N. S. L. Perkins,

Steam Slide Valve.

No. 19,098. Patented Jan. 12 1858.

Fig. 1

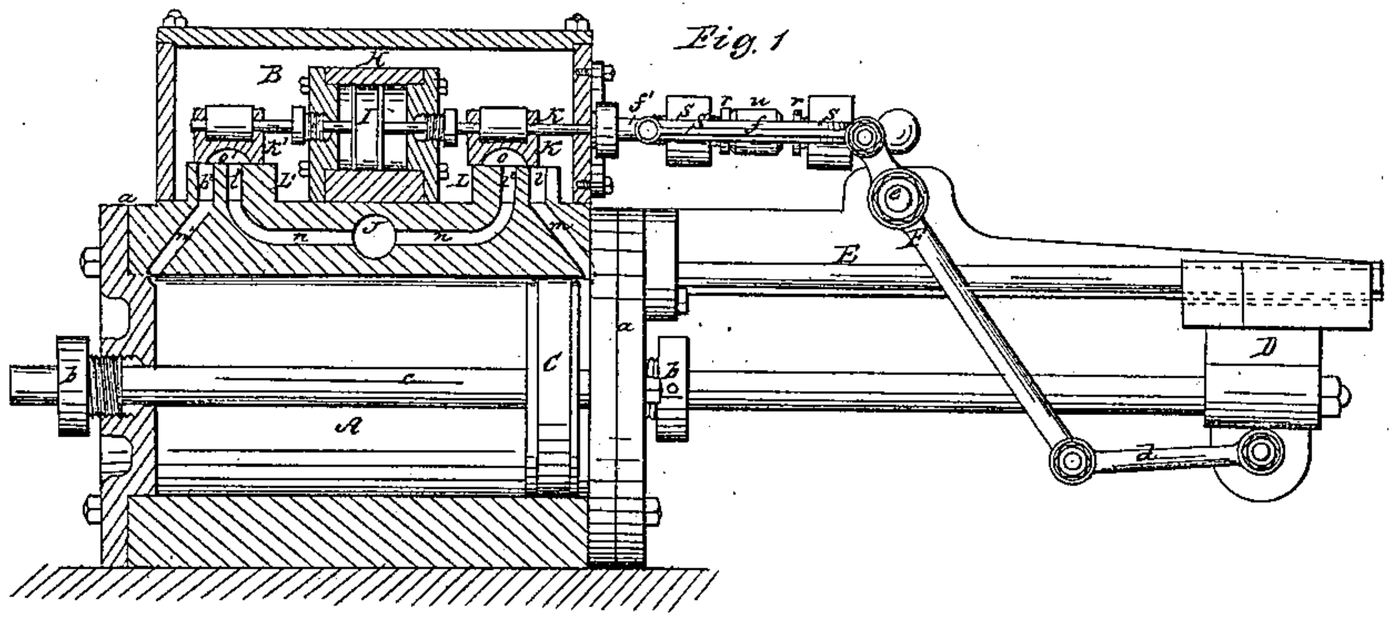

Fig. 2

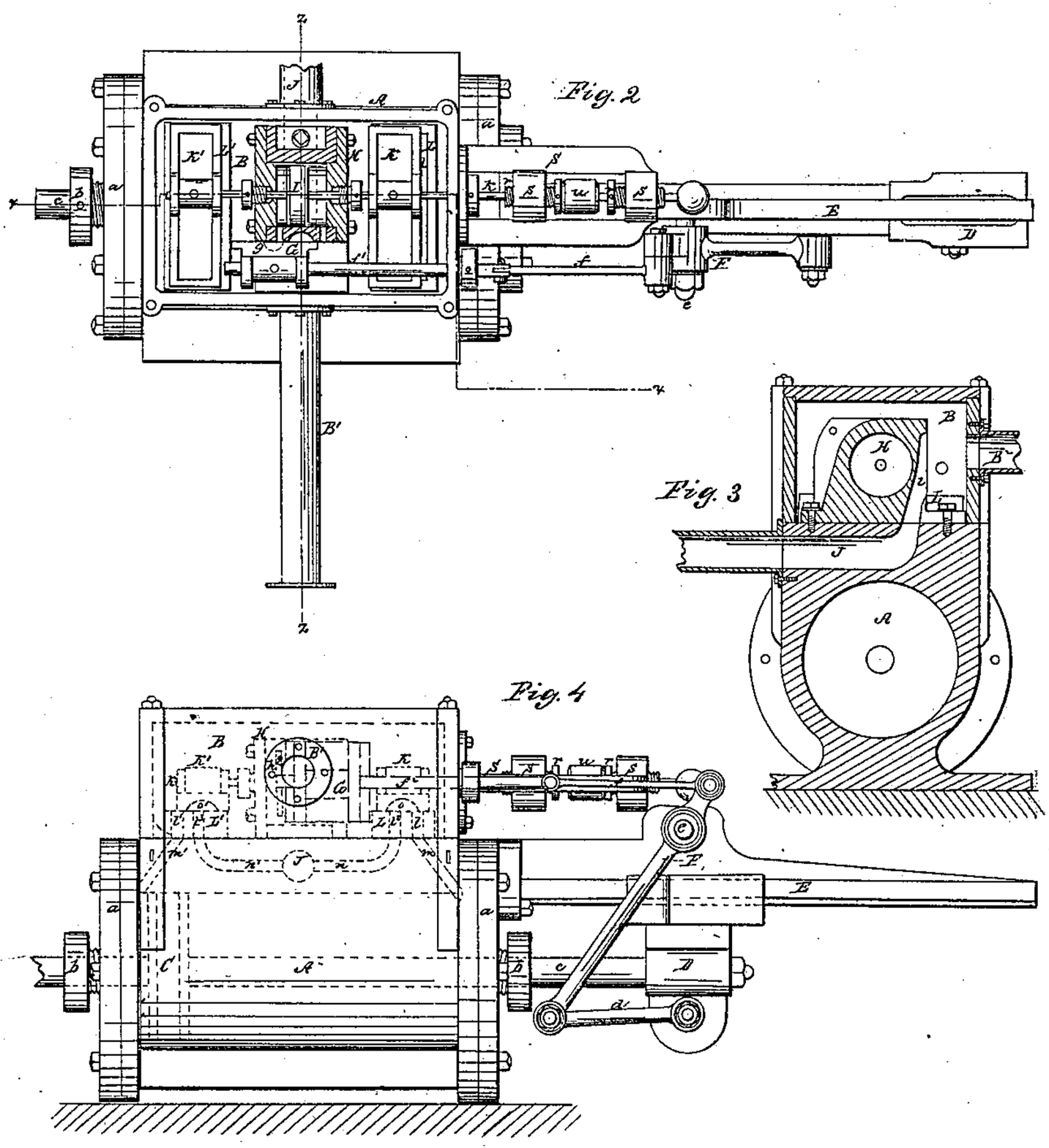

Fig. 3

Fig. 4

UNITED STATES PATENT OFFICE.

NAHUM S. C. PERKINS, OF NORWALK, OHIO.

VALVE ARRANGEMENT FOR STEAM-ENGINES.

Specification of Letters Patent No. 19,098, dated January 12, 1858.

To all whom it may concern:

Be it known that I, NAHUM S. C. PERKINS, of Norwalk, in the county of Huron and State of Ohio, have invented a certain new and useful Improvement in Duplex Valve Arrangements of Steam and other Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawing, which forms part of this specification, and in which—

Figure 1 represents a partly sectional side elevation of a horizontal reciprocating steam engine with my improvement applied thereto, said view being taken mainly as indicated by the irregular line, *x x*, in Fig. 2, which latter figure represents a top view or plan of the engine with the valve chest cover removed and showing a cylinder situated within said chest in section. Fig. 3 represents a transverse vertical section of the main engine cylinder and steam chest with its interior cylinder, taken mainly as denoted by the line, *z z*, in Fig. 2, but omitting representation of the valves and other operating parts, and Fig. 4 represents a side elevation of the engine, with certain of the interior operating parts, in colored and dotted lines, in positions the reverse of those shown for the same parts in Figs. 1 and 2.

Like letters of reference indicate like parts throughout the several figures.

My improvement has reference to that class of valve arrangements for reciprocating piston engines, in which, a main valve is made to open and close, in proper order to keep up a reciprocating action of the engine piston, the several inlet and exhaust ports to the main cylinder of the engine, through pressure of the propelling fluid brought to bear on and operate said main valve abruptly, at or shortly before the close of the engine piston stroke only, by means of a secondary or lap valve arranged to control the admission and escape of the propelling fluid to operate the main valve, said controlling valve being driven by the engine. These valves, for operation together as described, I preper to arrange in a steam chest common to them both and make one exhaust outlet serve for both, as has before been done in duplex valve arrangements of the character here referred to, and my improvement is designed more particularly to apply to direct acting engines of the reciprocating kind such as usually employed for driving pumps and saw mills by the direct connection of the driven machinery with the piston rod of the engine and without the intervention of a crank or rotary movement.

The engine represented in the accompanying drawing is shown in a horizontal position or as adapted for horizontal action. Its main cylinder (A) is provided with the usual end lids or covers (*a a*), glands or stuffing boxes (*b b*), and a steam chest (B) on its top having steam supplied it by a pipe (B′). The main or engine piston (C) has its rod (*c*) arranged to protrude through either end of the cylinder, though this need not, necessarily, be so.

Rigidly attached to the main piston rod (*c*), at or near its one end say, is an ordinary cross-head or block (D), that, during the reciprocating travel of the piston, slides along a fixed guide (E) fast to the main cylinder. The cross head (D), thus reciprocating with the piston, is made to give a uniform or constant swinging action, by means of a link rod (*d*), to a lever (F), whose fulcrum (*e*), is intermediate of the length of the lever on the fixed giude (E); the longer arm of said lever being driven by the crosshead, and the shorter arm of it serving to reciprocate, by the interposition of rods (*f f′*), a lap valve (G). This lap valve (G) is situated within the steam chest (B), has an exhaust cavity (*g*), and is arranged to reciprocate over or along a small steam cylinder (H) fixed within the steam chest, so as to admit steam and exhaust it alternately to and from either side of a piston (I) arranged within said small cylinder (H), which latter has a steam passage (*h h′*), near either, communicating with the steam space of the chest, and a central exhaust passage (*i*) communicating with the general exhaust outlet (J), as shown in Figs. 2 and 3 of the drawing. The lap valve (G) plays over the several passages, (*h h′* and *i*), to give a reciprocating action to the small piston (I), and is so pitched as regards lap and stroke as to make this action to said small piston an intermittent one and cause it only to be moved shortly before the engine piston (C) reaches the end of its stroke or single movement in either direction. This small piston (I) has a rod (*k*) that passes out through either end of the small cylinder (H). This rod (*k*) is also the stem or rod to the main valve or valves (K K′), which slide on or over seats (L L′) that have passages (*l l′*) communicating, by other passages (*m m′*), with either end of the main

steam cylinder (A), and have further passages (l^2 l^3) communicating with branch passages (n n') that form a connection with the main exhaust outlet (J).

The main valves (K K′) have exhaust cavities (o o') that, accordingly as said valves are moved by the action of the small piston (I), alternately open the main cylinder (A) on either side of the engine piston (C) to the exhaust, while said motion of the main valves, by the passage of their edges over either of the inlets (l or l'), open the main cylinder, on the opposite side of the engine piston, to the steam in the chest (B). The stroke of the main valves (K K′) and their piston (I) is preferably made adjustable and limited to vary the area of the passage surface uncovered for the admission of steam to the engine cylinder according to the slow or rapid motion of the engine, by extending the main valve stem (k) through the steam chest and through screw boxes or stops (r r) which work through bosses (s) of a standard (S) fast to the steam chest. These screw boxes freely turn on the valve stem (k), and, accordingly as they are brought nearer or farther apart by screwing or unscrewing them in or out of the bosses (s), is the stroke of the valves (K K′) made shorter or longer so as to open more or less the one or both inlet ports (l l') of the engine when said valves are thrown; by a stop or boss (u) on the valve stem (k) coming sooner or later into contact with the screw boxes (r r).

Supposing the several parts to be in the position shown in Figs. 1 and 2 of the drawing, which figures show a like position of the same parts, the main engine piston (C), it will be seen, is at the end of its forward stroke or in position of starting back on its return stroke, while the small piston (I) has been driven backward, by the lap valve (G) opening the one steam inlet (h) of the small cylinder (H), which back movement of the small piston (I) has, by connection of said piston with the main valves, operated said main valves (K K′) so as to give steam in front of the engine piston (C) through the passages (l m), and pass off the steam at the back of the engine piston through the passages (m', l'), valve cavity (o') and exhaust passages (l^3 n'), to the exhaust outlet (J). But upon the engine piston (C) reaching the extremity of its back stroke, or rather shortly previous thereto, as represented in Fig. 4 of the drawing, the lap valve (G), by the action of the lever (F), will have opened the opposite steam inlet h') of the small cylinder and thereby have caused the small piston (I) to be driven forward and the position of the main valves (K K′) to be changed so as to admit steam at back of the engine piston (C) through the passage (l' m'), and pass off the steam in front of the engine piston through the passages (m, l), valve cavity (o), and exhaust passages (l^2 n), to the exhaust outlet (J). The lap valve (G) alternately exhausts the small cylinder (H) on either side of its piston (I), by its exhaust cavity (g) alternately connecting the small cylinder ports (h h') with the central exhaust passage (i) that connects with the main outlet (J), and the arrangement shown in the drawing, it will be observed, is such, that the lap valve (G) exhausts the small cylinder, on the one side of its piston (I), before it admits steam on the opposite side of said piston to move the main valves, so as to insure a rapid and easy movement of the main valves, and secure the general exhaust outlet (J) being clear before the steam from the main cylinder is passed to it. In this way is a continuous reciprocating action kept up of the engine piston (C). The lap valve driving lever (F) being in permanent gear with the engine piston so as to have a constant motion during the entire travel of the piston and said auxiliary valve connection being a continuously operating one with or from the engine piston direct, all such destructive shock, jar, jerk or concussion as is produced by a lever or tappet struck by a moving portion of the engine to operate the valve is as perfectly avoided as if the auxiliary valve (G) were driven by the ordinary "eccentric gear" of an engine having a rotary motion, in comparison with which, apart from the greater compactness and simplicity of the one mode of action over the other, any sudden variation of velocity on part of the engine piston at, say, toward the close of the stroke, is, in the present arrangement more immediately felt by the lap valve (G) to govern its controlling action over the abruptly operating main valves (K K′), an important feature in duplex valve arrangements of the description here referred to, in which, it is a main object to open and close the engine ports abruptly at certain points, only, relative to the engine piston's travel, in contradistinction to a slow or gradual opening and closing of them as by an ordinary slide valve receiving its motion direct or otherwise in a constant, or regular manner, to open and close the engine ports direct; and which abrupt action of the main valves (K K′), at or shortly before the close of the engine piston stroke only, is here, by the construction and arrangement of parts as before described, effected in a most perfect and smooth manner and without presentation of irregular resistance on the part of the devices connected with the operating portions of the engine for effecting said abrupt or occasional movement of the main valve or valves, and the arrangement as a whole is one that, for its direct and smooth operation,

compactness, simplicity and efficiency, will be found most advantageous as applied to a direct acting engine, giving out no rotary driving force, in the many purposes for which such engines are used.

What I claim as new and useful, and desire to secure by Letters Patent, is—

The arrangement of the reciprocating driving lever (F) to the lap valve, when permanently geared with the piston rod (*c*) of the engine so as to have a constant motion with it in a direct and positive manner as shown and described, lap controlling valve (G) permanently linked or geared thereto for like continuous operation, and independent, intermittent, piston or pressure driven main valve or valves (K K′), for operation together relatively to each other and the engine piston as specified.

In testimony whereof, I have hereunto subscribed my name.

NAHUM S. C. PERKINS.

Witnesses:
CHAS. P. WICKHAM,
ED A. BUTTS.