Sept. 2, 1958 H. MÜLLER 2,849,799
FEELER-DEVICE
Filed March 14, 1955 2 Sheets-Sheet 1

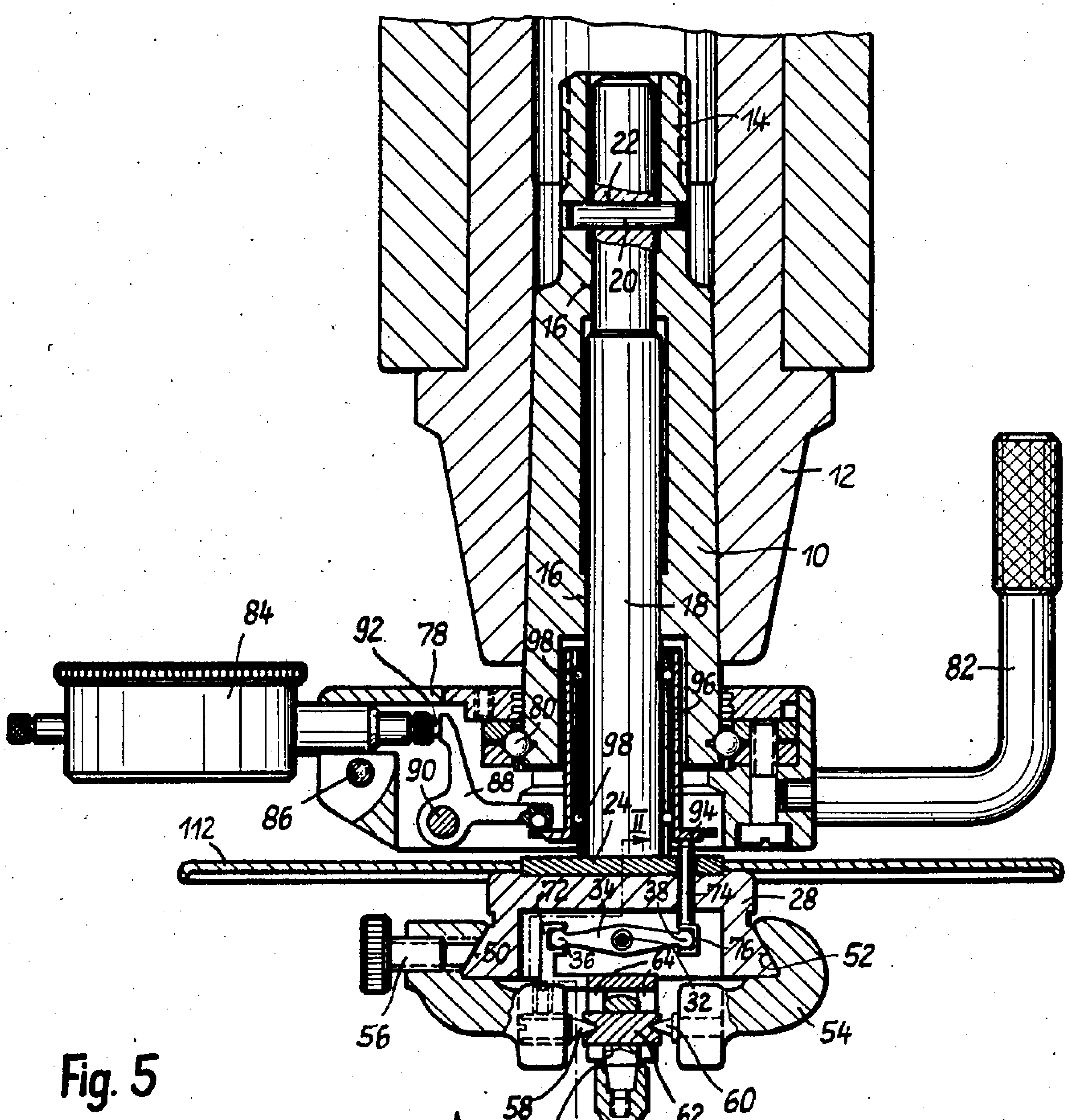
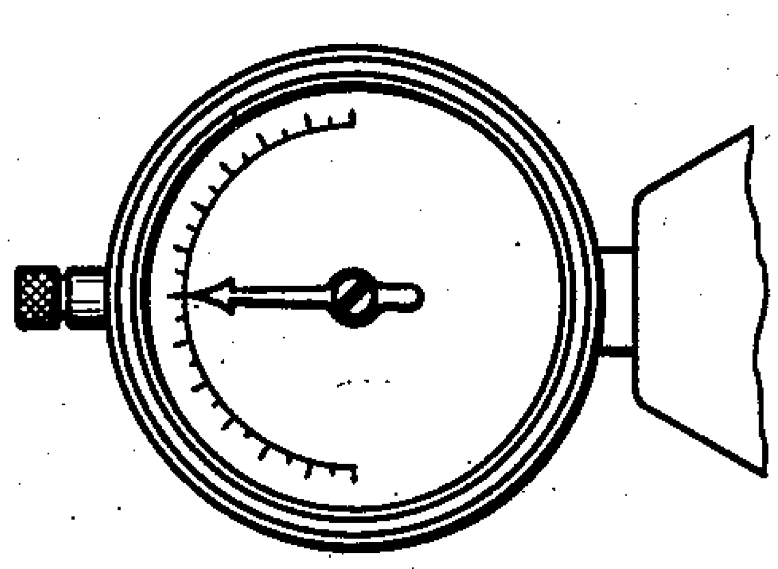


Fig. 1

Fig. 5



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FEELER-DEVICE

Filed March 14, 1955 2 Sheets-Sheet 2

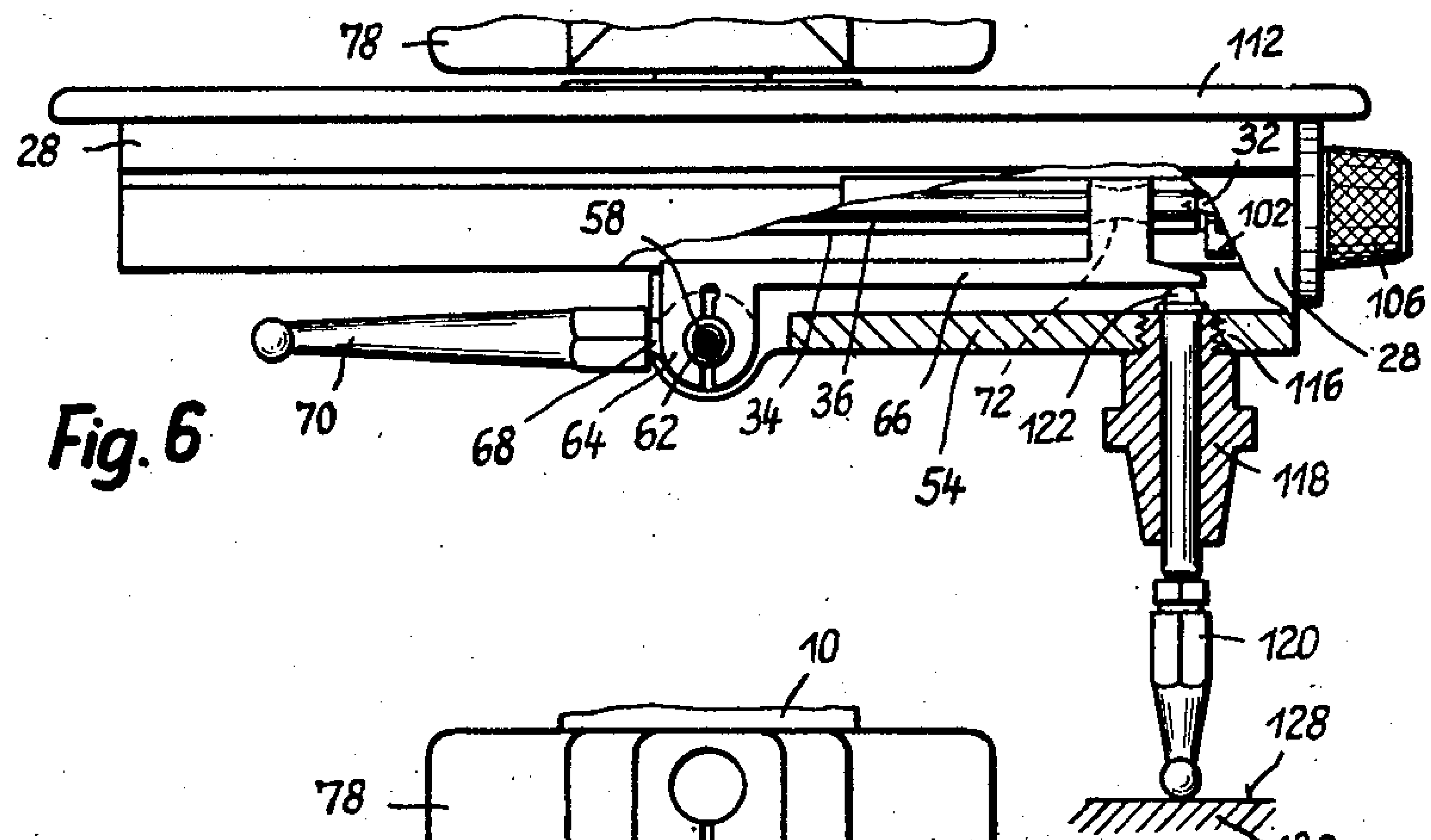

Fig. 6

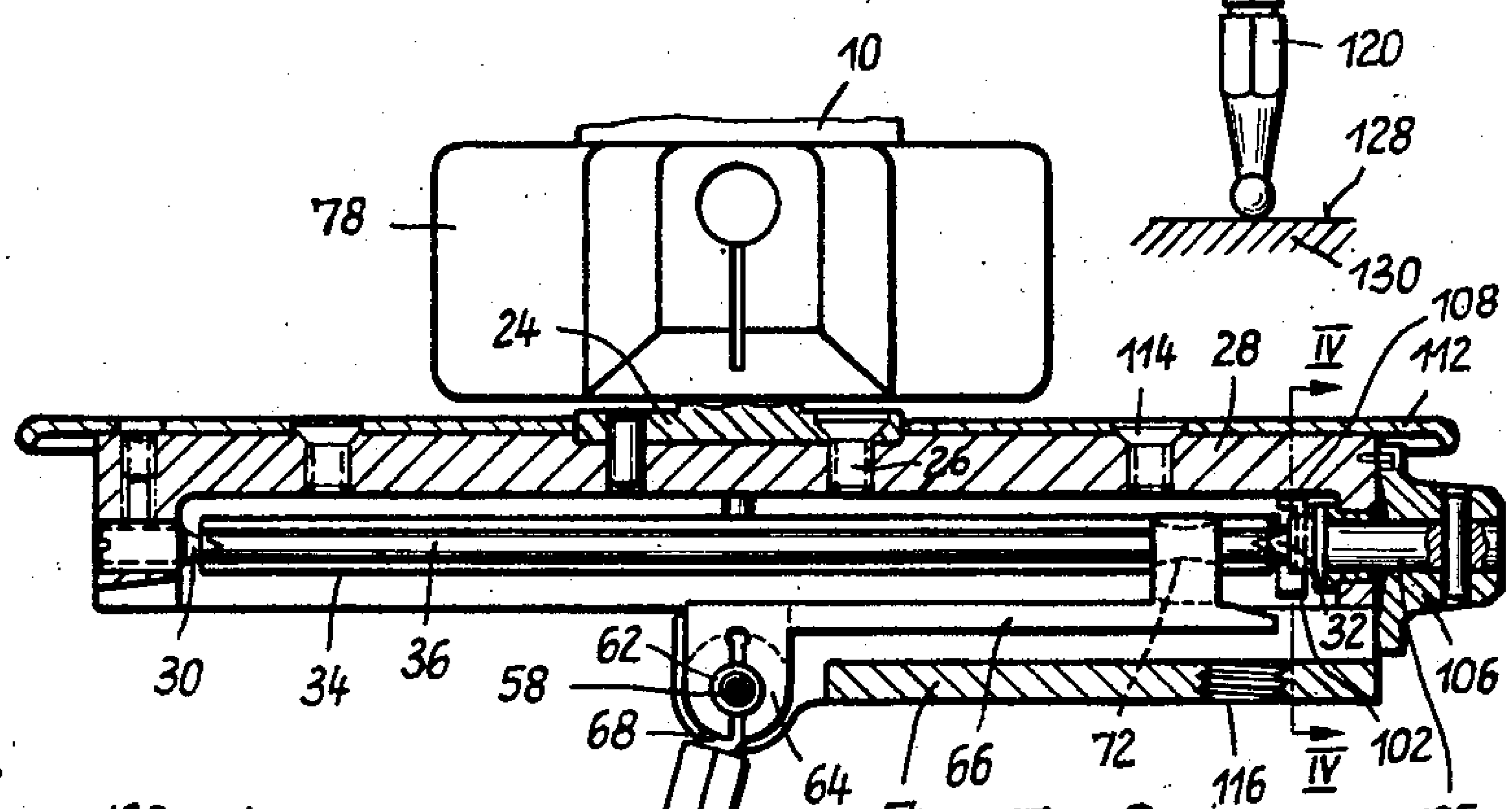

Fig. 2

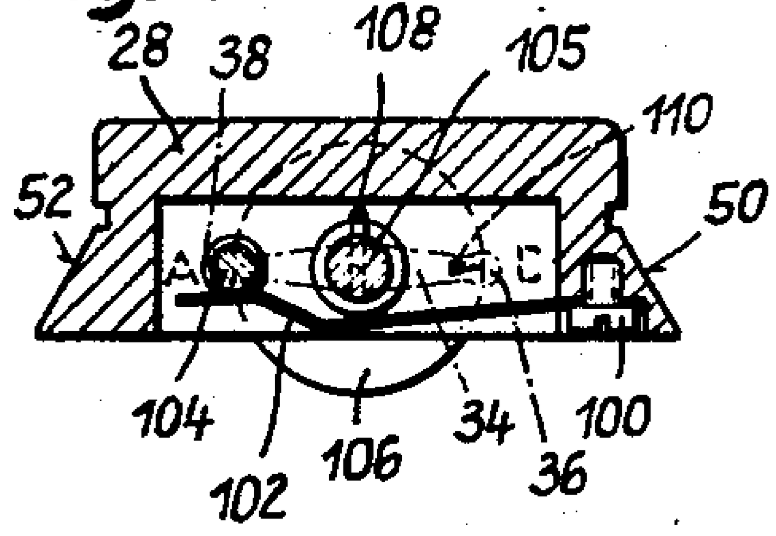

Fig. 4

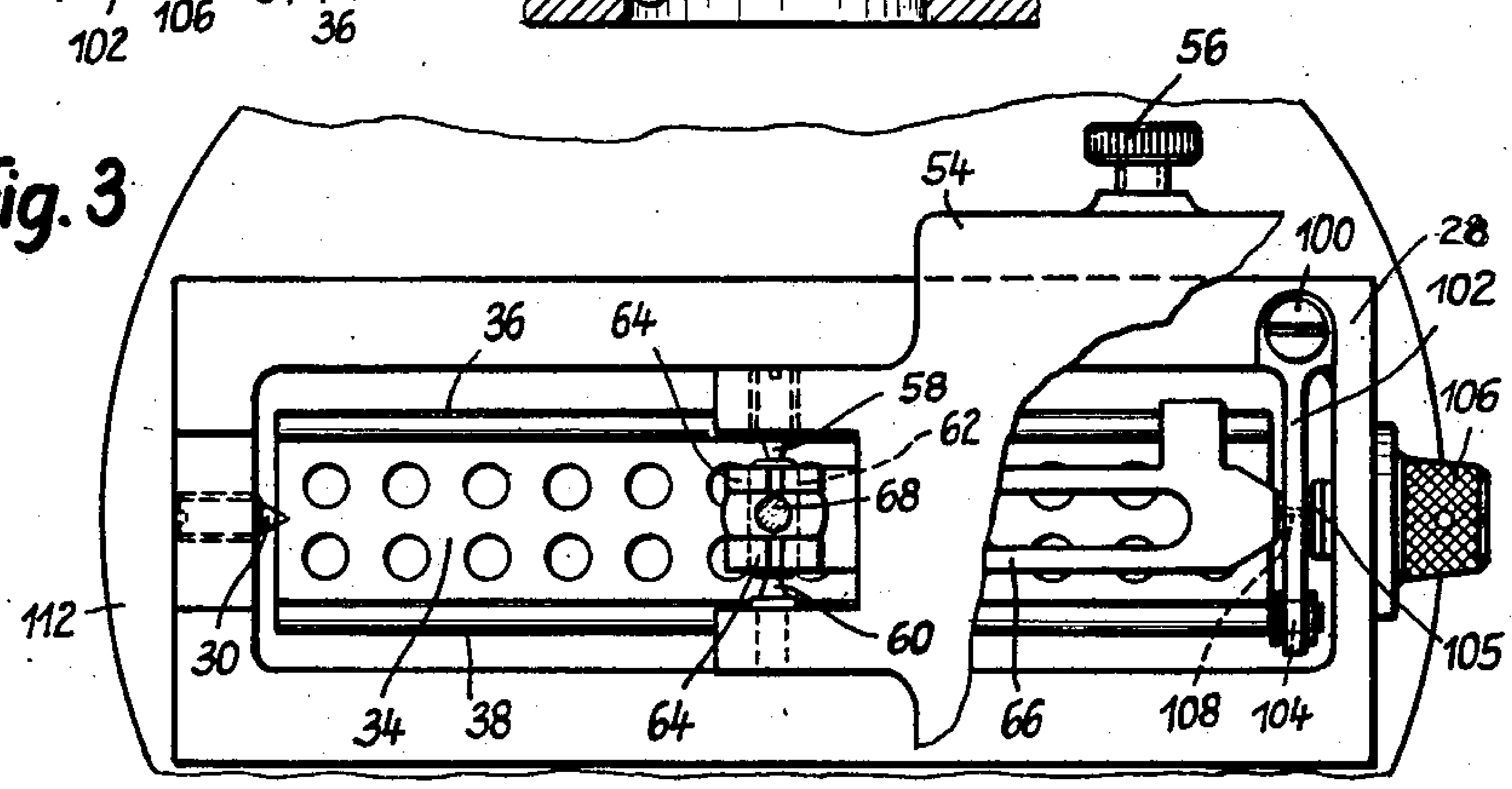

Fig. 3

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2,849,799

Patented Sept. 2, 1958

2,849,799

FEELER-DEVICE

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Application March 14, 1955, Serial No. 494,072

Claims priority, application Germany March 19, 1954

11 Claims. (Cl. 33—172)

My invention relates to a feeler-pin device of the kind comprising an adjustable feeler-pin or lever, a transmitting linkage and an indicator, said parts being mounted in a holder or carrier fitting into and driven by a spindle. This device is preferably employed for gauging or measuring purposes in machine tools or the like with rotatable spindles.

The object of the present invention is to provide a device in which the kinematical train of the transmitting elements from the rotating feeler to the indicating means forms in any position a weight-balanced system, so that it complies with the highest demands of accuracy.

A further object of the invention is to provide a gauging device without a variation in the transmission of the measured values, even in different positions of adjustment of the feeler-pin, so that for instance, parts having different diameters may be readily examined and checked by means of a single scale with a constant graduation associated to the indicator.

To the attainment of this object and in accordance with the invention, an oscillating member in form of a longitudinally extended oscillating plate is arranged in the transmission linkage parallel to the adjusting direction of the feeler or its carrier, the members of the transmission linkage leading to the indicator and the adjustable feeler which engages said oscillating plate.

According to a further characteristic of the invention the oscillating plate is mounted along its symmetrical axis, whereby the member of the transmission linkage leading to the indicator preferably engages the oscillating plate on the one longitudinal side and the adjustable feeler engages the plate on the other longitudinal side thereof, said parts extending in opposite directions with respect to the plane of the oscillating plate.

The invention will be more fully understood from the following specification which sets forth a representative embodiment of the invention by reference to the accompanying drawings wherein:

Fig. 1 represents a preferred embodiment of the measuring device according to the invention in vertical section;

Fig. 2 is a fragmentary vertical section taken substantially on line II—II of Figure 1;

Fig. 3 is an elevation of the embodiment of the invention in the direction of the arrow in Fig. 1;

Figs. 4 and 5 show details of said embodiment; and

Fig. 6 represents the measuring device in another position.

The illustrated feeler-pin measuring device is supported on a tapered arbor 10 adapted to fit inside the spindle 12 of the machine tool and to be secured therein in the usual manner at the end plug 14 thereof. The tapered arbor 10 has an axial bore 16 containing an axis 18. This axis is here fixed by a pin 20 traversing a bore hole 22. The axis 18 has at its lower end a flange 24 to which a caplike bearing carrier 28 is attached by means of screws 26 (Fig. 2) in such a manner as to accurately follow the rotation of the machine spindle 12 and therefore the tapered arbor 10 and the axis 18 of the measuring device.

The bearing carrier 28 contains two bearing points 30, 32 for a longitudinally extended oscillating plate 34 mounted in its symmetrical axis. Said plate 34 has two longitudinal sides 36, 38 which are rounded at their peripheral edges. A slide 54 is movable on the external longitudinal sides 50, 52 of the bearing carrier 28 and can be fixed in its set position by means of a clamping screw 56. An axle 62 is pivotally mounted between the bearing points 58, 60 of the slide 54 and rigidly coupled with the fork-shaped ends 64 of one arm 66.

Between the fork-shaped ends 64 of said first arm 66 there is fixed a second arm 68 which carries the feeler 70. The tensioned grip between the ends 64 of the arms 66 and the axle 62 results in substantial friction so that the arm 68 with the axle 62 can be maintained in different relative positions with respect to the arm 68 and 70. The arms 66 and 68 thus form a bell crank lever serving as a feeler lever or pin. The angle of said bell crank lever can be varied by adjusting the arm 68 with respect to the arm 66.

The arm 66 of the feeler-pin has a recess 72 having inwardly curved walls, which tangentially engage the longitudinally extended side 36 of the oscillating plate 34. The bearing carrier 28 contains an axially movable transmitting pin 74 having an opening 76 on one end thereof. The opening 76 is coupled with the longitudinally extending side 38 of the oscillating plate 34.

A carrier 78 is rotatably mounted on the tapered arbor 10 by means of a ball bearing 80. The carrier 78 shows a handle 82 by means of which it can be moved or held in any desired position with respect to the arbor 10 or the spindle 12. The dial gauge 84 is located in the carrier 78 and can be fixed in the set most advantageous position by means of a clamping screw 86. A bell-crank lever 88, which is rotatably mounted on the plug 90 of the carrier 78 engages on the one hand the axially movable and spring-loaded pin 92 of the dial gauge 84, and on the other hand the flange 94 of a sleeve 96 which is axially adjustable on the axis 18 by means of ball bearings 98. The transmitting pin 74 also is in engagement with the other side of the flange 94.

A leaf spring 102 is mounted by means of a screw 100 in the bearing member 28 and presses against a plug 104 of the oscillating plate 34 and tends to swivel this plate around its bearing points 30, 32. The engagement of this leaf spring 102 may be disconnected by means of a control knob 106 mounted on the shaft 105 of the bearing point 32. For this purpose this control knob is turned so far that a pin 108 transversely fixed in its shaft 105 disengages the leaf spring 102 from the plug 104 of the oscillating plate 34. An index 110 of the control knob 106 cooperates with the marks "A" and "I" of the bearing carrier 28. When set for "I" (internal diameter measuring) the leaf spring 102 is brought into contact with the oscillating plate 34; when set for "A" (external diameter measuring), said leaf spring 102 is out of contact.

A disc shaped metal sheet 112 is attached on the upper side of the bearing carrier 28 by screws 114; thus providing a protection of the operator against injury by the rotation of the bearing carrier 28 and the slide 54 is guaranteed.

The slide 54 shows at the lower side a tapped hole 116, in which may be screwed in certain cases a bearing bushing 118 for an additional or auxiliary axially movable feeler-pin 120, the free end thereof engaging the first arm 66 in order to cause the oscillating movement of the plate 34 for measuring purposes, as will be explained in more detail hereinafter.

The described device acts in the following manner: When it is required, for instance, to verify the centering of a bore 124 in a work piece 126, fixed on the work table of the machine tool, with reference to the axis of the machine tool spindle 12, the slide 54 is set along the guides 50, 52 until the feeler point 70 of the feeler-pin makes contact with the wall of the bore 124. The slide 54 is then fixed in this position by the clamping screw 56. When thereafter the spindle **12** together with the elements **10**, **28**, **34** and **54** of the feeler device are rotated, the feeler point **70** follows the profile of the bore **124** and is deflected in the process, such deflection being transmitted by the arm **66** of the feeler-pin to the oscillating plate **34** to which it thus imparts a slight oscillatory motion. This oscillation movement is transmitted through the transmitting pin **74** to the flange **94** as an axial thrust which again is communicated through the bell-crank lever **88** to the dial gauge **84**, **92** and is indicated there in known manner by deflection of the needle or pointer over the dial. In accordance with the indications of the dial gauge, the work piece **126** with its bore **124** can be centrally located with reference to the axis of the spindle **12** by the usual adjusting means.

The device is adapted to gauge not only bore but also external diameters or plane surfaces. When verifying the external diameters, the leaf spring **102** has to be disconnected, while all the other measuring operations are the same as described hereinbefore. When verifying plane surfaces, the feeler pin **70** has to be made inoperative by setting out (Fig. 6) and the bushing **118** with the additional feeler **120** has to be screwed in the bore **116** of the slide **54**. The plane surface **128** of a work piece **130** (Fig. 6) is measured by turning the bearing carrier **28**, and the deflections are transmitted as an axial stroke of the feeler pin **120** over the arm **66** to the oscillating plate **34**, which again communicates the deflections thereafter in the mentioned way to the dial gauge **84**.

By virtue of the described inventive construction of the oscillating plate as a longitudinally extended oscillating plate **34** in the kinematical train of the transmission elements from the dial gauge, set in a suitable position for reading, relative to the rotary feeler-pin **70**, on arm **66** the oscillating plate causes a weight-balance in the train of the parts, said balance being necessary for fine and exact measuring. Because the engagement between one longitudinal side of the oscillating plate and the feeler is adjustable in longitudinal direction, without altering the transfer or transmission ratio between the feeler and the transmission linkage accurate and precise measurements are assured. Thus it is possible to verify directly different diameters on the work pieces by means of a single calibrated scale of the dial gauge and in this way to read the measured values directly in all cases.

The arrangement according to the invention may also be employed on measuring devices where the dial gauge is not fixed and wherein the whole measuring device rotates. Also the oscillating plate itself and the adjusting slide for the feeler may be arranged in other ways, that is inclined with reference to the axis of the spindle.

While I have described one of the preferred embodiments of my invention I realize that modifications may be made and I desire that it be understood that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

What I claim is:

1. A feeler device comprising a holder, a feeler-pin mounted for adjustable movement diametrically of said holder, a transmission linkage and an indicator, said parts being mounted in said holder, said holder fitting into and being rotatably driven by a spindle, the transmission linkage comprising an oscillating member in the form of an elongated plate extending parallel to the direction of adjustable movement of said feeler-pin, and being pivotally mounted along an axis lying in its longitudinal direction, said elongated plate being connected to the indicator and to the feeler-pin, said transmission linkage being connected to the indicator and to the feeler-pin.

2. A feeler device as set forth in claim 1, in which said plate is pivotally mounted along its symmetrical axis, and wherein the transmission linkage connecting said indicator connects with the plate on one longitudinal side and wherein the feeler-pin connects with said plate on the other longitudinal side thereof, said connections extending in opposite directions with respect to the plane of the plate.

3. A feeler device as set forth in claim 1, in which the plate is mounted in a bearing carrier, rigidly coupled with and rotatably driven by the holder, and a slide arranged on said bearing carrier and adjustable thereon in a direction longitudinally of the plate, said feeler-pin being mounted on and adjustable with said slide.

4. A feeler device as set forth in claim 1, which includes a bushing movable in the axial direction of the holder and forming a part of the said transmission linkage between said plate and said indicator, the rotational movement of the plate transmitting an axial stroke of the bushing.

5. A feeler device as set forth in claim 1, in which said plate is mounted in a bearing carrier, and wherein a spring means is located in the bearing carrier and connected with said plate for subjecting said plate to tension.

6. A feeler device as set forth in claim 1, which includes a bearing carrier, spring means located in said bearing carrier, a control device rotatably mounted in said bearing carrier and engaging said spring means for engaging and disengaging said spring means with respect to said plate.

7. A feeler device as set forth in claim 1, which includes a bearing carrier, a bell-crank lever having a pair of arms adjustable in angular position mounted in said carrier, one arm thereof engaging said plate and the other arm thereof being connected to said feeler-pin.

8. A feeler device as set forth in claim 1, which includes a bearing carrier rigidly coupled and rotatably driven by said holder, a slide arranged on said bearing carrier and adjustable thereon in a direction longitudinally of said plate, said slide including holding means for mounting an auxiliary feeler-pin, and an auxiliary feeler-pin mounted on said slide and engageable with said plate.

9. A feeler device for measuring the eccentricity of round objects, borings and the like, comprising a tool holder, a holder insertable into the tool holder, a carrier supported by said holder, slides mounted on said carrier, a feeler-pin displaceable radially on said slides whereby said feeler-pin may be adjusted to the diameter of an object to be measured, an elongated plate pivotally mounted in said carrier on an axis extending in the longitudinal direction of said plate, a feeler connected with one peripheral edge of said plate and adjustable longitudinally along the plate, a connection between said feeler-pin and said feeler, a force transmitting member displaceably mounted in said carrier and engaging the opposite peripheral edge of said plate, a stationary support rotatably journaled on said holder, an indicator mounted on said support, and means interconnecting said transmitting member and said indicator.

10. A feeler device for measuring the eccentricity of round objects, borings and the like as set forth in claim 9, in which said elongated plate is symmetrical with respect to its axis of rotation whereby the lever arms operating said feeler and said transmitting member are identical.

11. A feeler device for measuring the eccentricity of round objects, borings and the like as set forth in claim 9, in which said means interconnecting said transmitting member and said indicator comprises a cylindrical bushing concentrically surrounding said holder and displaceable in an axial direction with respect thereto, an annular flange on said bushing, said force transmitting member engaging said flange, and a connection between said flange and said indicator.

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