No. 751,769. PATENTED FEB. 9, 1904.

O. W. YOUNG.

VALVE GEARING.

APPLICATION FILED AUG. 1, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

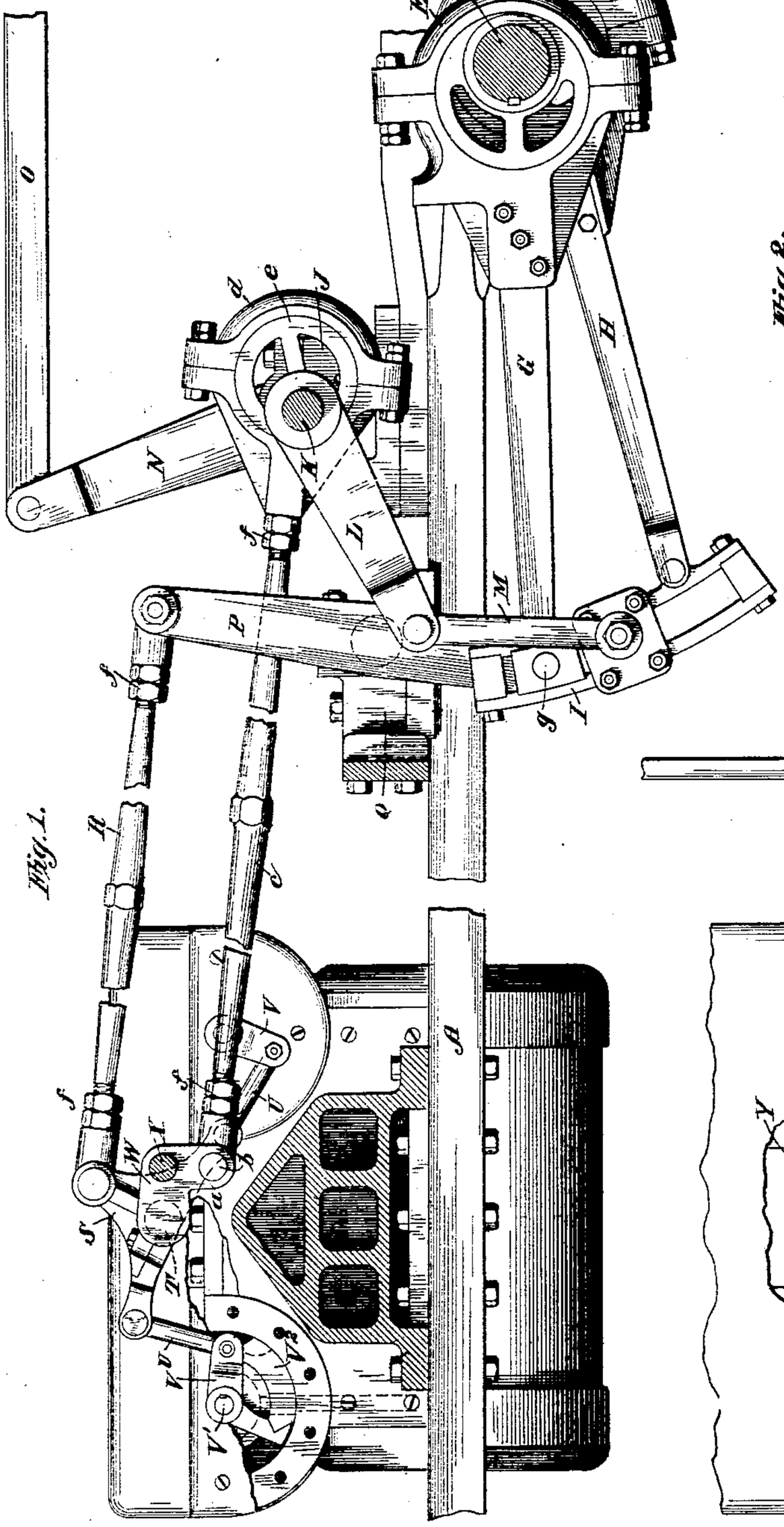
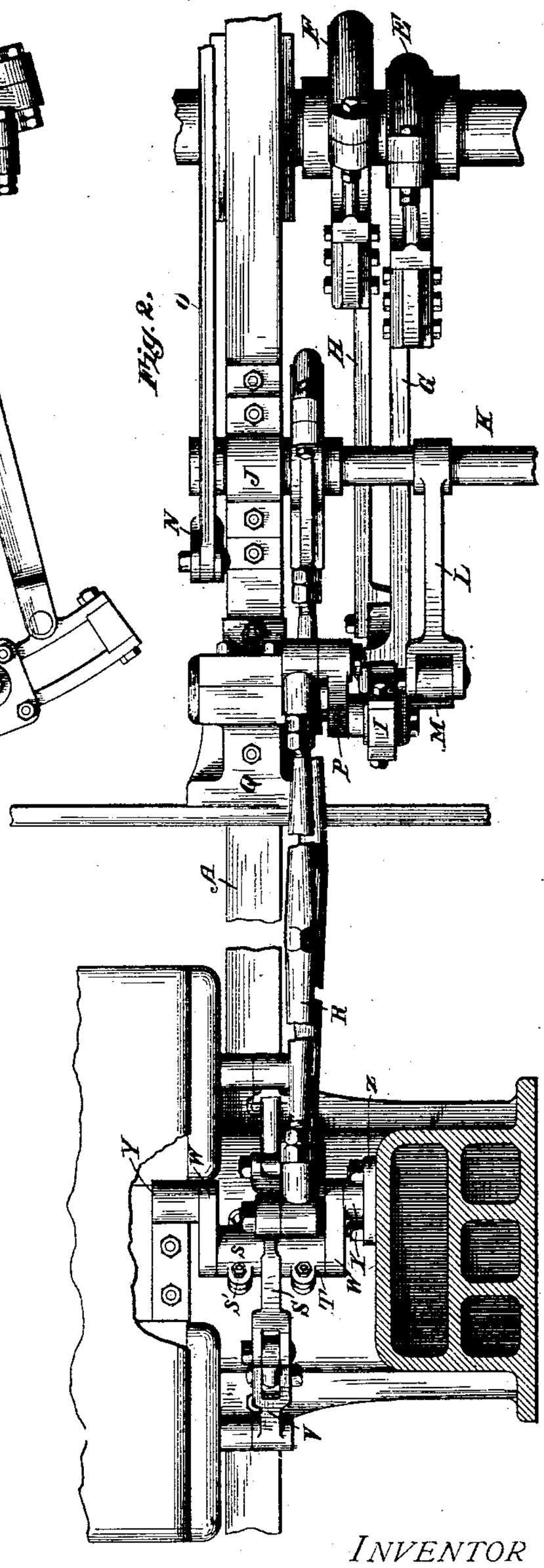


Fig. 2.



WITNESSES:

H. S. Austin

J. A. Williams

INVENTOR

Otis W. Young

BY

L. S. Bacon

Attorney

No. 751,769. PATENTED FEB. 9, 1904.

O. W. YOUNG.

VALVE GEARING.

APPLICATION FILED AUG. 1, 1901.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

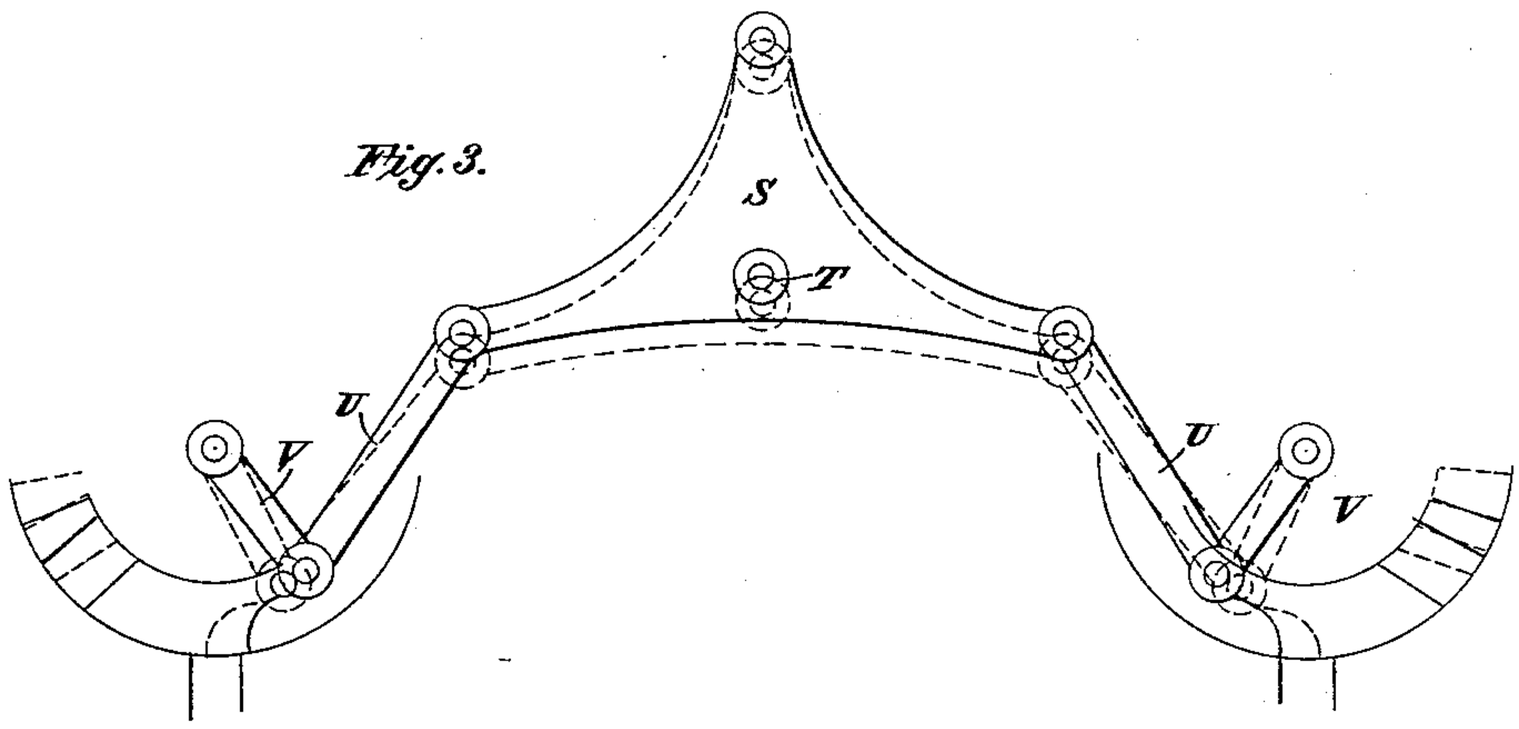


Fig. 4.

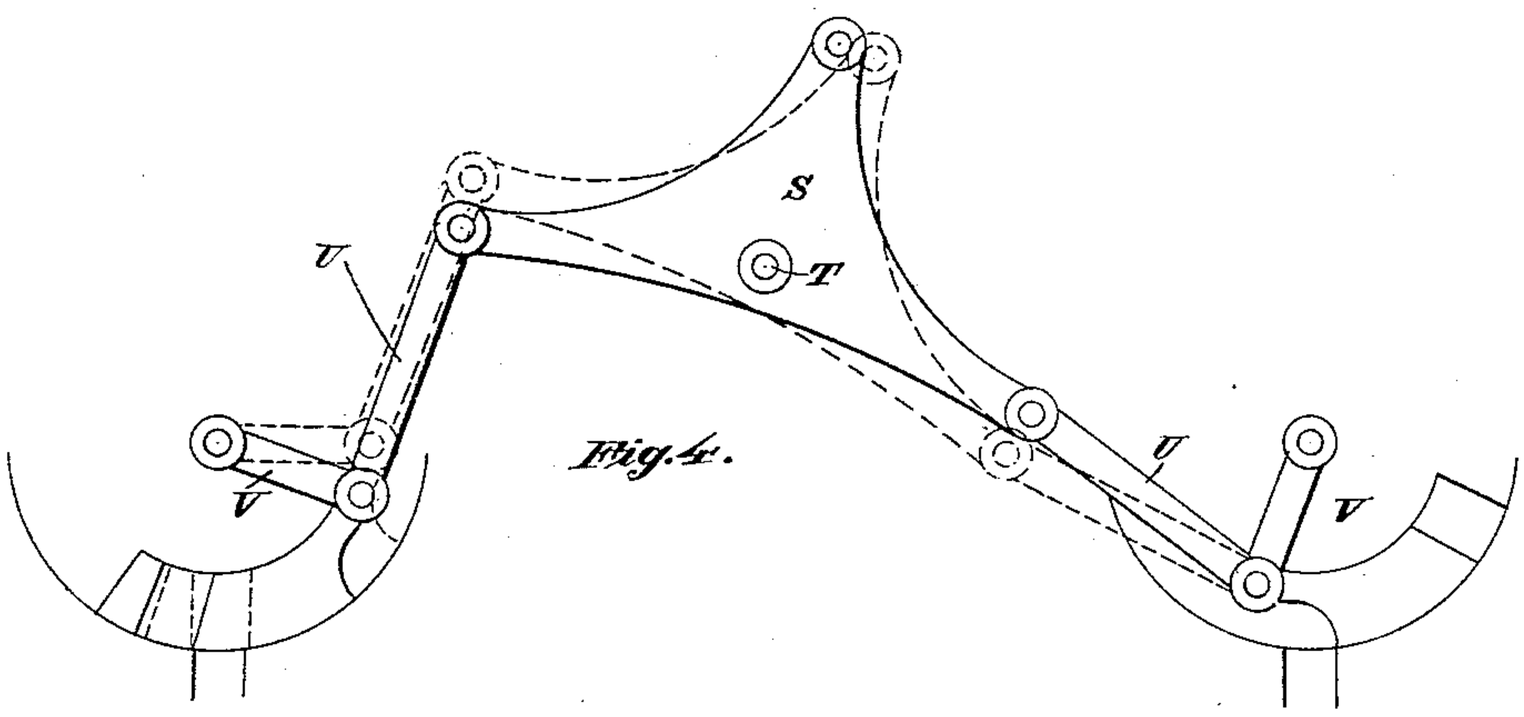


Fig. 5.

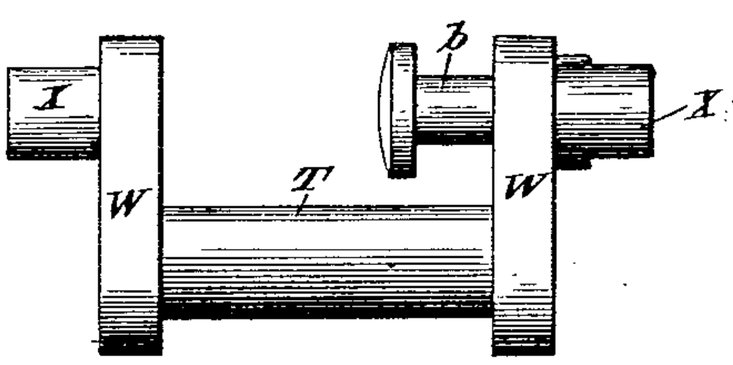
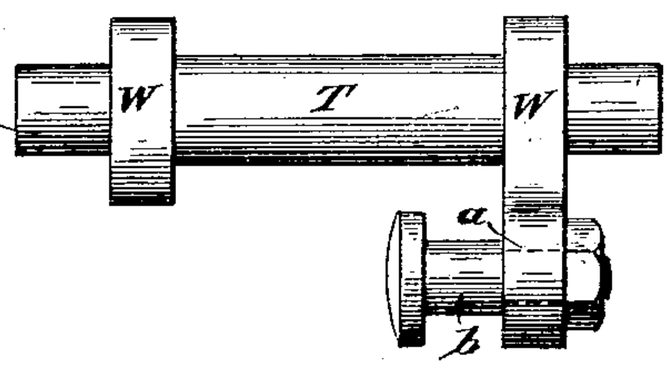


Fig. 6.



INVENTOR

WITNESSES:

H. S. Austin

J. P. Williams

BY Otis W. Young

L. S. Bacon

Attorney

No. 751,769. Patented February 9, 1904.

UNITED STATES PATENT OFFICE.

OTIS W. YOUNG, OF ROCKFORD, IOWA.

VALVE-GEARING.

SPECIFICATION forming part of Letters Patent No. 751,769, dated February 9, 1904.

Original application filed November 8, 1900, Serial No. 35,785. Divided and this application filed August 1, 1901. Serial No. 70,511.

(No model.)

To all whom it may concern:

Be it known that I, OTIS W. YOUNG, a citizen of the United States, residing at Rockford, in the county of Floyd and State of Iowa, have invented certain new and useful Improvements in Valve-Gearing; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improvement in valve-gearing, and it is embodied in the construction, arrangement, and combination of parts presently to be described, and defined in the claims.

It is now a recognized fact that one of the most serious obstacles encountered in the effort to attain high speed and fuel economy in locomotives and other engines is in securing proper valve action, and it is also a recognized fact that the present best forms of valve mechanisms, especially such as are adapted for locomotive construction, are inadequate when a speed greater, say, than sixty miles an hour is to be attained and so largely for the reason that for speeds greater than sixty miles an hour the fuel consumed is relatively increased at such a ratio and to such a proportional extent that for general purposes high speed is prohibited. Such being the condition as at present existing, the object of my invention is the provision of means and mechanisms whereby the valve-motion may be properly controlled, so that the highest practicable rate of speed may be attained, a construction which will lessen the strain upon the working parts and avoid in that particular unseeming or dangerous ruptures and which will produce the best results from the fuel consumed. The objects thus attained result in the securing of more efficient economy in steam distribution than has heretofore been found feasible.

The invention, as stated, relating to valve-gearing is designed largely for application to the rotary or oscillatory valve and is especially applicable to the construction of valves shown in my application for Letters Patent filed on November 8, 1900, Serial No. 35,785, of which the present application is a division.

In the accompanying drawings is shown a practical embodiment of my invention when used in connection with the Stephenson link-motion, such as is in most general use in this country and as applied to a locomotive-engine using the style of valves above referred to; but I wish it understood that this form is employed for the purpose of illustration, and the principles of my invention are not limited in their useful application to the particular construction which is there delineated, as with slight modifications of form the elements of its combination can be readily applied to impart motion to other forms of valves and other classes of engines.

It is to be understood that the particular construction of valve stated and its associated parts are shown herein largely in diagram, as the same specifically in this particular application is not herein claimed, but forms the subject-matter of my aforesaid application.

In the drawings, Figure 1 represents a side elevation; Fig. 2, a plan. Figs. 3 and 4 are diagrams illustrating various mechanical effects. Figs. 5 and 6 are enlarged detail views of the cranks and shafts which constitute the bearing for the wrist-plate.

Similar letters refer to similar parts throughout the several views.

Referring to the drawings, A represents the engine-frame, forming the support or foundation to which the various parts are secured.

B is the driving-journal, to which are secured the eccentrics C and D. These eccentrics are embraced by the straps E and F, having rods or blades G and H, connected at their ends to the link I. Secured to the frame A is a box J, in which is journaled the tumbling-shaft K, to which is attached the lifting-arm L. The link I is supported by the arm L by the link-hanger H, which connects them. The reverse-rod N is fastened to the tumbling-shaft K and connects with the reverse-lever (not shown) by the rod O. This combination is commonly known as the "Stephenson link-motion," and by raising and lowering the link I the valves are moved for "go-ahead" or "back-up" motion and for various points of cut-off.

In the mechanism above described, which is, as stated, described for the purposes of illustration, the movement and general adjustments are well understood; but to effect proper adjustments of the valves and the direct action of the ports thereof I have employed the following mechanism: A rocker-arm P is journaled in a box Q, mounted on the frame A, and receives its motion from the link I, the link being attached to the lower end of the rocker-arm in any convenient manner. The upper end of the rocker-arm is pivotally connected with the reach-rod R, which in turn is connected to a wrist-plate S. The wrist-plate is conveniently in the form of a triangle, and is mounted centrally upon a transverse shaft T, located between the castings of the steam-chest and the steam-passages. The shaft T constitutes a rigid connection between the outer ends of two crank-arms W, which in turn are carried by stub-shafts X X′, mounted in suitable bearings Y and Z on the fixed part of the structure. The wrist-plate is provided with a suitable collar *s*, which extends on opposite sides thereof, as shown in Fig. 2, which embraces the shaft T and is held in position by the crank-arms W, the collar being split and held in position by suitable nuts and bolts *s′*. The upper arm of the wrist-plate is pivotally connected to the reach-rod R, while the opposite arms have pivotally connected thereto the valve-actuating rods U, which in turn are connected to the cranks V, rigid on the stem V′ of the valves V^2. This connection between the wrist-plate and the valves is such that the motion of the wrist-plate causes one valve to move with a gradually-increasing speed, while the other valve moves at a decreasing speed, thus securing a rapid opening and closing of the admission part and a dwell before closing the exhaust part, thereby utilizing to the utmost the advantages that have been proven to be valuable in the well-known "Corliss movement."

Extending at right angles to the arm W, carried by the shaft Z, is a crank-arm *a*, having a wrist-pin *b* thereon, this crank *a* conveniently extending downward, while the cranks W extend more nearly horizontal. The construction and arrangement of cranks and shafts represented at T, W, X, X′, and *a* are preferably and conveniently made in one piece or rigid one with the other, and it will be evident that in the absence of other supports the shafts would turn in their boxes. Secured to the lower crank *a* and the pin *b* is one end of the adjustable rod *c*, its other end being attached to the strap *d*, embracing the eccentric *e*, which is keyed to the shaft K. The rod *c* in this manner prevents the crank-shafts from turning in their bearing. The rods R and *c* are shown to be fashioned at their opposite ends with right and left hand threads, so that by turning in one direction will lengthen and in the other will shorten the distance between the points they connect, and the nuts *f* lock them in the desired position. It will be perceived that the eccentric *e* is secured to the shaft K in such a position that by moving the reverse-lever so as to bring the rod N in a vertical position, consequently turning the shaft K, raising the arm L, and the link I, so that the center of the link is opposite the pin *g* in the lower end of the rocker-arm, a straight line through the centers of the pin *b* and shaft K, Fig. 1, would intersect the circumference of the eccentric *e* at its greatest distance from the shaft K, thus pulling the rod *c*, and consequently lowering the shaft T, upon which the wrist-plate is mounted, and a continued turning of the eccentric *e* and raising of the link I until it is an equal distance above its central position to that previously occupied in its lower position would restore the wrist-plate bearing to its former position, and the link would then be in position for the back-up motion of an engine. While I prefer to use an eccentric for this purpose, the same result could be attained by securing an arm to the tumbling-shaft or forming the shaft in the shape of a crank. This automatic lowering of the wrist-plate as the link approaches a central position is for a purpose which will hereinafter be fully explained.

By the foregoing description it is evident that a rotary motion of the driving-journal B will, through the agency of the eccentric C, strap E, rod G, and link I, impart a rocking or oscillating motion to the arm P, and this motion being transmitted, by means of the rod R, to the wrist-plate S will cause a similar motion by the connection U to the cranks V, which operate the valve V^2.

By means of a mechanism such as above described I attain the following important advantages:

First. A better distribution of steam through a more perfect valve-motion than any of which I am aware, as reference to Fig. 4, in which the position of the valves is indicated by solid lines when in position for the left-hand valve to commence uncovering the inlet-port and by dotted lines when it has moved to its limit of overtravel after uncovering the port, shows that during the entire movement between these positions the valve then governing the exhaust-port remains practically stationary, the mechanism serving to cause a dwell in the movement of one of the valves, affording an uninterrupted flow of exhaust-steam. The exhaust-port being entirely uncovered before the admission-port commences to uncover and remaining uncovered until the admission-port is closed and the steam-supply into the cylinder cut off results in an early prerelease and late compression, thus reducing the back pressure upon the piston to a minimum. The leverage being such between these positions of the valves that a slight movement of the top of the wrist-plate

produces a greater movement of the admission-valve upon its seat, a rapid opening and closing of the inlet-port is thereby obtained, which results in high initial pressure against the piston at the beginning of its stroke, and this pressure is maintained during almost the entire period of admission.

Second. It is a well-known fact that in locomotives running at a high rate of speed it is more difficult to exhaust steam from the cylinders than it is to admit it. This is principally due to the fact that with the link-motion and slide-valves generally in use it is desirable to raise the link toward a central position as the speed increases, thus shortening the travel of the valve and cutting off the period of admission shorter and not only economizing in the use of steam, but reducing the amount to be exhausted. One of the defects, however, of this method is that shortening the period of admission also contracts the opening for exhaust and chokes the free exhaust just at the time when it is most needed. Another defect is that as the cut-off is shortened the lead of the valve is correspondingly increased, these two facts resulting in more compression and preadmission than are necessary to cushion the piston, and a very decided back pressure is thereby created, which causes a serious loss of power and makes it difficult and expensive to attain as high a rate of speed as is frequently desired. These defects are fully overcome by the mechanism herewith described for lowering and raising the bearing upon which the wrist-plate is mounted, for it is apparent that as the link approaches a central position, thus lowering the wrist-plate bearing, reference to Fig. 3, (in which the dotted lines show that lowering the wrist-plate changes the relative position of the valves toward each other and in their relation to the cylinder-ports,) demonstrates that the increased lead is counteracted, and as the throw of the eccentric *e*, Fig. 1, governs the movement of the wrist-plate bearing the designer of an engine has only to determine what portion of the variation he wishes to nullify, as either a uniform or constant lead or any desirable variation are practicable in this form of construction.

In addition to regulating the lead of the valves the adjustable wrist-plate bearing possesses the important advantage also of regulating the valve governing the exhaust, for, referring again to Fig. 3, it will be perceived that while the solid lines show both valves in their central position covering the two steam-ports, so that they lap over the inside edge of the ports, the dotted lines caused by lowering the wrist-plate exhibit the valve covering only a portion of the ports and producing an inside clearance instead of an inside lap. The beneficial results of automatically changing the adjustment of the valves for the lower points of cut-off, and consequently reducing the amount of preadmission and compression, and thus the excessive back pressure upon the piston, are that practically all the steam admitted into the cylinder is effective to its greatest force for useful work and having less back pressure to overcome may be cut off earlier in the stroke and the piston brought to a state of rest at the end of the cylinder by decreasing the force of the power propelling it, instead of counteracting it by an opposing power, and the further advantage resulting from diminishing these opposing forces are conducive to less strain upon the cylinder-heads and wearing parts.

The particular construction embodying the wrist-plate and its especial actuating mechanism has been found to be eminently satisfactory, but the principle of the invention there disclosed may be employed with other forms of construction and with entirely-different types of mechanism, which will result in securing either automatically or otherwise the dwell and a uniform lead of the valve movement. It will therefore be apparent that the invention is wider and broader in the general principle and scope than the details of construction shown and described herein.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is—

1. The combination with valves which control the inlet and exhaust, of an operating wrist-plate therefor; a movable bearing for the wrist-plate positioned and arranged relatively to the valves to increase the exhaust-lead by its adjustment in one direction, and means for so adjusting said bearing.

2. The combination with valves which control the inlet and exhaust, of an operating wrist-plate connected thereto; a movable bearing for the wrist-plate positioned and arranged to increase the lead by its adjustment in one direction, and means acting for so adjusting said wrist-plate bearing when the cut-off is shortened.

3. The combination with valves which control the inlet and exhaust, of an operating wrist-plate therefor; a crank-shaft on which said wrist-plate is mounted, positioned and arranged relatively to the valves to increase the exhaust-lead when the crank-shaft is rocked in one direction, and means operating said crank-shaft to so rock it, comprising an eccentric and a rod operated by the eccentric connected to the crank-shaft.

4. The combination with valves which control the inlet and exhaust, of an operating wrist-plate therefor, a movable bearing for said wrist-plate positioned and arranged relatively to the valves to increase the exhaust-lead by movement in one direction, operating means for so moving the wrist-plate bearing, a shifting link, means for shifting said link,

said means connected to the operating means for the wrist-plate bearing, substantially as described.

5. The combination with valves, of an operating wrist-plate therefor, a crank-shaft upon which said wrist-plate is mounted to rock, means for operating said wrist-plate, an eccentric, a rod operated by the eccentric and connected to said crank-shaft, and means for moving the eccentric, substantially as described.

6. The combination with valves, of an operating wrist-plate therefor, means for operating said wrist-plate, a crank upon which said wrist-plate is mounted to rock, and means for shifting the crank to change the position of the wrist-plate bearing, including an eccentric, a rod operated by the eccentric and connected to the crank-shaft and means for moving the eccentric, substantially as described.

7. The combination with valves, of an operating wrist-plate therefor, a movable bearing for said wrist-plate, means for operating said wrist-plate including a shifting link, an eccentric shifting with said shifting link, a rod operated by said eccentric and connected to the wrist-plate bearing and means for operating said eccentric, substantially as described.

8. The combination with valves, of an operating wrist-plate therefor, means for operating the wrist-plate, a movable bearing for the wrist-plate, an eccentric, a rod connecting the eccentric and wrist-plate bearing and means for adjusting said rod, substantially as described.

9. The combination with valves which control the inlet and exhaust, of a wrist-plate for operating the same, a movable bearing for the wrist-plate positioned and arranged relatively to the valves to increase the exhaust-lead by movement in one direction, means for so moving the bearing, and adjusting means to determine the amount of movement of the bearing, substantially as described.

10. In valve mechanism for steam-engines the combination with valves, of mechanism for causing the valves to travel with a uniform or constant steam-lead for all points of cut-off, and an increased exhaust-lead for the shorter points of cut-off, and means for actuating said mechanism.

11. In valve mechanism for steam-engines, the combination with valves, of a link mechanism and mechanism for relatively adjusting the valves to increase the exhaust-lead and reduce the steam-lead.

12. In a valve-gearing the combination with valves each of which operates alternately for inlet and exhaust, a link mechanism, and means for shifting the link, of a valve-actuating mechanism, a connection between the link mechanism and the valve-actuating mechanism, and means actuated by the link-actuated mechanism for shifting the valve-actuating mechanism for the purposes described.

13. In a valve-gearing the combination with valves each of which operates alternately for inlet and exhaust, of a link mechanism, means for shifting the link, a valve-actuating mechanism, a connection between the link mechanism and the valve-actuating mechanism, means for changing the active position of the valve-actuating mechanism and a connection between such changing means and the link-shifting means, substantially as described.

14. The combination with a link mechanism of a rocker-arm P, a wrist-plate, valves connected with the wrist-plate, an adjustable device, a pivotal connection between the adjustable device and the wrist-plate, link-shifting mechanism and a connection between the link-shifting mechanism and the adjustable device, substantially as described.

15. The combination with link mechanism and means for shifting the link, of oscillating valves each of which operates alternately for inlet and exhaust, a wrist-plate, a pivotal connection between the wrist-plate and the valves, an adjustable support for the wrist-plate, means connecting the said support with the link-shifting mechanism and a connection between the link mechanism and the wrist-plate, substantially as described.

16. In combination valve-seats, valves thereon each of which operates alternately for inlet and exhaust, and requiring to be moved in opposite directions to cover the corresponding ports of their respective seats; a member for operating the valves, and means for varying the spread or distance between their paths of travel on their respective seats.

17. In combination with the valves each of which operates alternately for inlet and exhaust; a member for operating them; a movable support for the operating member; and means for moving the support to vary the "spread," or distance between the paths of travel, of the valves.

18. In combination with the valves each of which operates alternately for inlet and exhaust; a pivoted member for operating them; links from such pivoted member to the valves respectively; a movable support for said operating member; and means for adjusting the support to vary the spread of the valves.

19. In combination with the valves each of which operates alternately for inlet and exhaust; a member for operating them; means for varying the spread of the valves; means for regulating the cut-off; and connections from the cut-off-regulating means to the spread-varying means for adjusting the latter automatically with the cut-off.

20. In combination with the valves a member for operating them; means for varying the spread of the valves; a rocking shaft for adjusting the cut-off; an eccentric on such rocking shaft; and connections from such ec-

centric to the means for varying the spread of the valves; whereby said spread-varying means is operated with the adjustment of the cut-off.

21. In combination with two valves which operate alternately as inlet and exhaust valves; means for operating such valves; and means for changing their relative positions to cause the lead of the valve operating as an inlet to be reduced at the same time that the valve operating as an exhaust-valve is caused to open earlier and close later.

22. In combination with two valves which operate alternately as inlet and exhaust valves; a member by which they are operated; a movable support for the operating member positioned and arranged relative to the valves so that by its adjustment the exhaust-lead can be increased and the steam-lead reduced; and means for moving the support.

23. In combination with two valves which act alternately as inlet and exhaust valves; a member by which they are operated; links connecting said operating member with the valves respectively; a movable support for said member; and means for adjusting such support to vary the spread or distance between the paths of travel of the valves.

24. In combination with two valves which act alternately as inlet and exhaust valves; a member for operating said valves; links from the operating member to the valves respectively trending in opposite directions; a movable support for said operating member; and means for adjusting it to vary the trend of the links.

25. In combination with two valves which act alternately as inlet and exhaust valves; a pivoted member by which they are both operated; links trending in opposite directions from said pivoted member connecting it to the valves respectively; a movable support for said pivoted member; and means for adjusting it to modify the trend of the links.

26. In combination with two valves which operate alternately as inlet and exhaust valves; means for adjusting their relative positions; means for adjusting the cut-off; and connections from the cut-off-adjusting means to the means for adjusting the relative position of the valves, arranged to retard the valve operating as an inlet when the cut-off is shortened, and advance the valve operating for exhaust.

27. In combination with two valves which act alternately as inlet and exhaust valves; a pivoted member by which they are both operated; and oppositely-inclined links connecting said pivoted member to the valves respectively.

28. In combination with two valves which act alternately as inlet and exhaust valves; a pivoted member by which they are both operated; and links trending in opposite directions from said pivoted member connecting said valves respectively, to operate them.

29. The combination with valves which operate for exhaust, of an operating wrist-plate therefor, a movable bearing for the wrist-plate, and exhaust-lead-regulating means for shifting the said bearing, substantially as described.

30. The combination with valves which operate for exhaust, of an operating wrist-plate connected thereto, a movable bearing for the wrist-plate, and exhaust-lead-regulating means acting for adjusting said wrist-plate bearing to different points of cut-off, substantially as described.

31. The combination with valves, of an operating wrist-plate therefor, a crank-shaft upon which said wrist-plate is mounted, and lead-regulating means for operating said crank-shaft to change the position of the bearing for the wrist-plate, comprising an eccentric, or crank, and a rod operated by the eccentric and connected to said crank-shaft, substantially as described.

32. The combination with valves, of an operating wrist-plate therefor, means for operating said wrist-plate, a crank-shaft upon which said wrist-plate is mounted to rock, and lead-regulating means for automatically shifting the crank-shaft to change the position of the wrist-plate bearing, including an eccentric, a rod operated by the eccentric and connected to the crank-shaft, and means for moving the eccentric, substantially as described.

33. The combination with valves which operate for exhaust, of a wrist-plate for operating the same, a movable bearing for the wrist-plate, lead-regulating means for moving the bearing and adjusting means to determine the amount of movement of the bearing, substantially as described.

34. In a valve mechanism for steam-engines, the combination with valves, of mechanism for causing the valves to travel with a uniform or constant steam-lead, combined with an increased exhaust-lead for the shorter points of cut-off; substantially as described.

35. In combination with two valves which operate alternately as inlet and outlet valves, a member by which they are operated, a movable support for the operating member, and lead-regulating means for moving the support

In testimony whereof I affix my signature in presence of two witnesses.

OTIS W. YOUNG.

Witnesses:
L. A. SANFORD,
B. R. MOORE.