piston from rotating or turning within the cylinder, while at the same time allowing the rounded edges of said slot or opening to freely slide back and forth from one edge of the abutment to the other as the said piston shifts from side to side of the cylinder. The steam being admitted into one of the ports J, the wobbling piston is in such a position that the steam is admitted to one side thereof. Owing to the disposition of the abutment I, the steam forces its way against that portion of the piston which is in contact with one of the conical sides of the steam cylinder, and throws such portion of the piston outward and against the opposite side of the steam cylinder. This action of the steam on the piston disposes the latter at a different angle, so that the live steam now enters on the opposite side of the piston and causes a reverse movement thereof, these two movements being sufficient to make one complete wobble of the piston, and it will of course be apparent that as the said piston wobbles or shifts from one angle to the other the steam will be exhausted from both sides thereof out of the steam port J, on the other side of the abutment I. This movement of the piston H, causes the extremities of the piston shaft *h*², to make a complete circular movement in the bearing openings F, in the cylinder sides, and this is due to the fact that the said shaft extremities are always held disposed at an angle to the horizontal center of the cylinder, whereby the piston is permitted to wobble at an angle inside of the cylinder, and thereby impart a circular movement to the shaft extremities. This circular movement of the shaft extremities is utilized to transmit a rotary motion to

the shaft devices which I shall now proceed to describe.

The outer opposite sides of the cylinder B, are recessed at their edges as at M, to remov-
ably receive the inner flanged ends of the cup
bearing plates *m*. The cup bearing plates *m*,
are suitably secured to the cylinder by means
of the screws *m'*, and are bored out suffi-
ciently large in order to accommodate the cir-
cular movement of the ends of the shaft *h*².
The said cup bearing plates are further pro-
vided with the outer bearing collars N, pro-
vided with the ball bearings *n*, in which are
journaled the short drive shafts *n'*, and suit-
able lubricators *n*², provide a supply of oil to
the said bearings. The short drive shafts *n'*,
have securely keyed to their outer ends the
drive or belt wheels O, from which motion is
transmitted to any suitable machinery, and
upon the inner ends of the shafts *n'*, and
working inside of the cup bearing plates *m*,
are mounted the inner shaft heads P. The
inner shaft heads P, are provided in one edge
thereof with the squared slots *p*, which are
adapted to loosely receive the bearing boxes
p', having side tongues *p*², engaging side
grooves *p*³, in the sides of said slots. The
said bearing boxes *p'*, are provided with the
curved bearing notches or openings Q, which
bearing notches or openings Q, are adapted
to loosely receive the extremities of the in-
clined shaft *h*², and said curved or rounded
bearing notches or openings are disposed at
the same angle as said shaft in order to pre-
vent the binding thereof in said boxes. An
adjusting set screw R, engages a threaded
opening *r*, formed in the shaft heads P, and
works against the loose bearing boxes *p*, so
as to adjust the same toward the edge or cir-
cumference of said shaft heads, in order to
firmly hold the bearing ball of the piston to
its bearings and therefore to hold the shaft
at the proper angle. Now it will be apparent
that as the wobbling piston is moved by steam
pressure in the manner just described, the
circular travel of the piston shaft ends will
transmit a rotary movement to the drive
shaft *n'*, by reason of its connection with the
heads P.
The steam ports J, are threaded to receive
the lower ends of the threaded steam nipples
S, the other ends of which are threaded into
the bottom steam openings or ports *s*, formed
in the bottom of the valve head or casing *s'*.
The valve head or casing *s'*, is provided with
a central circular valve bearing T, the upper
side of which is pierced by the upper steam
openings *t*, which lead from the bottom of
the transverse steam chamber *t'*, formed in
the upper portion of the said valve head or
casing. A single steam supply opening *t*²,
connected with the feed pipe, opens into the
top of the steam chamber *t'*, and an oil open-
ing *t*³, also opens into said steam chamber and
has connected therewith an oil cup *t*⁴. The
said valve head or casing is further provided
in opposite sides of the central bearing therein

with the oppositely arranged exhaust open-
ings U, which are out of alignment with each
other and are located near the opposite ends
of said bearing. The said valve bearing is
adapted to loosely receive the oscillating
valve plug V. The oscillating valve plug V,
is cylindrical in cross section to fit the said
opening, and is provided with the short trans-
verse steam grooves *u*, cut at an angle to each
other, so as to provide means for readily re-
versing the engine, or for entirely cutting off
the supply of steam thereto. The said valve
plug V, has removably attached to one outer
end the adjusting handle V', which carries a
spring pawl or dog adapted to engage the
teeth of the segment W, secured to one side
of said valve head or casing. A securing
plate X, attached to the opposite end of the
said valve plug, and working outside of said
head or casing, serves to hold the same to its
work inside the bearing.

Now it will be apparent that by adjusting
the valve plug in its bearings, one of the short
steam grooves *u*, in the valve will connect one
of the upper steam openings *t*, with the steam
opening *s*, directly below the same in order to
provide for supplying live steam directly to
one side of the steam chest, while at the same
time the other steam groove of the valve will
connect one of the bottom ports or openings
s, with one of the side exhaust openings *u*.
This position of the valve can be easily re-
versed to change the travel of the engines by
adjusting the handle, or the supply of steam
entirely cut off so that the said valve will act
in the double capacity of a cut off and a re-
versing valve. The exhaust circulation of
steam is also sufficient to carry the lubricant
from the oil cup *t*⁴, directly into the steam
cylinder whereby the several parts of the en-
gine inside the cylinder are kept constantly
lubricated to insure the easy working thereof.
At this point it may be well to observe that
in order to reduce the friction between the
working parts of the engine and to render the
movement thereof free and uniform I employ
the anti-friction rollers or sleeves X, loosely
mounted on the extremities of the piston
shaft *h*², and loosely working in the bearing
boxes of the shaft heads.

A blow-off cock Y, is attached to the cylin-
der and provides means for draining the same
of accumulations of water and oil at any time
desired.

Changes in the form, proportion and the
minor details of construction may be resorted
to without departing from the principle or
sacrificing any of the advantages of this in-
vention.

Having thus described the invention, what
is claimed, and desired to be secured by Let-
ters Patent, is—

1. In a steam engine, the combination of the
cylinder having an interior annular steam
chest and opposite inner conical sides pro-
vided with central bearing openings beveled
at their inner edges, a vertical partition abut-

ment arranged in the top of and intersecting said steam chest, a wobbling disk piston rolling within said steam chest and provided with a central bearing ball turning in said beveled bearing openings, and a vertical slot loosely embracing said abutment, metallic wear cups removably fitted on the opposite portions of the piston ball at both sides of the disk thereof and working in contact with the beveled edges of the central bearing opening, and rotary shaft connections for the shaft extremities of the said piston, substantially as set forth.

2. In a steam engine, the cylinder having an interior annular steam chest and opposite inner conical sides provided with central bearing openings beveled at their inner edges and having notches in said edges, removable wear rings fitting said beveled edges and having studs engaging the notches thereof, a wobbling disk piston rolling within said steam chest and having a central bearing ball turning in said beveled bearing openings and provided in its opposite portions with notches, removable metallic wear cups fitting the opposite portions of the ball and having pins or studs engaging the notches thereof, removable wear plates attached to opposite faces of the piston disk, packing inserted in the periphery of said piston disk, and rotary shaft connections for the shaft extremities of said piston, substantially as set forth.

3. In a steam engine, the cylinder having exterior recessed sides opposite side bearing openings and an interior annular steam chest, a disk piston wobbling within said steam chest and having opposite shaft extremities swinging in a circle within said bearing openings, opposite cup bearing plates having inner flanged ends clamped to the opposite exterior recessed sides of the cylinder, and outer bearing collars drive shafts mounted within said bearing collars and carrying at their inner

ends inside of the plates shaft heads provided at one side with bearing notches or openings loosely receiving the piston shaft ends, substantially as set forth.

4. In a steam engine, the cylinder having an interior annular steam chest, the disk piston wobbling in said steam chest and having shaft extremities moving in a circle in the opposite sides of the cylinder, cup bearings clamped to opposite sides of the cylinder over the piston shaft extremities, drive shafts journaled in said cup bearings and having at their inner ends shaft heads, bearing boxes adjustably mounted in one edge of said heads and provided with rounded inclined bearing notches or openings adapted to receive the piston shaft ends, substantially as set forth.

5. In a steam engine, the cylinder having an interior annular steam chest and opposite recessed outer sides, flanged cup bearing plates removably clamped to the recessed outer side of the cylinder, and having outer bearing collars provided with ball bearings, the wobbling piston rolling in said steam chest and having shaft extremities moving in a circle inside of said cup bearing plates, the short drive shafts journaled in the bearing collars of said plates and having at their inner ends shaft heads provided in one edge with squared slots, and bearing boxes adjustably mounted in said squared slots of the shaft heads and provided with rounded inclined bearing notches or openings loosely receiving the piston shaft ends, substantially as set forth.

In testimony that we claim the foregoing as our own we have hereto affixed our signatures in the presence of two witnesses.

WILLIAM N. CHRISTOPHER.

CALVIN F. CHRISTOPHER.

Witnesses:

JOHN H. SIGGERS,

E. G. SIGGERS.