

No. 894,555.

PATENTED JULY 28, 1908.

G. A. WEBSTER.
STEAM ENGINE INDICATOR.
APPLICATION FILED MAR. 25, 1908.

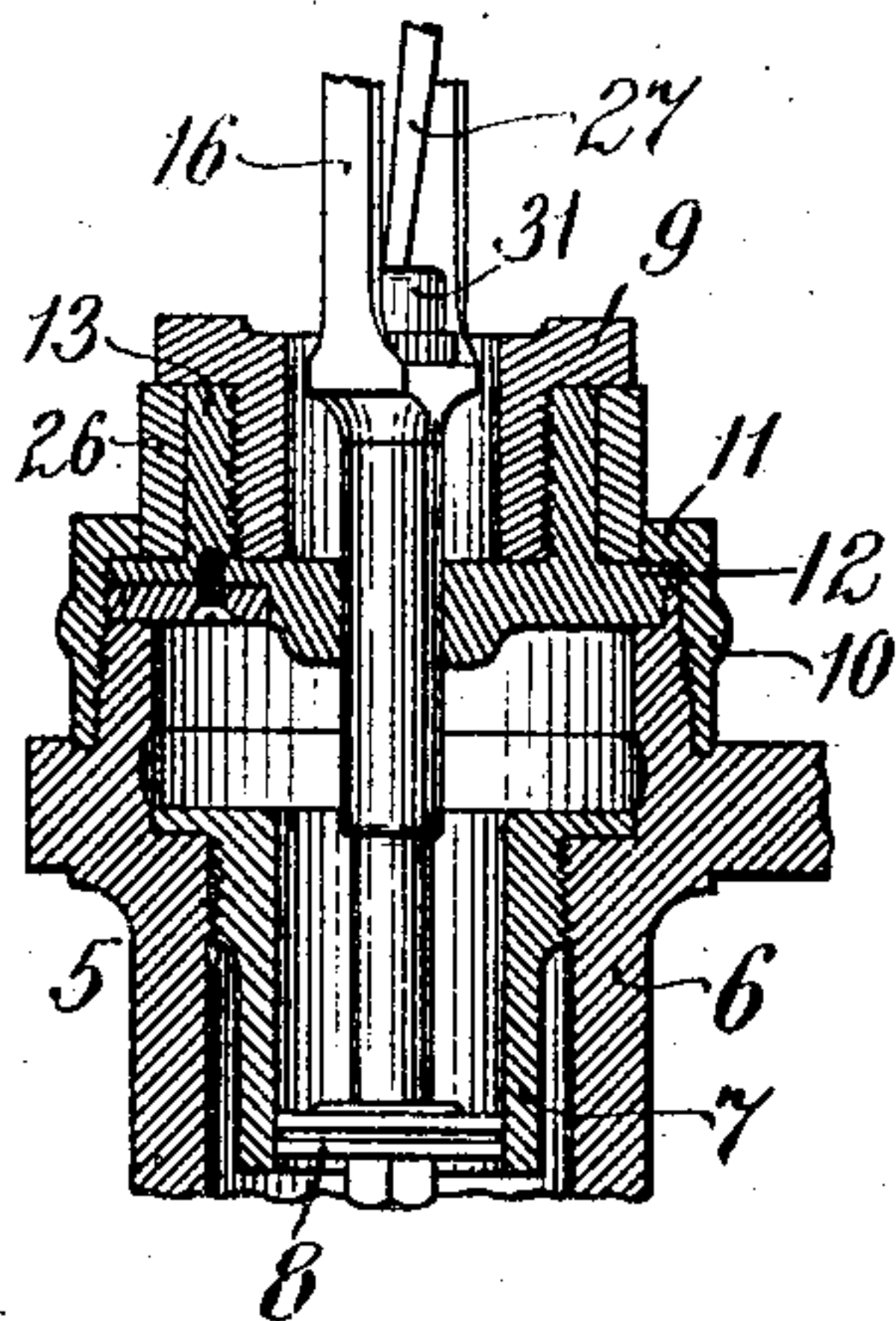


Fig. 2.

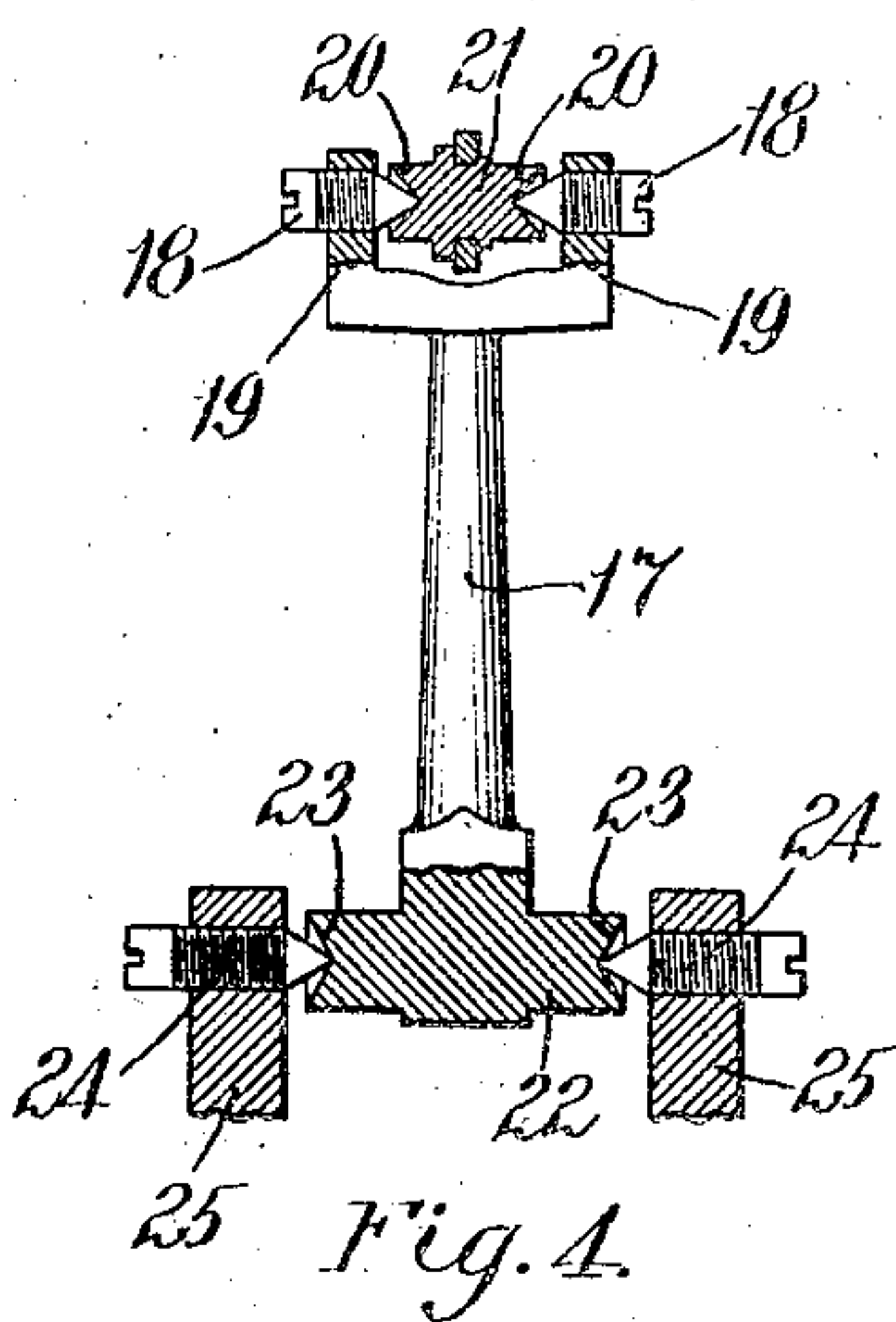


Fig. 4.

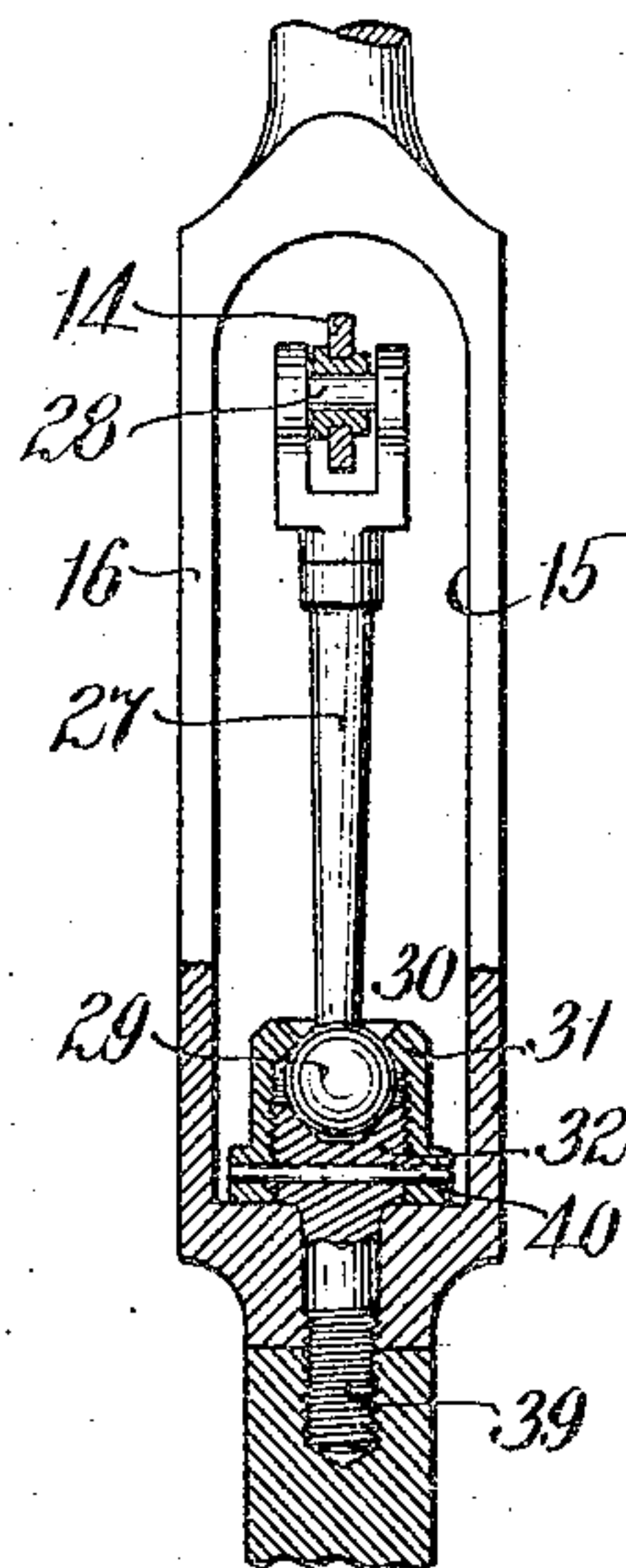


Fig. 3.

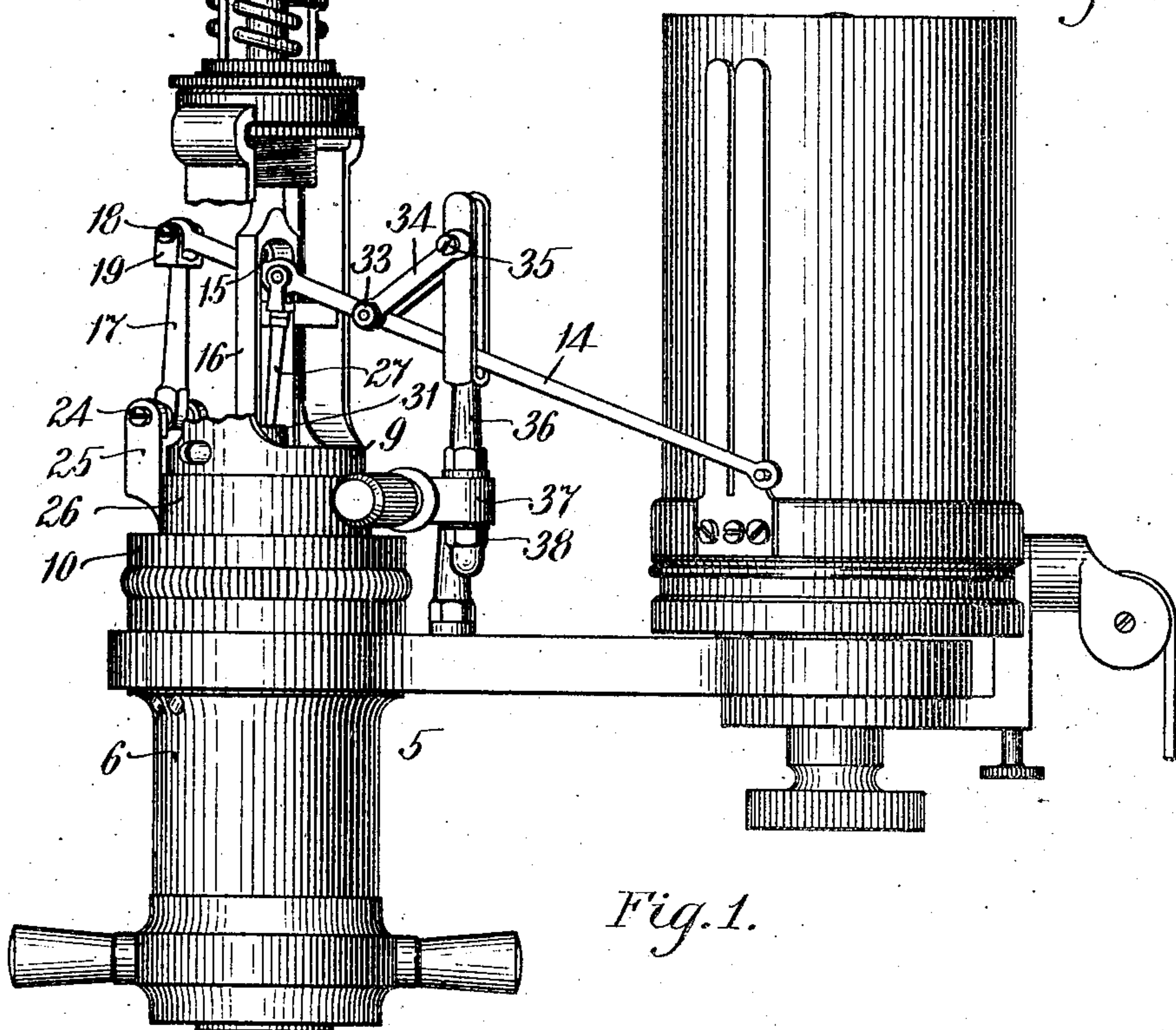


Fig. 1.

Witnesses.
Franklin E. Low.
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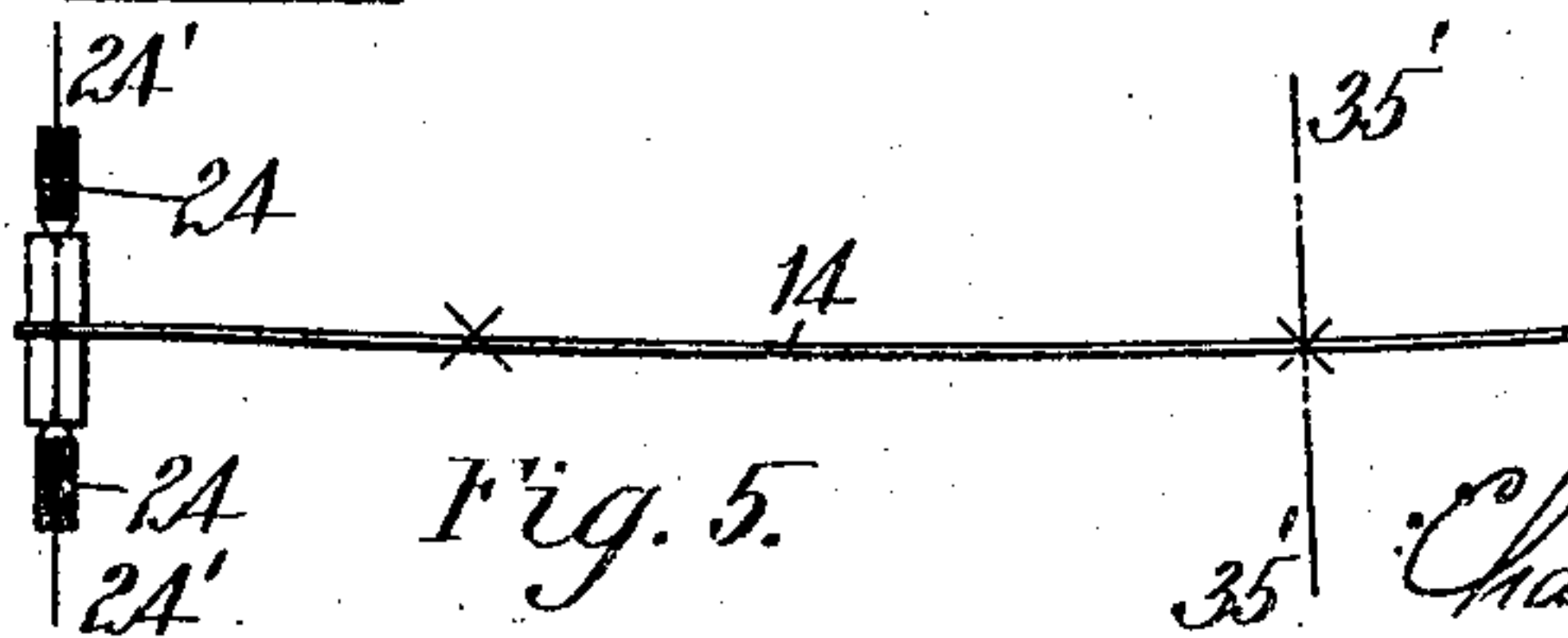


Fig. 5.

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UNITED STATES PATENT OFFICE.

GEORGE A. WEBSTER, OF SOMERVILLE, MASSACHUSETTS, ASSIGNOR TO STAR BRASS MANUFACTURING CO., OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

STEAM-ENGINE INDICATOR.

No. 894,555.

Specification of Letters Patent.

Patented July 28, 1908.

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To all whom it may concern:

Be it known that I, GEORGE A. WEBSTER, a citizen of the United States, residing at Somerville, in the county of Middlesex and State of Massachusetts, have invented new and useful Improvements in Steam-Engine Indicators, of which the following is a specification.

This invention relates to improvements in steam engine indicators and while the present improvements are applicable to various types of indicators, I have chosen to illustrate the same as applied to an indicator for which I have been granted Letters Patent of the United States, No. 861,490, July 30, 1907, to which reference may be had for such details of construction and operation as are not herein shown and described. In assembling the pencil mechanism of an indicator of this character, it is often found difficult to so assemble its parts that the axes of the pivotal connections of the parts of the pencil mechanism shall be perfectly parallel with each other and so that there shall be no cramping or binding of the parts in operation since such binding would greatly impair the accuracy of the instrument. In assembling the parts of pencil mechanisms it is usually necessary to carefully bend the pencil lever to bring its pivots into perfect parallelism. This manner of assembling the pencil mechanism is a matter of great difficulty and requires an expenditure of considerable time.

The object of my present invention is to provide a pencil mechanism with suitable adjustments so constructed and arranged that the mechanism can be easily, quickly and accurately assembled and adjusted with the pivotal axes in perfect parallelism and so that there shall be no binding of the parts in operation.

The invention consists in the combination and arrangement of parts set forth in the following specification and particularly pointed out in the appended claims.

Referring to the drawings: Figure 1 is an elevation of a steam engine indicator similar to that shown and described in the aforesaid Letters Patent and showing my present improvements applied thereto. Fig. 2 is a central vertical sectional elevation through the indicator cylinder showing the piston and piston rod therein. Fig. 3 is an enlarged de-

tail sectional elevation of a portion of the piston rod showing the pencil lever in transverse section, and in elevation the link which connects said pencil lever to said piston rod. Fig. 4 is an enlarged detail sectional elevation illustrating the rocker arm and its pivotal connection with the pencil lever and with the ears on the collar or support which carries the pencil mechanism. Fig. 5 is an illustrative diagram showing the manner of making the adjustment.

Like numerals refer to like parts throughout the several views of the drawings.

In the drawings, 5 is an indicator cylinder consisting of an outer jacket or casing 6 into which is screwed the inner casing 7 in which the piston 8 is adapted to reciprocate. A standard 9 is secured to the top of the cylinder 5 by a coupling 10 which has screw-threaded engagement with the casing 6 of the cylinder 5 and is provided with an inwardly extending rim 11 which projects over a flange 12 formed on the base 13 of the standard 9. A pencil lever 14 extends through an opening 15 in a piston rod 16, said piston rod being connected to the piston 8 and slidably arranged in the base 13, said pencil lever being pivotally connected at its rear end to a rocker arm 17 by means of two screws 18, 18 having screw-threaded engagement with ears 19, 19, respectively, formed upon said rocker arm. The points of the screws 18 are preferably conical in form and are located in conical depressions 20, 20 formed in opposite ends, respectively, of a hub 21 fast to the pencil lever 14. The rocker arm 17 is provided at its lower end with a hub 22, the opposite ends of which are provided, respectively, with conical depressions 23, 23 in which are located conical ends of pivotal screws 24, 24, having screw-threaded engagement with ears 25, 25, respectively, formed on a collar 26 which is adapted to rotate upon the base 13. The pencil lever 14 is connected to the piston rod 16 by a link 27 which is forked at its upper end and straddles said pencil lever, the pivotal connection consisting of a pivot 28 passing therethrough. It will be noted that there is a slight space or clearance on each side of the pencil lever 14 between said lever and the sides of the forked upper end of the link 27. Formed upon the lower end of the

link 27 is a ball 29 located in a socket 30 which consists of two parts 31 and 32 having screw-threaded engagement with each other, the part 32 having also screw-threaded engagement with the piston rod 16. Thus it will be seen that the link 27 is free to rock laterally with relation to the piston rod 16 and to turn about the axis thereof.

The pencil lever 14 is pivoted at 33 to a pair of links 34, said links being pivotally connected at 35 to a bifurcated post 36 which post passes through an ear 37 upon the collar 26 and is secured thereto by a nut 38. When the nut 38 is loosened the post 36 is adapted to be adjusted about its axis.

A description of the remainder of the indicator will be unnecessary to a clear understanding of my present improvement.

In order that the indicator shall be absolutely accurate in its operation, it is necessary that the axis of the pivot 35 shall be exactly parallel with the axis of the pivots 24 and furthermore that there shall be no binding or cramping at any of the pivotal connections of the pencil mechanism. It frequently happens in assembling an indicator of this character that owing to bends in the pencil lever 14 and other slight inaccuracies in manufacture the axis 35', 35' of the pivot 35 does not stand parallel with the axis 24', 24' of the pivots 24, as seen in diagram in Fig. 5. This may be corrected in the following manner, without throwing pressure upon the pivotal connections of the pencil mechanism and without causing cramping or binding of the same. The pivotal screws 24, 24 are both screwed in a direction toward which the axes 24', 24' and 35', 35' converge and it being understood that the nut 38 is loosened at this time the post 36 will be rocked about its vertical axis by the swinging movement of the pencil lever which is occasioned by the adjusting of said screws. By moving the screws 24, 24 a proper amount it will be understood that the post 36 may be rocked about its vertical axis until the pivotal axis 35', 35' lies perfectly parallel with the axis 24', 24'. The nut 38 is then carefully tightened.

During the foregoing adjustment which is in all cases extremely slight, the pencil lever 14 moved very slightly transversely of the axis of the piston rod 16, the clearance between the sides of said pencil lever and the sides of the forked upper end of the link 27 permitting such movement. The ball 29 and socket 30 also permit the link 27 to swing about the axis of the piston rod 16. If desired, the adjustment of the pencil mechanism may be accomplished by means of the pivotal screws 18 instead of the pivotal screws 24 in a similar and obvious manner.

The piston rod 16 is preferably formed in two parts as shown in Fig. 3, said parts being rigidly connected to each other by means of a

screw-threaded shank 39 formed on the part 32 of the socket 30. By reason of this separable construction of the piston rod when it becomes necessary to clean the piston 8 the lower part of the piston rod 16 is rotated in the proper direction relatively to the upper part of said piston rod to disengage the screw-threaded shank 39 from said lower part. It will be noted that the construction is such that when the parts are reassembled the pencil point will be located exactly at the atmospheric line. In assembling the socket 30 with the ball 29 the part 31 of the socket is screwed down until there is no play between said ball and said socket and yet said ball is perfectly free to turn easy in said socket. When the parts have been thus adjusted, a hole is drilled through the parts 31 and 32 and a pin 40 is driven therethrough to prevent relative rotation of said parts.

Having thus described my invention, what I claim and desire by Letters Patent to secure is:

1. In an engine indicator, a cylinder, a piston and piston rod, a pencil lever, a post adapted to be swung about an axis parallel with the axis of said piston, a link pivotally connected at one end to said post and at its other end to said pencil lever, a second link pivotally connected at one end to said pencil lever and at its other end connected by a universal connection to said piston rod, a support, and a rocker arm pivotally connected at one end to said pencil lever and at its other end pivotally connected to said support and adapted to be adjusted relatively to said pencil lever and transversely thereof.

2. In an engine indicator, a cylinder, a piston and piston rod, a pencil lever, a post adapted to be swung about an axis parallel with the axis of said piston, a link pivotally connected at one end to said post and at its other end to said pencil lever, a second link pivotally connected at one end to said pencil lever and at its other end connected by a universal connection to said piston rod, a support, and a rocker arm pivotally connected at one end to said pencil lever and at its other end pivotally connected to said support and adapted to be adjusted in a direction transversely of said pencil lever.

3. In an engine indicator, a cylinder, a piston and piston rod, a pencil lever, a post adapted to be swung about an axis parallel with the axis of said piston, a link pivotally connected at one end to said post and at its other end to said pencil lever, a second link pivotally connected at one end to said pencil lever, a ball and socket joint connecting the other end of said second link to said piston rod, a support, and a rocker arm pivotally connected at one end to said pencil lever and at its other end to said support and adapted to be adjusted in a direction transversely of said pencil lever.

4. In an engine indicator, a cylinder, a piston and piston rod, a pencil lever, a post adapted to be adjusted about an axis parallel with the axis of said piston, a link pivotally connected at one end to said post and at its other end to said pencil lever, a second link pivotally connected at one end to said pencil lever, a universal connection between the other end of said second link and said pencil lever, a support, a rocker arm pivotally connected at one end to said pencil lever and at its other end to said support, and means to adjust said rocker arm in a direction transversely of said pencil lever.

5. In an engine indicator, a cylinder, a piston and piston rod, a pencil lever, a post adapted to be adjusted about an axis parallel with the axis of said piston, a link pivotally connected at one end to said post and at its other end to said pencil lever, a second link pivotally connected at one end to said pencil lever, a ball and socket joint connecting the other end of said second link to said piston rod, a support, a rocker arm pivotally connected at one end to said pencil lever and at its other end to said support, and two screws opposed to each other and adapted to adjust said rocker arm in opposite directions, respectively, transversely of said pencil lever, said screws constituting pivots for said rocker arm.

6. In an engine indicator, a cylinder, a piston and piston rod, a pencil lever, a post adapted to be adjusted about an axis parallel with the axis of said piston, a link pivotally connected at one end to said post and at its other end to said pencil lever, a second link pivotally connected at one end to said pencil lever, a ball and socket joint connecting the other end of said second link to said piston rod, a support, two ears on said support, a rocker arm located between said ears and pivotally connected at one end to said pencil lever, and two screws having screw-threaded engagement with said ears, respectively, and adapted to adjust said rocker arm in opposite directions, respectively, said screws constituting pivots for the other end of said rocker arm.

7. In an engine indicator, a cylinder, a piston and piston rod, a pencil lever, a post adapted to be adjusted about an axis parallel with the axis of said piston, a link pivotally connected at one end to said post and at its other end to said pencil lever, a second link pivotally connected at one end to said pencil lever, a ball and socket joint connecting the other end of said second link to said piston rod, a support, two ears on said support, a rocker arm located between said ears and provided with two oppositely located substantially conical depressions, and two screws having screw-threaded engagement with said ears, respectively, and provided with substantially conical ends located in

said depressions, respectively, said rocker arm being also pivotally connected to said pencil lever.

8. In an engine indicator, a cylinder, a piston and piston rod, a pencil lever, a post adapted to be adjusted about an axis parallel with the axis of said piston, a link pivotally connected at one end to said post and at its other end to said pencil lever, a second link pivotally connected at one end to said pencil lever, a ball and socket joint connecting the other end of said second link to said piston rod, a support, a rocker arm pivotally connected at one end to said support, and two opposed screws having screw-threaded engagement with said rocker arm and having substantially conical ends located, respectively, in substantially conical depressions provided in said pencil lever.

9. In an engine indicator, a cylinder, a piston located in said cylinder, a piston rod connected to said piston, a pencil mechanism comprising a pencil lever, and a link connected thereto, a ball and socket joint connecting said link to said piston rod, said joint comprising a socket formed in two parts having screw-threaded engagement with each other, and a member adapted to hold said parts against relative rotation.

10. In an engine indicator, a cylinder, a piston located in said cylinder, a piston rod connected to said piston, said piston rod being formed in two parts, a pencil mechanism comprising a pencil lever and a link connected thereto, and a ball and socket joint connecting said link to said piston rod, said joint comprising a socket formed in two parts, one of said socket parts constituting a screw adapted to hold said piston rod parts together.

11. In an engine indicator, a cylinder, a piston and piston rod, a pencil lever, a post adapted to be swung around an axis parallel with the axis of said piston, a link pivotally connected at one end to said post and at its other end to said pencil lever, a second link pivotally connected at one end to said pencil lever in such a manner as to be adapted to be movable transversely relatively thereto, said second link being connected at its other end by a universal connection to said piston rod, a support, and a rocker arm pivotally connected to said support and adapted to be adjusted transversely of said pencil lever.

12. In an engine indicator, a cylinder, a piston and piston rod, a pencil lever, a post adapted to be swung about an axis parallel with the axis of said piston, a link pivotally connected at one end to said post and at its other end to said pencil lever, a second link provided at one end with a fork which straddles and is pivotally connected to said pencil lever, there being a space between said pencil lever and the sides of said fork, whereby said second link and pencil lever are adapted to

be moved relatively transversely, said second
link being connected at its other end by a
universal connection to said piston rod, a
support, and a rocker arm pivotally con-
5 nected at one end to said pencil lever and at
its other end pivotally connected to said
support and adapted to be adjusted trans-
versely of said pencil lever.

In testimony whereof I have hereunto set
my hand in presence of two subscribing
witnesses.

GEORGE A. WEBSTER.

Witnesses:

CHARLES S. GOODING,
DANIEL A. ROLLINS.