

Sept. 4, 1951

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2,566,970

EXPANSION GAUGE

Filed Dec. 21, 1948

2 Sheets-Sheet 1

FIG. 1

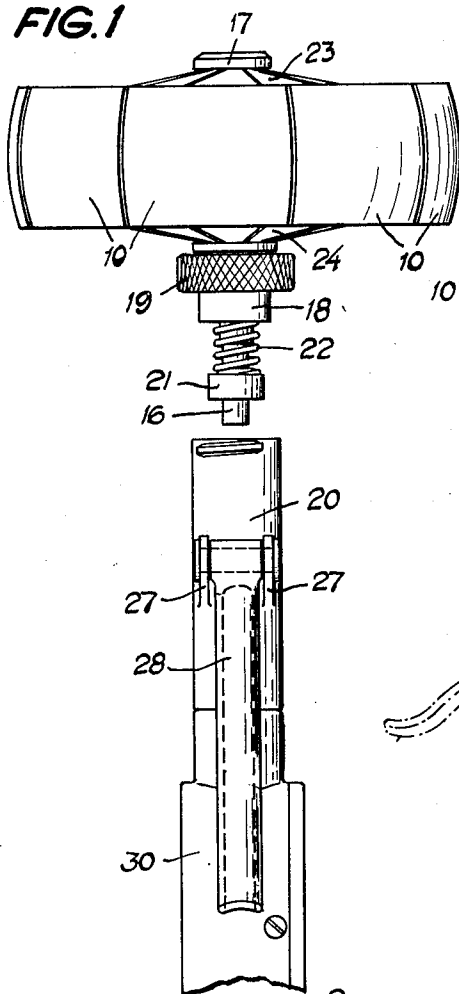


FIG. 2

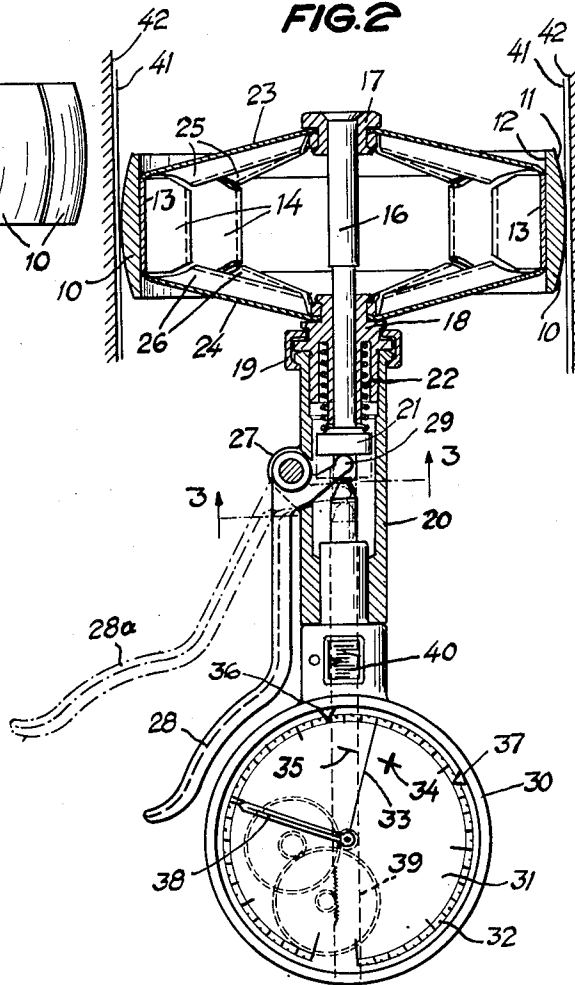
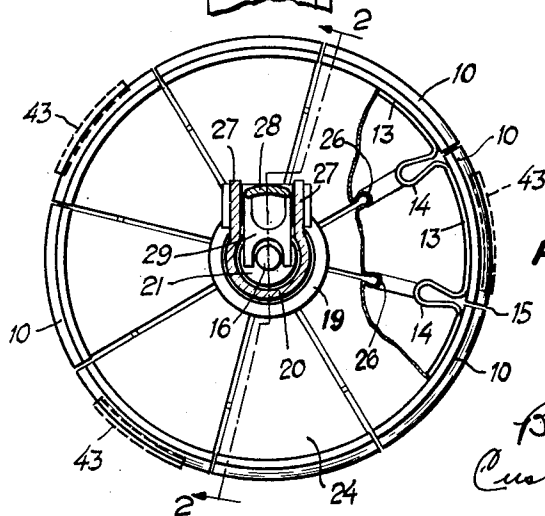


FIG. 3

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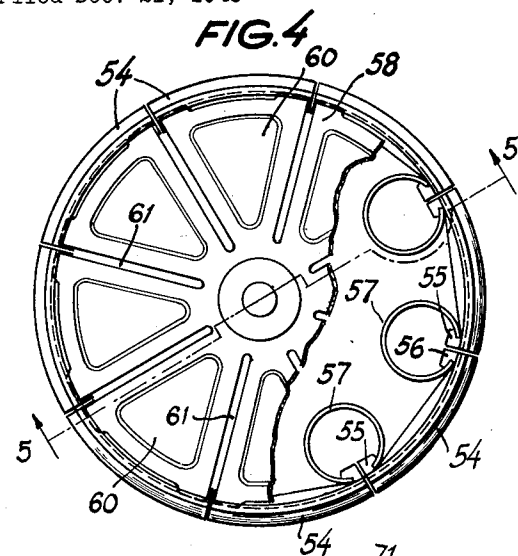
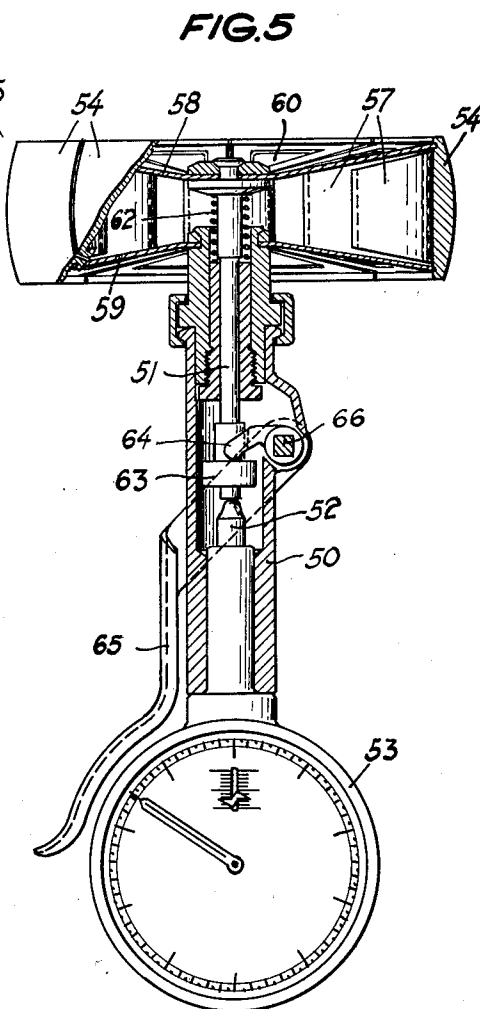
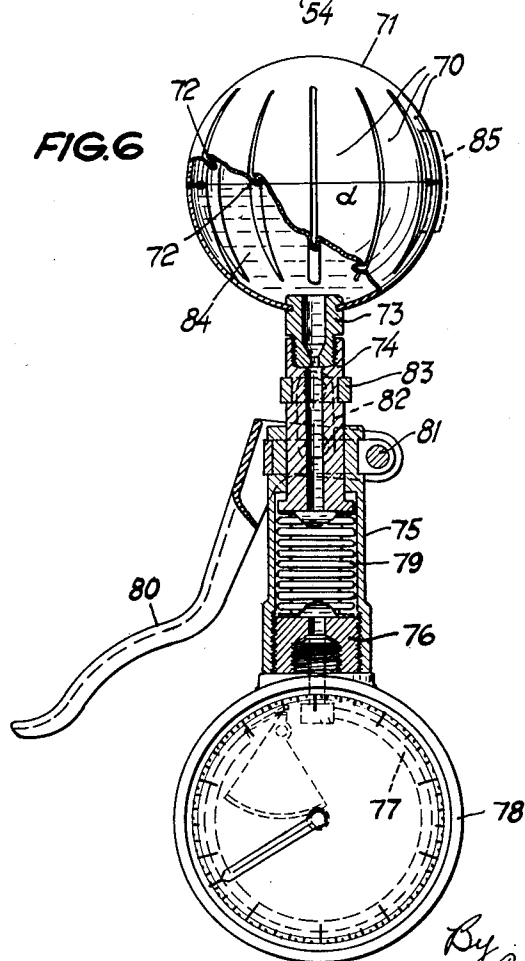
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EXPANSION GAUGE

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2 Claims. (Cl. 33-178)

1

This invention relates to expansion gauges for taking measurements of holes or similar cavities and has for its primary object to provide an improved construction which is easy to manipulate and ensures a high degree of exactness.

I attain this and other objects by mechanism illustrated in the accompanying drawings, in which

Fig. 1 is an elevation of an expansion gauge constructed in accordance with this invention and viewed from the left of Fig. 2, the upper and lower portions of the gauge being shown as separated from each other, and part of an appertaining indicator being broken away; Fig. 2 is a sectional view of the gauge along the line 2-2, Fig. 3; Fig. 3 is a cross-section taken on the line 3-3, Fig. 2; Fig. 4 is a top view of a modified embodiment of the invention; Fig. 5 is a sectional elevation thereof, the section being taken on the line 5-5, Fig. 4; and Fig. 6 is a section in part of a third embodiment of the invention.

Referring to Figs. 1 to 3, reference numerals 10 denote a number of abutting members spaced from each other and disposed such as approximately to form parts of an annular body. The members 10 have substantially spherical outer faces 11 and cylindrical inner faces 12 and are at their inner faces soldered, welded or otherwise secured to cylindrical sections 13 of a resilient member, the sections 13 being interconnected by inwardly projecting portions 14. The portions 14 are resilient in the circumferential direction and tend to move the sections 13 and members 10 radially inwardly so as to reduce the clearances 15 between the members 10.

Centrally within the member 13, 14 there is provided a rod 16 which at its upper end is connected with a collar 17. The rod 16 extends with a sliding fit through a guide member 18 which by means of a bayonet-catch 19 is detachably secured to a tubular housing 20. Near the lower end of the rod 16, there is an enlarged portion or collar 21 against which rests one end of a helical spring 22 the other end of which abuts against the bottom of a recess in the guide member 18. Between the inner faces 12 of the abutting members 10 and the members 17 and 18 there are provided slightly conical and thin-walled covers 23 and 24, respectively, which at their central portions are inserted into annular recesses in the members 17 and 18 and at their outer edges abut against the faces 12 and the upper and lower edges of the sections 13. The conical covers 23 and 24 have a number of in-

2

wardly pressed portions 25 and 26, respectively, so that the covers are substantially rigid in radial directions, but resilient in the circumferential direction.

The housing 20 has two lugs 27 in which is pivotally mounted a lever or handle 28 having a bifurcated arm 29 extending into the housing through an opening in the wall thereof so as to be able to engage the lower face of the collar 21.

The housing 20 is further connected with an indicator 30 of any suitable construction. In the embodiment illustrated, the indicator comprises a dial 31 having a scale 32, a zero mark 33 and plus and minus marks 34 and 35. The indicator further has two allowance marks 36 and 37. Although not shown in the drawing, it will be understood that means known per se may be provided for adjusting the dial and the marks 36 and 37 in order to adapt the indicator to different ranges of measurement. The pointer 38 of the indicator is actuated by a gear wheel transmission indicated by dotted lines and in turn actuated by a toothed bar 39 the upper end of which abuts the lower end of the rod 16. The bar 39 may have characters 40 indicating the number of revolutions of the pointer 38.

The mode of operation of the gauge described is as follows.

With the handle 28 in the position shown by full lines in Fig. 2, the arm 29 keeps the rod 16 against the action of the spring 22 in a position in which the collar 17 is remote to a great distance from the guide member 18. The covers 23 and 24 maintain the members 10 and 13 in positions such that the outer faces 11 of the members 10 are touching an imaginary cylindrical surface indicated by the lines 41, 41 in Fig. 2. In this position, the abutting members 11 can be introduced into a hole 42, 42 having a diameter greater than the diameter of the cylindrical surface 41, 41. If then the handle 28 is released, the spring 22 will force the rod 16 in a downward direction as viewed in Fig. 2 so as to turn the handle toward the position indicated by the dot-and-dash lines 28a. As a result of the downward movement of the collar 17, the apex angles of the cones formed by the covers 23 and 24 will be increased, and the outer edges of the covers will move radially outwardly, this being rendered possible on account of the resiliency of the inwardly projecting portions 25 and 26. Consequently, the members 13 and 10 will be forced radially outwardly against the resiliency of the portions 14, and during this movement the outer faces 11 of the members

3

10 will touch imaginary cylindrical surfaces having gradually increasing diameters until the movement will be stopped when the faces 11 come into contact with the wall 42, 42 of the hole to be gauged. Since the movement of the rod 16 is transmitted to the pointer 38, the diameter of the hole can be read on the scale 32. In order to withdraw the gauge from the hole, the handle 28 should be slightly depressed toward the position indicated by full lines so as to force the abutting members 10 radially inwardly.

Instead of having all of the members 10 abut against a common cylindrical surface it may in certain cases be desirable to gauge a hole by contact at three points only. To this end, contact members may be permanently and detachably secured to three of the members 10, such contact members being indicated by dotted lines 43 in Fig. 3.

Turning now to the modified form of construction shown in Figs. 4 and 5, the housing 50, rod 51, bar 52 and indicator 53 are generally designed in a similar manner, and serve the same purposes, as the corresponding parts of the embodiment described with reference to Figs. 1 to 3. Each of the abutting members 54 is provided with two inner projections 55 and 56 having vertically extending recesses or grooves which are engaged by the edges of slotted cylindrical members 57, as will be clearly seen from Fig. 4 in which, for the sake of clearness, part of the upper cover is broken away and the lower cover is omitted. The cylindrical members 57 consist of a suitable resilient material and tend to force the members 54 circumferentially toward each other. In this embodiment, too, there are provided an upper conical cover 58 and a lower conical cover 59 abutting against the recessed inner faces of the members 54. In the present instance, the apices of the cones formed by the covers are directed inwardly against each other, whereas in the previously described embodiment they are directed from each other. In order to make the covers as rigid and resistant as possible in the radial direction, they are formed with depressed portions 60, and in order to render possible variations of the apex angle of the cone, each cover has a number of radial slots 61 serving the same purpose as the portions 25 and 26 of the first embodiment.

The rod 51 is secured to the central portion of the upper cover 58 and is subject to the action of a helical spring 62 which tends to force the rod upwards and thus to increase the distance between diametrically opposed abutting members 54. The rod 51 has a collar 63 to be engaged by an arm 64 of a handle 65 pivotally mounted at 66.

The mode of operation is substantially the same as that described with reference to Figs. 1 to 3. In Fig. 5, the handle 65 is shown in its depressed position in which the spring 62 is compressed and the members 54 can be introduced into a hole to be gauged. When the lever 65 is released, the spring 62 tends to make the conical covers more nearly plane with the result that the members 54 will be forced radially outwardly against the resilient action of the members 57.

In both embodiments described, the covers are preferably constructed in a manner such that in entirely unloaded conditions they are less conical than in their inserted positions so that the covers, too, will tend to force the abutting mem-

4

bers outwardly against the resiliency of the members 14 and 57.

In the embodiment illustrated in Fig. 6, the abutting members for contacting the wall of a hole to be gauged are constituted by sections 70 of a substantially spherical hollow member 71, the sections 70 being spaced apart by inwardly pressed portions 72 extending along meridians of the sphere. The member 70 is made of some resilient material, and the portions 72 tend to contract the member 70 such as to decrease the diameter d thereof. The portions 72 thus act in the same manner as the portions 14 shown in Figs. 2 and 3 and as the resilient members 57 shown in Figs. 4 and 5. At its bottom, the member 71 has an opening the edges of which are tightly attached to a nipple 73 threaded into a tube 74 which slidably extends into a housing 75. Into the lower portion of the housing, there is threaded a hollow plug 76 which communicates with a Bourdon tube 77 of a pressure gauge 78. Between the lower end of the tube 74 and the upper end of the plug 76, a flexible bellows 79 is inserted in a liquid-tight manner. A handle or lever 80 mounted on the housing 75 at 81 is articulated to a link 82 which is pivoted on a ring 83 inserted in a recess in the tube 74. The hollow system, that is, the spherical member 71 and the Bourdon tube 77 as well as the passages therebetween are entirely or to a considerable degree filled with a liquid 84, such as oil.

In operation, the member 71 is introduced into the hole to be gauged. Then the lever 80 is depressed so as to force the tube 74 downwards within the housing 75. Due to the resultant increase in pressure of the liquid, the member 71 will be expanded until the outer faces of the sections 70 will touch the wall of the hole. The pressure of the liquid prevailing at that moment will obviously be a function of the diameter of the hole and will be indicated by the pointer of the pressure gauge 78, the seal of the same being preferably graduated so as to indicate the diameter of the hole in a convenient unit of length. It will be manifest that the conical abutting members 23 and 24 (Fig. 2) and the conical members 58 and 59 (Fig. 5) may either directly bear against the inner faces of the abutting members 10 and 54 respectively or each may engage a suitable member carried by the adjacent abutting member and constitute a part thereof.

If desired, contact members may be secured to the outer faces of the sections 70, as indicated by the dotted line 85. Also in other respects, the constructions described may be modified within the scope of the appending claims.

What I claim is:

1. An expansion gauge comprising in combination a plurality of abutting members disposed circumferentially with respect to a common axis and having outer faces which touch an imaginary circumscribed cylindrical surface, resilient means engaging said abutting members substantially in the circumferential direction thereof and tending to move said members radially inwardly, two substantially conical members abutting against the inner faces of said abutting members, a stationary part secured to the central portion of one of said conical members, a displaceable rod secured to the central portion of the other one of said conical members, said conical members being circumferentially resilient, resilient means engaging said stationary part and said rod and tending to move said rod so as to increase the apex angles

5

of said conical members whereby to move said abutting members radially outwardly against the action of said first-named resilient means, and means indicating the position of said rod.

2. An expansion gauge comprising in combination a plurality of abutting members disposed circumferentially with respect to a common axis and having outer faces which touch an imaginary circumscribed cylindrical surface, resilient means engaging said abutting members substantially in the circumferential direction thereof and tending to move said members radially inwardly, two substantially conical members abutting against the inner faces of said abutting members, a stationary part secured to the central portion of one of said conical members, a displaceable rod secured to the central portion of the other one of said conical members, said conical members being circumferentially resilient, resilient means engaging said stationary part and said rod and tending to move said rod so as to increase the apex angles of said conical members whereby to move said abutting members radially outwardly against the action of said first-named resilient means, manually operable means for counteracting the tendency of said second-named resilient means

6

whereby to decrease the apex angles of said conical members and permit said first-named resilient means to move said abutting members radially inwardly, and means indicating the position of said rod.

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