

(No Model.)

3 Sheets—Sheet 1.

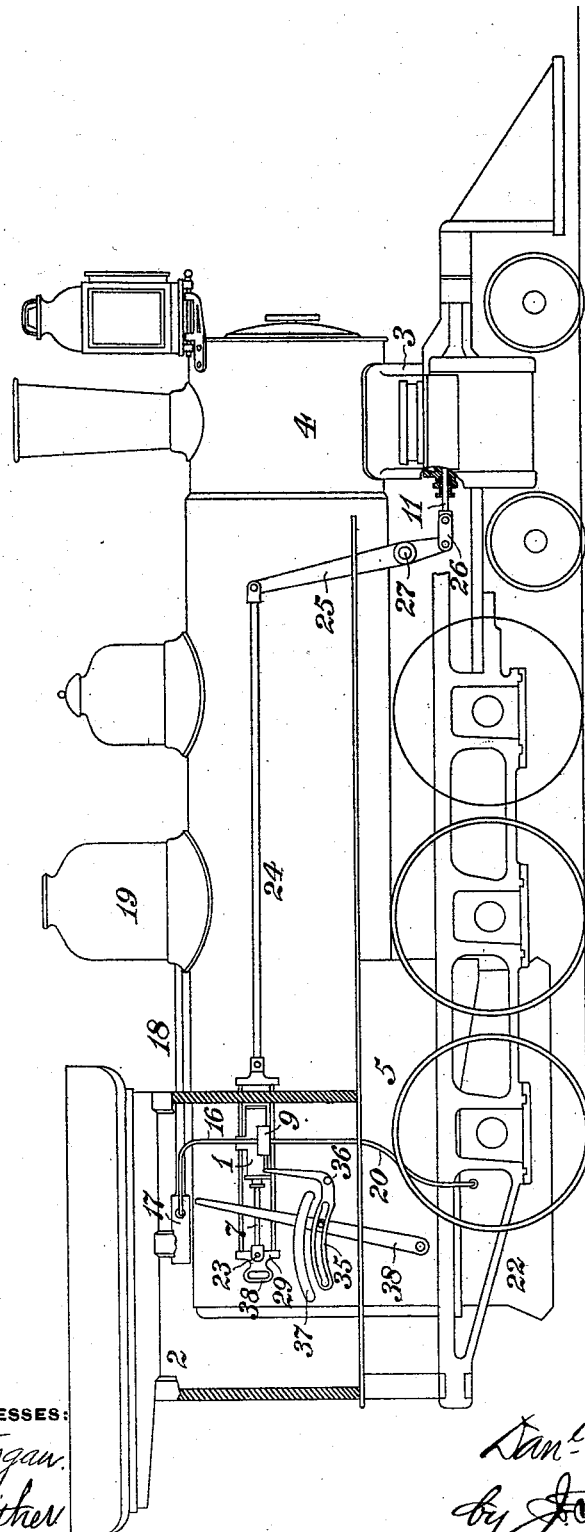
D. A. WIGHTMAN.

## STARTING APPLIANCE FOR COMPOUND ENGINES.

No. 522,544.

Patented July 3, 1894.

**Fig. 1.**



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(No Model.)

3 Sheets—Sheet 2.

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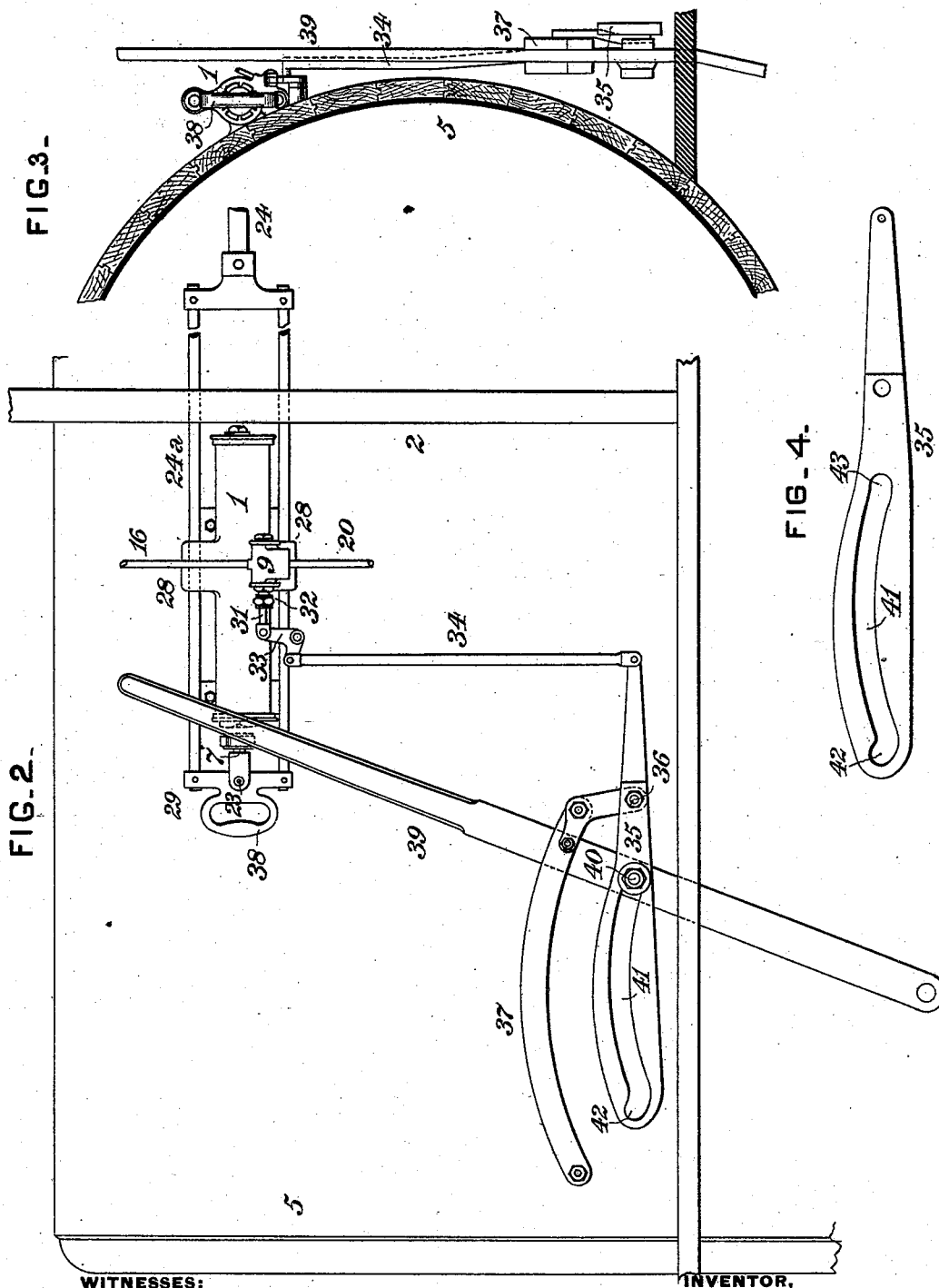


FIG. 2.

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(No Model.)

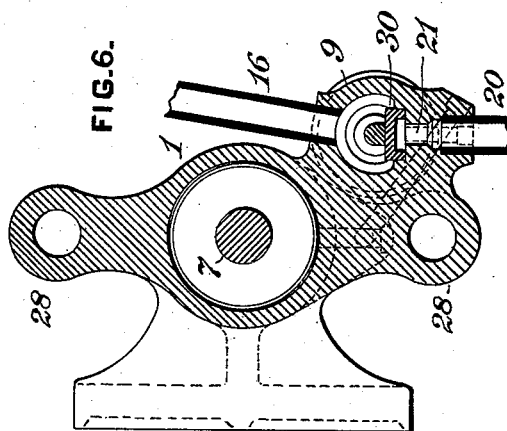
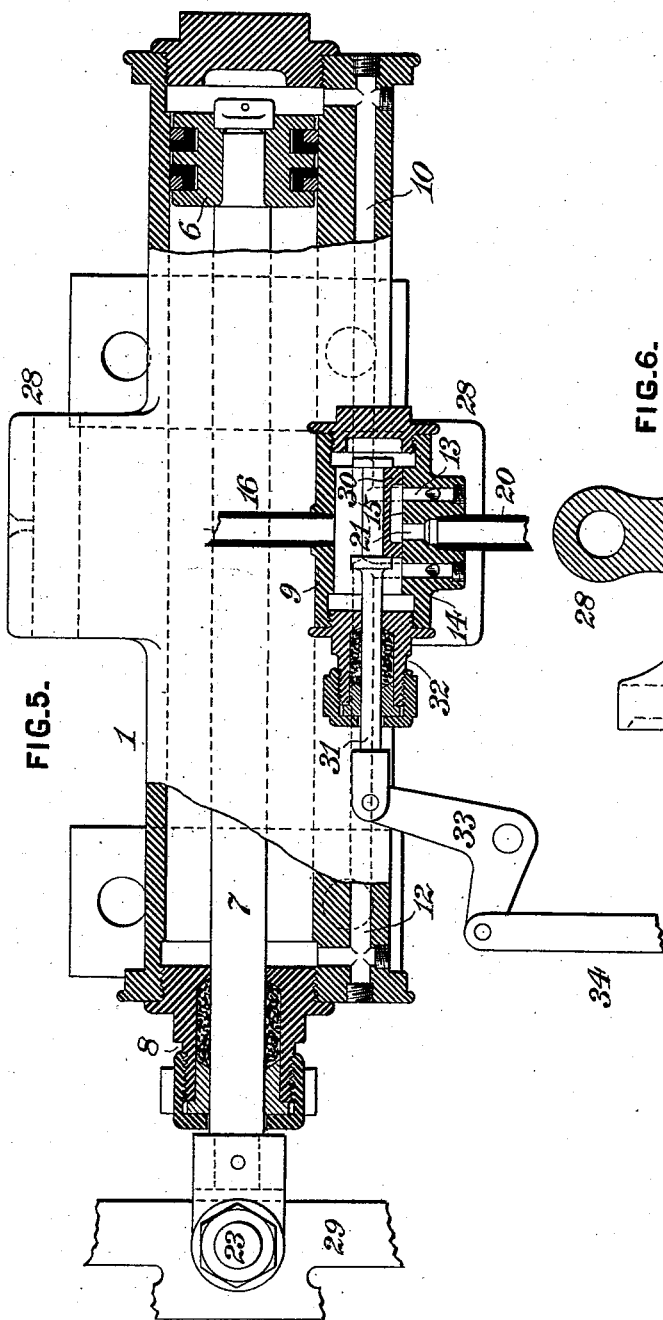
3 Sheets—Sheet 3.

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STARTING APPLIANCE FOR COMPOUND ENGINES.

No. 522,544.

Patented July 3, 1894.



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# UNITED STATES PATENT OFFICE.

DANIEL A. WIGHTMAN, OF ALLEGHENY, PENNSYLVANIA.

## STARTING APPLIANCE FOR COMPOUND ENGINES.

SPECIFICATION forming part of Letters Patent No. 522,544, dated July 3, 1894.

Application filed July 13, 1893. Serial No. 480,343. (No model.)

*To all whom it may concern:*

Be it known that I, DANIEL A. WIGHTMAN, of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a certain new and useful Improvement in Starting Appliances for Compound Engines, of which improvement the following is a specification.

The object of my invention is to provide simple and effective means for positively actuating the converting valve mechanism of a compound engine, either by fluid pressure or by manually applied power as desired, in order to enable the engineer to operate the engine as a simple or non-compound engine, whenever and during such periods, of any desired length, it may become necessary, or be deemed advisable, to so operate it, as when starting a train, or ascending a long and heavy grade, and to immediately reinstate it in normal operation as a compound engine when the conditions are such as to make compound operation proper or desirable.

To this end, my invention, generally stated, consists in the combination of a fluid pressure cylinder, a piston working therein, a valve operating rod connected to said piston and to a converting valve mechanism, a distribution valve controlling the action of motive fluid upon said piston, a stem connected to said distribution valve and connections for positively actuating said stem by the reversing gear of a compound engine.

The improvement claimed is hereinafter fully set forth.

My invention is more particularly designed for application in two cylinder compound locomotive engines, in which provision has heretofore been made for the direct admission of boiler steam to, and the independent exhaust of steam from, both cylinders of the engine, in the manner of a simple or non-compound engine, when a temporary increase of power is required, as in starting a train. The converting valve mechanisms employed for this purpose, which are of various constructions, are adapted, in many instances, to be automatically operated by variations of pressure, and in others to be operated by hand, through connections to a lever moved by the engineer. Inasmuch as it is desirable to avoid as far as possible, the use of levers additional to those required in the normal operation of the en-

gine as a compound, starting valves have been actuated through connections to the ordinary reverse lever, as in the so-called Lindner system and others, but it will be obvious that in such cases, the friction and unbalanced pressure, if any, which resist the movement of the valve or valves actuated by the engineer, impose additional labor upon him in moving the reverse lever.

Under my invention, the converting valve mechanism is normally and ordinarily actuated by fluid pressure, which is applied by the engineer, preferably in and by the movement of the reverse lever, and the only additional manual power exerted by him is that required to effect a short traverse of a small distribution valve, which is so slight as not to be appreciable. In the event of damage to or derangement of any of the fluid pressure members of the appliance, the mere detachment of the bolt connecting the piston thereof with the rod which operates the converting valve mechanism, enables the latter to be operated by hand whenever desired.

In the accompanying drawings: Figure 1 is a diagrammatic side view of a compound locomotive engine, illustrating an application of my invention; Fig. 2, a side view, in elevation, showing the fluid pressure cylinder, the reverse lever, and the intermediate connections from the reverse lever to the distribution valve; Fig. 3, an end view, of the same; Fig. 4, a side view of the cam lever; Fig. 5, a view, partly in elevation and partly in section, and on an enlarged scale, of the fluid pressure cylinder, the distribution valve, and its chest, and Fig. 6, a transverse section through the same.

In the practice of my invention, as applied in connection with a two cylinder compound locomotive engine of the general type now employed in American railroad service, I provide a fluid pressure cylinder 1, which may be, as shown, located within the cab 2, and secured to the side of the fire box 5. The cylinder 1 is provided with a properly packed piston 6, secured upon a rod 7, which passes through a stuffing box 8, in one end of the cylinder. A valve chest 9 is formed upon or secured to the cylinder 1, and communicates therewith, near each of its ends, by induction and eduction passages 10 and 12, leading re-

spectively to supply ports 13 and 14 in a valve face 15 within the valve chest 9. A supply pipe 16, leads into the valve chest, above the valve face 15, from any suitable source of fluid pressure supply, being, in the instance shown, a chest 17, communicating, by a pipe 18, with the dome 19 of the boiler, and an exhaust pipe 20, leads from an exhaust port 21, located in the valve face, between the supply ports 13 and 14, to any convenient point of discharge, as for example, the ash pan 22. It will, however, be obvious that in engines which are provided with an air brake equipment, as is now generally the case, the supply pipe 16 may be readily connected with the main air reservoir, or other suitable member of the air brake apparatus, so as to admit of the employment of compressed air for the actuation of the piston 6, in lieu of steam as in the specific construction shown, and such connection, which is preferable when facilities therefor are available, I include in my invention as the mechanical equivalent of that shown.

The piston rod 7 is connected, by a detachable pin or bolt 23, to a valve operating rod 24, which extends toward the smokebox 4, of the engine, and is coupled by suitable intermediate connections, in this instance a double armed lever 25, and a link 26, to the stem 11, of a converting valve mechanism of any suitable and approved construction, which is fitted to reciprocate in a chest in one of the saddle sections 3, on which the smoke box 4 is supported and to which the cylinders of the engine are connected. The lever 25 is journaled on or by a pin 27, and the relative lengths of its arms are such as may be proper to impart the desired range of reciprocating movement to the stem 11 and the converting valve mechanism connected thereto.

Inasmuch as any suitable and preferred mechanism may be employed, and as the same does not, in and of itself, constitute part of my present invention, it will not be herein at length described.

In order to insure the rectilineal movement of the valve operating rod 24, said rod is, adjacent to the fluid pressure cylinder 1, bifurcated or fixed to two parallel guide rods 24<sup>a</sup>, which pass through guides 28 on the cylinder 1, and are connected, at their rear ends, by a block 29, which receives the connecting pin or bolt 23 of the piston rod 7, and is provided with a handle 38. In the event of the derangement or breakage of any member of the fluid pressure apparatus, or of the failure of supply thereto, the connecting pin 23 may be detached, and the rod 24 and connected converting valve mechanism be operated by the engineer by the application of manual power to the handle 38.

The supply and exhaust of motive fluid to and from each end of the cylinder 1 are effected and controlled by a distribution valve 30, which is preferably, as shown, of the short D slide type, and is fitted to be reciprocated on

the valve face 15 of the chest 9. The stem 31, of the distribution valve, passes through a packed stuffing box 32, in one end of the chest, and is normally actuated, through intermediate connections, by the reversing gear of the engine, said connections being so organized that when the reverse lever is moved to or near its full forward or its full backward position, the distribution valve 30 will be, in either case, and in and by such movement of the reverse lever, moved into the position shown in Fig. 5, thereby admitting motive fluid on the rear side of the piston 6 and exhausting it from the front side thereof, while, in and by the movement of the reverse lever to any intermediate position, the distribution valve will be moved backward, so as to uncover the forward supply port 13 and place the rear supply port 14 in communication with the exhaust port 21, through the exhaust recess of the valve, thereby admitting motive fluid on the front side of the piston 7 and exhausting it from the rear side thereof. The piston 7 will correspondingly be forced to and remain at the front or the rear end of the cylinder 1, and the converting valve mechanism be moved into position for the operation of the engine as a simple or as a compound engine, as the case may be.

In the instance exemplified, the stem 31 of the distribution valve 30 is shown as coupled, either directly, as in Fig. 1, or intermediately, through a bell crank lever 33 and link 34, as in Figs. 2, 3, and 5, to one end of a cam device consisting of a double armed cam lever 35, which is journaled on a pin 36, below and adjacent to the segment 37 of the reverse lever 39. A curved slot 41 is formed in the arm of the cam lever 35, opposite to that which is coupled to the distribution valve stem, said slot being located below and eccentric to the segment 37 of the reverse lever, and having upwardly curved cam ways 42 and 43 at its ends. A pin or bolt 40, fixed to the reverse lever 39, traverses in the slot 41, and moves the cam lever 35 about its pivot 36, by its engagement with and disengagement from the cam ways 42 and 43, as the reverse lever 39 is moved into or out of either its extreme forward or its extreme backward position.

The entrance of the pin 40 into either of the cam ways 42 or 43, depresses the arm of the cam lever 35 in which said cam ways and the intermediate slot 41 are formed, and elevates the opposite arm, thereby moving the distribution valve 30 to the right, and effecting the movement of the piston 6 in the same direction, by the admission of motive fluid thereto through the then open passage 12. Such movement of the piston moves the connected converting valve mechanism into the position proper for the operation of the engine as a simple or non-compound engine, which operation is continued so long as the reverse lever remains at, or closely adjacent to, either extremity of its arc of traverse. By the movement of the reverse lever, in either

direction toward the middle of its arc of traverse, for the purpose of cutting off steam at a desired point in the stroke of the pistons, as is practiced ordinarily after the train has  
 5 been started, the pin 40 is moved into the portion of the slot 41 between the cam ways 42 and 43, elevating the arm of the cam lever 35 in which said slot and cam ways are formed and depressing the opposite arm,  
 10 thereby moving the distribution valve 30 to the left, and effecting the movement of the piston 7 in the same direction, by the admission of motive fluid thereto through the then open passage 10. Such movement of the piston  
 15 moves the connected converting valve mechanism into the position proper for the normal operation of the engine as a compound engine, which operation is continued so long as the reverse lever stands in such position,  
 20 or is so moved, that the pin 40 remains out of contact with either of the cam ways 42 or 43. The cam ways may, if desired, be so proportioned that the pin 40 will remain in contact therewith when the reverse lever is  
 25 moved one or more notches out of either of its extreme positions, and it will be noted that the rear cam way 42 is made of greater depth than the forward one, 43, to accommodate the increased degree of movement of the  
 30 cam lever 35 at and near its rear end, due to the greater distance thereof from the pivot 36 of the lever.

While the provision of means for actuating the distribution valve in and by movements  
 35 of the reverse lever, as above set forth, is deemed by me to be preferable in practice, inasmuch as independent operation of said valve by the engineer is thereby rendered unnecessary, said means are not an essential element of my invention. Such manual operation  
 40 may also be practiced, in the event of breakage or derangement of any member of the intermediate connections between the distribution valve stem and the reversing gear, upon the detachment of the valve stem therefrom.  
 45

Inasmuch as the upper arm of the reverse or link lifting shaft, in locomotive engines of the ordinary type, is coupled, by a reach rod,  
 50 to the reverse lever, and has a similar movement thereto, it will be obvious that the cam lever 35 could, if preferred, be actuated by said reverse shaft arm, in lieu of by the reverse lever, and such construction I include as the mechanical equivalent of that shown  
 55 in the drawings. It will, further, be obvious, to a mechanic skilled in the art, that the requisite reciprocating movements of the distribution valve 30 may be imparted thereto, from  
 60 the reversing gear of the engine, through intermediate connections differing structurally from those described and shown, without de-

parture from the spirit and essential features of my invention. I do not, therefore, limit myself to such specific intermediate connections, and desire to include, as the mechanical equivalent therefor, any other connecting  
 65 elements whereby the distribution valve is, as in the instance herein set forth, moved, in one direction, in and by the movement of the  
 70 reverse lever to or near either of its extreme positions, and is moved, in the opposite direction, in and by the movement of the reverse lever to any intermediate position.

I claim as my invention and desire to secure  
 75 by Letters Patent—

1. In a compound engine, the combination, substantially as set forth, of a fluid pressure cylinder, a piston working therein, a valve  
 80 operating rod connected to said piston and to a converting valve mechanism, a distribution valve controlling the action of motive fluid upon said piston, and actuating mechanism connecting the distribution valve with the reversing gear of the engine.  
 85

2. In a compound engine, the combination, substantially as set forth, of a fluid pressure cylinder, a piston working therein, a valve  
 90 operating rod connected to a converting valve mechanism, a detachable connection between said rod and said piston, a distribution valve controlling the action of motive fluid upon said piston, and actuating mechanism connecting the distribution valve with the reversing gear of the engine.  
 95

3. In a compound engine, the combination, substantially as set forth, of a fluid pressure cylinder, a piston working therein, a valve  
 100 operating rod connected to said piston and to a converting valve mechanism, a distribution valve controlling the action of motive fluid upon said piston, a cam device coupled to a vibratory lever of the reversing gear and actuated in opposite directions by the movement  
 105 of said lever to extreme positions or to intermediate positions respectively, and intermediate connections from said cam device to the stem of the distribution valve.

4. In a compound engine, the combination, substantially as set forth, of a fluid pressure  
 110 cylinder, a piston working therein, a valve operating rod connected to said piston and to a converting valve mechanism, a distribution valve controlling the action of motive fluid upon said piston, a pivoted cam lever having  
 115 a curved slot provided with cam ways at its ends, a pin or bolt fixed to a reverse lever and traversing freely in said slot and cam ways, and a connection coupling said cam lever to the stem of the distribution valve.

DANIEL A. WIGHTMAN.

Witnesses:

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 J. CLARENCE REEVE.