

W. S. WEIKEL.

MULTIPLE POWER ENGINE.

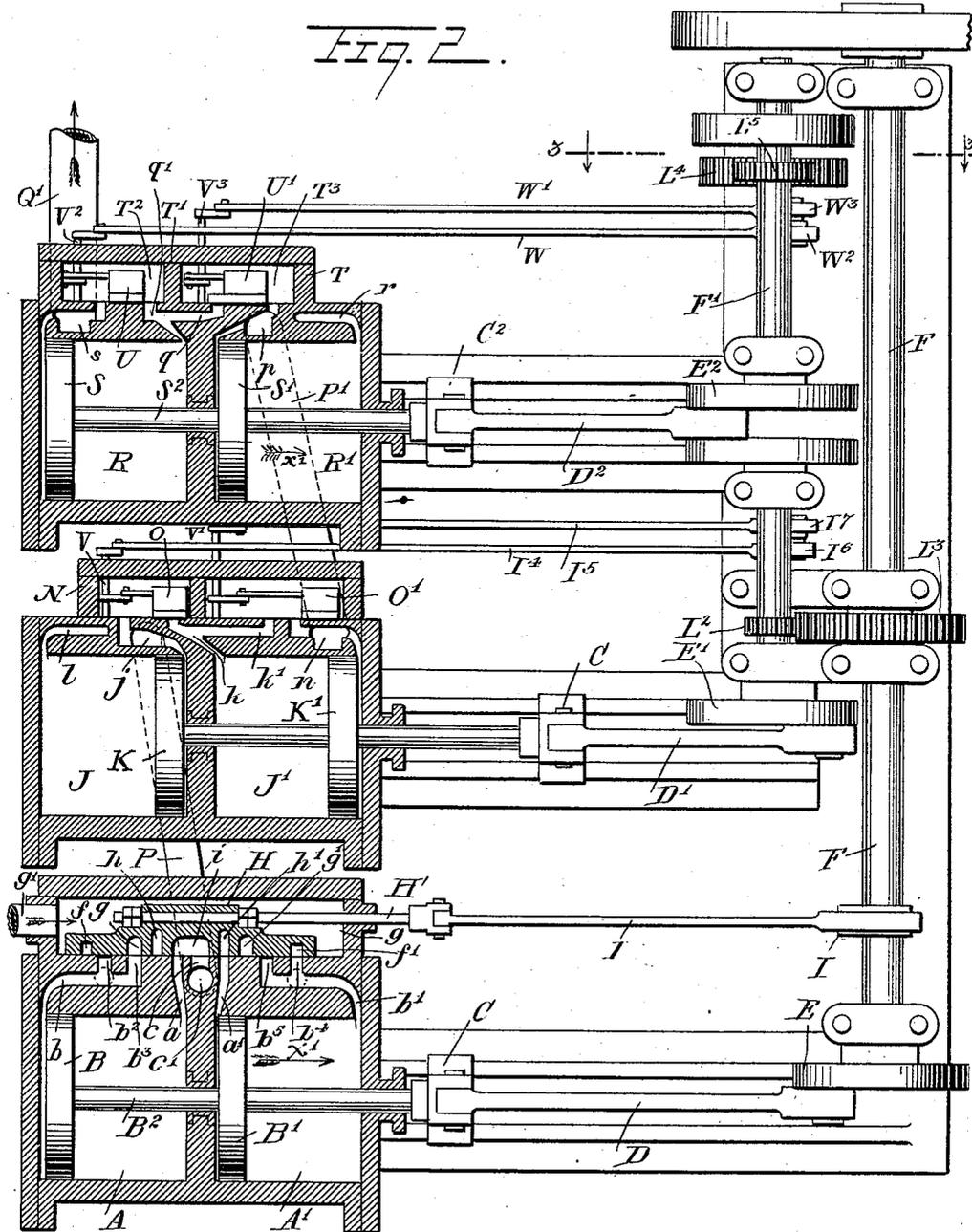
APPLICATION FILED AUG. 8, 1913.

1,084,512.

Patented Jan. 13, 1914.

3 SHEETS—SHEET 2.

FIG. 2.



WITNESSES

H. J. Walker
New J. Hooster

INVENTOR

Wilbur Smith Weikel

BY Munn & Co

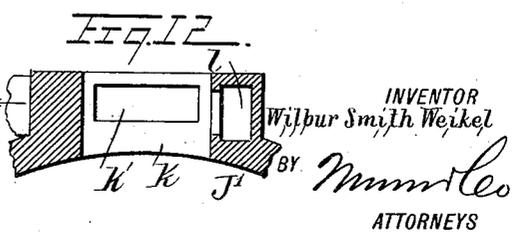
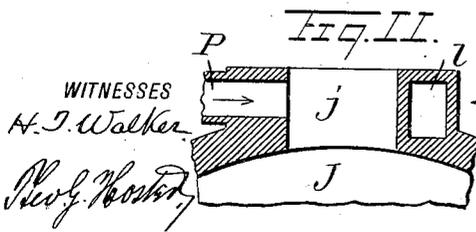
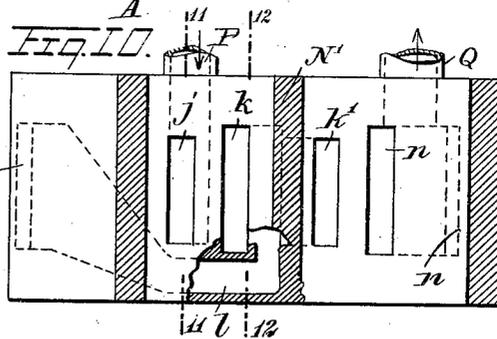
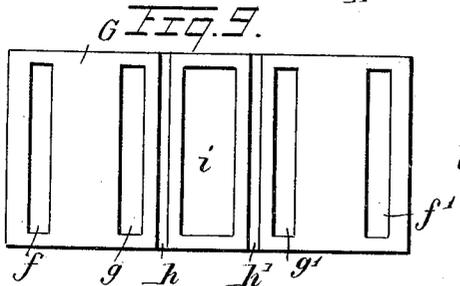
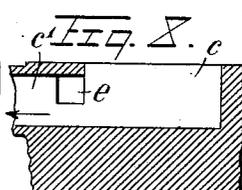
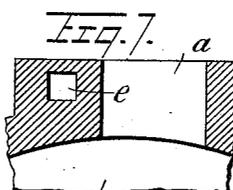
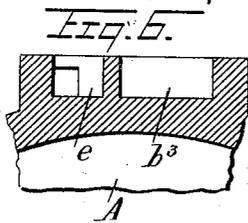
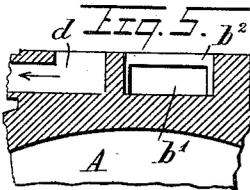
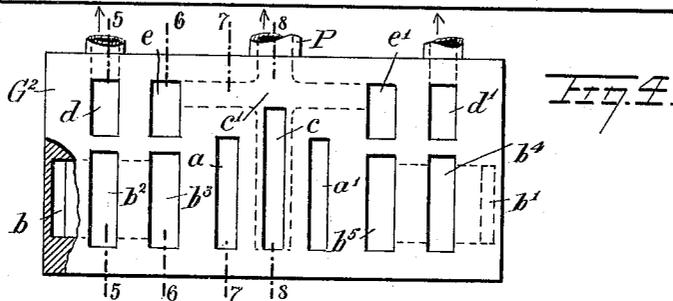
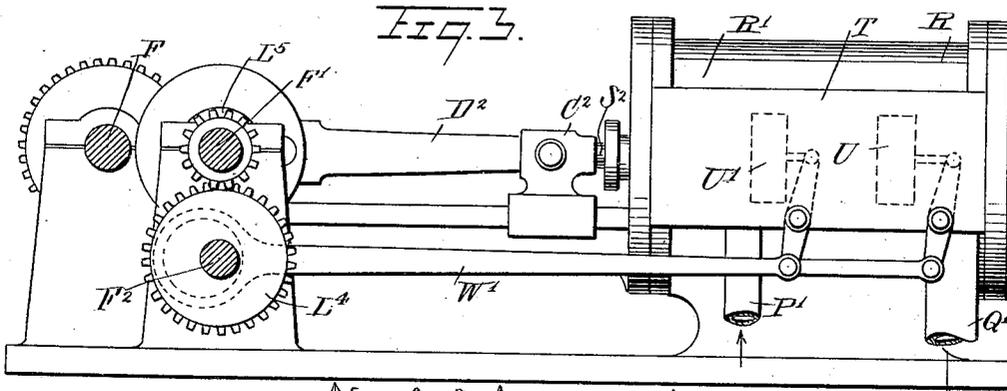
ATTORNEYS

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3 SHEETS—SHEET 3.



WITNESSES
 H. J. Walker
 Geo. H. Hester

INVENTOR
 Wilbur Smith Weikel
 BY *Mumtco*
 ATTORNEYS

UNITED STATES PATENT OFFICE.

WILBUR SMITH WEIKEL, OF LILLYDALE, WEST VIRGINIA.

MULTIPLE-POWER ENGINE.

1,084,512.

Specification of Letters Patent.

Patented Jan. 13, 1914.

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To all whom it may concern:

Be it known that I, WILBUR SMITH WEIKEL, a citizen of the United States, and a resident of Lillydale, in the county of Monroe and State of West Virginia, have invented a new and Improved Multiple-Power Engine, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved multiple power engine arranged to utilize the motive agent expansively in a very simple manner.

In order to accomplish the desired result use is made of a pair of high pressure cylinders, a pair of low pressure cylinders, connected pistons in each pair of cylinders, steam chests for each pair of cylinders and connected by sets of admission and exhaust ports with the ends of the corresponding cylinders, valves in the said steam chests and controlling the said ports, the exhaust motive agent from one end of a high pressure cylinder passing partly into the other end of the same cylinder and partly into one of the low pressure cylinders, and the exhaust motive agent in one low pressure cylinder being used expansively in the other low pressure cylinder, the pistons in the low pressure cylinders reciprocating at double the speed of that of the pistons in the high pressure cylinder.

A practical embodiment of the invention is represented in the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a sectional plan view of the multiple power engine provided with a pair of high pressure cylinders and a pair of low pressure cylinders; Fig. 2 is a similar view of the multiple power engine provided with one pair of high pressure cylinders and two pairs of low pressure cylinders; Fig. 3 is a rear sectional elevation of the same on the line 3—3 of Fig. 2; Fig. 4 is a plan view of the bottom of the main valve seat, part being broken out; Fig. 5 is a cross section of the same on the line 5—5 of Fig. 4; Fig. 6 is a similar view of the same on the line 6—6 of Fig. 4; Fig. 7 is a similar view of the same on the line 7—7 of Fig. 4; Fig. 8 is a similar view of the same on the line 8—8 of Fig. 4; Fig. 9 is an inverted plan view of the main valve; Fig. 10 is a plan view with parts in section of the low pressure valve seat; Fig. 11 is a cross section of the same on the line

11—11 of Fig. 10; and Fig. 12 is a similar view of the same on the line 12—12 of Fig. 10.

The high pressure cylinders A and A' are arranged in axial alinement and are provided with reciprocating pistons B, B' attached to a piston rod B² connected with a cross head C pivotally connected by a pitman D with a crank E on the main shaft F of the engine. A steam chest G is mounted on the cylinders A, A' and is connected by a pipe G' with a boiler or other suitable source of motive agent supply. A slide valve H is mounted to reciprocate within the steam chest G on the main valve seat G² and the said slide valve H is provided with a valve stem H' connected at its outer end with the eccentric rod I' of an eccentric I mounted on the main shaft F so that when the latter is rotated a reciprocating motion is given to the slide valve H in the steam chest G. The high pressure cylinders A, A' are connected at their inner ends by admission ports a, a' with the valve seat G², and from the outer ends of the said cylinders A, A' lead admission ports b, b', of which the port b is provided with branch ports b², b³ leading to the valve seat G², and the port b' is provided with branch ports b⁴, b⁵ likewise leading to the valve seat G². A port c is arranged at the middle of the main valve seat G² and leads to an exhaust port c'. The valve seat G² is further provided with air ports d, d' leading to the atmosphere and arranged in transverse alinement with the branch ports b², b³, as plainly indicated in Fig. 4. Auxiliary exhaust ports e, e', lead from the valve seat G² and connect with the exhaust port c', the said ports e, e' being arranged in transverse alinement with the branch ports b³, b⁵, as indicated in Fig. 4. The main slide valve H is provided at its under side with end cavities f, f' adapted to register with the branch ports b² and b⁴ and the air ports d, d', respectively, and the under side of the said main slide valve H is provided with cavities g, g' spaced inward from the cavities f, f' and adapted to register with the branch ports b³, b⁵ and the exhaust ports e, e', respectively. The under side of the main slide valve H is further provided with transverse channels h, h' opening at their ends into the steam chest G to allow the motive agent to pass into the said channels, and the said channels h, h' are adapted to register with the admission ports a, a'

to conduct the live motive agent into the inner ends of the high pressure cylinders A and A'. The under side of the main slide valve H is provided at its middle with a main exhaust cavity *i* adapted to connect the ports *a* and *c* with each other and the ports *a'* and *c'* with each other on shifting the slide valve H, as hereinafter more fully explained. Adjacent the high pressure cylinders A, A' is arranged a pair of alined low pressure cylinders J, J' in which reciprocate pistons K, K' attached to a piston rod K² connecting with a cross head C' connected by a pitman D' with a crank E' secured on an auxiliary shaft F' connected by a pinion L with a gear wheel L' secured on the main shaft F, so that when the latter makes one revolution the auxiliary shaft F makes two revolutions and consequently the pistons K and K' reciprocate at double the speed of that given to the pistons B, B', or, in other words, the pistons K, K' make two full strokes to one full stroke of the pistons B, B'. A steam chest N is arranged on the low pressure cylinders J, J' and is provided with a transverse partition N' to form two compartments N², N³ in which reciprocate slide valves O, O' secured on a valve stem O² connected at its outer end with the eccentric rod I² of an eccentric I³ secured on the auxiliary shaft F' so that when the engine is running a reciprocating motion is given to the slide valves O, O' traveling at double the speed of the main slide valve H. The steam chest compartment N² is connected with the inner end of the low pressure cylinder J by a port *j* and the said port *j* is connected by a pipe P with the exhaust port *c'* of the high pressure cylinders A, A'. A port *h* connects the inner end of the low pressure cylinder J' with the chamber N² and this port *h* is controlled by the valve O which opens and closes the said port *h*. The port *h* is provided with a branch port *h'* leading into the other compartment N³. The outer end of the low pressure cylinder J is connected by a port *l* with the ports *h*, *h'* (see Fig. 10). The outer end of the low pressure cylinder J' is connected by a port *n* with the chamber N³ and this port *n* is controlled by the valve O' which opens and closes the said port *n*. The port *n* is connected with an exhaust pipe Q for carrying off the exhaust motive agent. It is understood that the ports *j* and *h'* are always open and are not controlled by the valves O and O'.

The operation is as follows: When the engine is running and the several parts are in the position shown in Fig. 1, then the live motive agent in the steam chest G passes by way of the channel *h* and port *a* into the inner end of the high pressure cylinder A to force its piston outward in the direction of the arrow *x*. During the movement of the

piston B in the direction of the arrow *x* the piston B' moves in the same direction and the steam in the cylinder A' in front of this piston passes by way of the port *a'*, cavity *i* and port *c* into the exhaust port *c'* from which a portion of the steam passes by way of the port *e'*, cavity *g'*, branch port *b³* and port *b'* into the right-hand end of the cylinder A' to act on the piston B' with a view to balance the same in the direction of the arrow *x*. The other portion of the steam passing into the exhaust port *c'* is conducted by the pipe P into the port *j* from which the steam passes into the inner end of the low pressure cylinder J to act on the piston K to force the same outward in the direction of the arrow *x*. It will be seen that by this arrangement the exhaust steam from the left-hand end of the high pressure cylinder A' is used expansively in the right-hand end of the said cylinder and in the corresponding end of the low pressure cylinder J. When the pistons B, B' have traveled about half of their stroke in the direction of the arrow *x* the pistons K, K' have completed their strokes in this direction and at this time the valves O, O' are shifted so that the port *h* is uncovered and the port *n* is closed. When the pistons K, K' are on the return stroke a portion of the steam in the right-hand end of the cylinder J passes by way of the port *j*, chamber N² and port *h* into the left-hand end of the cylinder J' to act on the piston K' therein, and a portion of this steam passes by way of the ports *h* and *l* into the left or outer end of the low pressure cylinder J to force the pistons K, K' in the inverse direction of the arrow *x*. When the pistons B, B' reach the end of their outward stroke in the direction of the arrow *x* the pistons K, K' have made a complete stroke and returned to the position shown in Fig. 1. During the stroke of the pistons B, B' in the direction of the arrow *x* the slide valve H is shifted at any desired point of cut-off so that the channel *h'* connects with the admission port *a'*, the cavity *i* connects the ports *a* and *c* with each other, and the cavity *g* connects with the branch ports *b³* and *e* while the cavity *f'* registers with the ports *b⁴*, *d'*. The live motive agent now passes into the left-hand end of the cylinder A' to move the piston B' in the inverse direction of the arrow *x*. The steam in the right-hand end of the other high pressure cylinder A now passes by way of the port *a* and cavity *i* into the exhaust port *c'* from which a portion of the steam passes by way of the pipe P into the port *j* and the right-hand end of the cylinder J to act on the piston K and force the same in the direction of the arrow *x* the same as previously described. Another portion of steam in the port *c'* passes by way of the port *e*, cavity *g*, branch port *b³* and port *b* into the outer or left-hand end of the cylin-

der A to act expansively therein on the piston B to move the latter in the inverse direction of the arrow α . During the next movement of the pistons B, B' in the direction of the arrow, the steam in the left-hand end of the cylinder A in front of the piston B is exhausted by way of the ports b, b^2 , cavity f and exhaust port d , and during the next movement of the pistons B, B' in the inverse direction of the arrow α the steam in the right-hand end of the cylinder A' is exhausted by way of the ports b', b^4 , cavity f' and exhaust port d' . When the pistons K, K' are traveling in the direction of the arrow α the steam in the left-hand end of the cylinder J in front of the piston K passes by way of the ports l, l' , chamber N³ and port n to the exhaust pipe Q, and the steam in the left-hand end of the cylinder J' in front of the piston K' passes by way of the ports l, l' , chamber N³ and port n to the exhaust pipe Q. The right-hand end of the cylinder J' is always connected with the atmosphere by way of the port n and exhaust pipe Q.

From the foregoing it will be seen that the live motive agent is used in the cylinders A, A' under full boiler pressure, and a portion of the steam is subsequently used expansively in the said cylinders and in the cylinder J, and the steam exhausting from the right-hand end of the cylinder J is again used expansively in the left-hand ends of the cylinders J, J'.

It will be noticed that the cylinders A, A', J, J' are practically alike in size so that the motive agent exhausting from either cylinder A, A' into the cylinders A', J or A, J can act expansively therein against the corresponding pistons B', K or B, K, and likewise the steam exhausting from the right-hand end of the cylinder J can act expansively in the left-hand ends of the cylinders J and J' against the pistons K and K'.

In the modified form shown in Figs. 2 and 3 use is made of a high pressure engine and two low pressure engines, of which the high pressure engine having the cylinders A, A' and the first low pressure engine having the cylinders J, J' are practically the same as the ones above described in reference to Figs. 1 and 4 to 12, so that further description of the same is not deemed necessary. The second low pressure engine is provided with alined cylinders R, R' practically the same in size as the cylinders J, J', and in the said cylinders R, R' reciprocate pistons S, S' attached to a piston rod S² connected with a crosshead C² which in turn is connected by a pitman D² with a crank E² secured on the auxiliary shaft F' which in this case is connected by gear wheels L² and L³ with the main engine shaft F to rotate the said shafts at a ratio of 4 to 1. A steam chest T is provided for the

cylinders R and R' and this steam chest has a transverse partition T' dividing the chest into chambers T² and T³ containing slide valves U, U' similar to the slide valves O, O' in the steam chest N of the low pressure engine. The valves O, O' and U, U' are actuated from the valve shaft F² connected by gear wheels L⁴, L⁵ with the auxiliary engine shaft F' so to rotate the shafts F', F² at a ratio of 2 to 1. The valves O, O' are likewise actuated from the shaft F² so that the valves U, U' travel at the same speed as the valves O, O' shown in Fig. 1. The valves O, O' are connected with crank shafts V, V' extending through the sides of the steam chest N to the outside thereof, and the outer ends of the said crank shafts V, V' are connected with the eccentric rods I⁴, I⁵ of eccentrics I⁶, I⁷ held on the shaft F². The valves U, U' are similarly connected with the crank shafts V², V³ extending through the sides of the steam chest T and having their outer ends connected with the eccentric rods W, W' of eccentrics W², W³ mounted on the shaft F², so that when the latter is rotated a sliding movement is given to the valves O, O' and U, U'. The eccentrics I⁶, I⁷, W² and W³ are set to give the valve O' a slight lead over the valve O, to give the valve U' a slight lead over the valve O', to give the valve U a slight lead over the valve U', and to give the valve O a slight lead over the valve U.

The steam chest T is connected by a port p with the left-hand end of the cylinder R, and this port p is also connected by a pipe P' with the exhaust port n of the first low pressure engine so that the exhaust steam can pass from the port n by way of the pipe P' into the chamber T³ of the steam chest T. The chamber T³ is connected by a port q with the right-hand end of the cylinder R and this port q has a branch port q' leading to the chamber T² of the steam chest T. From the right-hand end of the cylinder R' leads a port r which is similar to the port l of the first low pressure engine and leads to the port q . The left-hand end of the cylinder R is provided with an exhaust port s connected with the chamber T² and with an exhaust pipe Q' leading to the atmosphere.

The high pressure engine and the first low pressure engine work the same as above described in reference to the engine illustrated in Fig. 1 with the exception that the pistons K, K' make four strokes to one stroke of the pistons B, B'. The exhaust steam passing from the first low pressure engine to the port n passes by way of the pipe P' into the port p from which the steam passes into the left-hand end of the cylinder R' to act against the piston S' to move the same in the direction of the arrow

5 x' . On the return stroke of the piston S' the steam passes out of the left-hand end of the cylinder R' and passes by way of the port p into the chamber T^3 , from which a portion passes by way of the port q into the right-hand end of the cylinder R and another portion passes by way of the ports q, r into the right-hand end of the cylinder R' to act expansively on the pistons S, S' to move the same in the inverse direction of the arrow x' . On the next movement of the pistons S, S' in the direction of the arrow x' the valves U, U' have shifted so that the steam in the left-hand end of the cylinder R and the steam in the right-hand end of the cylinder R' passes by way of the ports s, r, q and q' into the chamber T^2 and by way of the exhaust pipe Q' to the open air.

20 Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. An engine, comprising a pair of high pressure cylinders, a pair of low pressure cylinders, connected pistons in each pair of cylinders, steam chests for each pair of cylinders connected by sets of admission and exhaust ports with the ends of the corresponding cylinders, and valves in the said steam chests and controlling the said ports, the exhaust steam from one end of a high pressure cylinder passing partly into the other end of the same high pressure cylinder and partly into one of the low pressure cylinders, and the exhaust steam in one low pressure cylinder being used expansively in the other low pressure cylinder.

2. An engine, comprising a pair of high pressure cylinders, a pair of low pressure cylinders, connected pistons in each pair of cylinders, steam chests for each pair of cylinders connected by sets of admission and exhaust ports with the ends of the corresponding cylinders, valves in the said steam chests and controlling the said ports, the exhaust steam from one end of the high pressure cylinder passing partly into the other end of the same high pressure cylinder and partly into one of the low pressure cylinders, and the exhaust steam in one low pressure cylinder being used expansively in the other low pressure cylinder, a main shaft connected with the pistons of the high pressure cylinders, and an auxiliary shaft rotating at double the speed of the said main shaft, the said auxiliary shaft being connected with the said pistons in the low pressure cylinders.

3. An engine, comprising a pair of high pressure cylinders, a pair of low pressure cylinders, connected pistons in each pair of cylinders, steam chests for each pair of cylinders connected by sets of admission and exhaust ports with the ends of the corresponding cylinders, valves in the said steam

chests and controlling the said ports, the exhaust steam from one end of a high pressure cylinder passing partly into the other end of the same high pressure cylinder and partly into one of the low pressure cylinders, and the exhaust steam in one low pressure cylinder being used expansively in the other low pressure cylinder, a main shaft connected with the pistons and valves of the high pressure cylinders, an auxiliary shaft connected with the pistons and valves of the low pressure cylinders, and a gearing connecting the said shafts with each other to rotate the auxiliary shaft at double the speed of that of the said main shaft.

4. An engine, comprising a pair of alined high pressure cylinders, pistons reciprocating in the said high pressure cylinders and having a common piston rod, a main shaft connected with the said piston rod, a steam chest connected with a source of steam supply and provided with an exhaust port and with admission ports leading to the ends of each high pressure cylinder, a valve actuated from the said main shaft and controlling the said exhaust port and the said admission ports, a pair of low pressure cylinders, of which one is connected with the said exhaust port, pistons reciprocating in the said low pressure cylinders and provided with a common piston rod, an auxiliary shaft connected with the said piston rod of the pistons in the low pressure cylinders, a gearing connecting the said main shaft with the auxiliary shaft to rotate the latter at double the speed of that of the main shaft, a divided steam chest connected at one side with the said exhaust port, and valves in the said divided steam chest and controlled from the said auxiliary shaft to control the steam from one low pressure cylinder to the other and to the atmosphere.

5. An engine, comprising a pair of alined high pressure cylinders, connected pistons reciprocating in the said high pressure cylinders, a main shaft connected with the said pistons, a main valve chest connected with a source of motive agent supply and provided with an exhaust port and with admission ports leading to the ends of the high pressure cylinders, a main valve in the said main steam chest and controlling the said ports, the said main valve being actuated from the said main shaft, a pair of alined low pressure cylinders, connected pistons in the said low pressure cylinders, a second steam chest for the low pressure cylinder and connected with the said exhaust port, the said steam chest having admission ports connecting with the ends of the low pressure cylinders and the said second steam chest having an exhaust port connected with one of the said admission ports of the second steam chest, valves in the said second steam chest and controlling the said admission ports of the

second steam chest, an auxiliary shaft connected with the said pistons in the low pressure cylinders, a gearing driving the said auxiliary shaft from the said main shaft at
5 four times the speed of that of the main shaft, a second pair of low pressure cylinders, pistons reciprocating therein and connected with the said auxiliary shaft, a third steam chest for the said second pair of low
10 pressure cylinders and having admission ports to the ends of the said second low pressure cylinders and having an exhaust port,

and a valve in the said third steam chest and connected with the said auxiliary shaft, the said last-mentioned valve controlling the
15 ports in the said third steam chest.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILBUR SMITH WEIKEL.

Witnesses:

FRED E. ALLISON,
D. B. WAGNER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."
