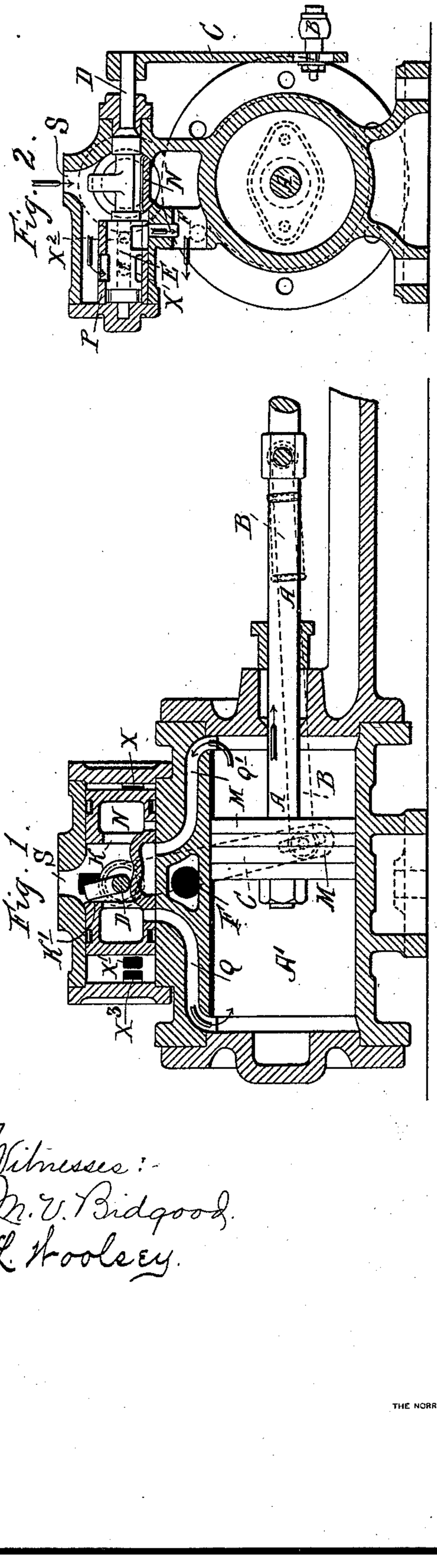
(No Model.)

# J. COCHRANE & W. WALKER.

## PUMPING ENGINE.

No. 529,678. Patented Nov. 20, 1894.




Witnesses:-
W. V. Bidgood.
L. Hookey.

Inventors:-
John Cochrane and William Walker
By Knight Bros
Attys.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

# UNITED STATES PATENT OFFICE.

JOHN COCHRANE, OF BARRHEAD, NEAR GLASGOW, SCOTLAND, AND WILLIAM WALKER, OF SALFORD, MANCHESTER, ENGLAND; SAID WALKER ASSIGNOR TO SAID COCHRANE.

## PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 529,678, dated November 20, 1894.

Application filed October 13, 1893. Serial No. 488,022. (No model.) Patented in England October 17, 1891, No. 17,805.

*To all whom it may concern:*

Be it known that we, JOHN COCHRANE, engineer, residing at Barrhead, near Glasgow, Scotland, and WILLIAM WALKER, mechanical engineer, residing at 12 Holly Street, Eccles New Road, Salford, Manchester, England, have invented certain new and useful Improvements in Reciprocating Engines, (for which we have obtained Letters Patent in Great Britain, No. 17,805, dated October 17, 1891,) of which the following is a specification.

Our invention relates to direct acting reciprocating engines and to means for operating the valves of the cylinder, for the purpose of reversing the motion of the main piston of the said cylinder, at or near the end of each stroke and producing a reciprocating action without the aid of a fly-wheel. We use by preference an ordinary three ported cylinder, and above it is formed an auxiliary steam cylinder which is bored out to receive a cylindrical and an auxiliary distributing valve for the purpose of distributing steam or fluid to the said main piston. The said cylindrical valve is made in this instance to reciprocate in the same longitudinal plane as the said main piston and the outer ends of the said cylindrical valve are closed, so as to fulfill the functions of pistons, as each end of the same is operated upon alternately by steam or fluid pressure, for the aforesaid purpose of distributing such steam or fluid pressure to one side or the other of the main piston as the case may be. The manner in which this is effected is as follows:—To the piston rod of the engine, between the pump and the cylinder glands, we attach a light connecting rod, and the said connecting rod is made to give a vibrating or swinging motion to a lever keyed to a rock-shaft, the rock-shaft having a rocking motion imparted to it by the swinging or vibrating lever. The said rock-shaft is made to pass transversely and centrally across and through the cylindrical valve and auxiliary cylinder. The outer end of the said rock-shaft carries an auxiliary valve-plug which fits into a suitable casing forming a part of the auxiliary steam cylinder. This valve plug controls the admission of steam to the cylindrical valve through suitable passages which are formed in the said auxiliary valve plug, and they are so arranged as to give steam to one end or the other of the cylindrical valve, and simultaneously place the opposite end thereof in direct communication with the main exhaust passage of the engine. The said rock-shaft is made to fulfill another duty, besides simply acting as a means for rocking the auxiliary distributing valve. The manner and purpose for which it is used is as follows:—A tongue or projection is formed on the said rock-shaft, and the said tongue or projection is of sufficient length to reach suitable projections formed on the inside of the said cylindrical valve in one direction or the other at each end of the stroke of the main piston, whereby the said cylindrical valve would be forced or pushed over in either direction, thereby insuring a positive reversal of the main piston, in the event of the sluggish "flashing" by fluid or steam pressure which might arise from the pressure of grit in the auxiliary steam cylinder, or other causes, especially when running at high speed.

In the accompanying drawings which form a part of this specification, Figure 1 is a longitudinal section of our engine through the auxiliary steam cylinder. Fig. 2 is a cross-section at right angles to Fig. 1, through the center of the auxiliary steam cylinder. Fig. 3 is a detail sectional view of the auxiliary valve-plug and casing, and the adjacent parts, showing the exhaust ports leading from either end of the cylindrical valve. Fig. 4 is a detail sectional view of the auxiliary valve-plug and casing and the adjacent parts, and showing the steam admission ports to either end of the cylindrical valve for flashing it over. Fig. 5 is an end view of the auxiliary valve-plug and casing, and showing the inner end of the rock-shaft for oscillating the said valve-plug and casing. Figs. 6, 7 and 8 are respectively detail views of the rock-shaft. Figs. 9 and 10 are respectively detail views of the auxiliary valve casing and plug.

Referring to the said drawing: A′ represents the main piston cylinder, provided with the steam inlet passages Q, Q, and the exhaust passage F, and M the piston head working therein and provided with the piston rod A.

A² represents the auxiliary steam cylinder, which contains the cylindrical valve N, and the auxiliary distributing valve plug and casing E, P. The ends of the cylindrical valve are closed as will be seen in Fig. 1, to permit of the steam as it is admitted to either end flashing it over.

Journaled with the auxiliary steam cylinder is the rock-shaft D formed with the projections Y and W. The projection W engages the cylindrical valve N at K, and K′, the object of which is to insure the flashing of the said valve when the engine is running at high speed, while the projection Y engages in an enlarged slot R in the valve plug E to change the position of the steam entrance ports during the operation of the engine. The slot R (see Fig. 5) is enlarged in order to permit of a lost motion or period of rest for the valve-plug before the main piston reaches the end of its stroke and it is necessary to change the position of the valve-plug, within the casing P. This said casing is provided with a number of ports for the admission and exhaust of steam as will be seen in Fig. 9. This rocking motion of the shaft D is obtained through the medium of the swinging lever C which is keyed to the shaft D and which is connected to the piston rod A by means of the connecting link B.

The operation of our engine is as follows:—As the engine is started steam is admitted through the supply port S to the opening S′ in the valve-plug casing P, and to the valve-plug E, through the passage X to one end of the valve N, (see Fig. 4,) which flashes the said valve over and allows steam to enter the main cylinder through one of the passages Q, Q′. At the same time steam is being exhausted from the other end of the valve N, through the passage X′ and the passage in the valve-plug E, through the main exhaust F. (See Fig. 3.) As the piston M is nearing the end of its stroke, the valve-plug E is turned by the projection Y on the rock-shaft D, which is rocked by the swinging lever connected with the piston rod so as to change the ports. In this position steam is admitted to the other end of the valve N through the passages in the valve-plug E and the passage X³, while at the same time the steam is exhausting from the other end of the valve N through the passage X² to the main exhaust F. As the piston M is again nearing the end of its stroke the projection Y again changes the position of the passages and the valve-plug E.

Having thus described our invention, the following is what we claim as new therein and desire to secure by Letters Patent:

In a reciprocating engine, the combination of the main cylinder and piston, an auxiliary steam cylinder located above the main cylinder, a reciprocating cylindrical valve and an auxiliary distributing valve, located at right angles to the reciprocating valve working in said auxiliary cylinder, a rock-shaft journaled in said auxiliary cylinder in line with the distributing valve and having a projection for engagement with the said valve, and a second projection for engagement with the reciprocating cylindrical valve, and a suitable connection between the rock-shaft and piston substantially as and for the purpose set forth.

In testimony whereof we have signed our names to this specification in the presence of four subscribing witnesses.

JOHN COCHRANE.
WILLIAM WALKER.

Witnesses to the signature of John Cochrane:

JOSEPH MCMILLAN,
JOHN MCDONALD,
*Both of 123 St. Vincent St., Glasgow, Solicitor's Clerks.*

Witnesses to the signature of William Walker:

JOHN HUTCHESON,
*Timber Mercht., Barrhead.*
GEORGE HARRISON,
*Joiner, Barrhead.*