

No. 637,346.

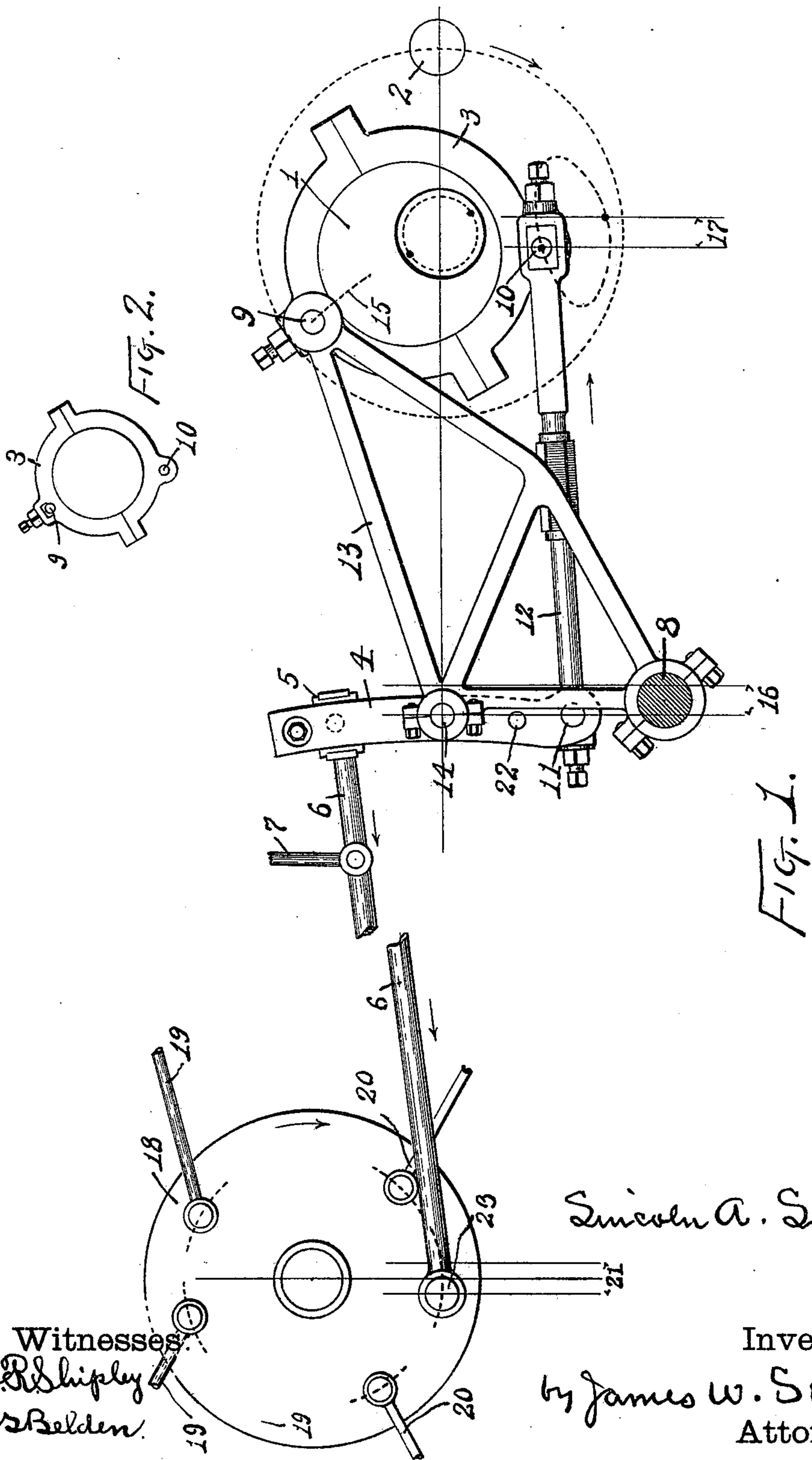
Patented Nov. 21, 1899.

L. A. LANG.  
VALVE GEAR.

(No Model.)

(Application filed Mar. 17, 1899.)

2 Sheets—Sheet 1.



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Inventor

by James W. See

Attorney

Witnesses  
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Mrs. Belden.

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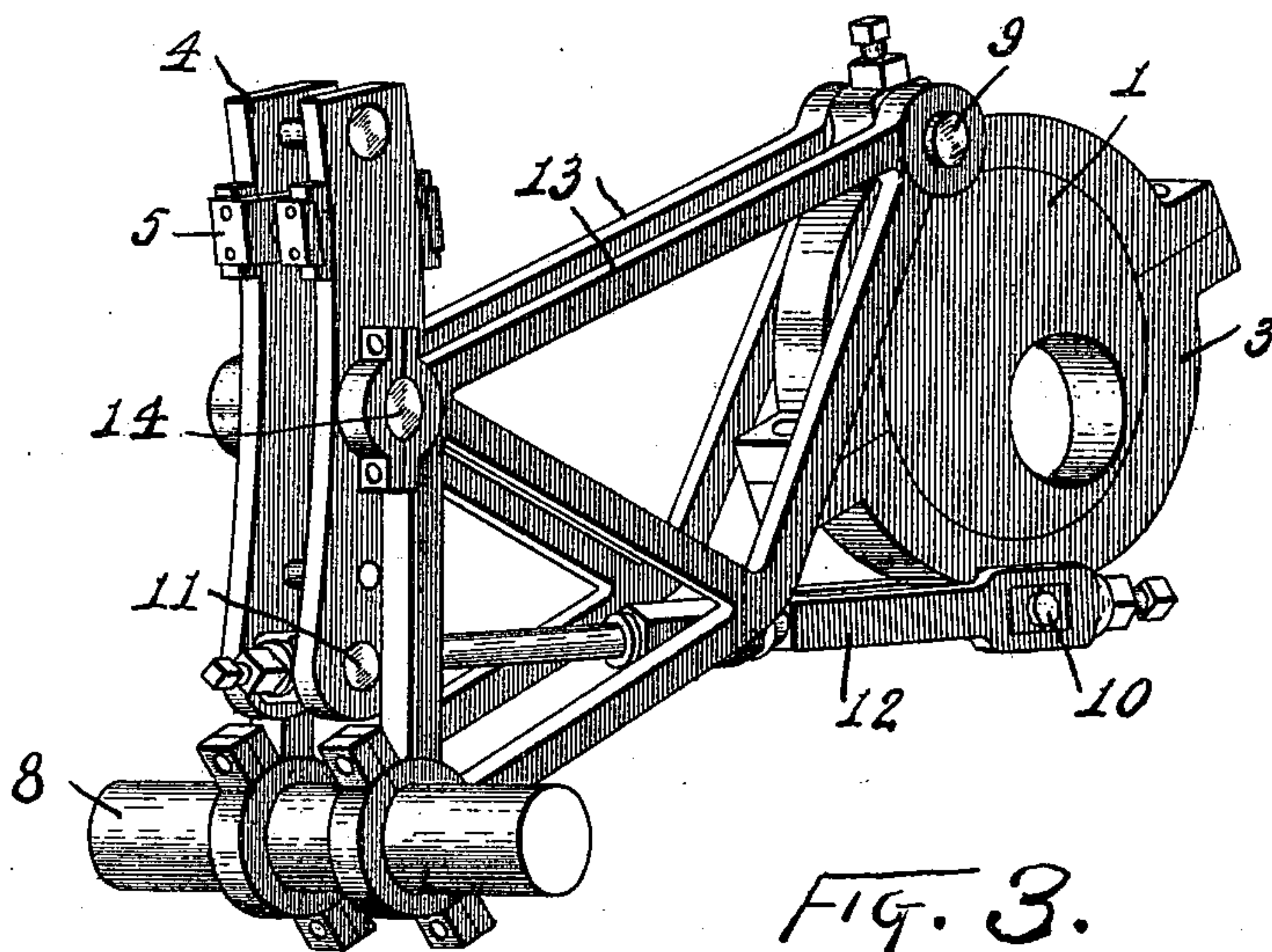
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Attorney



# UNITED STATES PATENT OFFICE.

LINCOLN A. LANG, OF YULE, NORTH DAKOTA, ASSIGNOR OF ONE-HALF TO  
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## VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 637,346, dated November 21, 1899.

Application filed March 17, 1899. Serial No. 709,459. (No model.)

*To all whom it may concern:*

Be it known that I, LINCOLN A. LANG, of Yule, Billings county, North Dakota, have invented certain new and useful Improvements in Valve-Gears, (Case E,) of which the following is a specification.

This invention, pertaining to valve-gears of the link type, will be readily understood from the following description, taken in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of a valve-gear exemplifying my improvement; Fig. 2, a side elevation of the eccentric-strap on a reduced scale, and Fig. 3 a perspective view of the eccentric and its immediate accessories.

In the drawings, 1 indicates the eccentric; 2, the crank-pin shown as on the back center, understanding the back center to be the one farthest from the cylinder; 3, the eccentric-strap, which is rodless; 4, the link vertically disposed forward of and in the vertical plane of the eccentric; 5, the link-block; 6, the link-rod pivoted to the link-block, its length representing the radius of the link; 7, a suspender for adjusting the link-block in the link, this suspender to have connection with any suitable adjusting device, such as a governor for automatic adjustment or a quadrant-lever for hand adjustment; 8, a fixed pivot disposed below the lower end of the link; 9, a pivot carried by the upper portion of the eccentric-strap; 10, a pivot carried by the lower portion of the eccentric-strap; 11, a pivot carried by the lower end of the link; 12, a coupling-bar pivoted to pivots 10 and 11; 13, a bell-crank oscillating on pivot 8 and having the extremity of its long arm connected with pivot 9 of the eccentric-strap, this bell-crank being formed of a pair of side members straddling the link and the eccentric-strap, each side member being of trussed skeleton form; 14, pivots carried by the link at about its mid-length and engaged by the extremities of the short arms of the bell-crank members; 15, the path of pivot 9; 16, a horizontal distance traversed by pivots 14 and 11 and the link in virtue of the movement of pivot 9 through its path 15; 17, a horizontal distance between points of travel of pivot 10, corresponding in time with the travel of pivots 11 and 14 through distance 16; 18, a wrist-

plate having connected with it the link-rod 6; 19, steam-valve rods connected with the wrist-plate; 20, the exhaust-valve rods connected with the wrist-plate, the wrist-plate and its valve-rods being, as usual, in wrist-plate valve-gears; 21, a horizontal distance representing the angular motion of the wrist-plate, due to the horizontal translation of the link through distance 16; 22, an extra pivot carried by the lower portion of the link, and 23 the main wrist of the wrist-plate, the one to which link-rod 6 is connected.

In Fig. 1 wrist 23 is at the left-hand extremity of distance 21. In this position the arc of link 4 is normal to link-rod 6, which forms its radius. Consequently while the link is in this position the lead is not altered while the link-block is being swept throughout the length of the link. Crank-pin 2 is at this time on the center. If the crank-pin be advanced to the opposite center, then pivot 9 will be swept to the lower extremity of its travel-line 15, the result being that pivot 14 is carried to the right the distance 16. During this crank travel pivot 10 will have traversed the left portion of its elliptical path and reached the right-hand extremity of distance 17, thus drawing pivot 11 back distance 16, distances 16, 17, and 21 being equal and representing the lap-and-lead requirements of valve motion. When the crank-pin shall thus have reached the opposite center, the link, which has been shifted to the right, comes again normal to link-rod 6. It follows that the link is normal to the link-rod when the crank is on either center and that lead will be constant for all positions of the block in the link. This shifting of the link the distance 16 is accomplished by the movement of pivot 9 through its path 15, the movement of pivot 10 securing normality for link position relative to its link-rod when the crank is on either center. The movement of pivot 10 sidewise beyond points comprehended by horizontal distance 17 becomes effective in oscillating the link upon pivot 14 and giving to the link-block the movements of port opening and closure, these movements being performed with extreme sharpness, comparatively long periods for entry and exhaust of steam being obtained. The sharpness of valve action is enhanced by the wrist-plate



action, the wrists of the valve-rods reaching the accelerating portions of their paths at the same time the link is making its most rapid movement of oscillation, the sum of the two  
 5 accelerations becoming potent on the valve-rods at periods corresponding with opening and closing the ports. If the link-block be adjusted in the link below pivot 14, then the direction of crank motion will be reversed,  
 10 the device forming a perfect reversing-gear having perfect constancy of lead and cut-off at all gears, together with peculiar sharpness of port-opening and cut-off, full port being obtained very early in piston travel. The distance required for lap and lead is controlled  
 15 by the proportionate length of the two arms of the bell-crank, and this may be planned for quite independent of the degree of port-opening, the degree of port-opening being  
 20 controlled by the distance of pivot 10 from the center of the eccentric. These two matters are therefore susceptible of being planned for independent of each other.

When employed as a reversing-gear, then  
 25 rods 20 may operate the exhaust-valves from the wrist-plate, as usual; but if reversal of engine motion is not desired then the link-block may traverse only the upper portion of the link, and the motion of the exhaust-valves  
 30 may, if desired, be derived from pivot 22, having constant stroke regardless of the adjustment of the link-block.

Reference is hereby made to my United States Patent No. 607,058, dated July 12,  
 35 1898, setting forth a link operated by a rodless strap through the medium of a bell-crank and a coupling-bar, the fixed pivot of the bell-crank being disposed above the link. In my present construction the pivot of the bell-crank is located below the lower end of the  
 40 link, and the change involves material modifications in the resulting motion of the valve. In the patented construction, as in the present construction, the path of the upper pivot  
 45 of the eccentric-strap was represented by the arc of a circle struck from the fixed pivot of the bell-crank. The enforced curvature of this path became reflected upon the valve motion as a deformity. An attempt to de-  
 50 crease the curvature of this path by lengthening the long arm of the bell-crank was inconsistent with a desired great difference between the length of the bell-crank arms. In the present construction the fixed  
 55 pivot of the bell-crank being located below the lower end of the link permits of a great extension of the long arm of the bell-crank and of an increase in the difference between the lengths of the two arms of the bell-crank.  
 60 This permits of the reduction of the lap-and-lead motion transmitted to the link center and at the same time permits of a correspondingly larger eccentric throw, resulting in a still faster tipping motion for the link on its  
 65 pivots, which of course accentuates the quick motion of the valve when opening and closing

the ports. The permitted increase in the throw of the eccentric is of high importance in reducing the ratio of lost motion in the eccentric to the full throw of the eccentric. 70  
 There must be necessarily some lost motion in the fit of the eccentric-strap upon the eccentric, and this lost motion will increase by wear. The greater the permissible throw of the eccentric the less becomes the disturbing 75  
 value of this lost motion. Again, in the present construction the permitted increase in the length of the bell-crank brings about an increase in the length of the coupling-bar 12 and lessens its angular vibration, thus im- 80  
 proving the action of the link upon the valve motion.

Again, in the patented construction the proportioning of the bell-crank necessarily threw its fixed pivot some distance outward from 85  
 the central line of the engine, requiring special facilities for the support of this pivot in various types of engines—as, for instance, in vertical marine engines. In the present construction notwithstanding the increased 90  
 length of the bell-crank its fixed pivot takes a position well inward, where it may conveniently find support upon the usual frame-columns of engines of the class just referred to. Again, in the patented construction en- 95  
 forced proportioning of the bell-crank brought the link so close to the eccentric-strap that any adjusting attachments, suspenders, or the like connected with the link-rod would necessarily have to be made upon the side of 100  
 the link farthest from the eccentric-strap, while in the present construction there is plenty of room permitted between the link and the eccentric-strap for adjusting attach- 105  
 ments to inward prolongations of the link rod or block, if desired.

The expressions "vertical," "right" and "left," and "above" and "below" have been employed; but it is to be understood that these terms are relative only. 110

I claim as my invention—

In a valve-gear, the combination, substantially as set forth, of an eccentric, a rodless strap therefor, an upper and a lower pivot carried by said strap, a vertical link, a link- 115  
 block sliding therein, a valve-rod pivoted to the link-block, a central pivot of oscillation carried by the link, a pivot carried by the lower end of the link, a fixed pivot below the lower end of the link, a bell-crank mounted 120  
 on said fixed pivot and having its short arm connected with the pivot of oscillation of the link and having its long arm connected with the upper pivot of the eccentric-strap, and a coupling-bar diagonally crossing the line of 125  
 the long arm of said bell-crank and connecting the lower pivot of the link with the lower pivot of the eccentric-strap.

LINCOLN A. LANG.

In presence of—

CHAS. N. BELL,

MARION F. CRAWFORD.