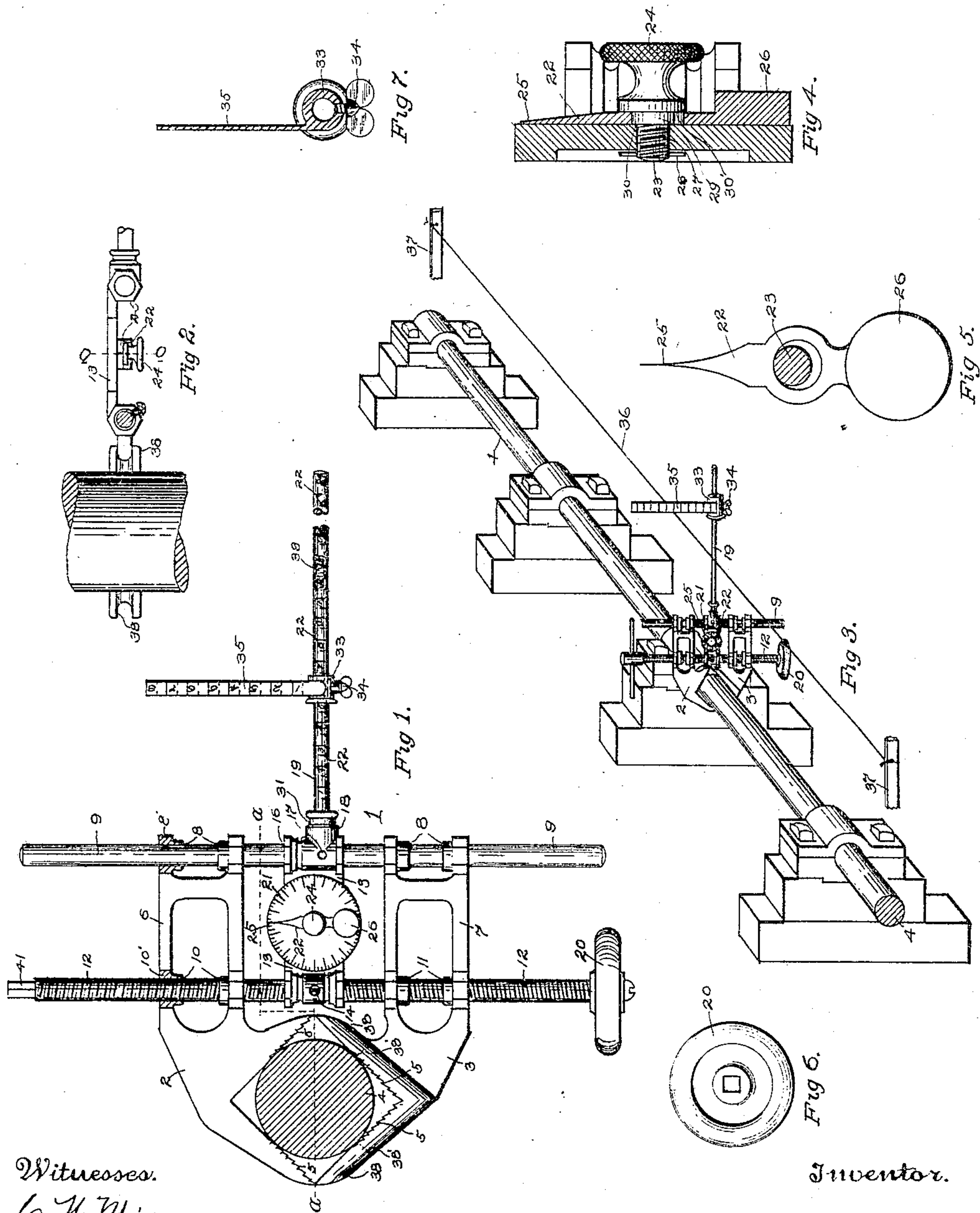


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F. E. HALL.  
SHAFT LINER.

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Witnesses.  
C. H. Miles,  
L. M. Hodges

Inventor.  
FRANK E. HALL.  
By Harry D. Wallace  
Attorney.



# UNITED STATES PATENT OFFICE.

FRANK E. HALL, OF CARTHAGE, NEW YORK, ASSIGNOR OF ONE-HALF  
TO MARY J. COFFIN, OF CARTHAGE, NEW YORK.

## SHAFT-LINER.

SPECIFICATION forming part of Letters Patent No. 791,900, dated June 6, 1905.

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*To all whom it may concern:*

Be it known that I, FRANK E. HALL, a citizen of the United States, residing at Carthage, in the county of Jefferson and State of New York, have invented certain new and useful Improvements in Shaft-Liners, of which the following is a specification.

This invention relates to improvements in shaft-liners designed for use in lining or truing up shafting, such as employed in factories, mills, and shops; and the invention relates particularly to that class of devices shown and described in Letters Patent heretofore issued to Warren D. Gardner, numbered and dated as follows: No. 563,226, dated June 30, 1896.

The object of this invention is to improve and simplify the construction and operation of the class of shaft-liners referred to, to provide for a more universal application of the device in the line of its employment and usefulness, to make certain parts more positive and reliable, and generally to improve and enhance the value of devices of the class.

A prominent feature of this invention as compared with previous inventions lies in the substitution of an oscillating plumb-bob provided with a needle-pointed indicator and a graduated dial in place of the glass tube or bulb provided with spirits and by which the leveling thereof is effected by means of the bubble in said tube or bulb.

Another feature of the invention consists in the providing a series of sharp teeth on the inner faces of each of the angular jaws employed for clamping the liner to a shaft. In all former devices of the class the jaws have been made smooth and great difficulty has been experienced in clamping the liner to the shaft, so as to rigidly hold it in a level position while the work of lining up is being carried out.

Another feature of the invention consists in providing a scaled bar in connection with the adjustable gage or collar disposed at right angles to the horizontal line indicator, the purpose of this bar being to enable a millwright to ascertain the exact amount of variation in a line of shafting between two points already established, so that he may be able to judge

of the most convenient method of correcting the defective alinement of a shaft.

Other features and parts of the invention will be understood by reference to the accompanying drawings, forming a part of this specification, and in which--

Figure 1 is a side elevation of the shaft-liner, partly in section, showing the device clamped on a shaft and showing the oscillating plumb-bob and graduated dial, together with the other improved parts. Fig. 2 is a horizontal sectional view substantially on the line *a a* of Fig. 1. Fig. 3 is a view in perspective showing the shaft-liner applied to a shaft and showing the application of the scaled bar in connection with the adjusting gage or collar. Fig. 4 is a vertical section of the central support, showing the manner of attaching the oscillating plumb-bob or indicator to the central support and dial. Fig. 5 is a detail of the plumb-bob, showing the same loosely mounted upon its pivot screw or rod. Fig. 6 is a face view of the adjusting hand-wheel attached to the threaded shaft or rod. Fig. 7 is an end elevation of the adjusting-gage and scaled bar.

Similar numbers of reference are given to corresponding parts throughout the drawings.

In the drawings, 1 represents the complete shaft-liner, as shown in Figs. 1 and 3.

2 and 3 represent a pair of oppositely-facing clamps, preferably made of cast-iron, and each having jaws of equal angles adapting them to be closed upon a shaft. The points of the jaws are made to interfit, so as to permit them to close on a shaft of comparatively small diameter.

5 represents a number of teeth or serratures arranged on the inner face or edge of each jaw, as shown in Fig. 1, and these are provided for the purpose of preventing the liner from turning or twisting on the shaft after it has been clamped. The teeth on the lower clamp 3 are arranged on either side of the intersecting angle of the jaws, while the teeth on the upper clamp 2 are shown on the outer ends of the jaws, the object in reversing the position of the teeth in the two clamps being



to limit the number of teeth which will engage a shaft of any size. Under this arrangement a shaft smaller than the one shown in Fig. 1 will engage only the teeth of the lower clamp, whereas a larger shaft than the one shown will only engage the teeth on the upper clamp. The clamps are provided with the truss-like lateral extensions 6 and 7, having at their ends double vertical slide-bearings 8 for the stationary guide shaft or rod 9. Between the clamps and the bearings 8 are provided the double internally right and left hand threaded portions 10 and 11, one of which is shown in section at 10'.

12 represents a right and left hand threaded screw or rod which has its bearing in the central plumb-bob support 13. The portion of the screw 12 which bears in the support 13 is without threads, and the said screw is held in place and allowed to be revolved by means of the set-screw 14, which has its seat in the groove 15, as shown in Fig. 2. The plumb-bob support is rigidly secured at 16 to the guide-shaft 9 by the pin 17. A boss or projection 18 extends from the outer end of the support 13 and is provided with internal threads to receive the line-indicator 19, which is screwed into the boss. The said boss and the line-indicator are arranged so that the top of the latter corresponds to the center of the shaft when the instrument is clamped thereon.

The reversely-threaded screw 12 is provided at its lower end with the adjusting hand-wheel 20, which is rigidly secured to said screw and is used for the purpose of closing or spreading the clamping members 2 and 3.

During the operation of the clamps 2 and 3 by means of the screw 12, whether to open or close the clamps, the central support 13 will always bear the same relation to the center of the shaft 4 by reason of the equal feed of the screw 12 in the bearings 10 and 11.

In the center of the face side of support 13 is provided a graduated or scaled dial 21, preferably graduated to represent the division of the circle into degrees, and concentric with said dial is pivoted or disposed the oscillating plumb-bob or indicator 22, held in place by the shouldered hand screw or bolt 23, which is provided at its outer end with the knurled head 24. The plumb-bob 22 is preferably made of metal. The point 25 is made sharp, so as to permit of close and exact indication, while the opposite end 26 of the bob is enlarged and made heavy for the purpose of causing the instant gravitation of the plumb-bob. To provide for the free oscillation or movement of the plumb-bob upon the pivot-screw 23, the latter is made considerably smaller in diameter than the hole in the plumb-bob, as shown in Figs. 4 and 5 of the drawings. The reason for substituting the oscillating plumb-bob in place of the spirit-level used in connection with former inventions of

the class is that in the employment of the spirit-level the shaft-liner can only be applied to a shaft in one position—viz., the bubble in the spirit-tube must be brought to and maintained exactly in the center of the bulb or tube in order to produce accurate results, whereas by the employment of the oscillating plumb-bob constructed and arranged as shown and described herein the operator is privileged to clamp the device to a shaft in the quickest and most convenient manner, and whether it is exactly level or not the needle-point of the bob will invariably point to some one of the closely-arranged dial-graduations, and it is only necessary for him to note or mark the graduation pointed to and then set the liner during the course of the lining up, so that the same graduation will be indicated. Another advantage in the use of the plumb-bob as compared with the spirit-level lies in the fact that frequently on account of the crowded condition of the machinery, &c., in a shop or mill it is inconvenient to apply the liner to a shaft in the horizontal or level position, as shown in the drawings, and it is preferred to clamp the liner to such shaft in a vertical position, either from above or below. The present invention is capable of being so applied, and it is believed that the leveling up of a shaft can be accomplished with greater reliability and ease by means of the plumb-bob and dial than by the use of the spirit-level.

The pivot-screw 23 is provided with threads on its inner end, which engage the threaded hole 27 in the center of the support 13 and projects beyond the back surface far enough to receive the pin 28, which is provided to prevent the said screw from being moved backward more than a small part of a turn. The screw 23 is also provided with a smooth portion 29, upon which the plumb-bob is balanced or hung, and with the shoulder 30, which is intended to bear against the face of the support 13 when the head of the screw 30' bears tightly against the plumb-bob. A feature of the construction and operation of the plumb-bob and the pivot-screw 23 consists in providing for the partial relieving of the tension of said screw by turning it to the left till stopped by pin 28 for the purpose of permitting the free oscillation or play of the plumb-bob at the time when the device is being used for lining up a shaft. Under this form of construction there is no danger of the plumb-bob sticking or failing to register reliably. In practice the operator just before tightening the clamp on a shaft will turn the pivot-screw 23 to the left slightly, which will free the plumb-bob, after which he will tighten the clamps of the device to the shaft. If he desires to set the device exactly level, he will adjust the same so that the needle-point of the bob will indicate the central or zero graduation at the top of the dial, and securing the clamps he is then



ready to proceed with the lining up of the shaft. When the work of lining up is finished, before the device is laid away the operator is supposed to tighten up the pivot-screw 23, so as to prevent unnecessary oscillation of the plumb-bob while being carried about.

The line-indicator 19, preferably in the form of a round rod or bar, is provided with a threaded shoulder portion 31, which adapts the same to be screwed into the boss 18 of the support 13. This rod 19 is provided throughout its entire length with graduations 32 substantially one inch apart for the purpose of enabling the operator to ascertain the exact amount of discrepancy in the level or line of a shaft. By the use of the scale or graduations on said rod he can set the line in the first place, and then by the same means he can adjust the intermediate sections of the shaft exactly to his line. 33 represents an adjusting gage or collar, which is made to slidably fit the line-indicator rod 19 and may be set and held in any desired position on said rod by means of the thumb or setscrew 34.

It is frequently desired by the operator or millwright to know also the exact distance or amount of variation of portions of a shaft either above or below the horizontal line-indicator, and for that purpose I have provided the vertical scaled bar 35, which is preferably cast or formed integrally with said adjusting-gage 33. The bar 35 may be employed, by reason of the slidable gage 33, in a horizontal as well as vertical position.

36 represents a line stretched taut on a level with the center of shaft 4, as shown in Fig. 3. This line may be secured to the supports 37 37 in any suitable manner. It frequently occurs that the line 36 must be set a considerable distance from the shaft and that the line-indicator 19 therefore must be of greater length than for ordinary use. In order to provide for such contingencies, the outer end of the rod 19 is provided with a screw-socket for the purpose of receiving an additional section 19', which is provided with a screw on one end and is also similarly scaled or graduated. The rod 19 is made in sections also to facilitate packing the same within a small space. In Fig. 1 of the drawings 39 represents the point where the two sections of the line-indicator are joined together. It is intended to provide these rods, for convenience, in twelve-inch lengths.

The jaws of clamp 3, as shown in Fig. 2, (and by the dotted lines 38' in Fig. 1,) are split or forked at 38 for the purpose of allowing the points of the jaws of clamp 2 to close or interfit therein. By this means the device is adapted to be clamped or applied on a shaft of comparatively small diameter.

The screw 12 is provided with the rectangular or square portion 41, to which the hand-

wheel 20 or any suitable adjusting-key may be applied, if desired.

8' represents a sectional view of one of the double bearings for the slide-rod 9. The other three are constructed in a similar manner.

The object in providing the double slide-bearings 8 and the double-threaded bearings 10 and 11 on the lateral extensions 6 and 7, as shown in the drawings, is to give to said extensions or arms a broader bearing and by reason of the peculiar truss-like construction of the same to increase the strength of the clamps without adding to their weight.

If desired, two or more of the shaft-liners may be clamped on different parts of a shaft at the same time in order to facilitate more rapid work.

My invention will be of great advantage for use in locating shafting in the first instance, as well as in adjusting and correcting the alinement of shafting already established in a shop or mill. It is simple, strong, and durable in construction and will stand considerable handling and abuse without getting out of order and by its use will effect the saving of much time as compared with the old and crude methods employed for setting or truing up a line of shafting.

It will be obvious that many changes and modifications may be made in my invention without departing from it, and I therefore do not wish to restrict myself to the precise form of construction described and shown herein.

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

1. In a shaft-liner of the class described, comprising a pair of oppositely-facing and reversely-operating clamps provided with lateral extensions, of equal-angled interfitting jaws provided with sharp teeth forming a part of said clamps, a right and left hand threaded screw, having a hand-wheel secured to one end, engaging said lateral extensions and adapted to open or close said clamps, a stationary guide-shaft passing through the ends of said extensions, a central plumb-bob support, a graduated dial formed upon one side of said support, an oscillating plumb-bob or indicator pivoted to the center of said graduated dial, a hand-screw forming the pivot for said plumb-bob or indicator, adapted to either permit or prevent the oscillation or movement of said plumb-bob, a sectional line-rod screwed into the end of the central plumb-bob support, an adjustable gage or collar adapted to slide upon the sectional line-indicator and to be set and held in any desired position, and a scaled bar or rod secured to said adjustable gage or collar, by means of which said bar is constantly held at right angles to said line-indicator, substantially as described.

2. In a shaft-liner of the class described, the



combination with a pair of oppositely-disposed clamps having lateral extensions and equal-angled interfitting jaws, a series of teeth arranged on each of said jaws, a reversely-threaded screw engaging said lateral extensions, a hand-wheel secured to, and adapted to operate said screw and thereby open or close said clamps, a vertical guide shaft or rod in engagement with the forked ends of said lateral extensions, a central support to one end of which said reversely-threaded screw is operatively connected, the opposite end being rigidly connected to said guide-shaft, a graduated dial integrally formed upon said central support, an oscillating plumb-bob pivoted concentrically with said dial, a shouldered thumb-screw forming the pivot for said plumb-bob and adapted to control the oscillation of said plumb-bob, an extensible line-indicator, comprising a series of graduated rods, connected to one end of said central support, an adjustable gage or stop slidable upon said line-indicator and capable of being adjusted to, and held in, a number of different positions, a graduated bar or rod integrally formed upon said gage or stop and capable of being disposed at any degree of angle or radiation from the center of said line-indicator, substantially as described.

3. In a shaft-liner, comprising a right and left hand threaded clamp-operating screw and a stationary guide-rod, of a central support rigidly secured to said guide-rod and operatively holding said clamp-operating screw, a pair of oppositely-disposed clamps having truss-like extensions in operative engagement with said threaded screw and said guide-rod, interfitting angular jaws arranged on said clamps, a plurality of teeth or serratures arranged on said angular jaws, the teeth or serratures on the lower jaws adapted to engage a small shaft and the teeth or serratures on the upper jaws adapted to engage a large shaft, a graduated or scaled dial upon the face side of said central support, an oscillating plumb-bob or pointer pivoted to the center of said dial, means for permitting or preventing the oscillation of said plumb-bob or pointer, a graduated line-indicator detachably connected to said central support, a collar or stop slidable upon said line-indicator, a graduated bar disposed at right angles to said collar or stop and to said line-indicator, and a thumb-screw adapted to hold or release said collar or stop, substantially as described.

4. In a shaft-liner, the combination with the substantially parallel clamping members adjustably and slidably mounted upon parallel rods, one of said rods being right and left hand threaded and operable by means of a hand-wheel secured to one end thereof, the other rod being a smooth, stationary guide-rod, of a central member disposed between said clamping members, and connected with

said parallel rods, a dial formed upon one side of said central member, a plumb-bob having a sharp point at one end and a round weighted portion at the opposite end, the bob being loosely pivoted to the center of said dial and said central member, a thumb-screw upon which said bob is mounted adapted to be set tightly against said bob for preventing the oscillation thereof, and further adapted to be operated to permit of the oscillation of said bob, a graduated rod screwed into the end of the central member, and adapted to indicate the center line of a shaft, and a scaled bar adapted, by means of a collar or sleeve formed on one end thereof, to slide upon and to be set and held in different positions on said graduated rod, substantially as described.

5. In a shaft-liner of the class described, comprising a pair of adjustable clamping members provided with lateral extensions having transverse openings therethrough, and having angular jaws adapted to close on shafts of different size, serrated notches or teeth on said jaws to engage large or small shafts and thereby prevent the said shaft-liner from twisting or turning while clamped to the shaft, a plumb-bob support between said clamping members, parallel rods, one right and left hand threaded and the other smooth, in engagement with said plumb-bob support and said clamping members, an oscillatable plumb-bob or indicator pivotally mounted on the center of said dial, a shouldered screw forming said plumb-bob pivot, a pin passing through the threaded end of said shouldered screw adapted to limit the operation of said screw, a plurality of graduated line-rods, and means for setting and holding one of said rods in different positions with reference to said shaft-liner and a shaft, substantially as described.

6. In a shaft-liner, the combination with the oppositely-arranged clamping members adjustably and slidably mounted upon parallel rods, of a hand-wheel secured to one of said parallel rods, a central support disposed between said clamping members and connected with said parallel rods, a graduated dial upon said central support, a plumb-bob pivoted to said dial and having a needle-point at one end, the other end being enlarged and made heavy to effect the instant gravitation of said bob, extensible and adjustable scaled rods adapted to be connected to said central support and to indicate the line and level of a shaft, and a series of teeth adapted to hold said shaft-liner in any desired position on a shaft, substantially as described.

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

FRANK E. HALL.

Witnesses:

EDGAR V. BLOODUGLE,  
HARRY DE WALLACE.