(No Model.)

P. J. SHELB.

VALVE MOTION.

No. 584,564. Patented June 15, 1897.

Fig. 2.

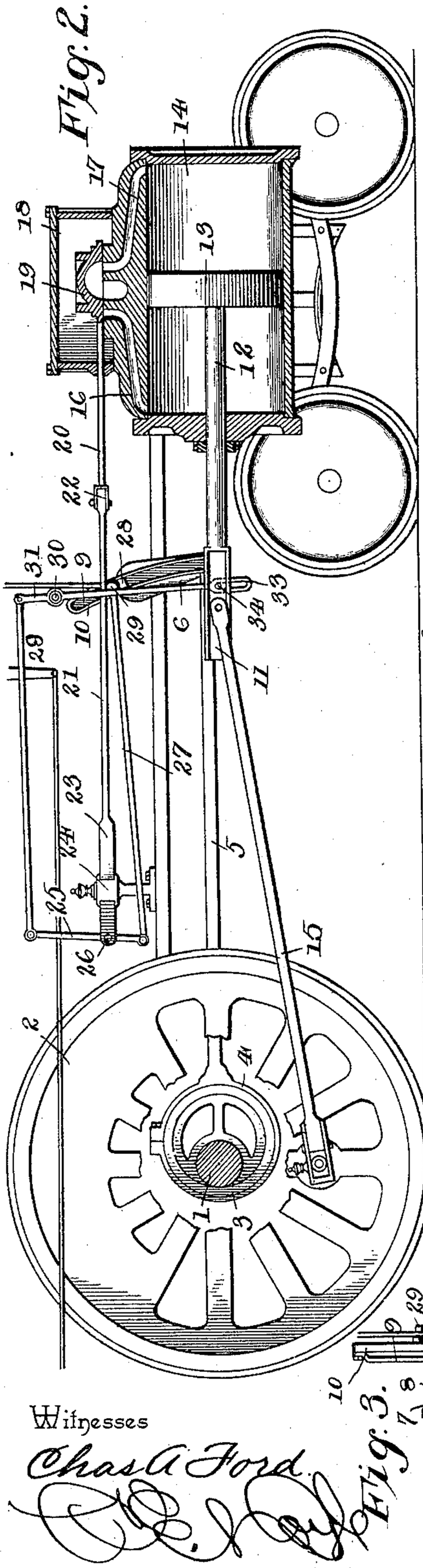
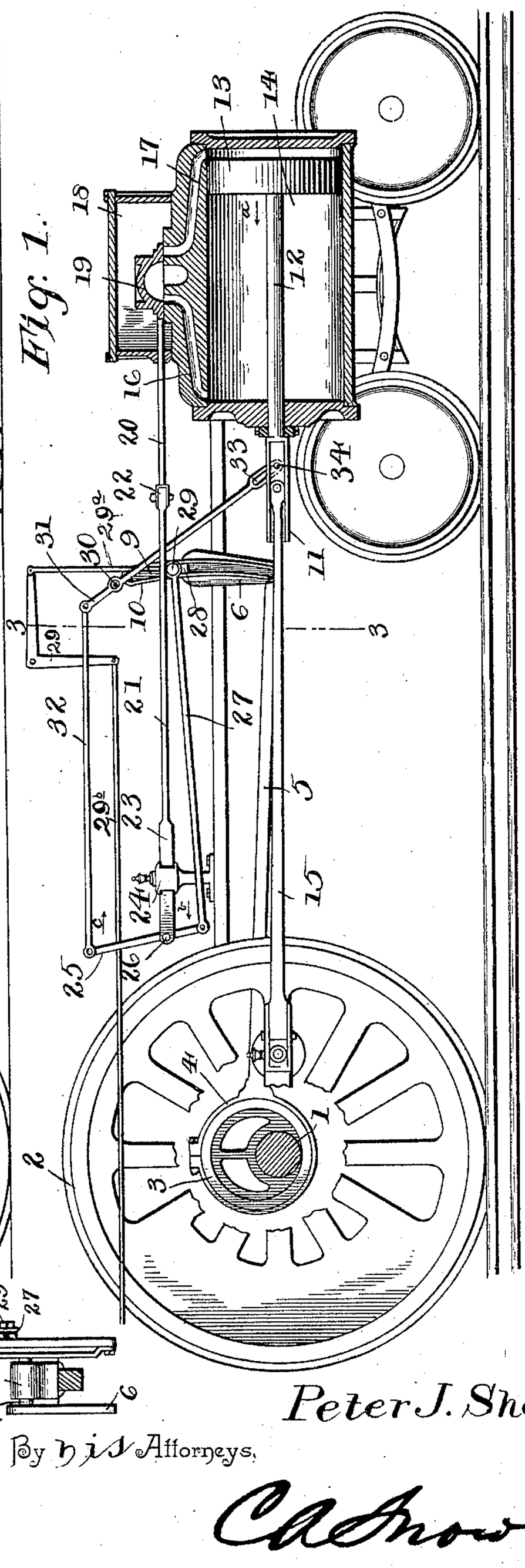


Fig. 1.



Witnesses

Chas A Ford.

E. L. Coyle

Inventor

Peter J. Shelb,

By his Attorneys,

Church & Co.

UNITED STATES PATENT OFFICE.

PETER J. SHELB, OF FORT WORTH, TEXAS.

VALVE-MOTION.

SPECIFICATION forming part of Letters Patent No. 584,564, dated June 15, 1897.

Application filed September 26, 1895. Serial No. 563,737. (No model.)

To all whom it may concern:

Be it known that I, PETER J. SHELB, a citizen of the United States, residing at Fort Worth, in the county of Tarrant and State of Texas, have invented a new and useful Valve-Motion, of which the following is a specification.

This invention relates to valve-motions and belongs to that class commonly known as "variable cut-off" valve-motions. The invention contemplates a valve-motion having simple and positive means for varying the points at which the ports of the engine-cylinder are opened and closed to vary the lap and lead, and while accomplishing this result the invention has especial reference to a form of valve-motion designed for use in connection with that type of locomotive or other engines in which there is a comparatively short space between the driver or driving-shaft and the engine-cylinder. It is therefore an important feature of the invention to provide such a compact arrangement of the parts of the motion as to adapt the same for use in the class of engines referred to, while at the same time permitting of the use of long connecting-rods between the different parts of the motion to secure a direct and uniform thrust for the valve, and thereby obviating the use of short rod connections, which necessarily work with a rapid jarring motion, and also obviating such a disposition of parts as will provide for the pull and thrust on the valve stem or rod at a point in close proximity to the valve-chest, and thereby tending to materially increase the friction of the valve stem or rod in the stuffing-box of the valve-chest.

With the aforementioned objects specially in view the invention consists in the novel relative disposition of parts hereinafter more fully illustrated, described, and claimed.

In the drawings, Figure 1 is a side elevation of a valve-motion or valve-gear with the parts thereof relatively disposed in the manner contemplated by this invention. Fig. 2 is a similar view showing the positions of the parts when the driver or driving-wheel has advanced a quarter-revolution from the position indicated in Fig. 1. Fig. 3 is a transverse sectional view on the line 3 3 of Fig. 1.

Referring to the drawings, the numeral 1 designates the driving-shaft of the engine, carrying the driving-wheel 2 and the eccentric 3, the latter having a strap 4, to which is attached the long eccentric-rod 5, which rod is of a length nearly equaling the distance between the driving-shaft 1 and the cylinder of the engine. The eccentric-rod 5 is pivotally connected to the lower end of a rock-arm 6, having a transverse spindle 7, turning in a fixed bearing 8 and carrying at its end opposite the arm 6 the segmental link 9, extending above and below the plane of the spindle 7, and having a slotted face-plate 10.

The cylinder 14 of the engine (designated by the numeral 14) is disposed in reasonably close proximity to the driving-shaft 1, as is common in some forms of locomotive and similar engines, necessarily leaving a short space between the cylinder and the driving-shaft, within which space the valve-motion is to be arranged; but the present invention contemplates a form of valve-motion especially adapted for use with engines of this character.

The cylinder 14 accommodates therein the piston 13 at the inner end of the piston-rod 12, connected at its outer end with the cross-head 11, which has a pitman connection 15 with the driving-wheel 2. The ports 16 and 17 of the engine-cylinder open into the valve chamber or chest 18 and are covered and uncovered by an ordinary form of slide-valve 19, having a stem 20, to the outer end of which stem is coupled, by means of the coupling 22, the inner end of the valve-stem extension 21. This valve-stem extension 21, in conjunction with the main stem 20, provides an extended valve-stem which is of a length nearly equaling the entire distance between the engine-cylinder and the driving-shaft 1, and at its end adjacent to the driving-shaft 1 the stem extension 21 is provided with a flattened portion 23, the flattened faces of which are disposed in vertical planes. The said flattened portion 23 of the valve-stem extension slidably registers in a correspondingly-shaped and correspondingly-disposed opening in the fixed guide 24, supported in a position in direct line with and remote from the slide-valve. By reason of the flattened portion 23 of the valve-stem extension a tendency of the valve-

stem to turn or strain in an axial direction is entirely obviated. During the operation of the valve-motion a looseness of joints between the various connections and a rapidity of movement of these connections would very often tend to exert a slight axial strain on the valve-stem and thereby materially increase the friction of the slide-valve, but the flattened portion 23 of the stem extension obviates this difficulty.

The extremity of the flattened portion 23 has pivotally connected thereto a rocking lever 25, the pivotal point of which lever is nearest the lower end thereof, and to the lower end of said lever, below its pivot 26, is connected one end of a rod 27, the other end of which rod is fitted to the slide-block 28 of the segmental link 9. The said slide-block 28 is adjusted and secured in its adjusted position by means of suitable hand-operating mechanism, including a bell-crank lever 29, a connecting-rod 29^a, and an operating-rod 29^b, which may be connected with a hand-lever. (Not shown.) Pivotally mounted at 30 upon a fixed portion of the frame is a directly-operated lever 31, the pivotal point 30 of said lever being arranged contiguous to the upper end thereof, and at this point it is to be observed that the pivotal points of the lever 31 and the link 9 are arranged in approximately coincident vertical planes, whereby the distance between the lever 25 and the link 9 and lever 31 is about the same, and it will also be observed that the lever 31 and the link 9 are disposed at a point in close proximity to the cylinder of the engine. The upper extremity of the lever 31 has a long rod connection 32 with the upper extremity of the lever 25, and the lower arm of the lever 31 is slotted at 33 for engagement with the pin 34 on the crosshead 11, whereby the motion of the piston is communicated directly to the lever 31 without the interposition of links or other connections.

In the position shown in Fig. 1 the piston is at the limit of its movement in one direction and the major axis of the eccentric is at right angles to the direction of movement of the piston. Hence at this point in the movement of the mechanism the eccentric-rod is in the position of greatest throw, and in advancing from this position to that indicated in Fig. 2, in which the driving-wheel has made a quarter-revolution and the major axis of the eccentric has moved from a plane at right angles to the direction of movement of the piston to a position in alinement with said direction of movement of the piston, the throw of the eccentric-rod will diminish. It is obvious that below this point the throw of the eccentric-rod will again increase until it reaches a position the opposite to that indicated in Fig. 1, when the piston will be at the opposite limit of its movement. The movement of the eccentric is communicated directly to the rocker-arm and moves the lower extremity thereof a distance equal to the throw of the eccentric, and this movement of the rocker-arm is communicated directly to the rocking lever either in the same or the opposite direction, according to the point of connection of the extremity of the rod 27 to the link, and to a greater or less extent according to the interval between the coupling-block and the axis of movement of the rocker-arm. As the eccentric advances from its position at the point of greatest throw, as shown in Fig. 1, the piston advances in the direction indicated by the arrow *a* in the cylinder and thereby imparts a rocking movement to the directly-operated lever 31, whereby as the lower arm of the rocking lever is moved in the direction of the arrow *b* the upper arm thereof is moved in the direction of the arrow *c*. The difference between these opposite movements imparted to the extremities of the rocking lever 25 determines the amount of movement of the valve-stem, and this difference between the movements of the opposite extremities of the rocking lever will be varied by the point of connection of the rod 27 with the slotted link carried by the rocker-arm. The engine will be reversed by arranging the point of connection of the rod 27 with the link below the plane of the axis of the rocker-arm.

From the above description it will be seen that the motion of the valve is the resultant of two motions imparted to the rocking lever, respectively, by the eccentric and by the piston, and that this resultant may be varied by changing the amount of throw of the coupling-block, the latter being accomplished by varying its distance from the axis of movement. The points of cut-off and inlet of steam are variable, and the rapidity of movement of the valve instead of being uniform, as it would be if derived directly from the eccentric or from the piston, is variable. The valve travels faster at certain points to overcome the lap of the valve and secure a quick and large port opening after the piston leaves the extreme point or limit of its travel, and at other points the valve travels more slowly to leave the port open a longer time and thus allow the live steam to follow the piston. This allows greater expansion of the steam after being cut off by the valve. The slow movement of the valve also has a tendency to allow a freer exhaust of the steam ahead of the piston and thus prevent back pressure.

It will be seen that the valve mechanism, as above described, is adapted for one or more engines connected to the same shaft, and in practice I employ a construction, as specified, for each engine independently of the others which may be operating in harmony therewith.

In the statement of invention it has been emphasized that an important feature of the invention is the relative and compact arrangement of the parts of the motion, so as

to adapt the same for use in connection with that type of locomotive or other engines in which there is a comparatively short space between the driver or driving-shaft and the engine-cylinder, and in the accomplishment of this result it is very important to have the valve-stem extension 21 and to locate the lever 25 at a point remote from the valve chamber or chest 18.

I am aware of the fact that it is old to attach an oscillating lever to the outer end of the valve-stem and to have the ends of this lever respectively connected with the link and one of the driving connections, and am also aware that it is old to provide a guide for the valve-stem exterior to the valve-chest and to have short eccentric connections with the link. I am also aware that it is old to employ valve-motions somewhat similar to the motion herein described, which valve-motions involve the use of short connecting-rods and cause the pull and thrust to be imparted to the valve stem or rod at a point in close proximity to the valve-chamber, but I believe myself to be the first to provide an elongated valve-stem in combination with the guide 24, located in a position so as to support the lever 25 at a point remote from the valve-chest, thereby permitting the link 9 and the lever 31 to be disposed close to the engine-cylinder and also admitting of the use of long rod connections for every part. By the extension of the valve-stem the main working parts of the motion can be very compactly arranged, while at the same time making the motion of the valve-stem more positive and direct by reason of the long interval between the guide 24 and the valve-chest. Furthermore, the relative disposition of the parts described, with long rod connections, insures an operation of the motion with less friction than valve-motions having short rod connections, and especially motions of that character having an oscillating lever fitted to the outer end of the valve-stem directly adjacent to the valve-chest.

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

In a valve-motion adapted for use with that type of engines having a short space between the driver or driving-shaft and the engine-cylinder, the combination with the slide-valve and its stem, and the reciprocating cross-head of the engine; of a guide 24 mounted in a fixed position in direct line with the slide-valve and at a point remote therefrom and near the driving-shaft of the engine, a valve-stem extension lineally alined with the main valve-stem and provided at its end nearest the driving-shaft with a flattened portion slidably registering in a correspondingly-shaped opening in the fixed guide 24 to provide for the support of one end of the stem extension and for bracing the same against strain in an axial direction, a rocking lever 25 pivoted between its ends to the flattened extremity of the valve-rod extension, a suitably-oscillated link carrying a link-block and mounted at a point in close proximity to the engine-cylinder between the latter and the fixed guide, a long rod connection between the link-block and the lower end of the lever 25, a lever 31, pivotally supported between its ends adjacent to the link and having its lower end directly connected with the cross-head, and a long rod connection between the upper ends of the levers 31 and 25, 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.

PETER J. SHELB.

Witnesses:
ROBT. S. BLAIR,
JORDAN Y. CUMMINGS.