

(No Model.)

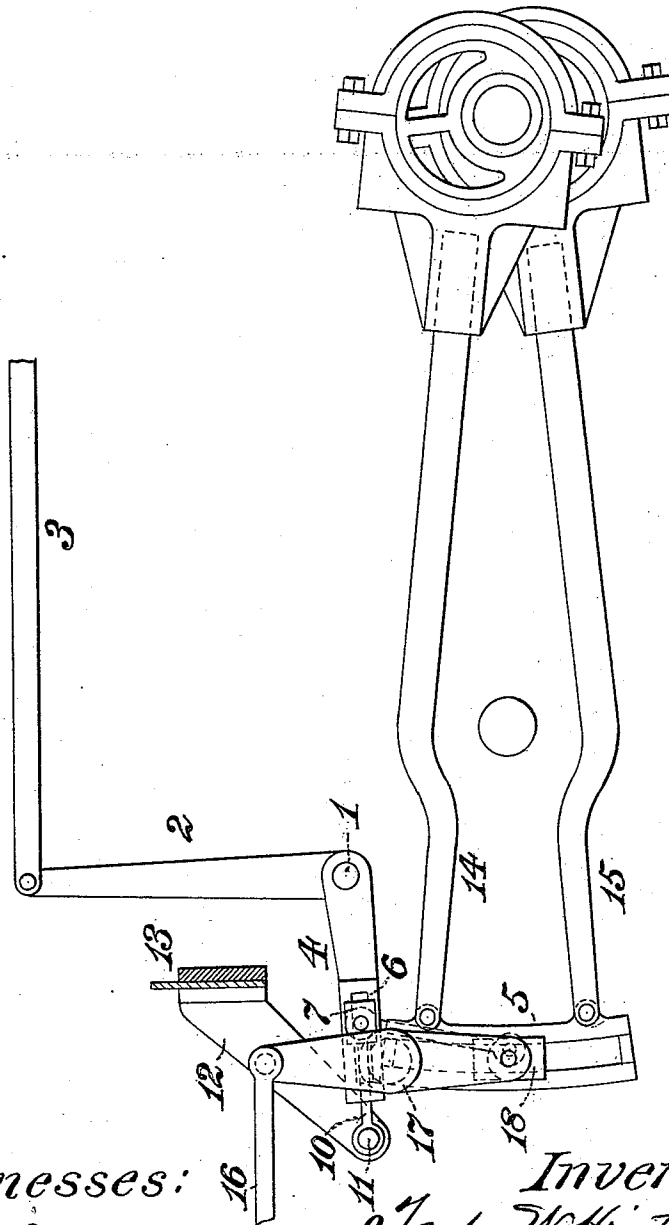
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T. W. HEINTZELMAN & C. T. NOYES.
VALVE GEAR FOR COMPOUND ENGINES.

No. 471,253.

Patented Mar. 22, 1892.

FIG. 1—



Witnesses:
T. J. Hogan.
F. E. Lathrop

Inventors,
Taylor W. Heintzelman,
Chas. T. Noyes
by J. Howard Pell, atty.

(No Model.)

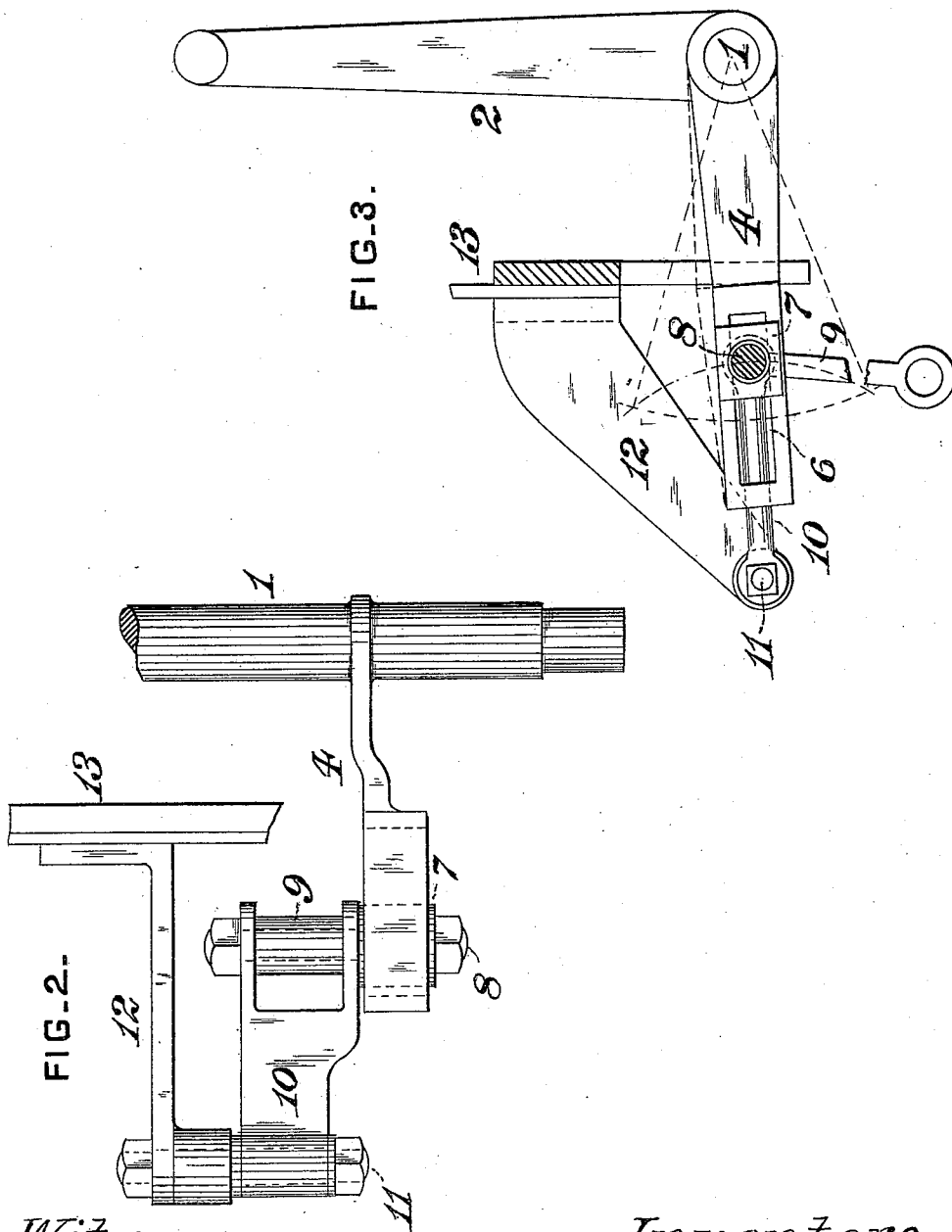
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No. 471,253.

Patented Mar. 22, 1892.



Witnesses:
T. J. Hogan.
F. E. Gaither.

Inventors,
Taylor W. Heintzelman,
Chas. T. Noyes,
by J. Rowden Bell,
att'y.

(No Model.)

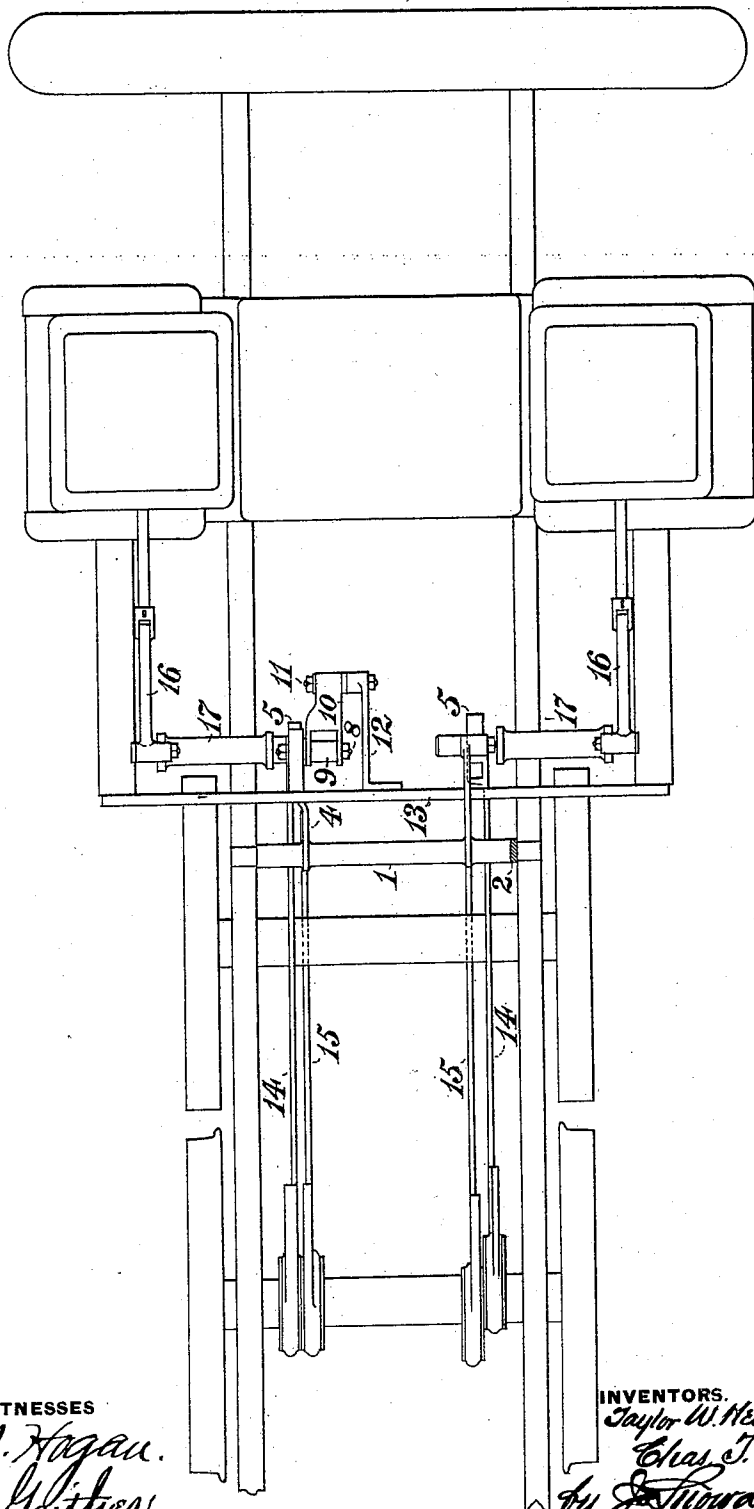
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T. W. HEINTZELMAN & C. T. NOYES.
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FIG. 4.



WITNESSES
T. J. Hagan.
F. E. Guther.

INVENTORS.
Taylor W. Heintzelman.
Chas. T. Noyes.
by J. Thurston Bell,
Att'y

UNITED STATES PATENT OFFICE.

TAYLOR W. HEINTZELMAN AND CHARLES T. NOYES, OF SACRAMENTO,
CALIFORNIA.

VALVE-GEAR FOR COMPOUND ENGINES.

SPECIFICATION forming part of Letters Patent No. 471,253, dated March 22, 1892.

Application filed October 21, 1891. Serial No. 409,382. (No model.)

To all whom it may concern:

Be it known that we, TAYLOR W. HEINTZELMAN and CHARLES T. NOYES, both of Sacramento, in the county of Sacramento and State of California, have invented a certain new and useful Improvement in Valve-Gear for Compound Engines, of which improvement the following is a specification.

The object of our invention is to enable the ordinary link-motion valve-gear to effect a differential cut-off in the cylinders of a compound engine in order that substantially equal work may be done in the two cylinders at all points of cut-off.

To this end our invention, generally stated, consists in the combination, with one of a pair of link-motion valve-gears actuating the distribution-valves of a high and a low pressure cylinder, respectively, of a device for automatically shifting the link of said gear in advance of that of the other in and by each coincident movement of both links made in varying the point of cut-off. The improvement claimed is hereinafter fully set forth.

In a two-cylinder compound engine having the distribution-valve of each cylinder actuated by an ordinary link-motion, which by the adjustment of its link effects variation of the point of cut-off, each coincident adjustment of the two links varies the point of cut-off equally in both cylinders, but the amount of work done by the steam at different points of cut-off is materially unequal in the two cylinders. If the cylinders, valves, and valve-motions are so proportioned and the valves so operated that equal work is done in both cylinders under full stroke of the valves, inequality of work in the two cylinders accompanies and increases rapidly with the shortening of the point of cut-off. The effect of this unequal exertion of power on opposite sides of the engine is not only structurally detrimental thereto, but also involves an uneconomical use of steam. These objections are obviated by the application of our invention, in the operation of which the cut-off is equal in the two cylinders at the full-valve stroke either in forward or backward motion; but each shifting movement of the links to-

ward the central position or that in which their die-blocks are midway between the eccentric-rod pins effects a greater reduction of the point of cut-off in one cylinder than in the other, the ratio of difference between the points of cut-off in the two cylinders increasing with the shortening of the points of cut-off. A relatively longer or shorter cut-off may be effected in either cylinder, and the result of such differential cut-off is an equalization of the work done by the steam in the high and in the low pressure cylinder.

In the accompanying drawings, Figure 1 is a side view in elevation of a link-motion valve-gear having our improvement applied; Fig. 2, a plan or top view, on an enlarged scale, of a portion of the lifting-shaft and its connections; Fig. 3, a side view, partly in section, of the same; and Fig. 4, a plan or top view of the cylinders, valve-chests, and valve-gear of a compound locomotive having our improvement applied.

Our invention is more particularly designed for application to and is herein shown in connection with the valve-gear of a two-cylinder compound locomotive-engine having a high-pressure cylinder on one side and a low-pressure cylinder on the other, the distribution-valves of the two cylinders being worked by separate link-motions, the links of which are shifted coincidently to effect reversal of movement or variation of the point of cut-off. Constructions of such general type are well known to those skilled in locomotive engineering, and a description of the specific features of structure and operation of our improvement as applied therein will enable the same to be fully understood without setting forth at length the known elements to which our improvement is accessory.

In the practice of our invention we provide for shifting one link in advance of the other by means of a construction in which the effective length of the lifting-arm of one of the link-motion valve-gears of the engine is automatically varied relatively to that of the other link-motion and additional vertical traverse imparted to the connected link in and by each movement of the lifting or reverse shaft which

is made by the engineer for the purpose of varying the point of cut-off.

In the preferred construction shown the lifting or reverse shaft 1 is provided with the usual vertical arm 2, which is connected by a reverse bar or reach-rod 3 with a reverse-lever, which is not shown and which serves to rock the lifting-shaft in its bearings and to simultaneously raise or lower both links in the ordinary manner. The lifting-shaft is, as heretofore, provided with two lifting-arms, each of which is coupled by a link-hanger to one of the links. Only one lifting-arm and one link-motion (these parts being those in connection with which our improvement is directly applied) are shown in Figs. 1, 2, and 3, the other link-motion being identical with that shown and the other lifting-arm being similar to that shown, except that it has a fixed link-hanger pin, as in the ordinary construction. Both links and the relative arrangement of the two link-motions are, however, shown in Fig. 4.

The lifting-arm 4 of the shaft 1, to which is coupled the link 5, which actuates the valve of one of the cylinders, (as, say, the high-pressure cylinder,) is provided near its outer end with a longitudinal slot 6, in which a block 7 is fitted to slide freely. The block 7 carries a pin 8, to which is coupled the upper end of a link-hanger 9, the lower end of said hanger being coupled in the usual manner to the link 5. The block 7 is also coupled to one end of a radial arm 10, the opposite end of which is journaled on a pin or stud 11, fixed in a bracket 12, which is secured to the guide-yoke 13 or to any other convenient support on or connected to the frame of the engine. The link 5 is coupled to the forward eccentric-rod 14 and backing eccentric-rod 15 in the usual manner, and the valve is reciprocated by a valve-stem 16 through a rocker 17, the lower arm of which carries a pin, on which is fitted a die-block 18, fitting in the slot of the link, the center of the lower rocker-pin being brought into line with either the forward or backward eccentric-rod or into any intermediate position by the vertical movements of the link effected by the movements of the lifting-shaft in the ordinary manner and through the connections above described.

It will be seen by reference to Fig. 3 that when the links are either lowered into full-valve stroke forward position or raised into full-valve stroke backward position the center of the movable link-hanger pin 8 stands at the maximum distance from the center of the lifting-shaft 1, which distance is the same as that of the fixed link-hanger pin of the other lifting-arm from said center. In either of such positions the two links will occupy the same vertical positions and the stroke of the valves of both cylinders will be equal. When, however, the links are moved into central position, being that shown in the drawings, the pin 8 will, through the action of the arm 10,

block 7, and slot 6, have been moved toward the center of the lifting-shaft 1 and will stand at its minimum distance therefrom, while the fixed pin of the other lifting-arm remains at an invariable distance therefrom during the traverse of the links to and when at their central position. The movable pin 8, by reason of its connection with the radial arm 10, continually approaches the center of the lifting-shaft as the links are moved toward central position to effect a shorter cut-off. The result of the combined movements of the pin 8—that is to say, its longitudinal movement upon the lifting-arm 4 in the reduction of its distance from the center of the lifting-shaft and its coincident movement in the arc of a circle with said arm is to move the link to which the movable pin is coupled in advance of the other link, which is coupled to the fixed link-hanger pin, and thereby to effect a differential cut-off in the high and low pressure cylinders, that in the cylinder whose valve is actuated by the link coupled to the movable pin being shorter than that in the other cylinder. It will be seen, further, that, as indicated by the curved line indicating the traverse of the movable pin in Fig. 3, the ratio of difference of cut-off in the two cylinders increases as the cut-off in both is shortened. The ratio of difference of cut-off may be increased by bending the lifting-shaft arm 4, so that the slot 6 may stand at an angle with a line from the center of the lifting-shaft to the center of the slot, as indicated by dotted lines in Fig. 3, and it may also be increased by shortening the radial arm 10 and be decreased by lengthening said arm.

We claim as our invention and desire to secure by Letters Patent—

1. In a two-cylinder compound engine having its distribution-valves actuated by separate link-motions, the combination, with one of said link-motions, of a shifting device for automatically advancing the link thereof relatively to the link of the other in and by each coincident movement of both links made in varying the point of cut-off, substantially as set forth.

2. In a two-cylinder compound engine having its distribution-valves actuated by separate link-motions, the combination, with one of said link-motions, of a shifting device for automatically varying the effective length of the lifting-arm thereof and by the resultant of such variation and of the normal traverse of the arm advancing the link thereof relatively to the link of the other link-motion in and by each coincident movement of both links made in varying the point of cut-off, substantially as set forth.

3. In a two-cylinder compound engine having its distribution-valves actuated by separate link-motions, the combination, with one of said link-motions, of a link-hanger pin fitted to traverse longitudinally on a lifting-arm, a hanger coupled to said pin and to the

link, and a radial arm coupled to said pin and to a fixed support, substantially as set forth.

5 4. The combination of a lifting-shaft, a lifting-arm fixed thereon, a block fitted to slide longitudinally on the lifting-arm, a link-hanger pin fixed to said block, a link-hanger coupled to said pin and to a valve-link, and a

radial arm coupled to said pin and to a fixed support, substantially as set forth.

TAYLOR W. HEINTZELMAN.
CHARLES T. NOYES.

Witnesses:

J. W. HUGHES,
H. J. PALMER.