No. 659,750. Patented Oct. 16, 1900.

L. A. LANG.

VALVE GEAR.

(Application filed Jan. 25, 1900.)

(No Model.)

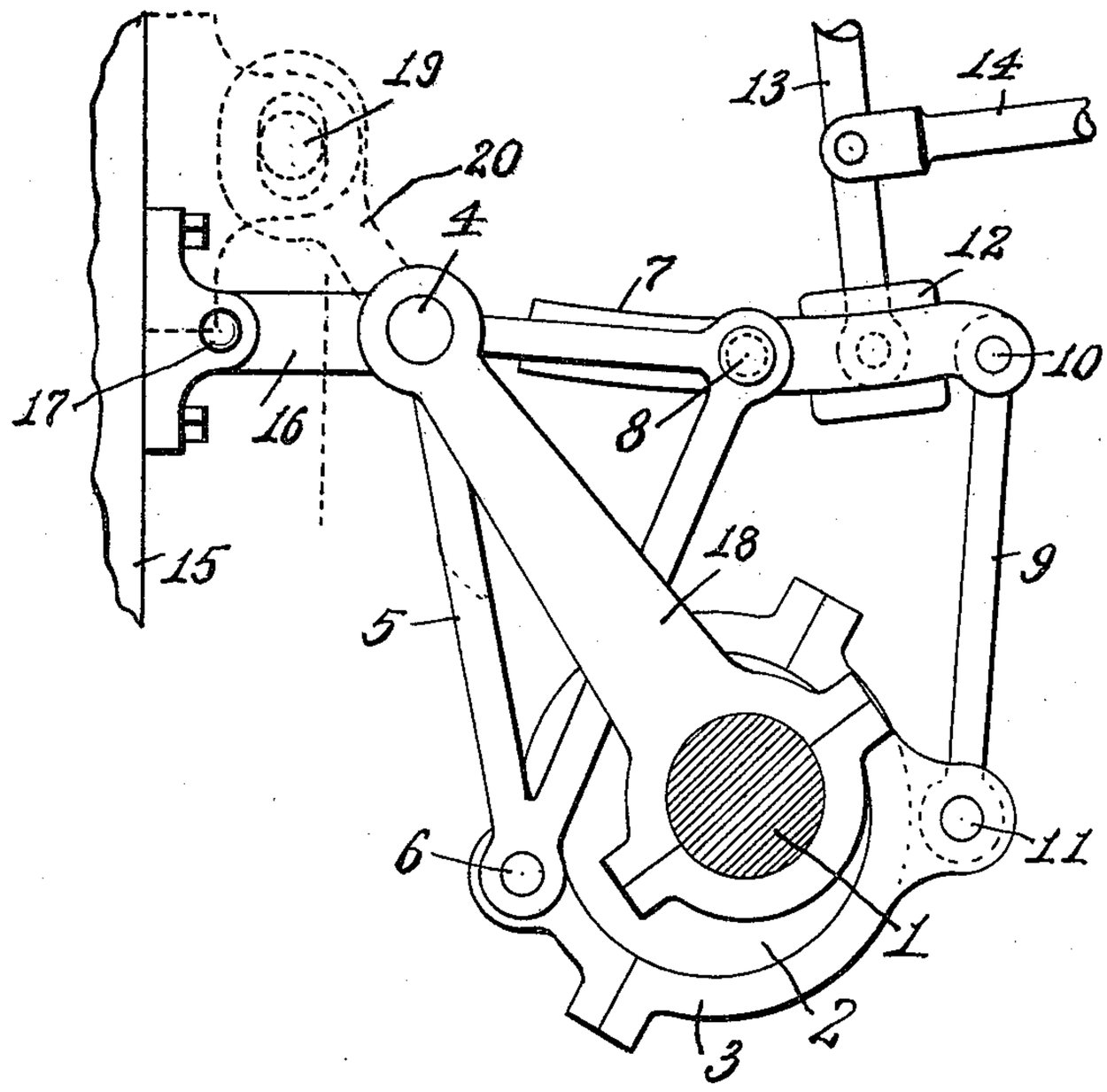

FIG. 1.

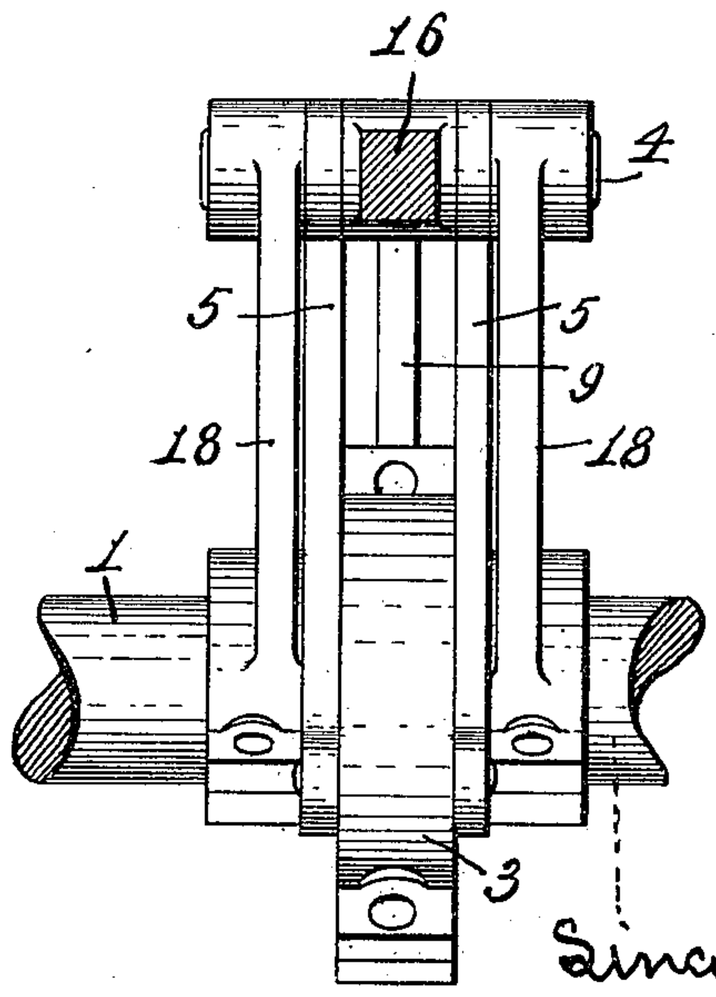

FIG. 2.

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UNITED STATES PATENT OFFICE.

LINCOLN A. LANG, OF YULE, NORTH DAKOTA, ASSIGNOR TO THE LANG RADIAL VALVE GEAR COMPANY, OF ST. PAUL, MINNESOTA.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 659,750, dated October 16, 1900.

Application filed January 25, 1900. Serial No. 2,749. (No model.)

To all whom it may concern:

Be it known that I, LINCOLN A. LANG, a citizen of the United States, residing at Yule, Billings county, North Dakota, (post-office address, St. Paul, Minnesota,) have invented certain new and useful Improvements in Valve-Gears, (Case F,) of which the following is a specification.

Reference is hereby made to the following United States Letters Patent granted upon application by me for improvements in valve-gears—viz., No. 607,058, dated July 12, 1898; No. 621,828, dated March 28, 1899; No. 621,829, dated March 28, 1899; No. 637,345, dated November 21, 1899, and No. 637,346, dated November 21, 1899.

The present invention relates to an improvement applicable to valve-gears of the type set forth in the above-mentioned patents, and the invention 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 of the type set forth in the above-mentioned patents, but embodying an exemplification of my present improvement; and Fig. 2 is an elevation of the same viewed in a direction at right angles of Fig. 1 from the left, shackle 16 appearing in vertical section.

In the drawings, 1 indicates the engine-shaft; 2, the eccentric; 3, the eccentric-strap; 4, a pivot, to be considered for the present as a fixed pivot; 5, a bell-crank rocking on pivot 4; 6, a pivot uniting the long arm of the bell-crank to the eccentric-strap; 7, the link of the valve-gear; 8, a pivot uniting the short arm of the bell-crank to the link at about its mid-point; 9, a connecting-bar having one end connected with the eccentric-strap and the other end connected with the outer extremity of the link; 10, the pivot uniting bar 9 to the link; 11, the pivot uniting bar 9 to the eccentric-strap; 12, the link-block, adjustable along the link; 13, the radius-rod, pivoted to the link-block and going to the valve connections, and 14 the bridle-rod, by means of which the radius-rod and link-block are shifted in the link.

The parts thus far referred to will be recognized as constituting a valve-gear of the Lang type as set forth in the patents heretofore referred to and having the same mode of operation, the rotation of the eccentric serving, through bar 9, to oscillate the link upon pivot 8 and also serving, through bell-crank 5, to bodily move the link to and from the shaft, there resulting a reversible valve-gear having but a single eccentric and possessing superior functional capacities.

Pivot 4, on which bell-crank 5 rocks, is to be viewed as a fixed pivot having a certain relationship to the shaft and other parts, and it will be obvious that an improper disturbance of the relationship of pivot 4 to the shaft may disturb the functional accuracy of the valve motion, which functional disturbance, while it might not be serious, becomes specially worthy of consideration in a valve-gear possessing the high measures of economical capacity found in the Lang gear.

Fig. 1 as drawn illustrates a gear for a vertical engine and shows the gear as applied in practice to marine engines. Pivot 4 being a fixed pivot some suitable support must be found for it, and such support has generally been founded upon one of the columns or some other part of the framing of the engine or upon a rigid standard projecting upwardly from the bed-plate. Let 15 indicate any fixed part of the engine-frame and let it be assumed that this part 15 rigidly supports fixed pivot 4. Under these assumed conditions everything will be quite satisfactory; but in marine engines engaged in long runs the main shaft will become vertically loose in its bearings and susceptible of a rising-and-falling motion therein at each turn of the engine to an extent of as much as an eighth of an inch in some cases. This vertical disturbance of the position of the center of the shaft will reflect upon the accuracy of the valve motion to some extent, and it is desirable to avoid it. I therefore cut pivot 4 loose from the engine-frame and mount it on a radial stretcher 18, having one end encircling the shaft. The result is that any rising-and-falling motion of the shaft produces an equivalent rising-and-falling motion of pivot 4, thus compensating for the disturbance in the position of the shaft. Pivot 4 having thus been cut loose from the engine-framing would tend to swing upon the shaft. I prevent this by introduc-

ing restraining-link 16, having its outer end pivoted to some fixed part of the engine structure. This link may be light, its only duty being to restrain the revolution of pivot 4 as the shaft turns, the link forming a guide for pivot 4 as it is moved vertically by the action of the shaft with stretcher 18. The swinging of link 16 obviously causes pivot 4 as it rises and falls to move through the arc of a circle, such departure from a straight line of motion being quite immaterial. In the case illustrated the inner pivot of link 16, connecting it with stretcher 18, coincides with pivot 4 of the bell-crank; but such coincidence is not at all essential, the position of the pivot uniting the outer end of link 16 to stretcher 18 taking such position relative to pivot 4 of the bell-crank as the exigencies of the valve-gear adaptation may call for. As link 16 is designed to furnish merely a restraint against revolution of stretcher 18, a full equivalent may obviously be found in other forms of restraining-guides connecting stretcher 18 with some fixed part of the engine structure. In Fig. 1 I have illustrated in dotted lines an obvious substitute for the link 16, the same consisting of a pivot 19 in a slotted guide connecting an extension 20 of stretcher 18 with the engine-framing.

Fig. 1 has thus far been assumed as illustrating the application of the Lang gear to a vertical engine. Now turn Fig. 1 till part 15 is uppermost, the valve-gear of a horizontal engine thus being illustrated. Assume it to be a locomotive-engine and that shaft 1 is capable of considerable rising-and-falling motion with reference to part 15, as exemplified in the spring-mounted axle-bearings of a locomotive. In one of the patents above referred to, No. 621,829, the effect of this motion of the axle upon the valve movement was considered and provided for by mounting pivot 4 on an eccentric having connection with the spring-mounted axle-box, so that the rising and falling of the box turned the eccentric and gave a compensating adjustment to pivot 4. Fig. 1 has heretofore been considered as compensating for the vertical movement of shaft 1 in a vertical engine, and at first glance it might appear that the merit of stretcher 18 was limited to cases in which it was desired to compensate for errors due to the motion of the shaft in the direction of the motion of the valve and that in the case of a locomotive, where the shaft has a very considerable degree of motion in a direction at right angles to the line of valve motion, the merits of stretcher 18 would disappear; but upon analysis it would be found that stretcher 18 is capable of fully compensating for the otherwise disturbing motions of the shaft in horizontal engines or locomotives as fully as the system of Patent No. 621,829 and by mechanism decidedly preferable in view of the fact that the present mechanism is independent of the wear of the shaft in its boxes and at the same time avoids imposing the thrusts of the valve-gear upon the framing. Still having Fig. 1 upon its side, to illustrate the locomotive example, assume shaft 1 as moving upwardly. The effect is, obviously, to move pivot 4 to the right, and when shaft 1 moves downwardly then pivot 4 will be swung to the left. It follows that any motion of shaft 1 in any direction whatever relative to the fixed parts of the engine structure will cause certain movements of pivot 4 and of all parts of stretcher 18. Given stretcher 18, with its movements due to the disturbing movements of the shaft, there may be located upon the stretcher a point for pivot 4 in perfect compensation for the movements of the shaft, the point of location for pivot 4 upon the stretcher being dependent largely upon the general angular relationship of radius-rod 13 to stretcher 18.

It is to be noticed that stretcher 18 meets the direct thrusts of the valve-gear motion, there being imposed upon the framing only such strain as is incident to the revolution of pivot 4 about the shaft.

In Fig. 2 stretcher 18 is illustrated as formed of duplicate members straddling the eccentric, a similar construction being carried out in bell-crank 5, this double-member system being, obviously, a preferable one in the case of large engines.

I claim as my invention—

In a valve-gear, the combination, substantially as set forth, of a shaft, an eccentric thereon, a rodless eccentric-strap carrying a pair of pivots, a stretcher engaging the shaft, a guide for the outer end of the stretcher, a pivot carried by the stretcher, a bell-crank lever mounted on said pivot and capable of pivotal motion only with reference to said stretcher and having one of its arms engaging one of the pivots of the eccentric-strap, a link pivoted to the other extremity of said bell-crank lever, and a connecting-bar connecting the other pivot of the eccentric-strap with the link.

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