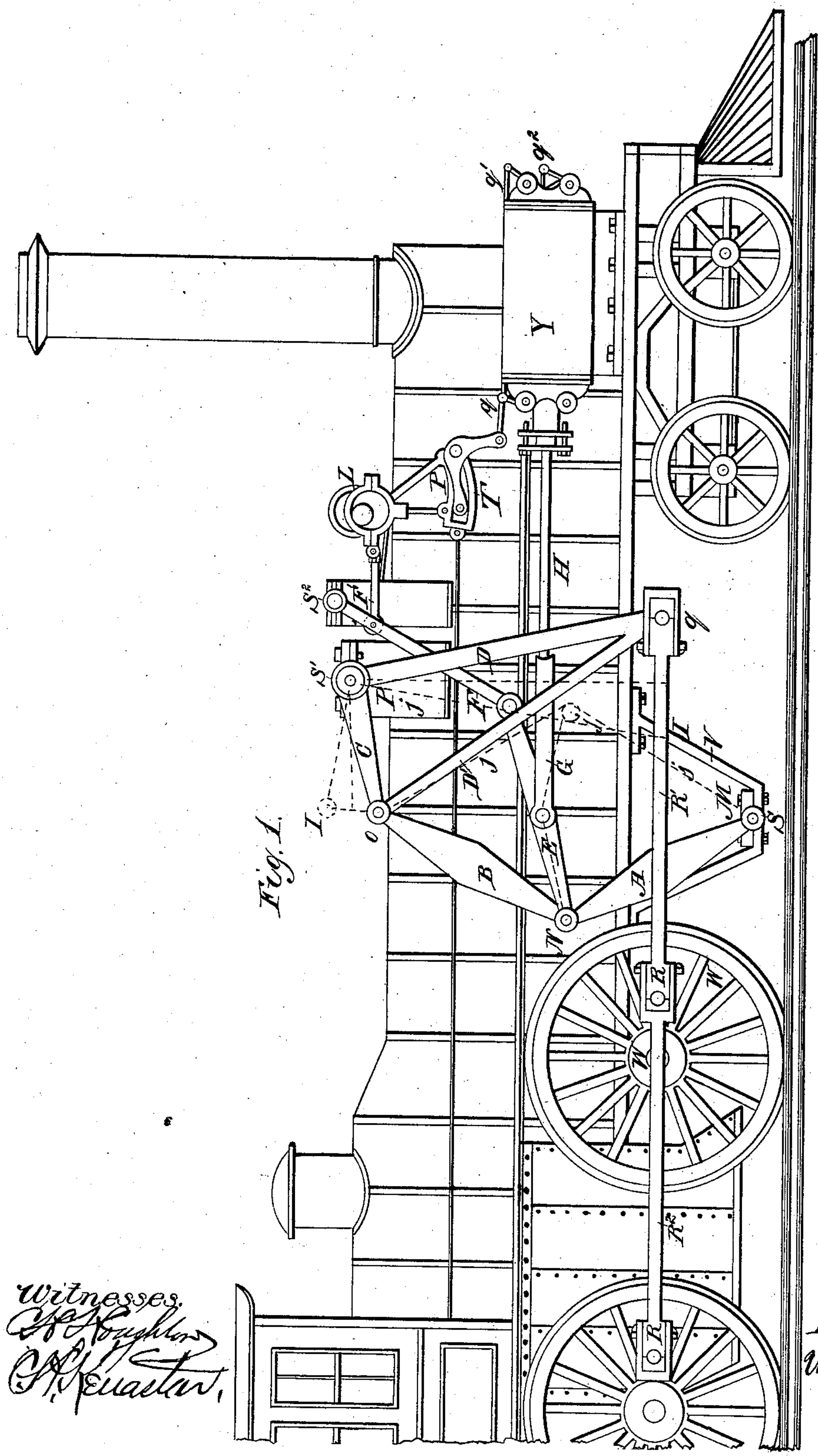
(No Model.)

3 Sheets—Sheet 1.

W. F. GOODWIN.

STEAM ENGINE.

No. 260,383. Patented July 4, 1882.



Witnesses.

Inventor.

(No Model.) 3 Sheets—Sheet 2.

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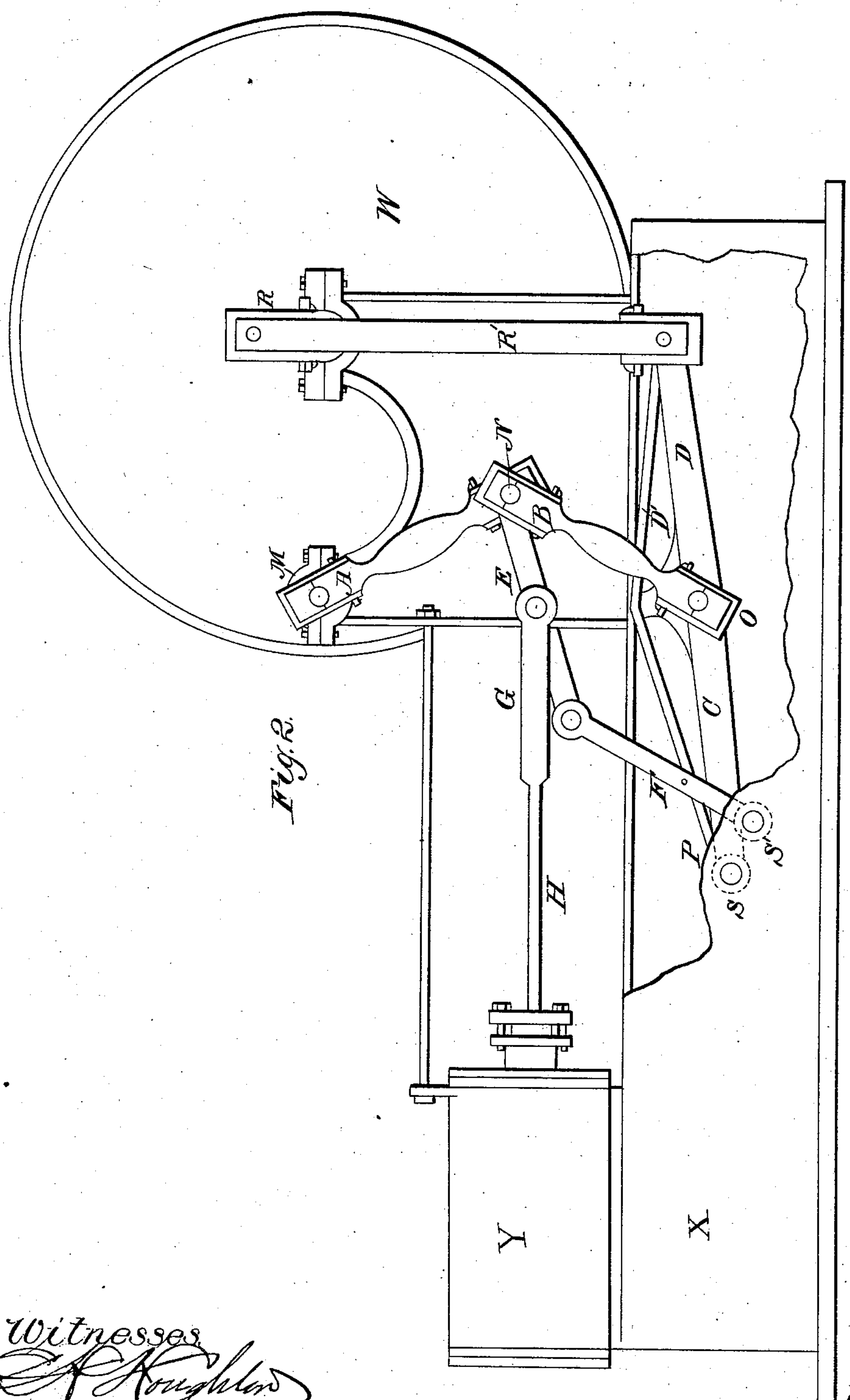

Fig. 2.

Witnesses:

Inventor.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 3.

W. F. GOODWIN.

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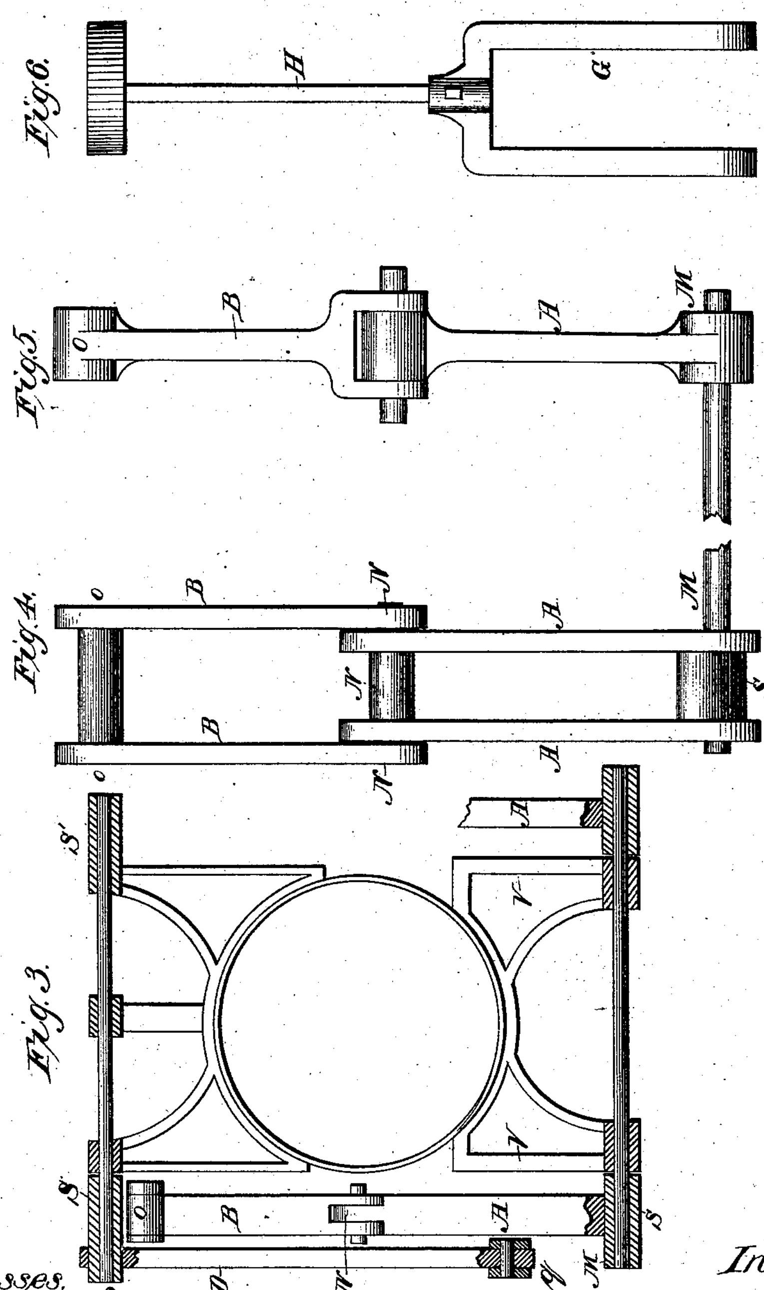

Witnesses.

[signature]

[signature]

Inventor.

Wm. Fran Goodwin

UNITED STATES PATENT OFFICE.

WILLIAM FARR GOODWIN, OF STELTON, NEW JERSEY.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 260,383, dated July 4, 1882.

Application filed April 3, 1882. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM FARR GOODWIN, of Stelton, in the county of Middlesex and State of New Jersey, have invented certain new and useful improvements in steam-engines for effecting one complete revolution of the crank-shaft to one stroke of the piston and reducing the number of valve-reverses one-half (as compared with the ordinary engine, in which latter two strokes of the piston produce one revolution of the crank-shaft) without changing the relations of power and speed of the piston and crank-shaft, and in which it is possible to work a piston-stroke four times the length of the crank, or longer, if desired, to maintain the piston-speed; or a shorter stroke may be employed and the same power maintained by enlarging the area of the piston in proportion as the stroke is diminished. The length of motion of the connecting-couples is not arbitrary, but may vary to suit various purposes and situations wherever steam-power and other expansive force may be employed through the medium of an engine; and the following lucid description, with reference to the drawings of this specification, will enable those skilled in the art to which my invention appertains to understand how the same is made and operated for practical use.

Figure 1, Sheet 1, is a sketch of a locomotive embodying my invention, representing a longitudinal side elevation, showing my invention as the medium by which and through which connection is made and power transmitted to the crank and driving-wheels. Fig. 2, Sheet 2, is a similar view of a stationary engine with part of the bed-plate cut away to show all parts of my invention which would be within the sides of the bed-plate. Figs. 3, 4, 5, and 6, Sheet 3, are detail views of the several parts of my invention detached.

Similar letters indicate similar parts in the several figures.

The objects of my invention are to make two complete revolutions of the crank-shaft where one was made before, and to require but one reverse movement of the valve to each revolution where two were required before to effect the same purpose; and the said objects are accomplished by means of the peculiar connection between the piston-rod and crank-wrist, composed essentially of the first four bars or pieces, marked A, B, C, and D, respectively, and jointed together at points marked M, N, O, P, and Q, respectively, and to the piston-rod H through the bars E and G, which latter, in connection with the bar F, serve as a parallel guide instead of a cross-head and slide; but, if preferable, under some circumstances one end of the connecting-bar E can be attached to a cross-head; but as one of the essential bars (marked A) acts as one of the parallels, only one bar (marked F) attached at one end (the cross-head end) of the bar or connecting-rod E is added to complete the system. The parallel bars are the simplest, and therefore afford the best motion.

The fixed pivots or fulcrums of the device are marked with the letters S for the base of indirect power and action; S′, for the fulcrum of changed motion at the elbow of the cranked lever, marked with letters C and D, with a brace-bar marked D′; S^2, the fixed end of the compensating-bar F as used with the locomotive, and shown in Fig. 1, Sheet 1.

The object of making the connecting-rod end of the vibrating lever D extend down within line with the axis of the driving-wheels is to cause the motion and momentum of the said parts to act in the line of motion of the locomotive to avoid shaking the locomotive up and down or bouncing or bounding it from the rail.

The operation of my invention is in the locomotive as follows: First, the backward stroke of the piston being finished, as represented, the toggle-joint N of bars A and B being pushed back to the extreme, and the fixed pivot S of the base-bar A being secured to the fixed bracket V, (which latter is secured to the main frame of the locomotive,) the joint N is forced through the arc of the radius of the bar A, which latter, being held down by its pivoted fulcrum, draws the bar B, joint O, and the short end C of the vibrating lever D down with it, and the long end of lever D is forced forward at Q, drawing the connecting-rods R′ and R^2, with crank-pins R, with it to the extreme forward position. The valve being reversed, steam enters the rear end of the cylinder and forces the piston forward again, drawing the toggle-joint N with it. When the piston is at half-stroke the bars A and B are in line vertically and the

cranks R are reversed to their backward extreme, and the ends of lever C D are at dotted lines *i i*, and a half-revolution of the driving-wheels is performed, and when the forward stroke of the piston is finished the joint N will be drawn forward into the position of the dotted lines *j*, and will draw down the end of the lever C at the joint O, and the revolution of the driving-wheels is complete with the one stroke of the piston. It is therefore obvious that one full movement of the toggle-bars from side to side effects two movements of the vibrating lever C D and cranks R, thus producing one revolution to each single stroke of the piston, thus reducing the valve motions one-half, and by the increased size of cylinder, either in length of stroke or diameter, the power is maintained, while one-half more time is gained in which to use steam expansively and clear the cylinder of back-pressure from cramped exhaust-steam, thus performing in part the function of a compound engine, as the action is the same as though two cylinders were used. The steam can be cut off at any desired point of the stroke and worked expansively for the remainder, and if the steam is cut off at half-stroke, then one-half revolution would be effected with live steam at full pressure, and the other half with expansive steam only. These advantages are very great for high-speed engines, and especially for locomotives and electric lights. The one-half of the dead-centers being passed without reversing the motion of the piston, the one-half of whatever is lost by reverse of action is gained, and also whatever is due to the continuous movement of the piston and momentum of parts in one direction for one-half the time. There is no gain or no loss in the system of mechanism employed to effect the purposes accomplished by my invention.

Fig. 2 is a similar view of the same device slightly modified and adopted for stationary purposes, the only difference being in the form and position and points of attachment of the vibrating lever C D; but all difference of form or position of the parts or points of attachment is merely incidental to the different purposes and requirements for which the device is used with the steam-engine.

Figs. 3, 4, 5, and 6 in Sheet 3 show plans of construction. According to my rules, the best proportions of the four links or bars A B E F should be their equal length between centers. They should also be of equal length with the stroke of the piston. The difference in the leverage of the ends C and D of the vibrating lever is compensated by the length of piston-stroke on the toggle principle, and distance, power, and time being equivalents, no multiplication or reduction of either takes place or is sought in the practical application of my invention, but simply to double the number of revolutions per strokes of piston and dispense with one-half the number of valve-reverses per strokes of piston, and benefit by the advantages thus gained.

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

1. The device composed of bars A, B, C, D, E, and F, arranged to act intermediately between the piston-rod and crank-rod, serving to connect and transmit the power and motion of the piston to the crank and imparting to the latter one revolution to one stroke of the piston and one reversed motion of the valves, substantially as described.

2. In combination with the piston-rod, vibrating beam or lever, and crank-rod of a steam or expansive power engine, the jointed bars A and B, arranged intermediately between the piston-rod and vibrating beam or lever in such a manner that the power and motion are transmitted from the piston-rod through the bars A and B to the vibrating beam or lever, and thence through the crank-rod to the crank and shaft, imparting to the latter one revolution for one stroke of the piston, substantially as described, for the purpose set forth.

WILLIAM FARR GOODWIN.

Witnesses:
CHAS. H. HOUGHTON,
CHAS. H. KENASTON.