

(No Model.)

A. KNUDSEN.
STEAM ENGINE.

No. 496,689.

Patented May 2, 1893.

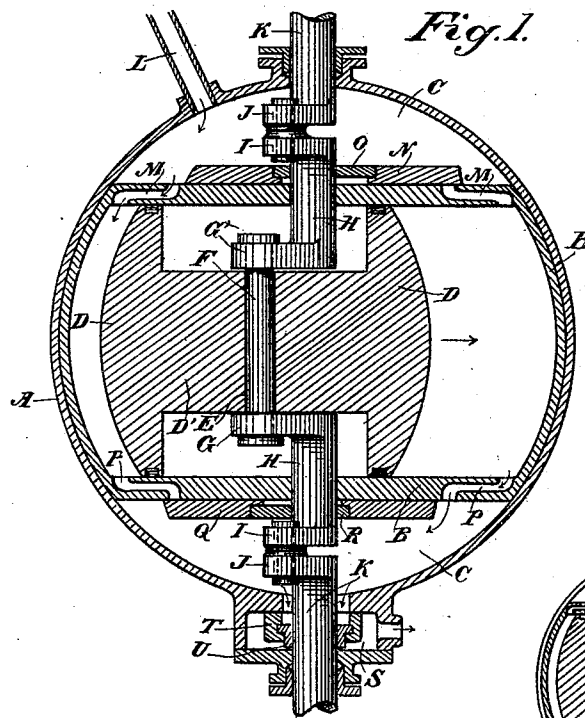


Fig. 2.

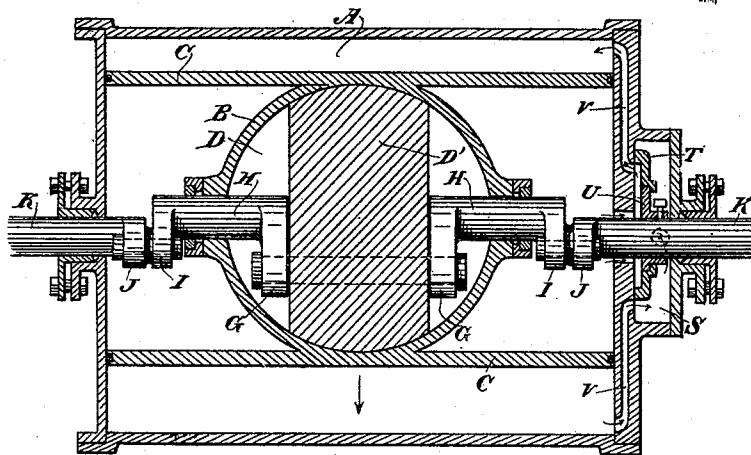


Fig. 3.

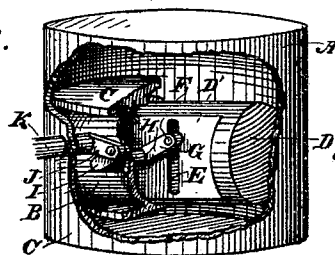


Fig. 4.

Witnesses,
R. T. Morse
H. F. Ascheck

Inventor,
Augustus Knudsen
By Dewey & Co.
attys

UNITED STATES PATENT OFFICE.

AUGUSTUS KNUDSEN, OF SAN FRANCISCO, CALIFORNIA.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 496,689, dated May 2, 1893.

Application filed December 8, 1892. Serial No. 454,500. (No model.)

To all whom it may concern:

Be it known that I, AUGUSTUS KNUDSEN, a citizen of Chili, residing in the city and county of San Francisco, State of California, have invented an Improvement in Steam-Engines; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to steam engines, and it consists in the novel construction and combination of parts hereinafter fully described and claimed.

In the accompanying drawings, Figure 1 is a horizontal section taken through the cylinders and piston. Fig. 2 is a vertical section of the same in the line of the drive shaft. Fig. 3 is a perspective view, with a portion of the two outer cylinders broken away to show the interior piston, crank shaft and cranks. Fig. 4 is a modification of the crank connections.

The object of my present invention is to provide an engine in which a crank shaft extends through the outer casing or cylinder having cranks in the interior which connect with a moving piston or pistons, and to provide a means for making suitable connection between the fixed crank shaft which enters through the sides of the exterior cylinder or case, and the interior parts while maintaining a properly packed joint around the crank shaft.

In the present case I have illustrated my invention by showing a piston reciprocating within a cylinder which in turn reciprocates transversely to the movement of the piston within an outer casing or cylinder, in which it fits. It will be manifest that the application may also be made to a single reciprocating piston, and where two are used, the steam may be employed either at high pressure in both cylinders, or it may be used expansively from one to the other. The latter construction is illustrated in the present case.

A is an exterior cylinder.

B is a second cylinder fitting transversely across the exterior one and having circular flanges C upon each side which fit within the outer cylinder with suitable packing so that the whole of this cylinder may reciprocate from end to end of the outer cylinder and transversely to the direction of its axis. The interior of this cylinder is also bored cylin-

drically to receive a double ended piston D which fits within it with suitable packing, and is adapted to reciprocate from end to end and transversely to the motion of the outer cylinder. The central portion of this piston is cut away so as to leave it flattened as shown at D'; and through this flattened portion, as shown in Fig. 3, is made a vertical slot E. A crank pin F passes through this slot and its ends are fixed in cranks G which are formed upon the short shafts H. These shafts pass through the sides of the intermediate cylinder B, being suitably fitted, and at the outer ends are provided with cranks I of half the throw of the interior cranks G. These cranks I are connected by pins with cranks J upon the inner ends of the main shafts K which pass through stuffing-boxes in the outer cylinder A to form a tight joint and stand in line with each other to form a continuous shaft as shown. By reason of the peculiar connection of these cranks, which is plainly shown in the perspective Fig. 3, and by the slot E in the inner piston, it will be seen that this inner piston D will be allowed to reciprocate from end to end of the cylinder B, while the cylinder B, itself, is reciprocating in a transverse direction from end to end of the outer cylinder A, and the motion thus derived will be communicated through the cranks to the crank shaft K.

In Fig. 4 I have shown the cranks G made one half the length and connected with the half cranks G' on the shafts H. When this construction is employed, the slot E is omitted, and the crank pin F passes through a hole in the flattened portion of the piston. In this case the additional crank allows the parts to move properly with relation to each other.

In order to admit steam into the cylinder and to exhaust it or transmit it from one to the other any suitable form of valve gear may be employed.

In the present case I have illustrated the operation as follows:—L is a pipe through which steam is admitted from the boiler into the space upon one side of the cylinder B, and between its flanges C. As these flanges fit the interior of the cylinder A and reciprocate from end to end they form a tight compartment within which the inner end of the steam

pipe L always remains, and this space serves as a steam chest from which steam is admitted into the inner cylinder B through ports M. These ports are alternately opened and closed, as shown. In the present case by means of a slide valve N which moves upon a valve face formed on the outside of the cylinder B, and is actuated by an eccentric O fixed to the shaft H as shown. Steam being alternately admitted through the ports M at opposite ends of the piston D, will cause the latter to reciprocate from end to end within the cylinder B. Upon the opposite side of the cylinder B are the exhaust valves P controlled by a valve Q which is actuated by an eccentric R in the same manner as described for the inlet valves. As the chambers upon each side of the cylinder B, and between the flanges C, are separated from each other by the thickness of the cylinder, it will be manifest that the steam is admitted into the chamber on one side and exhausted into the chamber upon the opposite side. The steam may be allowed to pass into the open air from this point, but I prefer to use the steam expansively and to compound the engine. Therefore the chamber which receives the exhaust acts as a receiver from which the steam is expanded into the outer chamber A so as to act upon the flanges C which form the piston-heads of the movable interior cylinder B, and thus cause them to reciprocate while the interior piston D is reciprocating within it. Steam may be transmitted from one cylinder to the other by a series of valves in various ways.

In the present case I have shown a valve chamber S surrounding the shaft K, interior to the stuffing-box, through which the shaft passes. Within this chamber is a slide valve T which is reciprocated by an eccentric U fixed upon the shaft K.

V V are steam ports which extend from the valve chamber S through the thickness of the metal forming the sides of the cylinder A, and they open at opposite ends of the cylinder B, so that as steam is alternately admitted behind one or the other of the piston-heads C, the cylinder B will be caused to reciprocate within the cylinder A, while at the same time the piston D is reciprocating within itself, and by reason of the peculiar arrangement of the cranks and crank shafts, the double motions thus produced are transmitted directly to the shafts K which extend outside of the cylinders and through which the power may be transmitted to any desired point.

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

1. In a steam engine, the exterior cylinders A, a cylinder B the axis of which is at right angles with that of the exterior cylinder, cir-

cular flanges or heads formed upon the sides of the interior cylinder, and provided with packing around their peripheries to fit in the exterior cylinder, a piston having heads and packing and fitting the interior cylinder B within which it reciprocates from end to end, a flattened web connecting the piston heads, a crank pin passing through said web, and connecting with cranks upon each side of the web, said cranks being connected by intermediate cranks with the main crank shafts which extend outwardly through the sides of the cylinders, substantially as herein described.

2. A steam engine, consisting of an exterior cylinder, an interior cylinder having its axis at right angles with that of the exterior cylinder, heads formed upon each side adapted to fit and reciprocate within the exterior cylinder, a piston consisting of a flattened web with heads at opposite ends fitting and reciprocating within the inner cylinder, a crank shaft K entering opposite sides of the outer cylinder A through stationary stuffing boxes and having cranks upon the inner ends of each section, supplemental shafts H passing through the sides of the inner cylinder having cranks I corresponding and connected with the cranks J of the exterior shafts, and other cranks G G' upon the inner ends upon each side of the web of the piston, said cranks being connected by a crank pin extending through the web of the piston whereby the piston and the inner cylinders are caused to reciprocate simultaneously within their containing cylinders, substantially as herein described.

3. In a steam engine the combination with the exterior cylinder A, a cylinder B, the axis of which is at right angles with that of the exterior cylinder, circular flanges or heads formed upon the sides of the interior cylinder, and provided with packing around their peripheries to fit in the exterior cylinder, a piston having webs and packing, and fitting the interior cylinder B, within which it reciprocates from end to end, a flattened web connecting the piston heads, a crank pin passing through said web and connecting with cranks on each side thereof, said cranks being connected by intermediate cranks with the main crank shaft which extends outwardly through the sides of the cylinders, the steam supply L, ports M and valve N, by which steam is admitted to reciprocate the interior piston, the exhaust port P, and valve Q, substantially as herein described.

In witness whereof I have hereunto set my hand.

AUGUSTUS KNUDSEN.

Witnesses:

S. H. NOURSE,
J. A. BAYLESS.