(No Model.) 3 Sheets—Sheet 1.

G. E. WRIGHT.

REVERSING VALVE FOR COMPOUND ENGINES.

No. 510,665. Patented Dec. 12, 1893.

Fig. 1.

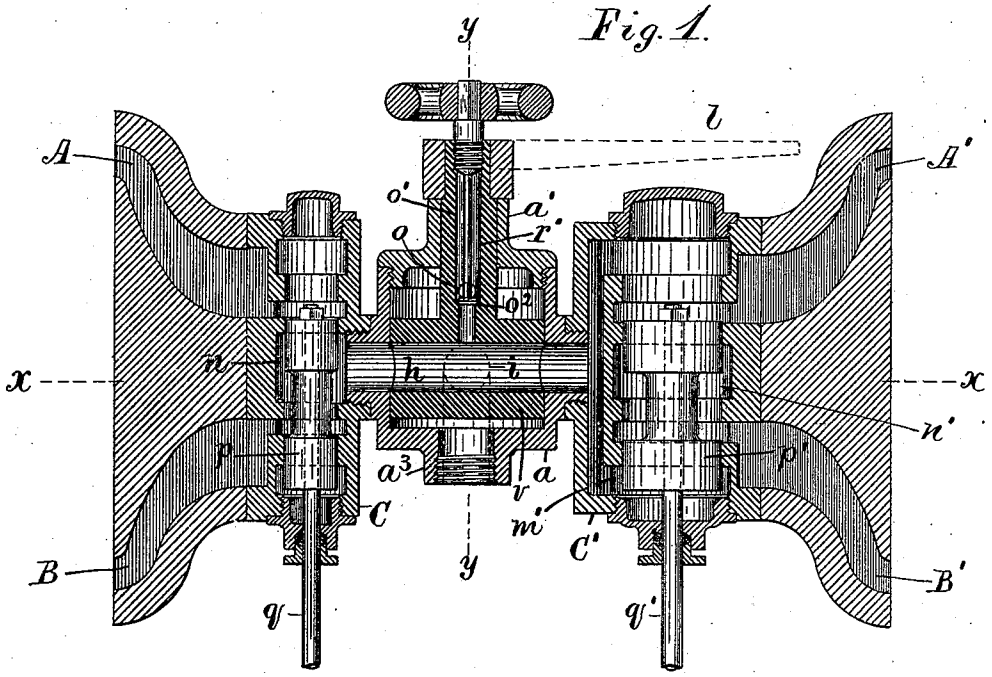
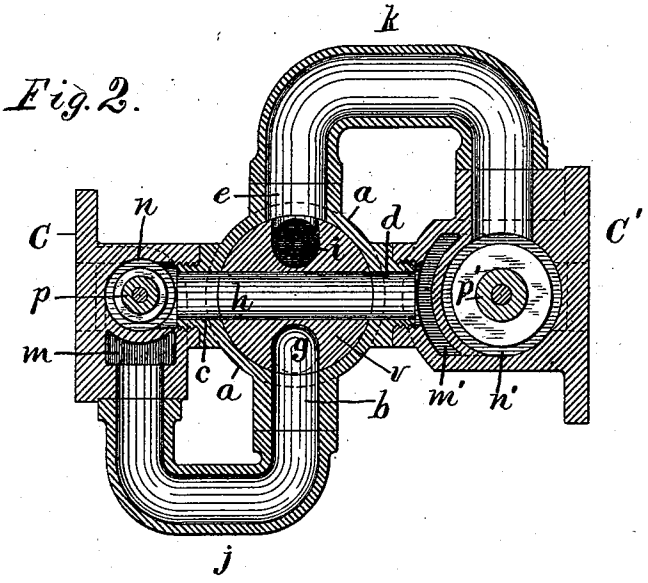


Fig. 2.



Attest:
L. Lee.
Edw. F. Kinsey.

Inventor.
G. E. Wright, per
Crane & Miller, attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

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Fig. 3.

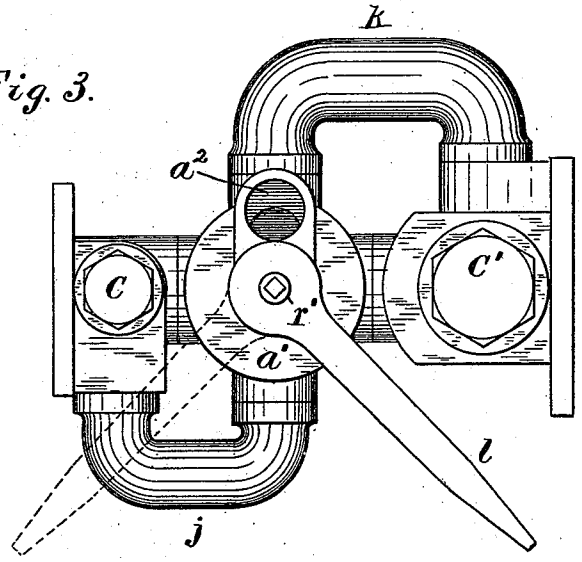
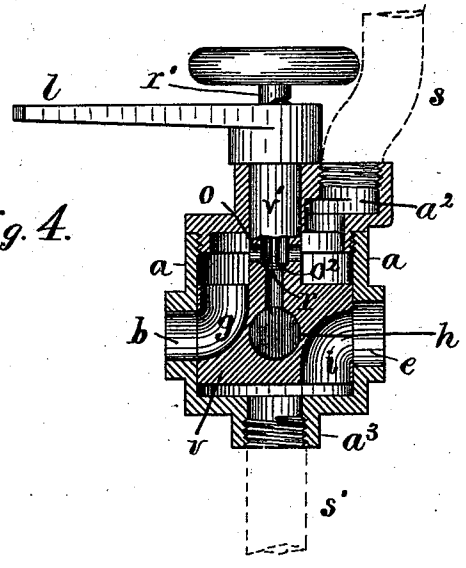


Fig. 4.



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THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

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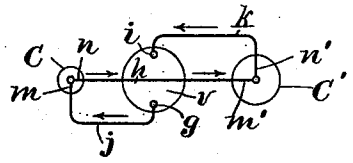
Fig. 5.



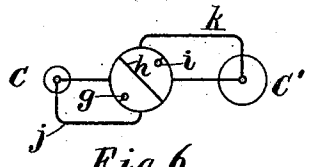


Fig. 6.

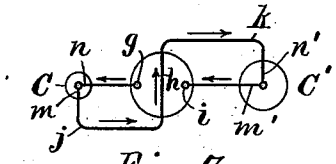


Fig. 7.

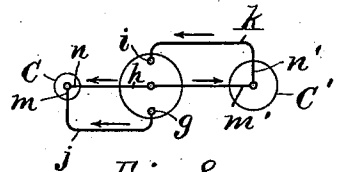


Fig. 8.

Attest:
L. Lee,
Edw. F. Kinsey.

Inventor.
G. E. Wright, per
Crane & Miller, attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

GEORGE E. WRIGHT, OF NEWARK, NEW JERSEY.

REVERSING-VALVE FOR COMPOUND ENGINES.

SPECIFICATION forming part of Letters Patent No. 510,665, dated December 12, 1893.

Application filed October 29, 1892. Serial No. 450,338. (No model.)

To all whom it may concern:

Be it known that I, GEORGE E. WRIGHT, a citizen of the United States, residing at Newark, Essex county, New Jersey, have invented certain new and useful Improvements in Reversing-Valves for Compound Engines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates especially to valves for small compound engines; and its object is to provide a single valve to govern both the quantity and direction of the steam admitted to the cylinders, and to conduct live steam directly to the low pressure cylinder from the boiler, when desired.

The invention consists essentially in the combination, with a suitable casing provided with a supply aperture at one end and an exhaust aperture at the other end, and constructed with lateral openings connected, respectively, with both ports of each of the valve chests of a compound engine, of a rotary valve plug fitted within such casing between its supply and exhaust apertures and having three passages; one being adapted to direct live steam to the high pressure valve chest, another to conduct the exhaust steam therefrom to the low pressure valve chest, and a third passage to direct the exhaust steam from the low pressure valve chest to the exhaust aperture in the casing.

The invention also consists in additional means for conducting live steam from the boiler directly to the low pressure valve chest, when desired.

The invention will be more fully understood by reference to the annexed drawings, in which—

Figure 1 is a central vertical section of my improved valve interposed between the valve chests of a compound engine, only that portion of each cylinder containing the steam ports being shown. Fig. 2 is a horizontal section of the same on line $x\ x$ in Fig. 1, with the portions of the cylinders omitted. Fig. 3 is a plan of the parts shown in Fig. 2; and Fig. 4 is a vertical transverse section of the valve on line $y\ y$ in Fig. 1. Figs. 5, 6, 7 and 8 are diagrams indicating the operation of the valve under the various conditions for which it is designed.

The valve casing a is shown of cylindrical form with the cap a' constructed with a boss a^2 having the supply aperture into which is screwed the steam pipe s (shown only in dotted lines in Fig. 4) which supplies all the steam for both cylinders of the engine. The casing is provided with four diametrically-opposed lateral openings b, c, d and e, the opposite openings being connected respectively with the induction port of one of the valve chests and the eduction port of the other. The casing is provided at its lower end with a boss a^3 having the exhaust aperture into which is screwed the pipe s' (indicated by dotted lines in Fig. 4). A cylindrical valve plug v is fitted to the inner periphery of the casing, and is provided with a stem v' projected through the cap a' and having a lever l for turning the valve plug. The valve plug v is provided with three passages g, h and i, each terminating in the periphery and adapted to register simultaneously with the lateral openings in the casing; the passage g leading to the upper face of the plug, the passage h terminating at both extremities in the periphery, and the passage i leading to the lower face of the plug. The casing is made a little longer than the valve plug, which latter is suspended therein by its stem, thereby affording a connection in all positions of the valve between the supply and exhaust pipes and the passages in the plug v.

The entrance and exit of the steam through the ports A and B of the high pressure cylinder and the ports A′ and B′ of the low pressure cylinder is effected by means of the ordinary "piston-valves" p and p', respectively, in the valve chests C and C′, which are provided with the induction ports m and m' and the eduction ports n and n'. The piston valves are reciprocated in the ordinary manner by means of the valve stems q and q'. A pipe j is applied to the valve chest C and the casing a to connect the induction port m with the opening b; and a similar pipe connection k is provided to connect the eduction port m' with the opening e in the casing. The casing being interposed between the two valve chests, the opening c communicates directly with the eduction port n of the high pressure valve chest, and the opening d communicates similarly with the induction port m.

The position of the valve plug shown in Figs. 1 to 4 inclusive directs the steam to the two valve chests as follows as indicated diagrammatically in Fig. 5 by the arrows:—Upon the entrance of the live steam through the supply aperture in the cap a', the same passes through the passage g and the pipe j to the induction port m, whence it is directed by the piston valve p to the high pressure cylinder. On the return stroke of the piston it passes through the eduction port n and the passage h in the plug v to the induction port m', whence it passes to the low pressure cylinder. On its return to the valve chest C′ as exhaust steam, it passes through the eduction port n', through the pipe k and downward through the passage i in the plug v to the exhaust pipe.

The diagram in Fig. 6 indicates the effect of turning the lever l through an angle of forty-five degrees, whereby the supply of steam is wholly cut off from the valve chests, as the passages in the valve plug cease to register with any in its casing. By turning the lever through another angle of forty-five degrees, as indicated in dotted lines in Fig. 3, and in the diagram in Fig. 7, the supply passage g in the plug v is made to register with the port n of the high pressure valve chest; the passage h connects the port m with the port n'; and the exhaust port i registers with the port m'; whereby the direction of the steam is reversed from that given by the valve in its normal position, as indicated by the arrows in the diagram.

It will be observed that the induction and eduction ports of the two valve chests are referred to in connection with the main valve in it normal position in the description of Figs. 1 to 4 inclusive; but that the reversal of the engine, as indicated in Fig. 7, necessitates the reversal of the operation of these ports,—the normal induction port becoming the eduction port of the valve chest when the engine is reversed, and the normal eduction port becoming the induction port.

In order to temporarily increase the power of the engine, a transverse hole o is formed in the stem v' a little above the valve plug v to intersect a longitudinal hole o' extending the whole length of the stem v' and terminating in the passage h. A valve seat o^2 is formed in the hole o' below the transverse hole o to which is fitted the conical valve r having its stem r' threaded at its upper end to fit a similarly threaded portion of the hole o' and having a hand wheel for turning the same to move the valve r to and from its seat. By opening this auxiliary valve, live steam is supplied through the passage h to the ports n and m', and also by means of the passage g to the port m when the valve plug is in its normal position, as indicated by the arrows in Fig. 8; whereby the pressure in the induction and eduction ports of the high pressure valve chest is equalized and the high pressure engine thus becomes of no effect, but the large increase of piston area afforded by the low pressure cylinder subjected to the impulse of the live steam direct from the boiler serves to materially increase the power of the engine as a whole, by overbalancing the loss of the smaller high pressure cylinder. It it obvious that the effect of the so-called "bleeding valve" r may be applied in the opposite direction by turning the valve plug v into the position indicated in Fig. 7, when the live steam would be admitted to the valve chest C′ through the port n'.

From the foregoing description it will be evident that the essential feature of my invention consists in the construction of the rotary valve plug with three passages each terminating in its periphery, one passage leading from one end, one leading from the opposite end, and a third terminating at both extremities in the periphery of the valve plug, the same being combined with a suitable casing and passages connected with both ports of the high and low pressure valve chests; but that the precise form of the valve plug (whether cylindrical or conical) and the exact arrangement of the passages therein, as shown in the drawings, are not material to the invention.

By applying the valve plug to the casing between the supply and exhaust apertures, I am enabled to secure certain advantages. First, as none of the passages are required to pass one another through the body of the plug, their form and arrangement may be much more simple and thus effective than in other constructions; second, only a single passage terminating at both ends in the periphery is required, and consequently the upwardly and downwardly extending passages may be formed in the body of the plug with only one end of each in the periphery, whereby the provision of lateral passages in the periphery may be avoided, the effect of such passages being to diminish the peripheral bearing surface of the plug and thereby diminishing the durability of the valve through rapid wear; third, the live steam being let into the casing above the plug, the constant downward pressure produced upon the valve stem operates to force the lower face of the shoulder formed by the handle l with the stem downward upon the end of the perforated boss (bearing the letter a' in Fig. 1) through which the stem is inserted, thereby forming a tight joint between such surfaces and avoiding the necessity of a stuffing box for the valve stem.

While the inclosed passages in the ends of the plug are preferable for the reasons set forth above, it is evidently not material to the essential feature of the invention that they should be of the precise form shown and described herein; as mere notches of sufficient area would operate as equivalent passages for the steam between the ends of the plug and the peripheral apertures in the casing, as before described.

I am aware that it has been proposed heretofore to construct a valve for a compound

engine for directing the live steam from the boiler at once to the low pressure cylinder when it is desired to temporarily increase the power of the engine, and that a valve has been constructed with three transverse passages to effect this result; but in such case a separate exhaust has been provided for the low pressure cylinder as well as a separate supply pipe for the high pressure cylinder, and a throttle valve in addition has been necessitated to cut off the whole supply of steam to stop the engine. In my invention, the single valve serves both to receive and discharge all the steam used in both cylinders, to deliver it in either direction to each cylinder, and to regulate or to wholly cut off the supply of steam when it is desired to stop the engine.

Although the auxiliary valve *r* is preferably applied to the valve plug *v* to adapt the engine for increased power in emergency, it is evident that it is not a material part of my invention; as such valve could readily be applied to a branch of the supply pipe connected directly with the valve chest of the larger cylinder, or omitted entirely, without affecting the operation of the main valve.

It will further be observed that one of the chief advantages of my invention is that the valve is adapted to be interposed directly between the high and low pressure valve chests, and that the straight transverse passage *h* in the plug thus serves, in conjunction with the similar passages *c* and *d* leading from the valve plug to the eduction port of the high pressure valve chest and the induction port of the low pressure valve chest respectively, to form a straight continuous passage to conduct the exhaust from the high pressure valve chest to the low pressure valve chest. Thus a passage of the shortest possible length is provided to lead the steam from one valve chest to the other, and forms the smallest possible space for the expansion of the steam in passing from one cylinder to the other. It will thus be seen that provision is made for the least possible loss of steam pressure between the high and low pressure cylinders.

Having thus set forth the nature of the invention, what I claim herein is—

1. The combination, with a valve casing having a supply and an exhaust aperture at the opposite ends, and four lateral openings, of a rotary valve plug fitted within such casing between its supply and exhaust apertures having three passages terminating in its periphery adapted to register with the lateral openings in the casing, to wit:—one passage leading from one end of the plug to its periphery, one leading from the opposite end of the plug to its periphery, and one terminating at both extremities in the periphery of the plug, as and for the purpose set forth.

2. The combination, with the valve chests of a compound engine, of the valve casing *a* having at one end the cap *a'* with supply aperture a^2, the exhaust aperture a^3 at the opposite end, and the lateral apertures *b*, *c*, *d* and *e*, the pipe connections *j* and *k*, the valve plug *v* having the passages *g*, *h* and *i* adapted to register with the said lateral openings in the casing and to connect the same with the supply and exhaust apertures, and means for turning the valve plug, substantially as herein shown and described.

3. The combination, with the valve chests of a compound engine, of the valve casing *a* having the cap *a'* with supply aperture a^2 at one end, the exhaust aperture a^3 at the opposite end, and the lateral apertures *b*, *c*, *d* and *e*, the pipe connections *j* and *k*, the valve plug *v* having the passages *g*, *h* and *i* arranged as described, the hollow valve stem *v'* having transverse passages *o* and the valve seat o^2, the valve *r* with stem *r'*, and means for independently turning the said valve plug *v* and valve *r*, substantially as herein set forth.

4. The combination, with the valve chests of a compound engine, of a valve casing interposed directly between the same having a supply and an exhaust aperture at opposite ends and connected by lateral apertures with both ports of each of the valve chests, and a valve plug fitted within the casing between its supply and exhaust apertures and provided with a transverse passage adapted to form a straight continuous connection between the eduction port of the high pressure valve chest and the induction port of the low pressure valve chest and to connect the supply and exhaust apertures of the valve casing with the other ports of the valve chests, respectively, as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

GEORGE E. WRIGHT.

Witnesses:
ROBERT H. MARTIN,
HENRY J. MILLER.