

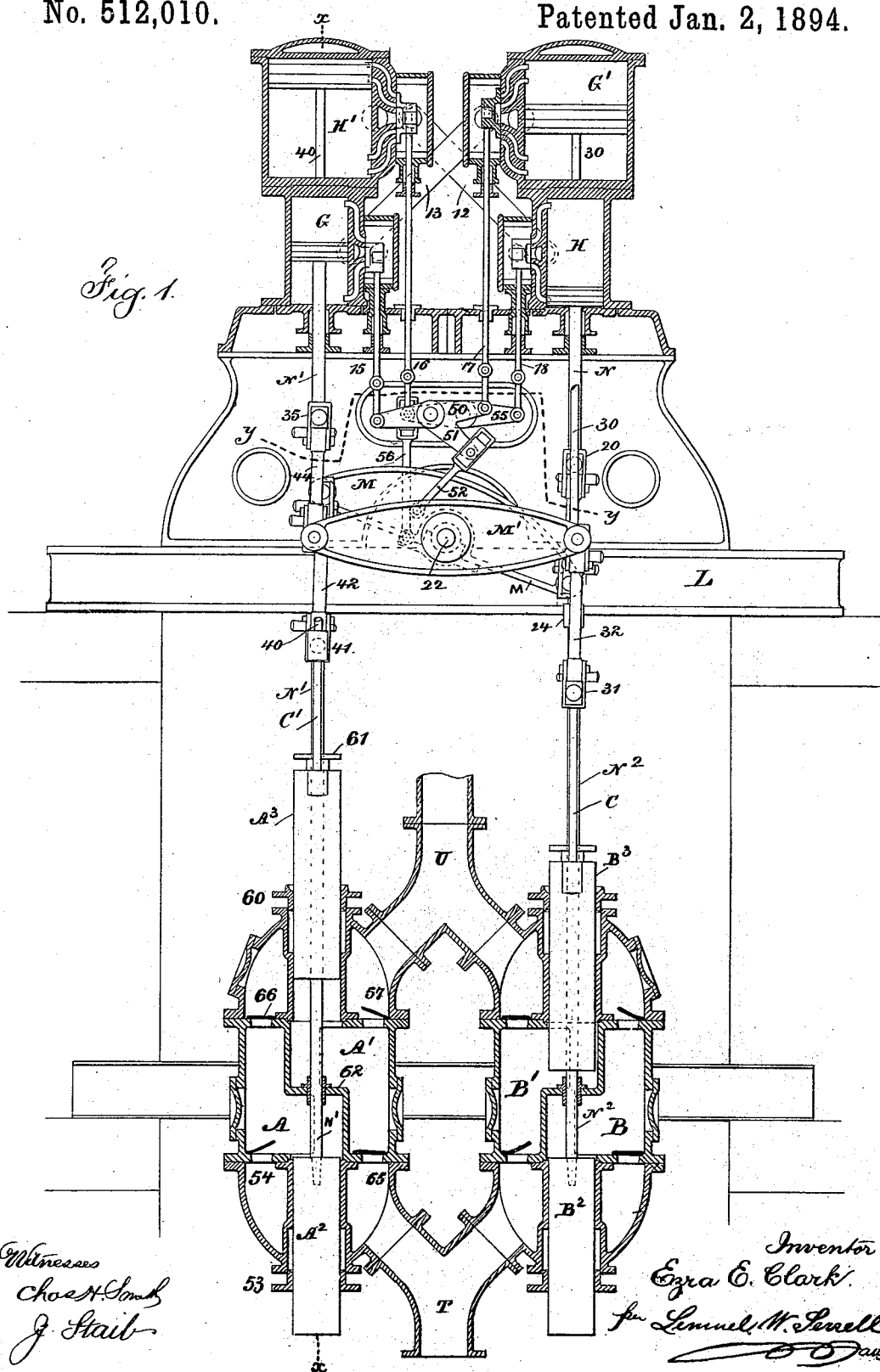
(No Model.)

3 Sheets—Sheet 1.

E. E. CLARK.
PUMPING ENGINE.

No. 512,010.

Patented Jan. 2, 1894.



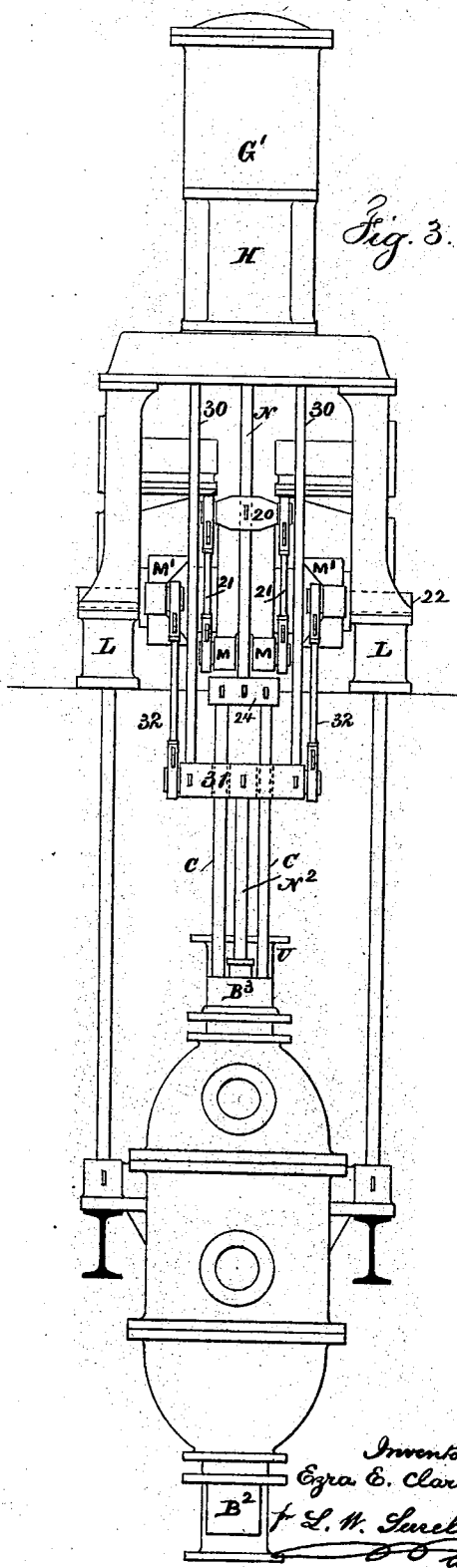
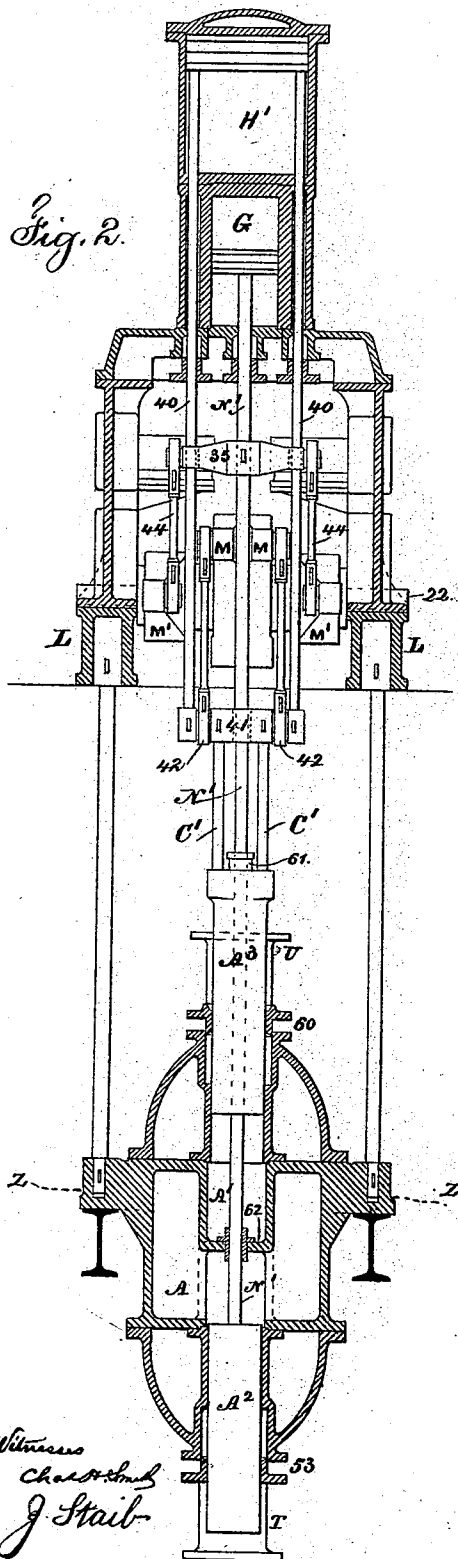
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3 Sheets—Sheet 2.

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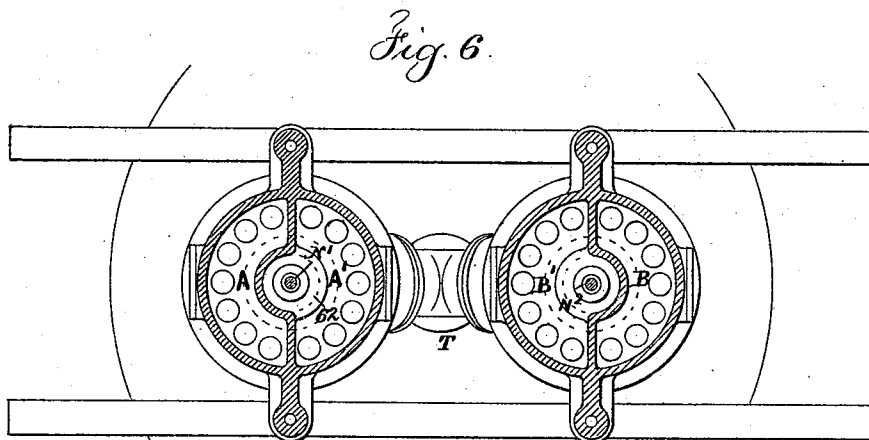
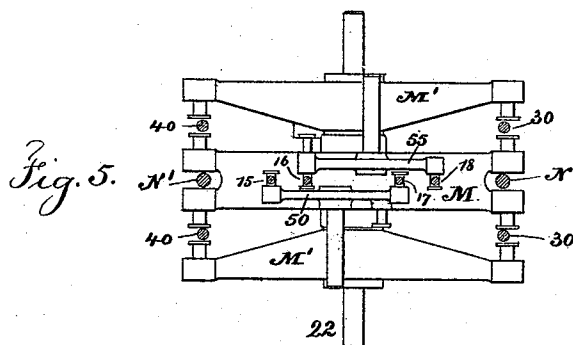
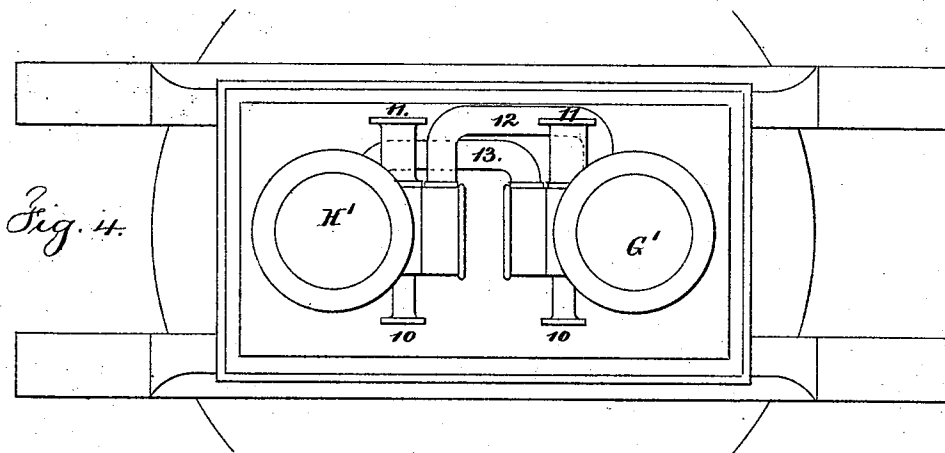
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3 Sheets—Sheet 3.

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PUMPING ENGINE.

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Witnesses

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UNITED STATES PATENT OFFICE.

EZRA E. CLARK, OF NORTHAMPTON, MASSACHUSETTS.

PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 512,010, dated January 2, 1894.

Application filed February 20, 1893. Serial No. 462,963. (No model.)

To all whom it may concern:

Be it known that I, EZRA E. CLARK, a citizen of the United States, residing at Northampton, in the county of Hampshire and State of Massachusetts, have invented an Improvement in Vertical Compound Balanced Duplex Pumping-Engines, of which the following is a specification.

This invention is a modification of and improvement upon the device for which Letters Patent No. 358,591 were granted to me March 1, 1887.

In my present improvements I place the high pressure and expansion cylinders in line with each other, and I construct the pumps so as to be double acting and they are in line with the respective pairs of actuating cylinders so that the power of each engine is exerted directly upon its pump plunger and the parts are balanced and regulated in their movements by walking-beams, so that the engines act in time, one with the other, and the valves of one engine receive their movement from a connection to the walking beam of the other engine and the parts are arranged in such a manner that the exhaust from one of the high pressure cylinders passes across to the larger and low pressure cylinder of the other pair of cylinders and these are moving together and near the end of the stroke change the valves so that the steam acts in the other high and low pressure cylinders to give motion to the same in the opposite direction, thus rendering the compound engines duplex in their action, and the weights of the respective parts are balanced or nearly so in order that there may be no loss of power and the parts standing vertical move with but little friction, and the wear upon the respective cylinders, stuffing boxes and journals is uniform or nearly so.

In the drawings, Figure 1 is a general vertical section. Fig. 2 is a section of the cylinders at the line xx Fig. 1. Fig. 3 is an end elevation. Fig. 4 is a plan of the steam cylinders. Fig. 5 is a sectional plan at the line yy of Fig. 1, and Fig. 6 is a sectional plan at the line zz .

The high pressure steam cylinders are represented at G and H and low pressure steam cylinders at G' H'. The cylinders H and G' are axially in line and so are the cylinders G and

H' and the steam at a high pressure is to be supplied by the pipes 10 and the exhaust led away by the pipes 11 and there are diagonal pipes 12 and 13 extending from the exhausts of the respective high pressure cylinders H and G to the valve chests of the respective cylinders H' G'.

The valves of these engines are to be of any suitable character. I have represented the same as the ordinary D slide valves and the valve rods 15 16 17 18 to the respective valves are actuated as hereinafter designated in such a manner as to admit steam under high pressure first to one cylinder G and then to the other cylinder H and the exhaust from the cylinder G goes by the pipe 13 to the valve chest of the cylinder G', and the exhaust from the cylinder H goes by the pipe 12 to the valve chest of the cylinder H'. The piston rod N of the cylinder H is connected to a cross head 20 that is connected by links 21 to the central walking-beam M which is supported and works upon a cross shaft 22 the ends of which shaft rest in suitable bearings upon the frames or beams L, and this piston rod N passes through the cross head 20 to a second cross head 24 having rods C C that pass to the plunger B³ of the pump, as hereinafter described, and the cylinder G' has rods 30 passing from the piston to the cross head 31, which cross head 31 has a rod N² passing through the middle of the plunger B³ and connected to the plunger B², and there are links 32 from the ends of the cross head 31 to the walking-beams M' M' which also have the shaft 22 for their support and upon which they are fixed. This shaft 22 works in bearings at the ends on the frames L L. The piston of the cylinder G has a piston rod N' that passes through and is connected with the cross head 35 and passes down through the plunger A³ and is connected with the plunger A², and the piston of the cylinder H' has rods 40 passing down and connected with the cross head 41 from which the rods C' pass down and are connected with the plunger A³, and there are links 42 42 extending up from the cross head 41 to the end of the central walking beam M. Upon reference to Fig. 2 it will be seen that the rods 40 pass freely through the cross head 35, the holes for such rods being slightly larger than the rods in order that the

movement may not be obstructed and the links 42 are connected with the cross head 41 inside, and between the rods 40. The piston rod N' passes down within the notched end of the walking-beam M, see also Figs. 3 and 5, and it passes freely through the cross head 41, and from the ends of the cross head 35 there are links 44 to the ends of the levers or walking-beams M', and upon reference to Fig. 3 it will be seen that the piston rod N passes freely through the notched end of the walking-beam M, and the links 32 are outside the rods 30 and are connected at the ends of the cross head 31, and the rods C C pass freely through holes in the cross head 31, the objects of these arrangements being that the parts connected with the piston of the cylinder G may be moving in the opposite direction to the parts connected with the cylinder H' and that the parts connected with the cylinder H may be moving one way while the parts connected with the piston of the cylinder G' may be moving the other way and the walking-beam M is connected at one end to the piston of the cylinder H and at the other end to the piston of the cylinder H'. Hence the pistons in H and H' move together but always in the opposite directions, and the piston of the cylinder G is connected at one end of the walking-beams M' and the piston of the cylinder G' is connected at the other end of such walking-beams M'. Hence the pistons of G and G' move together but in the opposite directions and the parts are balanced by being connected at the opposite ends of the respective walking-beams. It is preferable to key the walking-beams M' upon the shaft 22 so that these walking beams and the shaft move together, and the walking beam M is provided with a journal box or bearing upon this under side and swings upon this shaft 22 as it moves with the other parts.

The valve rods 15 and 17 are connected at opposite ends of the rocker 50 and there is an arm 51 to this rocker and a link 52 that connects the rocker to the walking-beam M, and there is a rocker 55 to the ends of which the valve rods 16 and 18 are connected, and there is a link 56 connecting this rocker to one of the walking-beams M'. Hence the valves of the cylinders G and G' receive motion from the walking-beam M and the valves of the cylinders H and H' receive motion from the walking-beams M' but the piston of G is connected to M', and the piston of the cylinder H is connected to M. Hence as the pistons of the respective cylinders move and the piston of H completes its stroke, it moves the valves of the cylinders G G' by the rocker 50 and connection to the walking-beam M, and the piston of the cylinder G as it completes its strokes, moves the valves of the cylinders H and H' by the rocker 55 and the connection 56 to the walking-beam M'; the movements of the parts therefore will be inter-dependent and the high pressure steam will be admitted to one side of the piston in the cylin-

der H as the steam passes from the other side of the said cylinder through the pipe 12 into the cylinder H' to move its piston in the opposite direction, and the same movements take place in relation to the pistons and valves of the cylinders G and G', and the valves of G and G' are dependent for their motion upon the movements of the pistons H and H', and the reverse, thereby not only are the parts balanced in their action but they are duplexed and the steam is expanded economically and there is no possibility of the engine stopping at any point so long as the proper pressure of steam is maintained; and I remark that the plungers of the respective pumps are moved with the respective pistons by the direct connections before described and the plunger in one pump is moving in the opposite direction to the plunger in the other pump, and these plungers or pistons and the pumps may be of any desired character or construction. I however prefer and make use of the pump next described.

I have represented the double acting pumps as side by side and parallel with each other, there being an inlet or suction pipe T and a discharge pipe U with branches extending to the respective valve chests of the pumps. The plunger A³ passes through the stuffing box 60 at the top of the valve chest of the pump A' and the rod N' passes through the stuffing box 61 at the upper end of the plunger A³ and through a partition 62 between the respective pump chambers A and A' and is connected with the plunger A² which passes through the stuffing box 53, and the inlet valves for the pump chambers A are provided at 54 and the discharge valves at 66 and those for the pump chambers A' at 65 and 57, and the chambers B B' are constructed in a similar manner, and it is to be understood that the plungers A³ and B³ move simultaneously and in opposite directions as actuated by the pistons in the cylinders H' and H', and that the plungers A² and B² move simultaneously and in opposite directions as actuated by the pistons in the cylinders G and G'. It however is to be understood that pistons may be made use of in place of plungers in the respective pumps and that any suitable character of duplex pump may be combined with this engine.

I claim as my invention—

1. The combination in a compound balanced duplex pumping engine, of the high pressure cylinders G and H in line with the respective low pressure cylinders H' G', the exhaust pipes crossing from the high pressure cylinders to their respective low pressure cylinders to form the pairs of high and low pressure cylinders, the valves and valve rods for the respective cylinders, the rockers connecting the valve rod of one high pressure cylinder with the valve rod of the opposite low pressure cylinder, the walking-beams, links and piston rods arranged substantially as specified and the connection from the walking-beam of one

pair of cylinders to the rocker for the valves of the other pair of cylinders, substantially as set forth.

2. The combination in a vertical compound
5 balanced duplex pumping engine, of high and low pressure cylinders axially in line, the pistons and piston rods of the high pressure cylinders in line with the pistons or plungers of the pumps and connected therewith, the pistons and piston rods of the low pressure cylinders, the cross heads, links and walking-beams, connected and arranged substantially as specified, so that the high pressure piston of one set of cylinders is connected with the
10 low pressure piston of the other set of cylinders and with one pair of pump plungers and the valves, valve rods, rockers and connections to the respective walking beams for the valves of the opposite cylinders to be moved
15 simultaneously and by the engine that is completing its stroke, substantially as set forth.

3. The high pressure cylinders G and H in line with the respective low pressure cylin-

ders H' G', the valve chest and valves for the respective cylinders, the pipes 12 and 13 crossing from the exhaust of the high pressure cylinders to the valve chests of the low pressure cylinders, in combination with the rockers 50 and 55 and the valve rods connecting the valve of one high pressure cylinder and of the opposite low pressure cylinder, the walking-beams M' M' and M and the shaft 22 for supporting such walking-beams, the pistons, piston rods, cross heads and links connecting the respective pistons at opposite ends of the walking-beams, and the double acting pumps with their plungers axially in line with the compound engines and connected to the respective piston rods and cross heads, substantially as set forth.

Signed by me this 8th day of February, 1893.

EZRA E. CLARK.

Witnesses:

EDWARD B. STRONG,

TIMOTHY G. SPAULDING.