July 21, 1936. W. A. PRICE 2,048,407

MICROMETER TUBE CALIPER

Filed Jan. 24, 1934

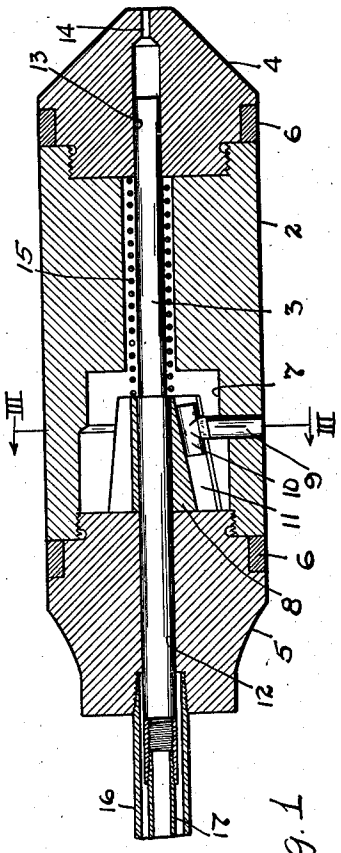


Fig. 1

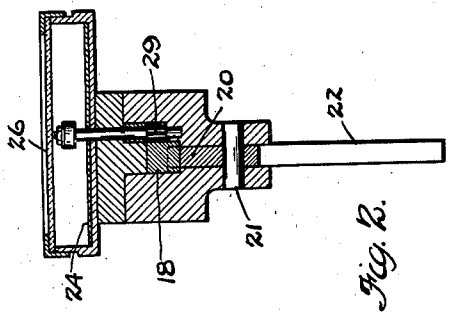


Fig. 2.

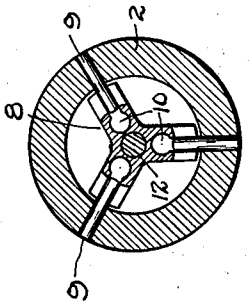
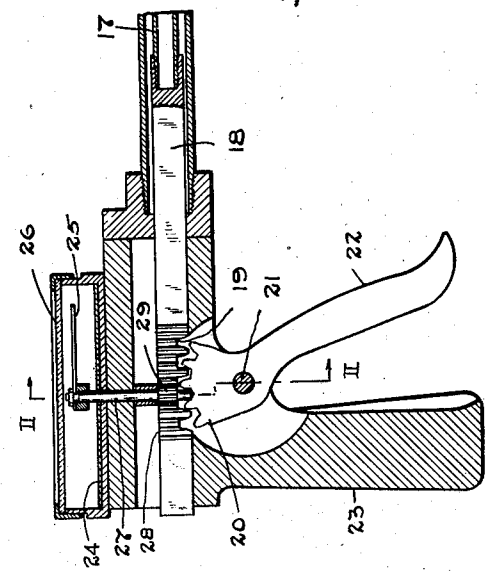


Fig. 3



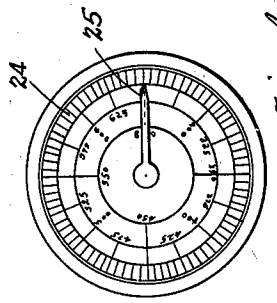


Fig. 4.

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MICROMETER TUBE CALIPER

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3 Claims. (Cl. 33—178)

In the use of constructions involving tubular heating elements, as in chemical industrial applications, oil heating and cracking, steam generation, etc., there has been no way heretofore to determine the changes due to corrosion and abrasion in the tubes. Where operating for instance with tubular heating elements in oil-cracking coils, it is known that the walls of the tubes are progressively reduced from the inside, this action being more or less rapid, depending upon the character of the runs and the character of the stock, etc., and by the best methods of inspection heretofore it has not been possible to always replace a thinned and weakened tube sufficiently promptly to avert blow-outs and fires. Some means by which an accurate check on the tube conditions may be had is therefore of prime importance, both as to attaining the utmost practical useful life out of tubing before replacing and also avoiding over-extension of usage and consequent disastrous blow-outs.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the features hereinafter fully described; and particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail an illustrative embodiment of the invention, this being indicative however of but one of the various ways in which the principle of the invention may be employed.

In said annexed drawing:

Fig. 1 is a longitudinal central sectional view of an embodiment of the invention, the central portion being broken out on account of space limitations; Fig. 2 is a section taken substantially on a staggered plane indicated by line II—II, Fig. 1; Fig. 3 is a section taken substantially on a plane indicated by line III—III, Fig. 1; and Fig. 4 is a plan view of the indicator.

In its general aspects, the invention contemplates a remote control micrometer having a head adapted to enter a tube to be measured, projectable meter-elements movable in such head, and a manual remote control head spaced apart from the tube head a considerable distance accommodating to requirements of exploration of tubes of great length, and a connecting means between the tube-entering head and the manual control head whereby the latter may operate the metering elements.

The tube-entering head may vary somewhat in its construction, but conveniently may be made up of a cylindrical member 2 bored for the passage of a plunger 3, and having a nose piece or end closure 4, advantageously somewhat tapered, and a rear closure member 5, the closure members being screw-threadedly engaged, and desirably provided further with gasket rings 6 to form a tight dirt-excluding union between the members. The body member 2 is further counterbored as at 7 for the accommodation of a tapering or wedge-like operating member 8, and engaging therewith are meter-elements of expansible type, preferably pins 9 radially mounted in the body-member 2 and having their heads 10 engaging in longitudinal under-cut grooves 11 in the tapering actuator. The actuator 8 being reciprocable in the chamber 7 can thus project and retract the meter-clements 9 according as its movements are forward or rearward. For the operation of the meter-pin actuator 8, the plunger 3 secured thereto serves to provide the forward or rearward movements. This plunger is mounted in bores 12, 13, of the respective heads, a vent 14 being provided in the forward head to allow equalization of air on movement. Coiled about the plunger 3 in the bore of the body is a spring 15, positioned between the front head 4 and the pin-actuator 8 whereby to normally thrust the latter into its rearward position.

Connection to the external or remote manual control head is had by a tube or housing 16, which may be of sufficient length to allow exploration in the tubes of whatever length are to be calipered. For instance, for usage in some types of equipment the extension 16 may be about 15 feet long, while for other types it may be 20, 25 or more feet in length, the length in any case being sufficient to allow transit of the tube-entering head throughout the length to be explored, from one end or from both ends, while the manual control head is on the outside in accessible position for use. Within the extension tube 16 is a connecting rod or tube 17, joined at one end to the plunger 3 and at its other end to a member 18 which is reciprocably movable by suitable hand-controlled means. One advantageous form is that shown, viz., the member 18 is toothed in the form of a rack 19, and engageable therewith is a toothed segment 20 pivoted as at 21 in the head, and extending out as a hand-lever 22. A grip handle 23, conveniently of pistol-grip type, is arranged in relation.

Upon the control head there is provided an indicator by which the position of the meter-elements 9 may be shown, and advantageously this is calibrated to read in terms of internal tube diameters, with graduations for instance to one-hundredths or one-thousandths of an inch. The

precise detail of the mechanism of the indicator may vary, but a desirable form involves a dial 24 over which an index hand 25 may move, a cover glass 26 affording protection. The index hand 25 mounted on the spindle 27 may be operated in step with the slide member 18, for instance by another set of teeth 28 on the latter coacting with a pinion 29 on the spindle 27.

The manner of use of the device will be readily understood from the foregoing. The tube-entering head is inserted into the tube to be measured, and the operator at the control head then presses the lever 22, thereby causing the rack and pinion motion to move the member 18, connecting rod or tube 17 and plunger 3 forwardly. The pin actuator 8 on the plunger 3 correspondingly moves forwardly, causing the heads 10 of the pins to be moved outwardly by engagement in the slots, and the pins 9 are projected against the inside wall of the tube. The dial is read. The lever 22 is released, and the spring 15 throws the plunger and actuator 8 rearwardly, thus retracting the pins 9. The device is then moved forward to a new position to be measured, and the lever 22 is again operated to project the meter pins 9 and a reading is taken. This is repeated progressively at the desired intervals until the tube has been explored throughout. In the case of very long tubes, operations may be conducted from both ends.

It will thus be seen that a precision survey of the interior of apparatus-tubes may be had, and their rate of thinning out may be exactly checked, so that when the thinning has advanced to an extent recognized as rendering replacement advisable, such replacement may be attended to before a disastrous blow-out may occur. When it is realized that tubes as employed in chemical industry, oil refineries, etc., are more or less continuously subjected to furnace conditions of extremely high temperature, while the liquid or gaseous material within is maintained under pressures upward of a thousand pounds to the square inch, the extreme importance of having a precision check on the condition of the tube walls is readily apparent.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the means stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. A remote control micrometer tube caliper, which comprises a head adapted to enter a tube to be measured, projectable meter-pins radially mounted in said head, a tapering member having longitudinal under-cut slots receiving the inner ends of said meter pins, a plunger carrying said tapering member, a manual control head spaced apart from said first-named head, an extension tube connecting said heads, a rack in said control head, a connection between said plunger and said rack, a dial indicator on said control head, a spindle and pinion for operating said dial, and a hand lever with toothed segment for operating said rack and thereby actuating the meter-pins and the indicator.

2. A remote control micrometer tube caliper, which comprises a head adapted to enter a tube to be measured, a tapered forward end closure for said head, means making a tight dirt-excluding union between said tapered forward end closure and said head, projectable meter elements radially mounted in said head, means engaging said elements to project or retract the same, a manually operated control head spaced apart from the said first-named head, means holding said heads together in predetermined relation, means on the control head for indicating the position of the meter elements, and connecting means between said manual control head and said meter elements.

3. A remote control micrometer tube caliper, which comprises a head adapted to enter a tube to be measured, projectable meter elements radially mounted in said head, actuating means movable against said meter elements, means making a tight dirt-excluding union at the peripheral forward joint between said tapered forward end closure and said head, a manually operated control head spaced apart from said first-named head, means holding said heads together in spaced relation, means on the control head for indicating the position of the meter elements, and a connecting member between said manual control head and said meter elements.

WILLIAM A. PRICE.