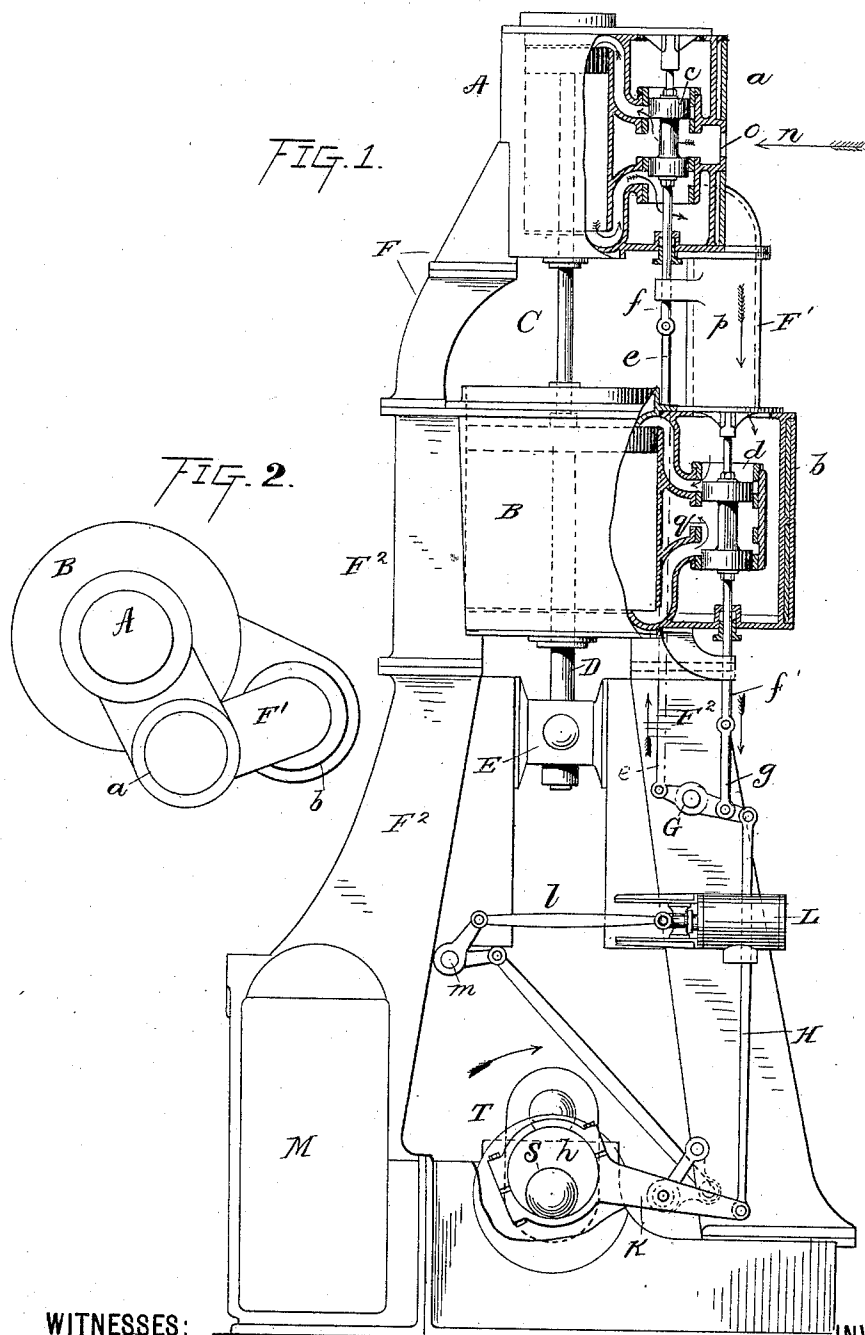


(No Model.)

H. SEE.
COMPOUND ENGINE.

No. 469,455.

Patented Feb. 23, 1892.



WITNESSES:

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COMPOUND ENGINE.

SPECIFICATION forming part of Letters Patent No. 469,455, dated February 23, 1892.

Application filed August 8, 1890. Serial No. 361,433. (No model.)

To all whom it may concern:

Be it known that I, HORACE SEE, of the city of New York, in the county and State of New York, have invented a new and useful Improvement in Compound or Progressive Expansion-Engines, which invention is fully set forth and illustrated in the following specification and accompanying drawings.

The object of this invention is to simplify the arrangement of the actuating-valves for the cylinders and the "valve-motions" for operating said valves.

The invention will first be described in detail, and then particularly set forth in the claims.

In the accompanying drawings, Figure 1 illustrates in side elevation a vertical compound engine with cylinders "tandem," the steam-chests being shown in vertical cross-section, exposing the main valves to view. Fig. 2 shows in plan the relative arrangements of the cylinders and their steam-chests and the exhaust-pipe connecting the two steam-chests.

In said figures the several parts are indicated by reference-letters, as follows:

The letter A indicates the high-pressure cylinder; B, the low-pressure cylinder, of a larger diameter; C, the piston-rod which connects the respective pistons of said cylinders, and D the continuation of said rod, or the low-pressure piston-rod, passing through the bottom of cylinder B and secured to the cross-head E. The usual connecting-rod between said cross-head and the crank T is omitted as unnecessary to the illustration of the invention herein claimed. The two cylinders are tied together by the top frames F and by the exhaust-pipe F', which pipe connects the respective steam-chests *a b* of the two cylinders A B. The housing or frames F² support the cylinders and all of the superstructural parts above said frames. The piston-valves *cd* are of the usual form of piston-valve, and their valve-stems *ff'* are connected by valve-rods *e g*, respectively, to arms secured on opposite sides of the beam or rock-shaft G. To one end or arm of said beam or rock-shaft is articulated a rod H, which at its opposite or lower end is also articulated to the eccentric-rod K, secured in the usual manner by a strap to the eccentric *h* on the main shaft S. Said

eccentric-rod between the eccentric and its outer end is suspended by a link on a movable center and connected by a system of rods and levers to a bell-crank or rock-shaft *m*, which rock-shaft is connected by one of its arms and the rod *l* to the cross-head of a reversing-engine L. This reversing-gear thus connected to said reversing-engine illustrates what is known as the "radial" gear or so-called "Marshall" valve-gear. It is obvious now that upon a reciprocating motion being imparted to the rod H that the beam or rock-shaft G will be caused to vibrate upon its center, thereby reciprocating the valves *cd* by means of their respective valve-stems and valve-rods *ff' g*, the lower valve *d* rising as the upper valve *c* descends, and vice versa. The steam entering the upper steam-chest *a*, as indicated by the arrow *n*, through the nozzle *o*, will thus enter the upper cylinder through the center of the piston-valve and escape from said cylinder when exhausted at the ends of said valve, whence it passes downward, as indicated by the arrow *p*, through the exhaust-pipe F' into the steam-chest *b*, whence said steam enters the low-pressure cylinder B from the ends of the valve *d* and is exhausted therefrom through the central portion of said valve, as indicated by the arrow *q*, into the condenser or into the atmosphere, as may be desired. In Fig. 1 the exhaust-steam passes around the cylinder B into the rear frame F², which, as a hollow column, serves to conduct the exhaust-steam downwardly into the condenser M.

This arrangement and combination of parts presents the following-named advantages:

None of the packing in any of the valve-stem stuffing-boxes is subjected to the high pressure of the steam coming direct from the boiler, but to only the pressure of the steam after having been at least once exhausted after doing work in a cylinder. This is due to the admission of the initial high-pressure steam only into the interior of the valve of the high-pressure cylinder.

The relative arrangements of the valves also is such that if the cylinders be set to operate vertically the weight of one valve tends to counterbalance the weight of the others.

The arrangement of steam-chests is such that the exhaust-pipe connecting the same

serves as a framing to support the upper cylinder or to tie the upper and lower cylinders together.

This system has also the advantage of short-
 5 ening the cylinder-ports by reducing to a minimum the distance between each valve and its cylinder, and the steam-chests, being placed circumferentially out of line, not only permit the valve-stem and valve-rod, either
 10 or both, of the smaller cylinder to pass by the side of the steam-chest of the larger cylinder, for the valve-stem itself, if prolonged, will pass by said side, but dispense with more than one stuffing-box on the steam-chest of either cylinder and avoid the intervention and multi-
 15 plication of long rock-shafts and beams and rods to operate the valves.

Although the drawings show this system applied only to the double-cylinder compound
 20 type of engine, yet so accessible are all the parts, so devoid of complications the arrangements of the valves, and so few the connections for actuating the same that the system can be readily extended to the "triple-expansion" engine with two or three cranks, as
 25 may be desired, or to the "quadruple-expansion" engine with cylinders of suitably-increasing volumes and with any suitable number of cranks that may be desired.

30 It is obvious that the advantages of this system do not inhere in merely locating the smaller or initial steam-cylinder most remote from the crank, for the smaller cylinder may be placed nearest the crank in certain sizes
 35 of engines, if desired, and the same advantages be preserved.

Having thus fully described my said invention, I claim—

1. In a steam-engine having cylinders for

compound or progressive expansion set in line 40 of axis or tandem, the combination of the following-named elements arranged and combined as follows: a valve admitting steam through its central portion to a cylinder and exhausting said steam at its ends and a valve 45 admitting said exhaust-steam to a lower-pressure or larger cylinder from the ends of the valve and exhausting the steam through its central portion, the steam-chests and valve-stems of said valves being set out of line circumferentially, so that the smaller cylinder's valve-stem may connect to its valve-rod at one side of the larger cylinder's steam-chest, substantially as and for the purposes set forth.

2. In a steam-engine having cylinders for 55 compound or progressive expansion set in line of axis or tandem, the combination of the following-named elements arranged and combined as follows: a valve admitting steam through its central portion to a cylinder and 60 exhausting said steam at its ends, a valve admitting said exhaust-steam to a lower-pressure or larger cylinder from the ends of the valve and exhausting the steam through its central portion, the steam-chests and valve- 65 stems of said valves being set out of line circumferentially, so that the smaller cylinder's valve-stem and valve-rod are connected together at one side of the larger cylinder's steam-chest, and rocker-arms connected to 70 said valve-rod and to the valve-stem of the larger cylinder, substantially as and for the purposes set forth.

HORACE SEE.

Witnesses:

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