(No Model.)

3 Sheets—Sheet 1.

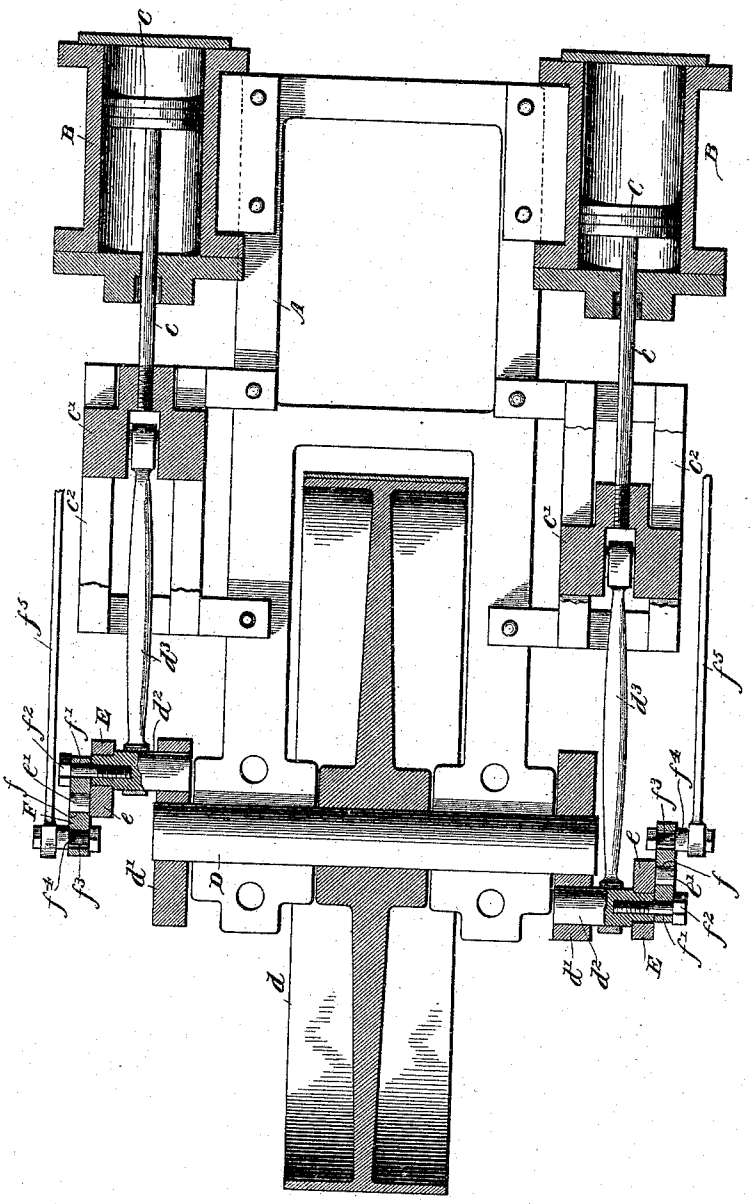
D. F. LEPLEY.

VALVE GEAR.

No. 492,302.

Patented Feb. 21, 1893.

Fig. 1



Witnesses;

J. M. Witherow.

D. P. Wolhaupter, Jr.

Inventor,

D. F. Lepley,

By his Attorneys,

C. A. Snow & Co.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.)

3 Sheets—Sheet 2.

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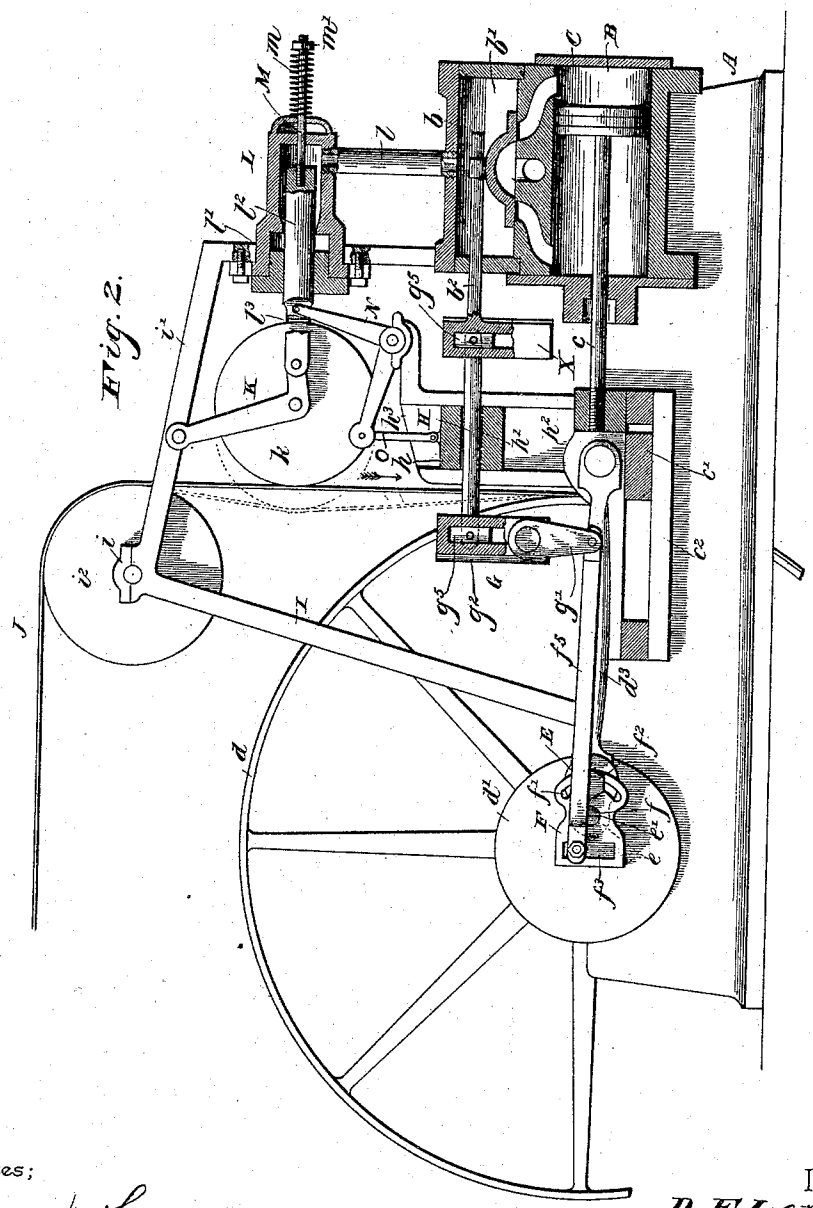

Witnesses;

J. M. Witherow.

L. P. Wolthaupter, Jr.

Inventor,

D. F. Lepley,

By his Attorneys,

C. A. Snow & Co.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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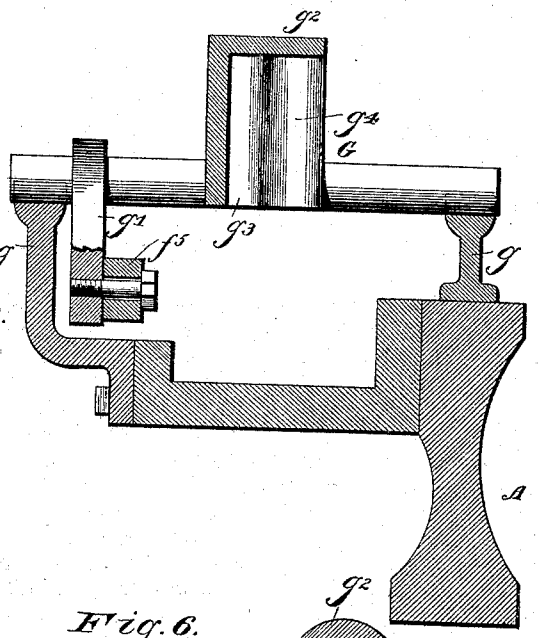
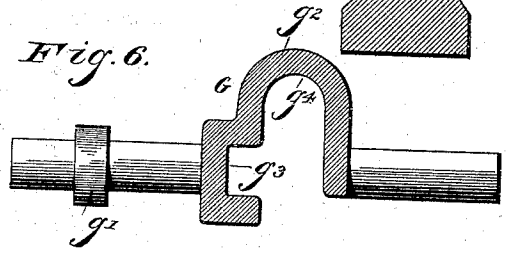


Fig. 3.

Fig. 6.



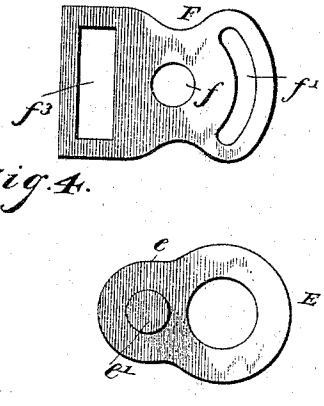
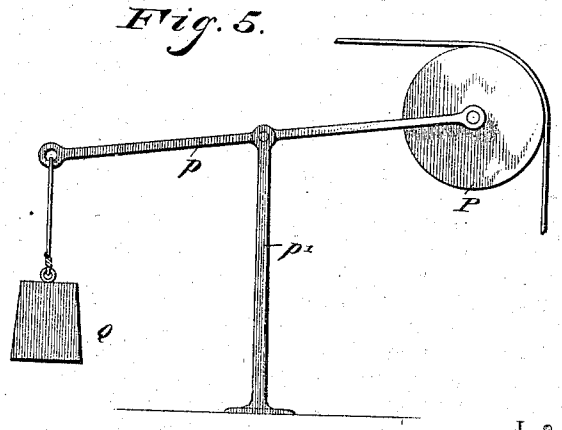


Fig. 4.

Fig. 5.



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UNITED STATES PATENT OFFICE.

DANIEL F. LEPLEY, OF BERLIN, PENNSYLVANIA.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 492,302, dated February 21, 1893.

Application filed January 15, 1892. Serial No. 418,142. (No model.)

To all whom it may concern:

Be it known that I, DANIEL F. LEPLEY, a citizen of the United States, residing at Berlin, in the county of Somerset and State of Pennsylvania, have invented a new and useful Valve-Gear for Engines, of which the following is a specification.

This invention relates to valve gear for engines; and it has for its object to provide an improved construction of valve gear which provides for an improvement in changing the lead of the valve for reversing the engine, and communicating motion to the valve stem, and in connection with such devices to provide means whereby the speed of the engine is accurately regulated and governed, automatically, to retain a normal and fixed rate of speed according to the load the engine is driving. To this end to provide an improved valve gear which supplants the use of the ordinary centrifugal governors, and in lieu of the same by the construction set forth to utilize the driving belt tension entirely for controlling the speed.

With these and many other objects in view which will readily appear as the nature of the invention is fully understood, the same consists in the novel construction, combination and arrangement of parts hereinafter more fully described, illustrated and claimed.

In the accompanying drawings;—Figure 1 is a sectional plan view of an ordinary stationary engine bed having my improved valve gear connected therewith. Fig. 2 is a side elevation partly in section of the same provided with valve gear and regulating devices constructed in accordance with my invention. Fig. 3 is a detail sectional view of the rock shaft and slotted guide head. Fig. 4 is a detail view of the valve reversing and regulating plates. Fig. 5 is a detail elevation of the belt tightener.

Referring to the accompanying drawings;—A represents the bed of an ordinary stationary engine. Located upon opposite sides and at one end of said bed are the opposite cylinders B, provided with the ordinary steam ports and located above which are the steam chests b, within which work the slide valves b', carried by the valve stems b^2, and said valves control the inlet and egress to and from said cylinders in the ordinary manner. Pistons C work within said opposite cylinders and drive the opposite piston rods c, carrying the sliding cross-heads c', working in the cross-head guides c^2, secured to opposite sides of the engine bed in front of the cylinders.

Journaled in the opposite end of the engine bed A is the horizontal power shaft D, carrying the main belt drive wheel d, and the opposite crank wheels d'. Said crank wheels d' are provided with the alternately disposed crank pins d^2 to which are connected the driving rods d^3, mounted over said crank pins and loosely connected or pivoted within the sliding cross-heads c', by which the said rods are driven and thus communicate motion to the power shaft in the usual manner.

Securely keyed upon the ends of the crank pins d^2 are the crank pin plates E, provided with the short arms e from which projects a coupling pin or stud e', upon which is pivotally mounted the reversing cam-plate F. The said cam-plate F over each pin plate or arm is provided with a central perforation f engaging over said pin or stud e', and upon one side of said perforation with the curved adjusting slot f'. A stud bolt f^2 passes through said radial or curved slot f' into the crank pin to which the same is secured and thus provides means for setting the said cam plate at an angle desired according to the movement of the slide valve required. The said cam plate is further provided in the end opposite to the radial slot f', with the straight slot f^3, within which works the squared crank bolt f^4 loosely carried upon one end of the connecting rod or pitman f^5, the other end of which is connected with a rock shaft G. The said rock shafts are journaled in suitable bearings g secured to the bed of the engine over the cross-heads, and the same are provided with the depending operating arms g' loosely connected with and controlled by the connecting rod f^5, and with the integral central grooved or slotted block guides or heads g^2 which are rocked with the shafts. The said heads are provided with the longitudinal squared groove g^3 and the adjacent curved recess g^4, said vertical squared groove g^3 being adapted to receive the pivoted sliding squared block g^5, to which is pivotally connected one end of the horizontal connecting bar H, the projecting end of which works and

travels within the curved groove or recess g^4 in said head. The connecting bar H passes through the projecting sliding bar-guide and adjustable support h, provided with a transverse perforation or bearing h', near the outer face thereof for the reception and working of the horizontal connecting projecting bar H. The bar guide h travels within the vertical groove h^2, formed in the face of the standard h^3 as illustrated, a corresponding standard of course being secured to the engine bed adjacent to the opposite cross-heads, and both standards being of course sufficiently in from the same to allow the rocking heads g^2 carried by the rock shafts to rock therewith. Said bar guide is supported by and controlled by means of the mechanism hereinafter described, employed for adjusting the horizontal connecting bar H up and down. To the other end of the connecting bar H is pivotally secured a sliding block g^5, corresponding to that secured to the opposite end working in the rocking heads, and this duplicate block is designed to slide within the reciprocating head X. The reciprocating head X is fixedly secured to the outer end of each of the valve stems of the engine and is constructed with a longitudinal squared groove and an adjacent curved recess identical to those with which the rocking heads are provided, and for the same purpose as will be readily seen from the drawings. By such a construction as described, it will be readily seen that by the revolution of the drive shaft, motion will be communicated from the reversing plates through the rock shafts, which shafts oscillate or rock the heads g^2 carried thereby, and which in turn reciprocate the connecting bar H and the reciprocating heads X which are fixedly connected to the outer ends of the valve stems. This movement will be apparent from the description taken in connection with the drawings. It can be seen that as the shafts G rock, the rocking heads g^2 carried thereby will either push or pull the connecting bars H, loosely connected with the opposite fixed heads g^8, so as to reciprocate the valve stems. By loosening the stud bolt f', holding the slotted cam plate F over the crank pin plate, the said cam plate may be turned upon the pivot stud or pin e', and be set either up or down to change the line of travel of the crank bolt f^4 working therein, thereby changing the lead of the slide valve when desired or necessary. It will be also noted, that by this construction, according to the set or angle of said cam plate F, or as the crank bolt is moved toward or away from the center of the slot in which the same works, the engine will be given an earlier or later point of cut off as desired for utilizing the expansion of high pressure steam. By a complete quarter turn of said cam plate in either direction to move the said bolt to the opposite end of the slot, the engine can be reversed. This construction entirely does away with the use of eccentrics or link connections as will be readily apparent, and at the same time provides for a steady and regular movement of the valves and at the same time on account of the simplicity of the combination, the said plates may be easily changed to set or adjust the valves when necessary.

Securely bolted to the bed A and extending above the same is a supporting stand or frame I, provided at its extreme upper end with the bearings i and the extended arm i', extending from said bearings to a point intermediate of the opposite steam cylinders and chests and supported thereover. A belt guide pulley i^2, is journaled in the bearings i in the top of said frame or standards and receives the main drive belt J, passing over said pulley in the direction indicated by the arrows and over the drive wheels d directly therebeneath and from which motion is communicated to said belt, the portion of which between said pulley and the main drive wheel being designed according to the tension thereof to control the stroke of the slide valves, and therefore the speed of the engine as will be presently described. Below and in rear of the guide pulley i^2 a pulley frame K is pivotally suspended from the standard arm i, and carries the swinging governor pulley k, journaled therein and which is designed to be in contact with the portion of the belt traveling between the guide pulley and the main drive wheel.

Intermediate of the opposite steam chests B a pressure regulating cylinder L is located and bolted to the outer end of the frame arm i'. The said cylinder receives the steam from the boiler and, by suitable pipe connections, l, is connected with each of the opposite steam chests, said cylinder being further provided with the gland and stuffing box l' that receives the regulating plunger l^2 working within said cylinder and actuated at the proper time by the steam pressure therein. The outer end of said plunger is bifurcated as at l^3 and is connected to the governor pulley frame K. An adjusting rod M is secured in the inner end of the regulating plunger l^2, within the pressure cylinder, and extending through the rear end of said cylinder accommodates and is regulated by the coiled adjusting spring m, fitted thereover and bearing against the end of said cylinder and the regulating nut or hand wheel m', adjustably engaging the outer end of said adjusting rod M. The adjusting spring m counteracts the pressure of the steam in the pressure cylinder upon the plunger working therein, and according to the tension of said spring, the speed of the engine can be regulated accordingly, even while the same is in motion, as will be readily apparent.

Journaled and working in suitable bearings upon the top of the guide standards h^3, are the rocking bell cranks N, one arm of which is connected to the outer end of the regulating plunger l^2, and the other arms of each bell crank are connected by means of suit-

able connecting links *o* with the top of each bar guide *h*, moving vertically in the vertical face grooves h^2, in the standards h^3, secured to the engine bed adjacent to the opposite cross-heads. It will be readily seen as the tension of the belt between the guide pulley and drive wheel is tightened or loosened, that the swinging governor pulley will be either forced in one direction or the other and thus raise or lower the bar guide *h*, which, consequently raises or lowers the connecting bar H, which carries the pivoted blocks g^5, in the rocking and reciprocating block guide heads g^2, and X respectively and thus causes the slide valves to have either a greater or less travel to admit more or less steam as the needs of the engine require.

When the various parts of the valve gearing and regulating devices are properly adjusted and the engine is working at its full capacity, for instance, under eighty pounds of boiler pressure, the section of the drive belt between the drive wheel and guide pulley will necessarily be straightened out and the tension of the same at the point of contact with the swinging governor pulley will be sufficient to overcome the pressure on the regulating plunger l^2. As already stated, this position of parts can be regulated by means of the regulating spring *m*, the tension of which is adjusted by means of the hand wheel *m'*, working upon the end of the rod M. Now under these conditions the engine will have a given speed, but as soon as the pressure of the steam goes above the supposed eighty pounds pressure, if the load the engine is driving remains the same, the engine would necessarily run faster. The pressure in the cylinder L on the plunger l^2 would consequently also be greater and would therefore force the same outward, and cause the swinging governor pulley to overcome the tension of the belt and move it out of the straight line as indicated by the dotted lines. Motion is thus communicated through the rocking bell cranks to the sliding bar guides *h*, which lower the connecting bars H, and thus cause the slide valves to reduce their travel and lessen the amount of steam admitted to the cylinders. The engine therefore retains the same speed as originally, although there is a greater steam pressure. Now on the other hand, if part of the load the engine is under should be diminished or taken off the drive belt, the tension of the belt at the point of contact with the governor pulley would be less in proportion, than originally, and the action of the governor mechanism would be precisely the same as just described. On the contrary, if the strain or load on the belt should be increased, the same instant the tension on the belt between the two pulleys is also increased. This will press back the regulating plunger, and thereby cause the bar guides to be raised. The slide valves then have a greater travel and allow a greater quantity of steam to be admitted to the cylinders to compensate for the increased load.

From the foregoing it will be apparent, that the different conditions of load control the speed of the engine regardless of the steam pressure and vice versa, while at the same time both forces work in harmony with each other.

In order to insure the proper and accurate working of the valve gearing and governor devices, a weight controlled tightening pulley P engages the driving belt J at any suitable point where the said belt runs slack. The said pulley P is journaled in the outer end of the weight actuated arm *p*, pivoted in the upper end of a suitable supporting arm *p'*, secured to any suitable point of attachment. Suitable weights Q are connected with the free end of said arm, *p*, and are adapted to be sufficient to accurately regulate the tension of the belt which will thus always be kept the same whether the belt shrinks or stretches, and the said tightener should be placed in such a position where the greatest amount of belt contact with the engine drive wheel can be secured.

The construction, operation and advantages of the herein described valve gearing and governor devices are thought to be apparent without further description.

Besides the advantages and workings of the governing devices herein described, it may also be noted, that, if the driving belt should break, the pressure of steam upon the regulating plunger l^2, would cause the connecting bar guides *h* to be forced downward to their limit of movement, thus causing the engine to stop of its own accord.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a valve gearing for engines, the combination with the engine slide valves and the driving crank wheels, of a crank pin plate or arm keyed to the crank pins, a cam plate pivotally mounted on said arm and provided with a working slot in one end, and a connecting rod or pitman working in said slot and connected with the slide valves, substantially as set forth.

2. In a valve gear for steam engines, the combination with the engine slide valves and the driving crank wheels, of a crank pin plate or arm keyed to the crank pins of said wheels and provided with a coupling pin or stud, a cam plate pivoted on said coupling pin or stud and provided at one end with a radial adjusting slot and at the other end with a straight working slot, and a connecting rod or pitman provided at one end with a pivoted crankbolt working in said straight slot and connected with said slide valves, substantially as set forth.

3. In a valve gear for steam engines, the combination with the slide valve stems and the driving crank wheels, of a crank pin plate or arm having a coupling pin or stud, a cam

plate pivoted on said stud and provided at one end with a radial adjusting slot and at the other end with a straight working slot, a stud bolt engaging the crank pins and said radial slots, rock shafts connected with said valve stems, and a connecting rod or pitman provided at one end with a pivoted crank bolt working in said straight slot and connected with said rock shafts, substantially as set forth.

4. A valve gear for steam engines, the combination with the slide valve stems having guide heads and the driving crank wheels, of a radially adjustable cam plate connected with the crank pins of said wheels, rock shafts having guide heads, a connecting bar working in said guide heads, and a connecting rod or pitman connected with said cam plates and said rock shafts, substantially as set forth.

5. In a valve gear for steam engines, the combination with the driving crank wheels, of the slide valve stems having vertical block guide heads provided with traveling grooves or slots, an oscillating rock shaft provided with upwardly extending block guide heads having similar working grooves or slots, an adjustable support and guide, a connecting bar passing through said support and guide and provided at each end with sliding blocks working in the valve stem and rock shaft heads, and a connecting rod or pitman connected with said rock shaft and said driving crank wheels, substantially as set forth.

6. In a valve gear for steam engines, the combination with the driving crank wheels, of the slide valve stems having grooved guide heads, rock shafts having upwardly extending guide heads, a connecting rod or pitman connected with said crank wheels and said rock shafts, a horizontal connecting bar working in said guide heads, and means for adjusting the position of said connecting bar by the steam pressure or the load upon the engine, substantially as set forth.

7. In a valve gear for steam engines, the combination with the driving crank wheels, of the slide valve stems having guide heads, rock shafts having guide heads, a connecting rod or pitman connected with said crank wheels and said rock shafts, vertically grooved guide standards, a sliding support and bearing block working in said grooved standards, a connecting bar working through said sliding blocks and at each end in the valve stem and rock shaft heads, and means for governoring said sliding bearing and supporting blocks by the belt tension or steam pressure, substantially as set forth.

8. In a valve gear, for steam engines, the combination with the driving crank wheels, of the slide valve stems having guide heads, adjacent rock shafts having similar guide heads, a connecting rod or pitman connected with said crank wheels and said rock shafts, vertically grooved guide standards, a sliding support and bearing block working in said grooved standards, connecting bars working through said sliding blocks and at each end in the valve stems and rock shaft heads, oscillating bell cranks journaled upon said standards and connected with said sliding blocks, and means for oscillating or governing said bell cranks by the driving belt tension and steam pressure, substantially as set forth.

9. In a valve gear for steam engines, the combination with the main driving belt, the driving crank wheels and slide valve stems, of valve motions connected with said crank wheels, a vertically adjustable connecting bar connecting said valve motions with the valve stems, a supporting frame, a swinging governor wheel or pulley suspended from said frame and normally bearing against the driving belt, a pressure cylinder, and a regulating plunger working in said cylinder and connected with said governor wheel or pulley and said connecting bars, substantially as set forth.

10. In a valve gear for steam engines, the combination with the main driving belt, the driving crank wheels, and slide valve stems, of a valve motion connected with said crank wheels, a vertically adjustable connecting bar connecting said valve motions with the valve stems, a supporting frame, a swinging governor wheel or pulley suspended from said frame and in contact with the driving belt, a pressure cylinder, a spring-actuated or regulated plunger working in said cylinder and connected with said governor pulley, and rocking bell cranks connected with said plunger and said adjustable connecting bars, substantially as set forth.

11. In a valve gear for steam engines, the combination with the main driving belt and slide valves, of a valve motions connected with said valves and provided with a vertically adjustable regulating connecting bar, a supporting frame, a guide wheel journaled in said frame and receiving the driving belt, a swinging governor wheel suspended from said frame and in contact with the driving belt below said guide wheel, a pressure cylinder suspended from said frame and connected with the opposite valve chambers, a spring regulated plunger working in said cylinder and connected with said swinging governor pulley, rocking bell cranks connected with said plunger, and supporting links connected with said bell crank and said vertically adjustable bars, substantially as set forth.

12. In a valve gear for steam engines, the combination with the main driving belt and slide valves, of the valve motions connected with said valves and provided with vertically adjustable valve regulating connecting bars, a sliding bearing and adjusting blocks receiving said connecting bars, a supporting frame, a guide wheel journaled in said frame and receiving the driving belt thereover, a swinging governor wheel suspended from said frame and in contact with the driving belt below said guide wheel, a pressure cylinder sus-

pended from said frame and connected with the opposite valve chambers, a spring regulated plunger working in said cylinder and connected with said governor pulley, rocking bell crank connected with said plunger, and supporting links connected with said bell cranks and said sliding blocks, substantially as set forth.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

DANIEL F. LEPLEY.

Witnesses:
SAMUEL DUPPSTADT,
ALEXANDER BRUBAKER.