March 4, 1941. C. W. McCLURE 2,233,626

GAUGE

Filed Oct. 20, 1939 2 Sheets-Sheet 1

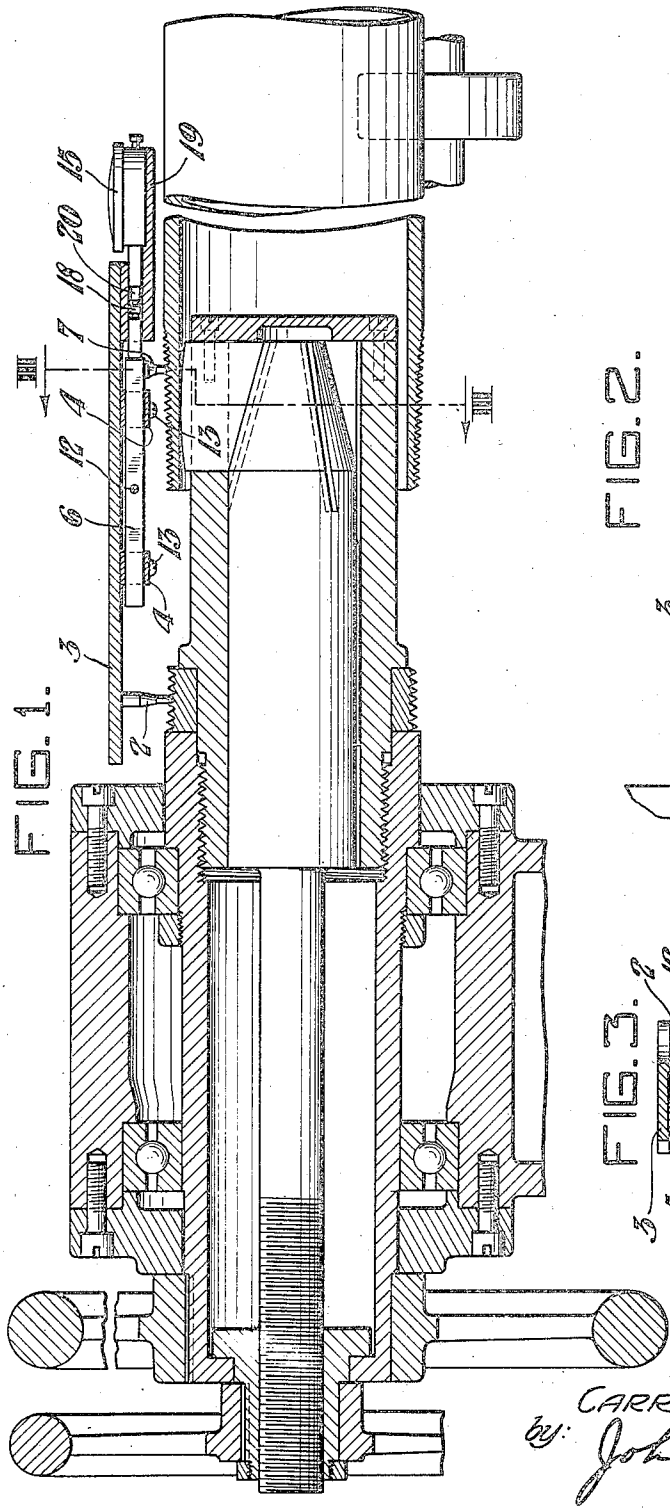


FIG. 1.

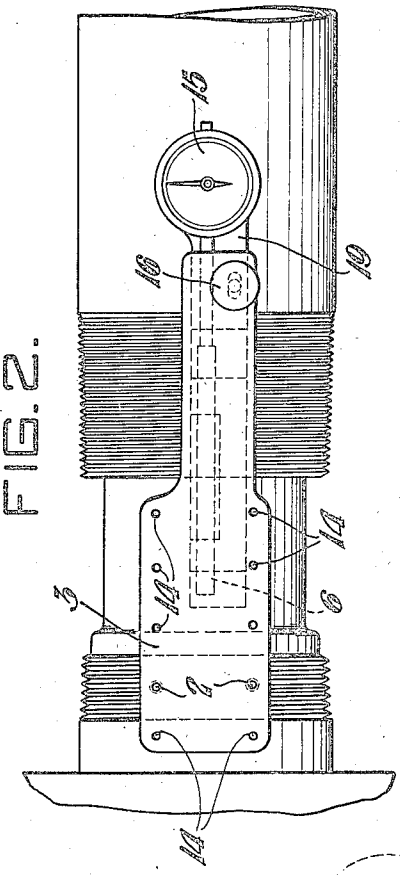


FIG. 2.

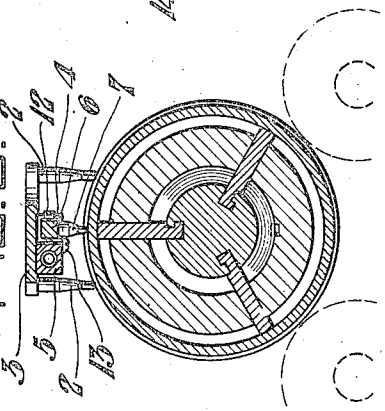


FIG. 3.

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Filed Oct. 20, 1939 2 Sheets-Sheet 2

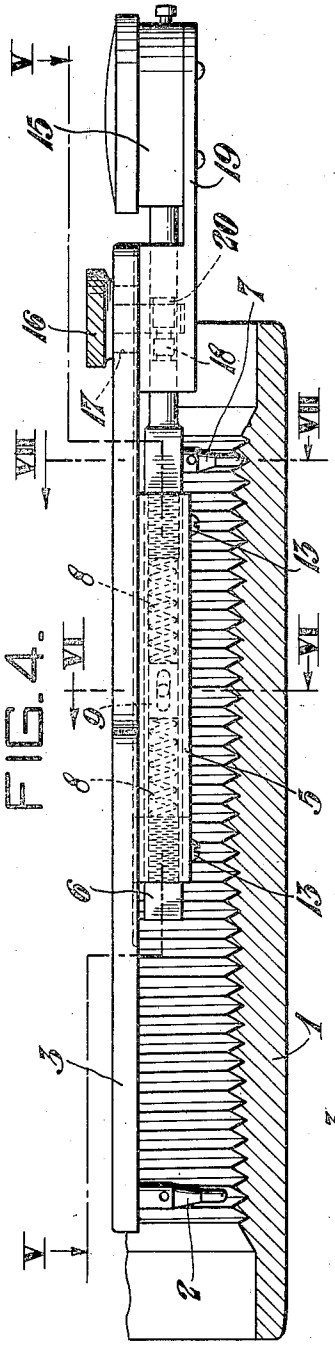


FIG. 4.

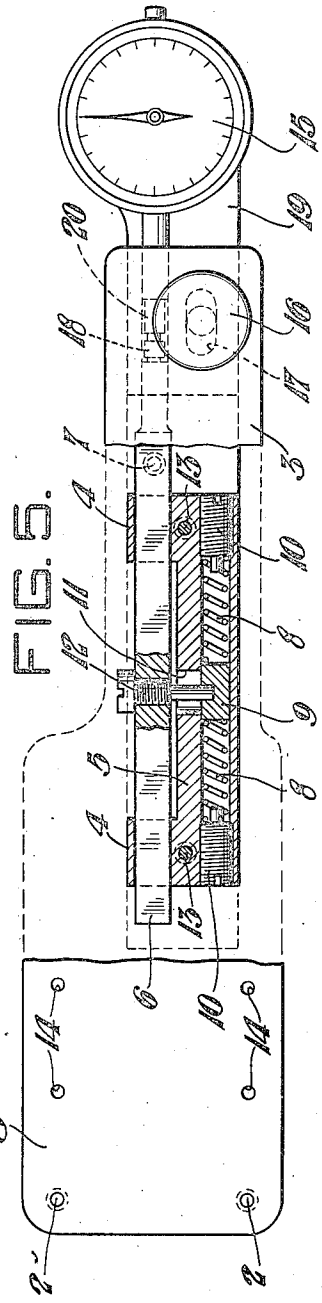


FIG. 5.

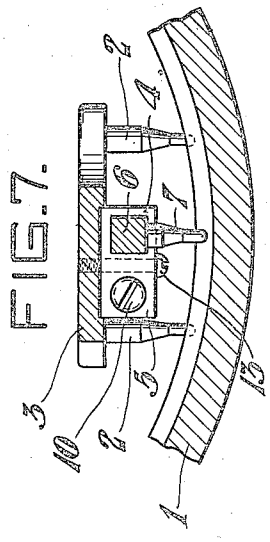


FIG. 7.

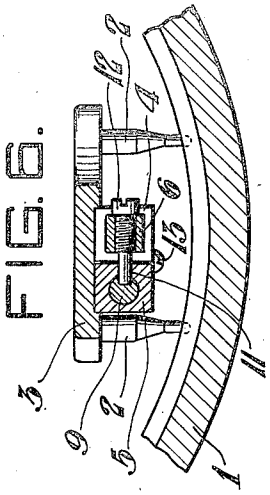


FIG. 6.

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UNITED STATES PATENT OFFICE

2,233,626

GAUGE

Carroll W. McClure, McKeesport, Pa., assignor to National Tube Company, a corporation of New Jersey

Application October 20, 1939, Serial No. 300,464

1 Claim. (Cl. 33—199)

This invention relates to gauges, and more particularly to those which are adapted for the inspection of screw-threaded tubular articles.

In manufacturing metallic tubular products, such as casing, drill pipe, tubing and line pipe, it is essential that the workmanship and finish shall be of a quality to meet the requirements of the oil and gas fields, where the product is most frequently used. There have been established standard specifications governing the alignment of pipe and couplings. The objective is to produce pipe which will, when screwed up into a string with couplings or tool joints, be straight from end-to-end. Deviation from this straight line is called "misalignment," and limitations, or tolerances, are specified beyond which the manufacturers are not permitted to go.

As the function of each classification of metallic tubular articles differs from the others, so the importance of straightness varies in all classifications. In a well, the straightness of the casing and tubing contributes to the ease of placing the string therein. The straightness of rotary drill pipe influences the ease of drilling, reduces vibration and makes for straightness of the hole. The reverse is true when the casing, tubing or drill pipe is out of alignment. Should the tubing not be straight, the pump rod wears against the inside wall of the tubing, and in time may cut through the wall. A crooked string of casing may be the cause of excessive wear as the rotary drill goes down, causing destruction of the drill pipe and damaging the casing. Finally, the rotating drill pipe, if out of alignment, causes a wobble of the pipe extending into the derrick, produces vibration in the drilling operation, damages both the casing and drill pipe and tends to contribute to the drilling of a crooked well.

Threads in couplings and on pipe are tapered, the usual tapers being ¾ inch or ⅜ inch per foot of diameter. The threads in a coupling expand from center to ends, mating with the thread on the ends of the pipe. A space interval exists between the ends of the pipe in a coupling after the joint has been made up and screwed tight. Threads may or may not be continuous in the coupling. When threads are continuous in a coupling, and are made in one operation (by means of a double taper pin, upon which ride threading segments, one set of segments expanding while the other set is receding) there is little or no misalignment. However, when couplings are tapped end-for-end (on individual spindles) the threads may be neither continuous nor in perfect alignment.

There are at present various methods of measuring and evaluating the misalignment in couplings and pipe.

Couplings and pipe are tested separately. In the case of pipe, each end is tested separately, and independent of the other end. Threads are cut normal to the axis of the pipe or coupling, this being the practice for all tapers. The longitudinal spacings of the threads are therefore all equal, and the distances of remote threads on a threaded specimen are definitely, and precisely, fixed. This is true, whether the thread is straight or tapered. Due to the threads advancing uniformly along the axis of the pipe, in conformity to the helix of the pitch, it follows that all threads are parallel to each other.

Since the threads of one end of a coupling are all parallel to each other, and the threads of the other end are also parallel to each one of that end, it therefore follows that the threads of the first end are parallel to the threads of the second end, provided that the axes of both ends are in true alignment.

Any deviation in parallelism of the threads of one end of a coupling to that of the other end, is an indication of misalignment, and it is among the objects of the present invention to minutely measure this deviation.

Another object is the provision of an instrument for the purposes hereinbefore stated which may be used for either couplings or pipe. In the testing of a coupling, one end is checked against the other and results noted. In the case of a pipe thread, the thread on one end of the pipe is checked, not against the other end but against a master thread turned upon a plug or ring mounted upon a spindle. Thus each end of the pipe is checked separately and individually.

The foregoing and other objects will be apparent after referring to the drawings, in which:

Figure 1 is a sectional elevation of the device of the invention as it is used for measuring the deviation from alignment of an exterior pipe thread from an exteriorly threaded master thread carried upon a spindle;

Figure 2 is a fragmentary plan of the showing of Figure 1;

Figure 3 is a sectional view on the line III—III of Figure 1;

Figure 4 is a side elevation of the device of the invention as it is used upon an interiorly screw-threaded coupling, the latter being shown fragmentarily and in section;

Figure 5 is a view on the line V—V of Figure 4;

Figure 6 is a sectional view on the line VI—VI of Figure 4; and

Figure 7 is a sectional view on the line VII—VII of Figure 4.

Referring more particularly to Figure 1 of the drawings, there is shown a master thread carried on a suitable spindle. Seated between the flanks of a thread on the master thread is a pair of spaced apart ball points, generally designated at 2. These ball points may be of any conventional design, and in the present instance are carried on the outside of a frame 3 which is shown as

comprising a metallic plate. Referring to Figures 2 and 3, the ball points 2 are spaced equidistantly from the center line of the frame 3. Disposed on the underside of the frame 3 is a pair of aligned horizontal bearings 4 which are carried in a housing 5 which is secured to the frame 3 in a manner to be later described. A horizontal slide bar 6 is mounted in the aligned horizontal bearings 4 in the housing 5 and carries on one of its ends, and exteriorly of the aligned horizontal bearings 4, a downwardly depending ball point 7 whose semi-spherical face is seated between the flanks of a thread on the end of a pipe which is aligned with the master thread.

Referring to Figure 5, it will be noted that the housing 5 carries a pair of opposed coil springs 8 which are seated against an intermediately disposed spring seat 9 and capable of adjustment by means of adjusting screws 10 which abut their outer ends. The adjustment of the springs 8, by means of the screw-threaded engagement of the adjusting screws 10 with the housing 5 applies a balanced pressure on both sides of the spring seat 9 and locates in the approximate center of the intermediately disposed slot 11 a screw pin 12 which is secured to, and locates the rest position of, the horizontal slide bar 6. This mounting of the horizontal slide bar 6 insures its free movement in either direction to conform to varying distances between thread grooves in which the pair of ball points 2 and the single ball point 7 are seated and permits recording by a dial micrometer (to be later described) of deviation from parallelism of the threads of the master thread and the threads of a pipe or deviation from parallelism of threads in the opposite ends of a coupling. In practice, the device of the invention is held stationary and the pipe and master thread, or coupling, rotated.

In order that the housing 5 be secured to the frame 3 to permit the foregoing construction and arrangement of parts, the said housing 5 is mated to the said frame 3 in tongue-and-groove relationship with screws 13 maintaining said relationship.

Varying lengths of couplings to be tested are accommodated by means of tapped holes 14 in the frame 3 which are provided in order that the downwardly depending ball points 2 may be placed in any desired pair of holes. The holes 14 are, as in the case of the holes used to mount the ball points in the manner previously recited, equi-distant from the center line of the frame 3.

A commercial type of micrometer dial indicator gauge 15 having the conventional rack-and-expansion gear is carried in tongue-and-groove relationship with the frame 3 by means of a thumb screw 16 which extends through a slot 17 in the frame 3 and engages, in screw-threaded relationship, a support 19 to which the indicator gauge 15 is suitably attached. The contact point 18 of the indicator is mounted on the end of the indicator spindle 20 and so disposed that it will touch the adjacent end of the horizontal slide bar 6. That is to say, the spindle 20 is aligned with the slide bar 6 and the contact point 18 will contact the latter when the indicator support 19 is suitably adjusted with respect to the slot 17 in the frame 3.

In Figure 4 of the drawings, the device of the invention is shown as used on an interiorly screw-threaded coupling, the latter being designated at 1.

In operation:

The coupling 1 is placed on rollers (not shown) and the gauge introduced, the springs 8 having been adjusted so that the screw 12 occupies a position at the middle of the slot 11, thus permitting the horizontal slide bar 6 to move an equal distance in each direction. The spherical faces of the ball points 2 find their seats between the flanks of a thread at one end of the coupling 1 and the spherical face of the ball point 7 will seat itself between the flanks of a thread at the other end. The pressure of the hand necessary to hold the gauge in the coupling is sufficient to actuate the springs controlling, within limits, the position of the ball point 7 so that proper seating of the latter results. While the gauge is held in the coupling the latter is rotated through 360 degrees and the pointer or hand of the indicator gauge registers. The reading of the pointer is actually the measure of the variation of the distance between the centers of the ball points 2 and 7 and since the distance between these points is determined by the flanks of the threads between which they are seated, it is the measure of the distance between the threads and any movement of the pointer signifies the lack of parallelism of the threads. It is to be noted that the location of the ball points provides a three point bearing on the coupling threads, symmetrical about the common center line of the spindle 20 of the gauge 15 and the horizontal slide bar 6. The adjustment of the contact point 18 of the gauge 15 permits it to move in either direction so that a positive or negative deviation from parallelism may register.

The device of the invention is used on a master thread and pipe thread in the same manner described immediately hereinbefore.

While I have shown and described one specific embodiment of the present invention, it will be seen that I do not wish to be limited exactly thereto, since various modifications may be made without departing from the scope of the invention, as defined by the following claim.

I claim:

A device for measuring the deviation from parallelism of screw threads comprising a frame, a pair of spaced stationary thread-contacting elements carried by said frame, a movable thread-contacting element, said movable thread-contacting element being movable toward and away from said stationary thread-contacting elements and longitudinally of the thread axis, and an indicator operated by said movable thread-contacting element, said stationary thread-contacting elements being disposed symmetrically about a line passing through the center of said movable thread-contacting element, said movable thread-contacting element being capable of motion within the distances between the threads engaging the stationary thread-contacting elements and said movable thread-contacting element as the thread being tested is rotated in contact with said stationary thread-contacting elements and said movable thread-contacting element through 360 degrees.

CARROLL W. McCLURE.