

(No Model.)

3 Sheets—Sheet 1.

W. D. SHERMAN.
STEAM ENGINE.

No. 532,250.

Patented Jan. 8, 1895.

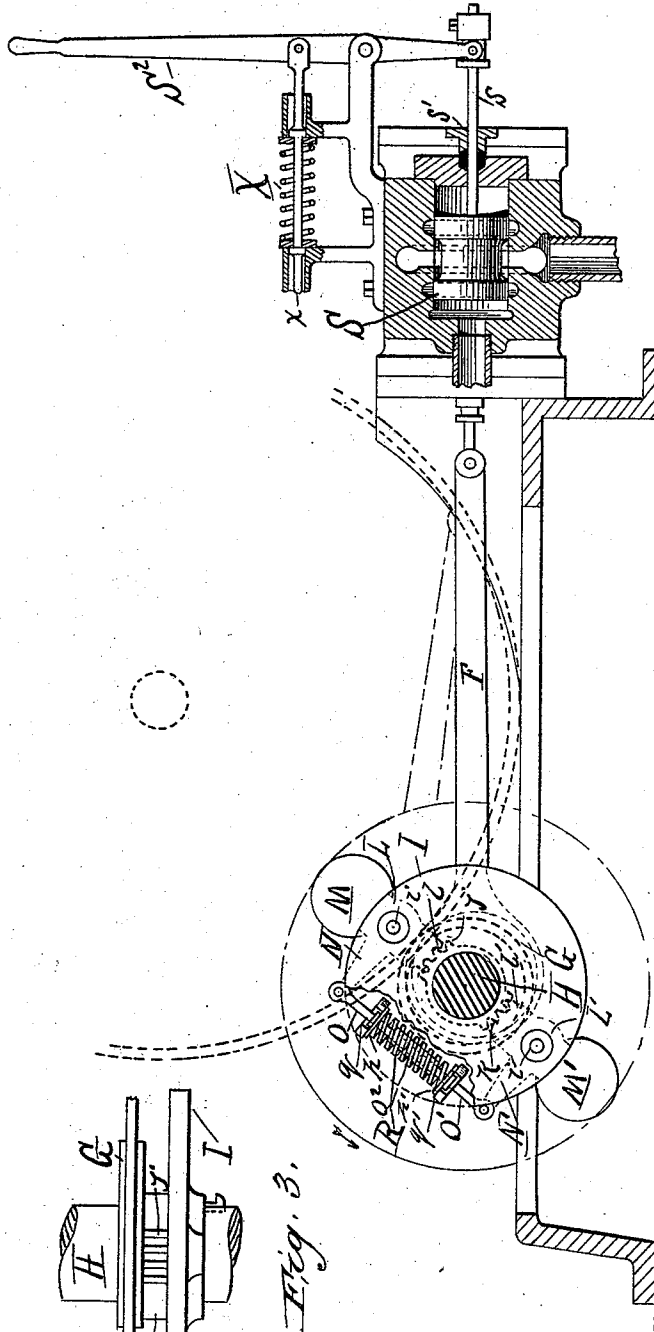


Fig. 1.

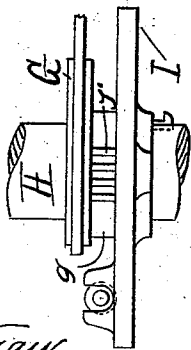


Fig. 3.

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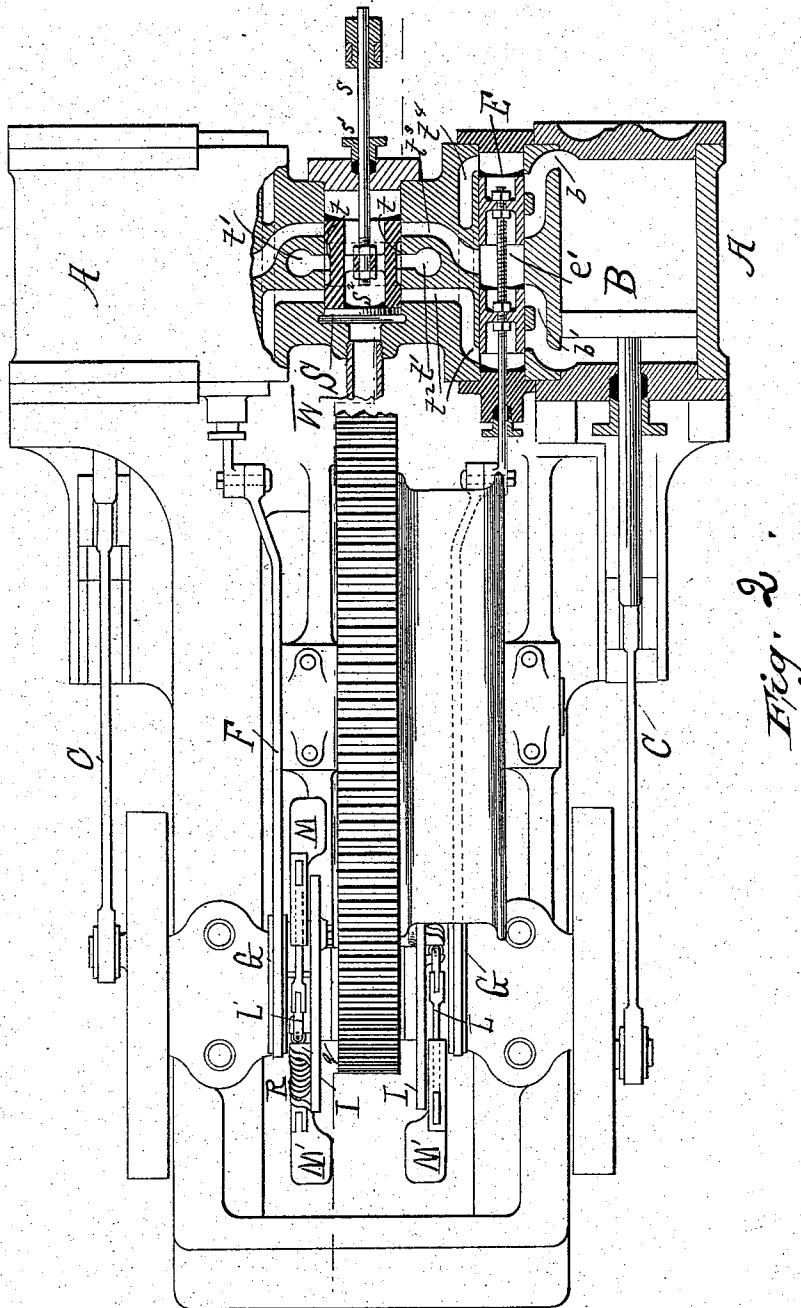
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3 Sheets—Sheet 2.

W. D. SHERMAN.
STEAM ENGINE.

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(No Model.)

W. D. SHERMAN.
STEAM ENGINE.

3 Sheets—Sheet 3.

No. 532,250.

Patented Jan. 8, 1895.

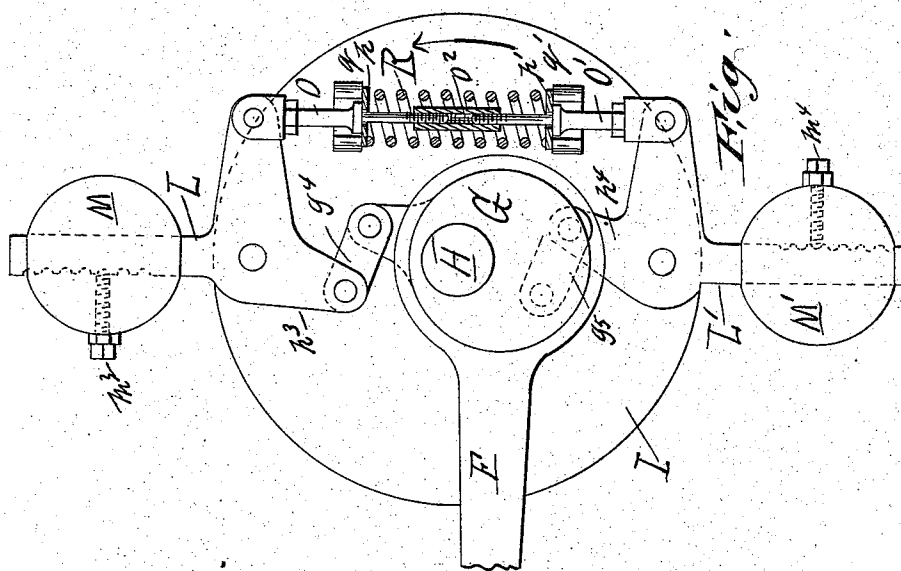


Fig. 6.

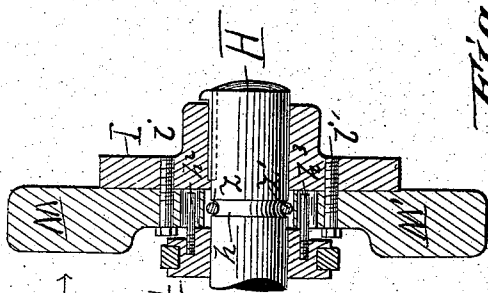


Fig. 5.

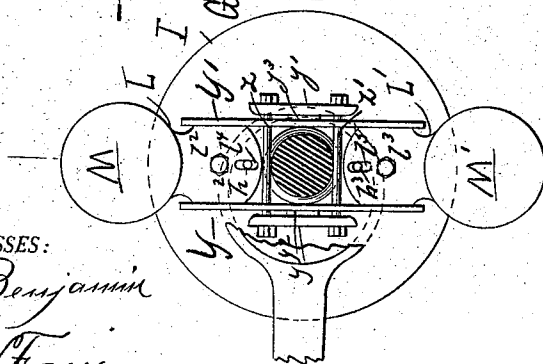


Fig. 4.

WITNESSES:

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UNITED STATES PATENT OFFICE.

WILLIS D. SHERMAN, OF BROOKLYN, NEW YORK, ASSIGNOR TO HIMSELF
AND CHARLES B. JOHNSON, JOHN J. WILSON, ELLIS H. BAILLIE, FRANK
B. JOHNSON, AND ELBERT SNEDEKER, OF SAME PLACE.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 532,250, dated January 8, 1895.

Application filed March 22, 1894. Serial No. 504,741. (No model.)

To all whom it may concern:

Be it known that I, WILLIS D. SHERMAN, a citizen of the United States, and a resident of Brooklyn, in the county of Kings, State of New York, have invented a certain new and useful Improvement in Steam-Engines, of which the following is a specification.

My invention relates to improvements in steam engines, and the invention is especially concerned with, first, the automatic steam counter balance for the same when applied to any reversing engine, and, second, the said automatic steam counter balance in combination with a port-reversing engine. In respect to the said steam counter balance, my present invention relates to and is an improvement on that class of contrivances for automatically varying the lead of the main valve which is described and claimed in my application for Letters Patent filed the 20th day of March, 1894, Serial No. 504,474, and now pending in the United States Patent Office. In my said application for Letters Patent, I describe and claim means for automatically varying the lead of the valve in steam engines through the variation in the speed of the main shaft, and show the same applied to a non-reversing engine. My present invention relates to improvements in such contrivances whereby they are adapted to reversible engines.

As stated in my previous application for Letters Patent, the automatic steam counter-balance is especially applicable to engines which are required to run under variable speed with constant load, such, as for example, hoisting engines in which, as it is well understood, the speed of the engine is usually slow when first starting the load, as when hoisting it out of the hatch of a vessel, and then becomes very rapid when carrying the load to its destination, and again slows down as the load is lowered. With engines of the present type applied to hoisting purposes the variations in speed are attended with great vibration which entirely unfits them to be placed in the towers of hoisting apparatus. It is, therefore, the especial purpose of my invention to overcome the vibrations of steam engines which are required to run under vari-

able speed with constant (or irregular) load in order to adapt them to be placed in the light towers of hoisting apparatus, such as shown and described in my application for Letters Patent, executed the 13th day of March, 1894, and now pending in the United States Patent Office, for, when the engine is equipped with my automatic steam counter balance, the inertia of the piston and other longitudinally moving parts, (to which the vibration is due) which at high speed becomes enormous, is overcome by a steam cushion which is interposed in front of the piston, and the proportion of the stroke, during which this steam cushion exists, increases or decreases with the increase or decrease of the speed of the engine, being controlled by the variable lead of the main valve which is effected by my invention. When the engine is equipped with such an automatic steam counter-balance its vibration is practically taken away entirely, and it can be placed without risk in the tower of the hoisting apparatus, thereby giving the engineer a survey of the field, and enabling him to effect the movement of the engine with greater celerity and accuracy than is otherwise possible.

In the second place, my invention relates to the combination of the automatic steam counter-balance with port-reversing engines. The utility of such engines for certain purposes has been recognized for some time, but their use has been limited by the fact that owing to the mode of operation of such engines, it has heretofore been impossible to provide the main valve with any lead. My invention has furnished the means of providing the lead for such engines whereby they are adapted not only to hoisting but to a variety of other purposes.

In the accompanying drawings I show several modifications of my invention illustrating how it can be applied to a steam engine in various ways, but I do not intend to be limited to the strict construction shown, since the essence of the invention consists in an automatic steam counter-balance effected by a variable lead as applied to a reversible steam engine, and the special manner in which the

device for varying the lead as connected with the engine will vary with circumstances without departing from my invention.

Referring to the drawings which accompany
 5 the specification to aid the description, Figure 1 is a side elevation, partly sectioned, showing the application in one form of my invention to a port-reversing engine. Fig. 2 is
 10 a plan view, partly sectioned, of the same engine. Fig. 3 is a detail on a larger scale, showing the eccentric, collar, and gearing for shifting the eccentric. The lagging weights are removed for the sake of clearness. Fig. 4 is a side
 15 elevation, and Fig. 5 is a section of a modification of the device. Fig. 6 is an elevation of still another modification of the device.

A represents the cylinders; B, the piston; C, the connecting rod; D the valve chest; E, the main valve; F, the connecting rod of the valve,
 20 and G the eccentric on the main shaft H of a port reversing engine.

I apply my improved automatic steam counter balance in the following manner: The eccentric G is connected or formed integral with
 25 the collar *g*, which has a working fit on the main shaft H, and is provided with teeth *j, k*, preferably arranged on opposite extremities of a diameter of the main shaft H, as shown. I is a disk, keyed on the said main shaft H, adjacent to the collar *g*, and pivoted on said disk
 30 I, at *i, i'*, are the levers L, L', which said levers L, L', are provided with lagging weights M, M'. The inner ends of said levers L, L', are provided with teeth *l, l'*, respectively,
 35 which mesh with the teeth *j, k*, of the collar *g*.

N, N', are arms of the levers L, L', respectively, and pivotally connected with rods O, O', which rods work through eyes in lugs *q, q'*, fixed on the disk I. The inner ends of said
 40 rods O, O' are preferably threaded in a sleeve *o²*, as indicated in Fig. 1, to facilitate the assembling of the parts, and also to vary the tension of the spring and said rods O, O', are shouldered at *o, o'*, to bear against the wash-
 45 ers *p, p'*, between which is a spring R, coiled loosely around the rods *o, o'*, and sleeve *o²*. The said parts are applicable to a reversing engine of any kind, and I, therefore, describe their application generally before passing to
 50 their combination with the port-reversing engine.

Suppose the engine to be running in a direction indicated by the arrow. Now the inertia of the lagging weights M, M', will cause
 55 them to tend to fall behind the main shaft H, and this tendency will affect the levers L, L', and cause them to shift the eccentric G in the direction the reverse of the main shaft, and this shifting of the eccentric will increase the lead
 60 of the main valve E, thereby admitting steam in front of the piston B, and forming a steam cushion to overcome the inertia of the piston and connected parts, do away with shock, and reduce the vibration of the engine at the end
 65 of the stroke. The higher the speed of the engine, the greater the tendency of the lagging weights M, M', to fall behind the shaft,

and the greater the lead of the valve, and the greater the proportionate part of the stroke at which the steam cushion is formed. Therefore, my invention provides an automatic
 70 steam counter balance for variable speed reversible engines, the steam cushion which overcomes the inertia of the piston and other longitudinally moving parts increasing or decreasing proportionately to the speed of the
 75 engine and to the inertia which is to be overcome.

It will be manifest to all versed in the art, that it is a matter of indifference which way
 80 the engine is running, for the lagging weights will act similarly in either direction.

Referring to the special application of the device to the port-reversing engine, S is an auxiliary balanced valve or throttle, operated
 85 by the rod *s*, working through a stuffing box *s'*, and connected with lever S². Said lever is preferably provided with a rod *x'* and spring X, operating in substantially the manner of the spring R, and set to always restore the
 90 valve S to the middle position, as shown in Fig. 1, wherein both ports of the cylinder A are closed, and a steam cushion is formed on each side of the piston B, which cushions act as a brake. The said valve S has a through
 95 and through steam way *s²*, and is provided with an annular port *t*, which connects with the exhaust port *t'*, and according to the position of said valve S, also with the ports *t², t³*,
 100 *t⁴*, said port *t⁴*, being a branch of the port *t²*, as shown. Now, supposing the engineer throws the valve S to the right so as to open the port *t²*, and connect port *t²*, with the annular port
 105 *t*, the steam entering through the pipe W, will pass to the right end of the cylinder A, by means of the ports *t², t⁴*, moving the piston to the left, and the engine will continue to run in a corresponding direction as long as the valve S, is retained in that position. If
 110 the operator desires to "brake" the engine, he allows the lever S², to go on the middle position, the valve S taking the corresponding position, and immediately the ports *t², t³*, are closed by the valve and a steam cushion is retained in the cylinder A on each side of
 115 the piston B, and the engine very quickly arrested. To reverse the engine, the operator throws the valve S to the left. The steam now enters the port *t³*, the exhaust *e'* of the valve E, and goes thence through the port *b'*
 120 to the left end of the cylinder A, throwing the piston B to the right, and the engine continues to run in the corresponding direction as long as the valve S is retained in that position.

It is evident that the ports *t², t³*, are alternately steam inlet to and steam outlet or exhaust ports from the cylinder A.

The condition of the operation of such port-reversing engines has heretofore prevented giving any lead to the valve E, the
 130 said valve requiring to be set exactly in the middle position in order for the engine to be started; but my invention has provided the

means of introducing a variable lead on such engines, because, although when the engine is at rest, my device for varying the lead is held at the middle position by the spring R and there is no lead to the valve E, yet, as soon as the engine begins to run, my device introduces a variable lead in the manner hereinbefore described.

The drawings show the engine provided with two cylinders, the connecting rods of which are connected with cranks at right angles to each other in the well known manner.

In Fig. 4 the levers L, L', are shown provided with cams l^2, l^3 , which cams bear on springs Y, Y', that are held in position by bars y, y' , provided with lugs y^2, y^3 , respectively, said bars y, y' , clamping the springs Y, Y', against the main shaft H by bolts, z, z' , as shown. The shaft H is preferably furnished with an annular groove h , for the bolts z, z' . The said levers L, L', are each connected with the eccentric G by means of pins h^2, h^3 , set in the face of the eccentric, and working in slots l^4, l^5 , respectively in the cams l^2, l^3 . The said springs Y, Y', normally hold the lagging weights M, M', in the middle position, but as soon as the main shaft H attains a determined speed, the inertia of the weights M, M', causes them to fall behind the shaft and of course, the weights M, M', act irrespective of the direction in which the shaft is moving, the eccentric being always shifted so as to increase the lead of the valve as the speed increases.

Referring to Fig. 6, the levers L, L', have arms, n^3, n^4 , respectively, which arms are connected with the eccentric collar g by means of links g^4, g^5 , respectively. The lagging weights M, M', are represented in this figure as adjustable on the said levers L, L' by means of set screws m^3, m^4 , which set screws engage sockets l^6 , in the levers L, L', as indicated. Evidently the said lagging weights M, M', will deflect the eccentric G in the manner hereinbefore described, according to the direction and speed of the shaft H.

Now, having described my improvement, I claim as my invention—

1. The combination in a reversible steam engine, of a cylinder, piston, ports, main valve controlling said ports, shaft, eccentric and devices revolved by said shaft and adapted to shift said eccentric and automatically in-

crease the lead of the main valve as the speed of the engine increases and to automatically decrease the lead of the main valve as the speed of the engine decreases in either direction, substantially as described.

2. The combination in a port-reversing engine of the main valve, the auxiliary valve, and devices for automatically varying the lead of the main valve according to the variation of the speed of the engine in either direction, substantially as described.

3. The combination in a port-reversing engine, of the main valve, the auxiliary valve, cylinder, piston, main shaft, eccentric, and devices adapted to automatically shift the eccentric and vary the lead of the main valve independently of the auxiliary valve according to the speed of the engine in either direction, substantially as described.

4. The combination in reversible steam engines of a cylinder, piston, main shaft, eccentric, valve, and lagging weights adapted to be revolved through the motion of the main shaft and to vary the lead of the valve according to the variation of the speed thereof in either direction, substantially as described.

5. The combination in reversible steam engines of a cylinder, piston, main shaft, eccentric, valve, lagging weights adapted to be revolved through the motion of the main shaft and to vary the lead of the valve according to the speed thereof in either direction, and springs adapted to restore the lagging weights to the middle position when the engine is at rest, substantially as described.

6. The combination in port reversing engines, of the main and the auxiliary valves, cylinder, piston, main shaft, eccentric, lagging weights adapted to be revolved by the main shaft and to vary the lead of the main valve according to the speed thereof in either direction, and springs adapted to restore the lagging weights to the middle position when the engine is at rest, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 13th day of March, 1894.

WILLIS D. SHERMAN.

Witnesses:

WILLIAM H. S. CARLILE,
FRANK B. JOHNSON.