THREAD GAGE

Filed Jan. 26, 1955 4 Sheets-Sheet 1

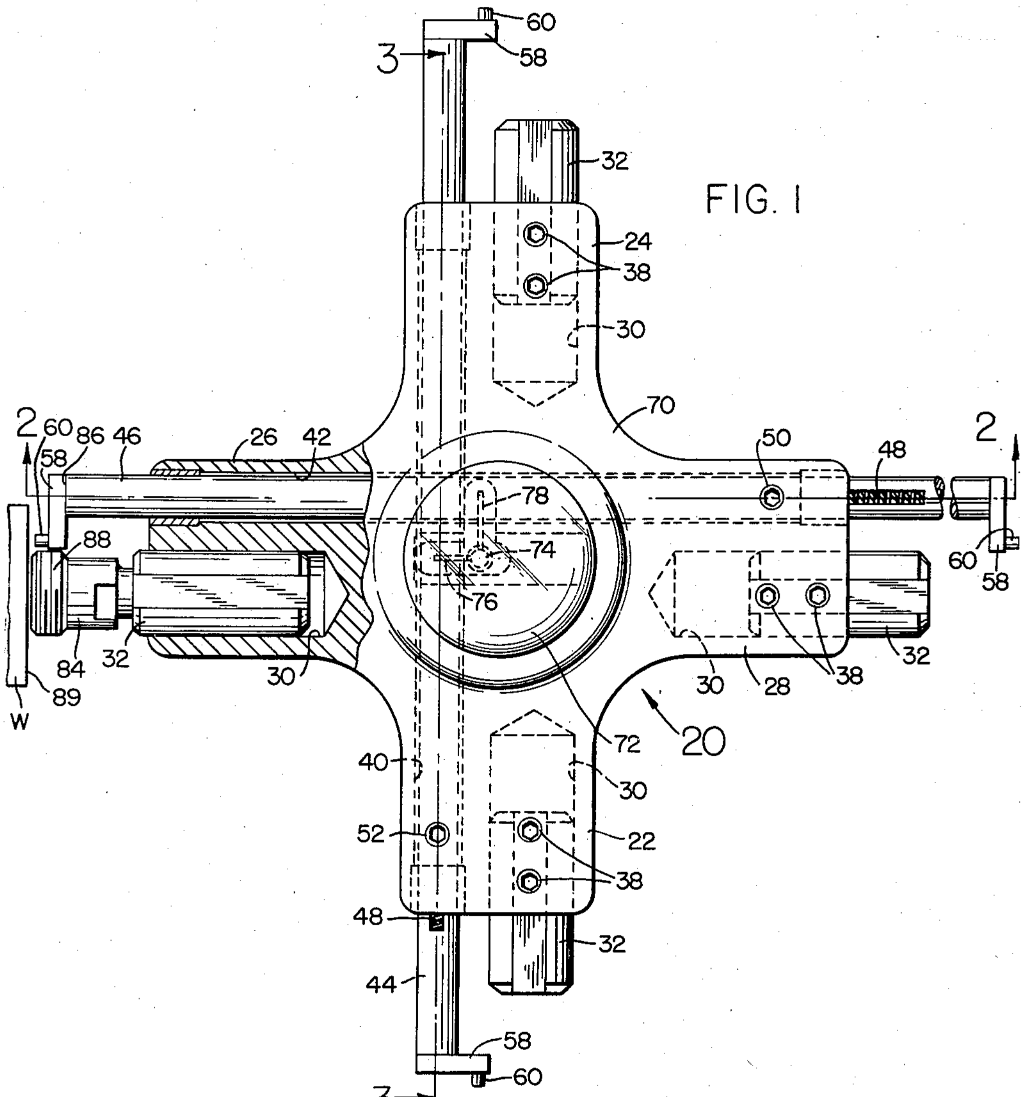

FIG. 1

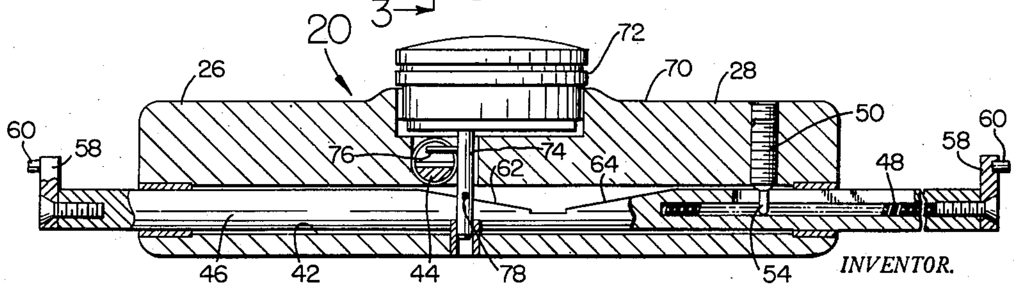

FIG. 2

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THREAD GAGE

Filed Jan. 26, 1955 4 Sheets-Sheet 2

FIG. 3

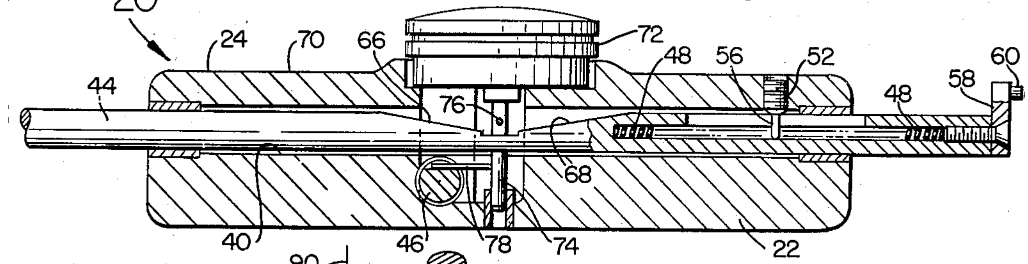


FIG. 4

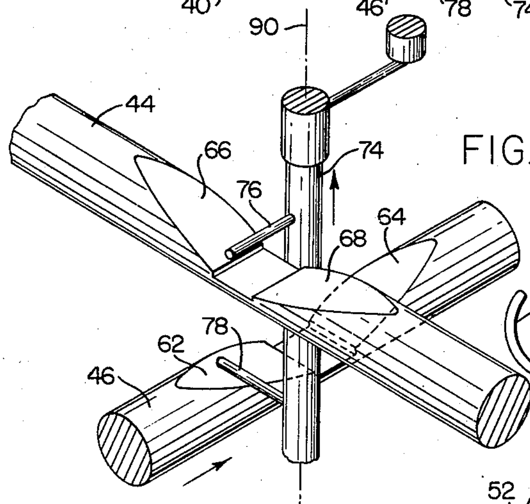
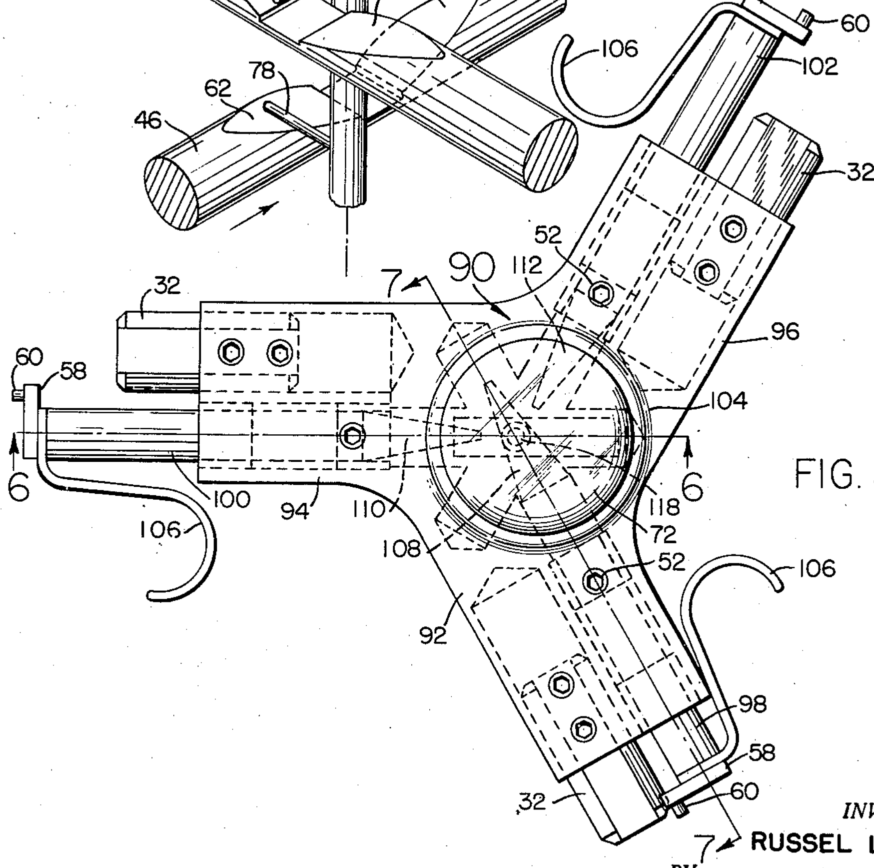


FIG. 5



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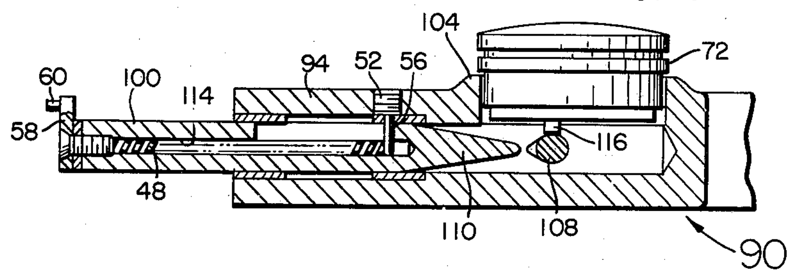
THREAD GAGE

Filed Jan. 26, 1955 4 Sheets-Sheet 3

FIG. 6



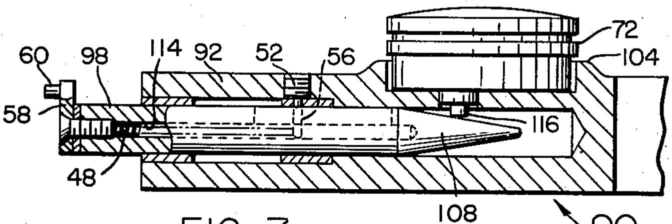


FIG. 7

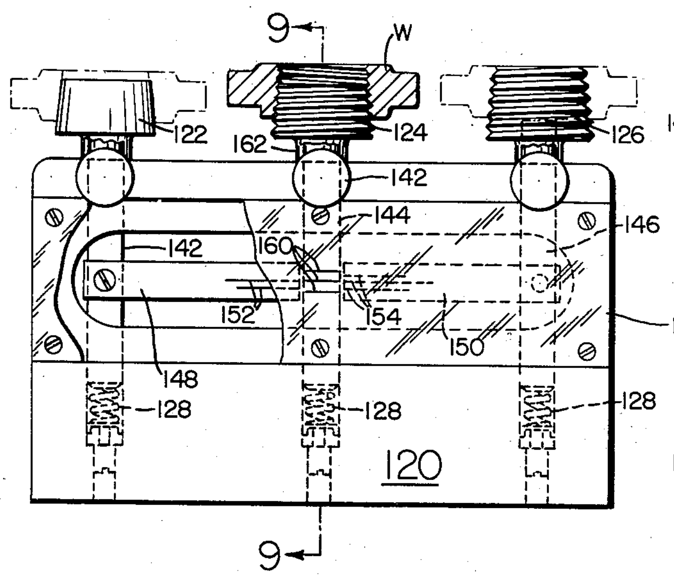
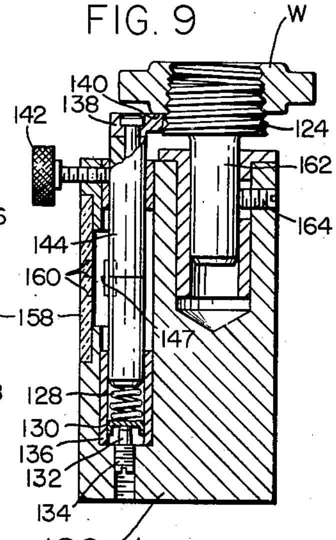


FIG. 8

FIG. 9



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THREAD GAGE

Filed Jan. 26, 1955 4 Sheets-Sheet 4

FIG. 10

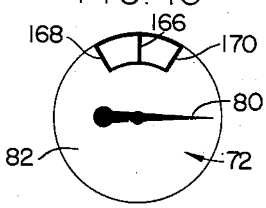


FIG. 11

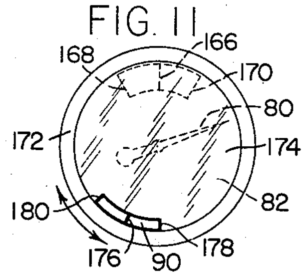


FIG. 12

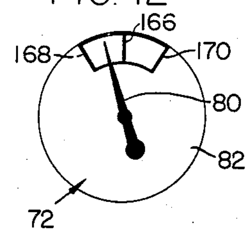


FIG. 13

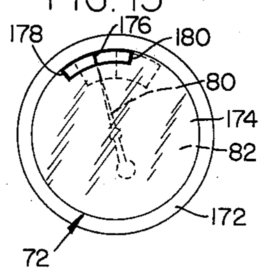


FIG. 14

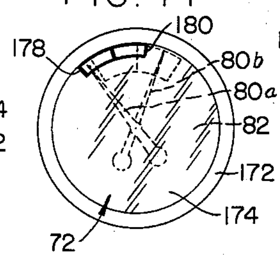


FIG. 15

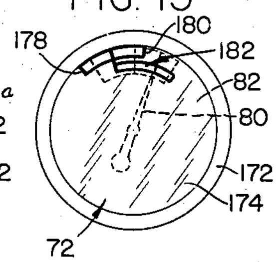
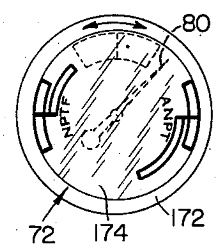


FIG. 16



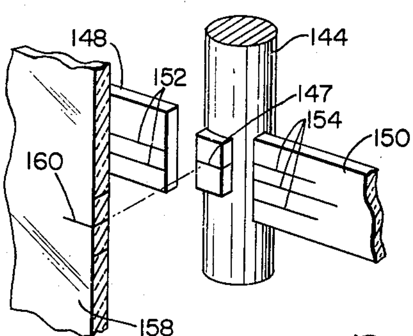


FIG. 17

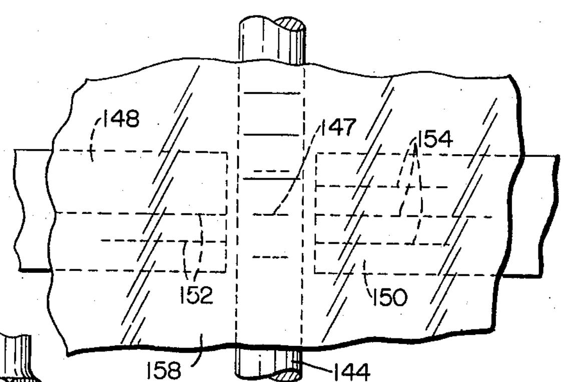


FIG. 18

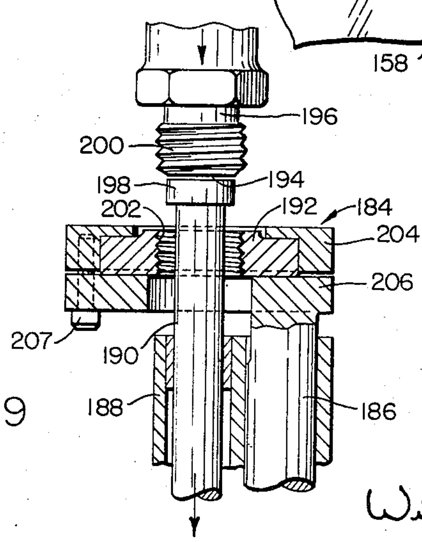


FIG. 19

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United States Patent Office

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Patented May 6, 1958

1

2,833,053

THREAD GAGE

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Application January 26, 1955, Serial No. 484,183

13 Claims. (Cl. 33—199)

This invention relates to thread gaging devices and particularly to devices for gaging tapered pipe threads and the like.

In the manufacture of taper threaded fittings, assurance of a quality product requires that the threads of a fitting be inspected for size, form, taper, truncation and any other special requirement peculiar to a given fitting. Generally speaking, however, in order for a taper threaded fitting to pass inspection, the threads must neither exceed a predetermined oversize pitch diameter tolerance range nor fall short of a predetermined undersize pitch tolerance range and, additionally, the taper of the threads and the truncation of both crests and roots of the threads must fall within an allowable tolerance range in relation to the pitch diameter. To inspect or gage the threads on the inside of a fitting or workpiece, i. e., interior diameter or I. D. threads, a socalled L_1 thread plug gage (a frustum of a cone having threads on its exterior wall surface), upon which have been accurately machined mating outside diameter or O. D. threads, is employed. If the threads in the workpiece are accurate, the L_1 thread plug gage will fit smoothly and snugly within the workpiece. If the threads are oversize, the L_1 thread plug gage will enter the workpiece too far, and, conversely, if the threads are undersize, the gage will be unable to enter the workpiece far enough.

The inspection of O. D. threads is the same in principle as the I. D. thread inspection just described, with the exception that a L_1 thread ring gauge, having accurately machined I. D. threads on the interior surface of the ring, is employed to check O. D. threads of a fitting or workpiece.

It is standard practice to employ four or more plug gages to make an inspection of a single workpiece. For a threaded fitting one gage will normally have threads cut to match the basic size of the upper threads in the threaded hole. A second gage will have threads cut to match the basic size at the small or bottom ends. A third plug gage will be a plain cylindrical tapered cone of proper size to check the truncation on the crests of the I. D. threads. A fourth gage will have threads of a sharper angle than on the workpiece and of proper size to permit a check on the truncation at the root of the product thread. In this way it is possible to determine the condition of the threads from top to bottom of the hole. In the case of plug gage inspection, each gage usually has from three to six sides ground flat, providing steps or ledges which indicate different depths of penetration of the plug gage into the fitting. The first step will indicate the minimum amount of penetration into the fitting which is acceptable, the second step will indicate the ideal or standard amount of penetration for an acceptable piece, and the third step will indicate the maximum amount which a plug gage may permissibly enter a workpiece in order for the piece to be considered acceptable. With respect to the L_1 plug gage adapted to gage the upper threads of a workpiece, the lower threads are eliminated from the gage so that only the threads being checked will be making contact with the workpiece. In the case of an L_3 plug gage adapted to gage the threads at the small end of a hole, the upper threads of the gage are ground away so as to eliminate thread interference with the upper threads of the hole while the lower threads of the gage and the workpiece are making engagement. The sharp angle or root truncation plug makes contact over the entire threaded portion of the workpiece as does the plain unthreaded conical or plan tapered plug for checking the truncation at the crest of the I. D. thread in the workpiece.

2

Each of these subsequent checks is a function of the first or basic size check.

These gages are separately mounted on suitable handles for an inspector to grip in assisting him manually to thread a gage into a workpiece whereby he may observe the extent to which the gage and the workpiece are coupled. The flats which are ground away on the three sides of the plug gage are machined at points corresponding to the standard minimum, basic and maximum allowable diameters. It will be understood that in gaging male fittings, a ring gage will be employed in lieu of the plug gage; otherwise the inspection procedure will be similar.

The principal difficulty in this type of sequential inspection is that the inspector must remember the degree of turn by which the first gage fails to make perfect engagement with the workpiece. Thereafter, the additional amount of turn which the second and fourth gages require to make perfect engagement with the remaining threads of the workpiece and the depth of penetration of the third or plain conical gage must also be kept in mind by the inspector in order to determine whether the total number of turns short or in excess of engagement between the gages and the workpiece exceeds the permissible tolerance range. Experience has shown that it is difficult for an operator to keep these fractions of a turn in mind and to correlate them properly with the condition of the threads in the workpiece determined by the basic pitch diameter of L_1 check.

It is, therefore, a principal object of this invention to provide a thread gaging device in which any number of inspections on a threaded workpiece may be made and the results of the series of inspections correlated accurately to indicate whether or not the threads inspected are within the acceptable standards required. Another object of the invention is to provide a thread gaging device adapted to make a plurality of inspections on a workpiece in which each subsequent inspection is indicated on a suitable indicating device as a function of the preceding inspection.

Other objects include the provision of a thread gaging device which is more accurate than those heretofore available; the provision of a thread gaging device which is simple to handle, rugged, efficient, and inexpensive; and the provision of a thread gaging device which may be manually operated and held in one hand by an operator during the thread gaging operation.

In order to avoid human error of judgment in making sequential inspections of a threaded workpiece, a preferred embodiment of the invention employs a single indicating means, such as a dial gage or the like, which will enable each inspection to be a function of the inspection preceding it. In this way, the memory of the operator is not required, and by following a series of simple instructions, the operator may arrive at an accurate determination of the condition of the threads without incorporating his personal judgment in the process. The manner in which this result is achieved may be best understood from a study of the drawings of preferred embodiments of the invention.

Figure 1 is a plan view of one embodiment of the invention with parts broken away to show some of the inner structure of the device;

Figure 2 is a sectional view of the embodiment of the invention shown in Figure 1 taken on the line 2—2 of Figure 1;

Figure 3 is a sectional view of the embodiment of the invention shown in Figure 1 taken on the line 3—3 of Figure 1;

Figure 4 is a perspective schematic detail drawing showing the means for actuating the dial indicator of the device shown in Figure 1;

Figure 5 is a plan view of another embodiment of the invention;

Figure 6 is a fragmentary sectional view of the embodiment of the invention shown in Figure 5 taken on the line 6—6 of Figure 5;

Figure 7 is a fragmentary sectional view similar to that of Figure 6 taken on the line 7—7 of Figure 5;

Figure 8 is an elevational view of yet another embodiment of the invention with parts broken away to show the structure;

Figure 9 is a sectional elevational view of the embodiment of the invention shown in Figure 8 taken on the line 9—9 of Figure 8;

Figure 10 is a schematic detail of the stationary opaque face of the dial gage used with the embodiments of the invention shown in Figures 1 and 5;

Figure 11 is a schematic detail of the transparent dial face secured in the rotatable bezel and mounted over the stationary opaque dial face of Figure 10;

Figure 12 is a schematic detail of the opaque dial gage face similar to Figure 10, but showing the dial needle revolved within scale markings on the face of the dial;

Figure 13 is a schematic detail of the dial gage similar to Figure 11, but with the bezel revolved until a scale on the transparent dial face overlies the scale on the opaque dial face;

Figure 14 is a schematic detail of the dial gage similar to Figure 13, but showing the dial gage needle in alternate positions;

Figure 15 is a schematic detail of the dial gage similar to Figures 13 and 14, but showing a different type scale on the watch crystal cover;

Figure 16 is a schematic detail of the dial gage similar to Figures 13–15, but showing additional scales or overlays on the movable transparent dial face;

Figure 17 is a schematic perspective fragmentary view of the transparent plate and center plunger of the embodiment of the invention shown in Figure 8;

Figure 18 is a schematic elevational fragmentary view of the transparent plate and center plunger similar to Figure 17; and

Figure 19 is a fragmentary elevational view of a ring gage adapter employed in one embodiment of the invention.

Attention is first directed to Figure 1 which shows a cruciform type of gage body **20** having pairs of opposed arms **22—24**, and **26—28**, extending radially from the center of the body. Each arm is provided in its end portion with a bore **30** for receiving and securing an adapter **32** for holding the taper shank of a standard plug gage **84** or ring gage **192** (see Figure 19). The adapters **32** holding the thread plug gages are locked in place by means of flush fasteners **38**, such as "Allen" head set screws or the like, so that the thread plug gage may be adjusted radially relative to the body in order to set up the gage for any series of measuring or gaging operations.

The opposed arms are provided with tunnels or bores **40** and **42** to house plungers **44** and **46**, respectively, which extend therethrough and outwardly beyond the opposite end portions of the arms. It will be seen in Figures 2 and 3 that these plungers are resiliently positioned by means of coil springs **48**. Screws **50** and **52**, and hold pins **54** and **56**, which extend from the ends thereof into the spring portions, position and hold the springs in their respective bores. Each plunger may be depressed from either of the opposite sides of the cruciform body and its spring will return the plunger back to a normal position of rest.

The opposite ends of the plungers are provided with small transversely projecting arms **58** having engaging tips **60** embedded therein, the purpose of which will be set forth in greater detail hereinbelow. The plungers are provided with pairs of opposed wedge-like surfaces **62—64** and **66—68** (see Figure 4) which are inclined inwardly and downwardly toward the centers of the plungers. It will be noted that each plunger resides in the body of the gaging device in a plane spaced from and parallel to the plane of the other plunger so that each may be reciprocated in its own housing without interference from the other. Thus, considering surface **70** to be the top surface of the gage, plunger **44** is in a plane spacing it above plunger **46**. This relationship is shown clearly in the perspective of Figure 4 wherein it may be seen that the plungers are normal to each other in parallel planes which are spaced vertically apart.

A dial gage **72** is secured to the top face **70** of the body **20** and has depending therefrom a dial actuating finger or plunger **74** which is provided with a pair of feelers or pins **76** and **78** projecting normally therefrom. The finger **74** is normal to both of the plungers **44** and **46** and the pins **76** and **78** are normal to both the finger **74** and their respective plungers. Thus, pin **76** is normal to plunger **44** and pin **78** is normal to plunger **46**. Pin **76** is adapted to be engaged by wedge surfaces **66** and **68** depending upon which direction the plunger **44** is moved and likewise pin **78** is adapted to be engaged by wedge surfaces **62** or **64**. Consequently, if either plunger is depressed in either direction, a wedge surface will engage one of the two feelers to cause the finger **74** to be forced upwardly in a direction normal to the direction of the movement of the plunger. Suitable connecting means are provided between the finger **74** and a needle **80** (see Figure 10) adapted to sweep the surface of the dial gage face **82**, so that vertical reciprocation of finger **74**, as shown in Figures 2 and 4, will be converted into rotary motion of the needle **80** over the face **82** of the dial gage **72**.

In operation, assuming that the interior threads of a workpiece are to be gaged, a plug gage **84** (see Figure 1) is integrally secured to shank **32** in any manner well known to those skilled in the art. The master ring gage is screwed onto the plug **84** until it reaches a snug position. The screws **38** are then loosened and the subassembly is depressed against the pin **60** actuating the needle **80** in such a manner as to make it flush with line **166** on dial **82**. Screws **38** are then screwed to hold adapted **32** securely in place. The master ring is then removed. Each of the other plugs in the unit is set in a similar fashion in relation to line **166** on dial **82**.

The end **86** of plunger **46** is then depressed to clear the threaded portion **88** of the plug gage **84** and the workpiece W to be gaged is threaded thereon. Tip **60** of arm **58** is then allowed gently to engage the under surface or reference surface **89** of the workpiece W. Axial movement of plunger **46** causes relative movement between wedge surface **62** and pin **78** to shift finger **74** on its axis **91** (see Figure 4). Movement of the plunger **46** will, as aforesaid, cause the needle **80** of the dial face **82** to revolve or oscillate about its axis until the tip **60** of the arm **58** comes to rest on the workpiece reference surface **89**.

The position of the needle **80** with respect to the tolerance zone on fixed dial (Figure 10) is noted. If the part is within tolerance, the position of the needle is marked by an adjustable overlay **93** (see Figure 11) or any other suitable marking means, and the gaging operation then proceeds to the next gage on one of the other arms of the body 20, wherein another element of threads may be gaged. Thereafter, the second position of the needle is noted and, if it is within a permissible marking on the overlay on the face of the dial, the gaging operation can proceed on to the third and fourth operation, noting each time whether or not the needle is within the permissible range for that particular gaging operation. If the needle is within each permissible marking for each corresponding gaging operation, then, at the end of the last gaging operation, it has been determined without any mental computation on the part of the operator that the piece is accepable for use. A preferred use and system of dial markings and overlays will be described more fully hereinafter in conjunction with gaging of workpieces.

Reference is now made to Figure 5 which shows a second embodiment of the invention particularly adaptable for gaging operations involving a series of three inspections. A body 90 comprises three arms 92, 94 and 96 which are equi-angularly spaced, one from the other, the axes of each being offset from the center of intersection of the plungers 98, 100 and 102, as will be more fully described hereinbelow. With the dial gage 72, as shown on the top face 104 of the body 90, the instrument may be very easily carried in one hand while the other hand places the fittings to be gaged on their respective gages secured in the arms of the body. If a workpiece is being gage on a gage carried on arm 96, then arm 92 may rest across the palm of the left hand, and arm 94 will rest between the thumb and forefinger of this hand, whereas arm 96 will extend outwardly along the fingers extended of the hand. The means for securing the adapters 32 of the gages in the arms is identical to that described in the first embodiment discussed and the engaging tips 60 and arms 58 integrally secured to the end portions of the plungers 98, 100, and 102 are also similar in construction.

Trigger means 106 are secured to the end portions of the plungers for depressing the plungers in order that they may be clear of the gages when workpieces are being threaded thereon. These trigger grips 106 are, of course, equally adaptable for use on the cruciform type gaging device 20 and it is not intended by merely showing the trigger grips in Figure 5 that they are restricted to this embodiment alone.

With the body of the gage positioned in the hand, as described, the index finger of the hand is then free to seize the trigger grip 106 and apply pressure thereto in order to depress the plunger 102. The position of each arm with respect to the hand is, of course, interchangeable with the position of any other arm, depending on the sequence of gaging operations and which particular gaging operation is being performed at the moment.

The principal difference between the embodiment of the invention shown in Figure 5 and that shown in Figure 1 is the construction of the inner portions of the plungers. Whereas in Figure 1 each plunger can extend entirely through a pair of opposed axially aligned arms; in Figure 5 this is not possible. Accordingly, the inner portions of each plunger are tapered at 108, 110, and 112 so that when depressed the tapered portion of each plunger will engage the dial gage actuating finger 116 to sweep the needle 80 over the face of the dial in the same manner as that set forth with respect to the apparatus described in conjunction with Figures 1, 2, 3, and 4. Plungers 98, 100, and 102 are spring-urged outwardly by means of coil springs 48. Spring pins 56, and set screws 52 delimit the position of the coil springs with respect to their housings 114 in the plungers. The construction and parts are the same in all three plungers. It will be noted that the axes of the plungers intersect at 118 beneath the lower end of finger 116, and it is this point 118 from which the arms 92, 94, and 96 are offset.

As shown in Figures 5 and 7, plunger 98 has been depressed and therefore has contacted the finger 116 and forced it upwardly, whereas the tapered ends 110 and 112 of plungers 100 and 102 have been withdrawn by means of their respective springs 48 so as not to be in interference with the movement of plunger 98. In the embodiment shown in Figure 1, movement of one plunger will deactivate the effect of movement of the second plunger. In the embodiment shown in Figure 5, once a plunger has been depressed there would be interference between plungers if a second one were to be actuated before the first one is released. This does not constitute a practical problem, however, inasmuch as the gaging is sequential and there is no need to depress more than one plunger at a time. Any accidental depression of a second plunger would cause no damage to the instrument, unless it were exceptionally severe.

The arm which rests across the palm of the hand may be likened to a pistol grip of a firearm and the trigger grip likened to the trigger mechanism of the firearm. If the body of the apparatus is held in the left hand, it would normally be more convenient to employ the trigger grip on the upper side of arm 96. (See Figure 5.) However, if desired, the body of the apparatus may be held in the right hand wherein the trigger grip would be in the position normally found on a pistol. Either position is perfectly adequate for inspection activities and it is a matter of preference which hand the instrument is held in. The offset arrangement of the arms with respect to the center of the body 90 is such that the apparatus can be comfortably operated irrespective of which hand is employed in holding the apparatus.

The embodiment of the invention shown in Figures 8 and 9 is more suitable for use in bench gaging, i. e., resting the apparatus on a work bench rather than in the hand, and comprises a rectangularly shaped body 120 which is adapted to hold a plurality of gages 122, 124, and 126 vertically aligned and adjustably locked therein. The means for locking the shanks of each thread gage is similar to that set forth in the embodiments of Figures 1 and 5, and each plunger is placed parallel and adjacent to its corresponding thread gage.

Plungers 142, 144, and 146 are urged upwardly by means of coil springs 128, and the pressures of the springs are adjusted by means of plates 130 and pins 132 contained in sleeves 136 and held in place by set screws 134 (see Figure 9). Arms 138 are secured to the upper ends of each plunger to engage the reference surface 140 of the workpiece being gaged. When a workpiece W is threaded onto the gage 124, it will depress the plunger 144 by means of contact with the arm 138 and the plunger may then be locked in position by means of set screw 141 which is threadedly engaged to the body 120 of the apparatus.

The center plunger 144 is provided with marking 147 (see Figures 9 and 17) and this plunger may be used in the initial gaging operation of a series of three operations, wherein the workpiece is placed first on the center gage 124, and the plunger is then locked in its depressed position. The outside plungers 142 and 146 are provided with horizontally and inwardly extending arms 148 and 150 which are also provided with markings 152 and 154, respectively, and are alignable with respect to the markings 147 on the center plunger 144. Thus, a workpiece W may first be placed on the center gage 124 and the plunger 144 locked in position as aforesaid. Whereinafter, the same workpiece W is then removed and placed on the thread gage 126 to the right and this corresponding plunger 146 is also depressed. If the marking 154 on the horizontal arm 150 align in any predetermined relationship with the marking 147 on the center plunger 144, it may be considered that the workpiece W is then ready for inspection by the taper gage 122 on the left. Depression of the plunger 142 by the workpiece W on the taper gage will cause the marking

152 on horizontal arm 148 to come into some degree of alignment with the markings 147 on the center plunger 144, and if they also are within a predetermined prescribed zone with respect to marking 147, the workpiece W will be considered acceptable for use.

In order to set up a gaging sequence, transparent plate 158 is provided on the front face of the body 120 and markings 160 are etched or otherwise suitably inscribed thereon corresponding to the marking 147 on the center plunger 144. The position of the shank 162 of the center gage 124 is next vertically adjusted with a master ring gage fully threaded onto the plug gage 124 and with the under or reference surface of the ring gage in pressure contact with arm 138. When the marking 147 on the plunger 144 coincide with the marking 160 on the transparent plate 158, the shank 162 is then locked in place in body 120 by set screw 164.

Alignment of marking 147 with markings 160 indicates an ideal match between parts with respect to the first inspection. With a production workpiece in lieu of a standard ring gage, the position of the marking 147 on the center plunger 144 with respect to marking 160 on plate 158 is fundamental. If these markings are not within an acceptable degree of coincidence or overlap, then there is no need to proceed with the second and third inspections since the piece W has been detected as faulty at the outset. If the markings are sufficiently close one with the other between the transparent plate 158 and the center plunger 144, the plunger is locked in place with thumb screw 141 (before workpiece W is removed). The workpiece W is then removed from gage 124 and screwed snugly onto gage 126. The position of the markings on the horizontal bar 150 is then observed with reference to the line 147. If the line 147 lies within the permissible limits 154, the workpiece W is removed from gage 126 and placed on gage 122. The position of the markings on horizontal bar 148 is noted with respect to the line 147. If the line 147 is within the permissible limits 152 on bar 148, the piece is considered good. The positions of markings 152 and 154 are, therefore, functions of the position of the marking 147 on the center plunger.

The embodiments of the invention, shown in Figures 1 and 5, employ the same principle of graphically or geometrically relating one tolerance area to another, each subsequent area being a function of a preceding tolerance area. Referring now to Figure 10, a dial gage 72 is seen having a dial face 82 and a rotatable needle 80 which sweeps across this dial face. On the dial face is a series of three markings indicating basic size 166 in the center, minimum undersize 168 to the left, and maximum oversize 170 to the right. Thus, if the needle 80 comes to rest anywhere between minimum line 168 and maximum line 170, the piece is acceptable as far as the first inspection step is concerned. The dial gage 72 is provided with a bezel 172 (see Figure 11) which is rotatable about the periphery of the dial 82. The bezel 172 houses a transparent dial face 174 upon which may be inscribed any desirable markings or overlays 93. The bezel 172 together with the transparent dial face 174 may be revolved to any position of the dial.

In the particular application of the dial gage, similar basic, minimum and maximum tolerance lines 176, 178 and 180 respectively are inscribed on the face of the transparent dial face. When the position of the needle 80 is determined following the first inspection operation (see Figure 12), the bezel 172 is rotated until the basic line 176 of the overlay 93 of the transparent dial face coincides with the arm of the needle 80 (see Figure 13). Thus, for example, if the workpiece being gaged at the first position causes the needle to fall halfway between basic line 166 and minimum line 168, then the basic line 176 on the overlay will be revolved to coincide with the needle position shown in Figure 13. The workpiece W is then shifted to the second gage and the plunger appropriately depressed. If the needle 80 then falls anywhere between the minimum and maximum lines 178 and 180 delimiting the acceptable zone for the second inspection, such as needle 80*a* in Figure 14, the piece is then ready for the third inspection. If, however, during the second inspection the needle should come to rest beyond the minimum and maximum lines 178 and 180, such as needle 80*b* in Figure 14, then it would be beyond the zone delimited on the face of the transparent dial face 174 and the piece would be rejected as failing to pass the second inspection. Thus, it may be seen that although a piece may pass the first inspection by virtue of the needle 80 being between minimum and maximum lines 168 and 170, the threads gaged in the second operation may be too far from standard to permit the piece to be passed.

Assuming, however, for purposes of illustration, that the needle did fall within the permissible range of the overlay, as shown by needle 80*a* in Figure 14, then the workpiece may be moved to the third gage which may be a plain taper plug used to check the taper and truncation of the threads. A second overlay 182 (see Figure 15) may be added to the first overlay 178—180 and, without moving the position of the bezel 172, if the needle stops within the limits of this second overlay, then the piece has passed all three inspections and is known to have acceptable threads.

It will be seen, therefore, that each subsequent operation is a function of the first inspection so that the position of the tolerance range of the second, third and subsequent operations is dependent on the size of the piece with respect to the first inspection. Thus, although any separate inspection might have indicated an acceptable workpiece, the various inspections in combination, each as a function of the first one, must be passed in that order. Any number of zones or overlays may be inscribed on the face of the bezel transparent dial face 174 depending on the number of different types of threads to be gaged on this particular apparatus, for instance, Army-Navy Pipe Thread Overlays, National Gas Connection Pipe Thread Overlays, Dry Seal Pipe Thread Overlays and the like (see Figure 16).

To gage a different type of thread having different standards, it is merely necessary to remove the adapters secured with the plug gages and replace with other plug gages having matching shanks.

In order to gage O. D. threads, a ring gage adapted 184 (see Figure 19), secured to shank 186 on one side of the adapter, is locked in place on an arm 188 of the apparatus so that a plunger 190 may pass concentrically through the ring gage 192. The adapter comprises a clamping plate 204, a base plate 206, and shank 186. The ring gage 192 is positioned and clamped between plates 204 and 206 by means of threaded fasteners such as 207. No plunger depressing trigger, such as trigger 106 shown in Figure 5, is required with this adapter inasmuch as the end 194 of the workpiece 196 will contact the plunger flange or cap 198 and depress it as the O. D. threads 200 of the workpiece make threaded engagement with the I. D. threads 202 of the ring gage 192.

Thus, it may be seen that the present invention provides a practical production line thread gaging device which eliminates all guesswork from the separate gaging operations and quickly gives a final indication on a dial gage or other means, indicating unfailingly whether the workpiece threads are acceptable for use or not.

While herein shown and described are preferred embodiments of the invention, it is contemplated that the invention is susceptible of embodiment in other forms, and is applicable to a variety of situations, without departing from the spirit or scope of the invention.

I claim:

1. A thread gaging device comprising: a body; a plurality of gages secured to and projecting outwardly from said body; means to axially adjust said gages; a resilient

plunger housed in said body parallel and adjacent to each of said gages, each plunger being spring urged outwardly from said body; means for depressing each plunger responsive to sequential threaded engagement of a workpiece with each gage; means for holding each plunger in a depressed position; a scale secured to said body; and tolerance limit markings on said plungers alignable with gradations on said scale, whereby depression of said plungers in a predetermined sequential order provides a relationship between said scale and said tolerance limit markings to enable the classification of the threads of said workpiece.

2. The device set forth in claim 1 wherein said gages are of the plug type and are mounted on shanks adapted to be axially adjustable with respect to said body.

3. The device set forth in claim 1 wherein said gages are of the ring type and are mounted on shanks adapted to be axially adjustable with respect to said body and with said ring type gages being concentrically alignable with respect to said plungers, whereby said plungers are axially depressible by contact with workpieces threadedly received in said ring type gages.

4. The device set forth in claim 1 wherein said gages are parallel and outwardly extending from the same side of said body.

5. A thread gaging device comprising: a multiarmed body; a gage secured to and projecting outwardly from the end of each arm; means to axially adjust said gages; a plunger housed in each arm parallel and adjacent to each of said gages, each plunger being spring urged outwardly from the end of its respective arm; first means for depressing each plunger responsive to sequential threaded engagement of a workpiece with each gage; a dial gage secured to said body at the intersection of said arms having an actuating plunger extending inwardly therefrom to intersect the paths of movement of said reciprocating plungers; the inner ends of said plungers being tapered and normally positioned clear of the intersection of the paths of movement of said plungers, whereby inward movement of the tapered ends of each plunger in sequential order responsive to the sequential engagement of a workpiece on each gage will engage said dial gage actuating plunger to operate said dial gage.

6. The device set forth in claim 5, including second means for depressing each plunger comprising a strap secured to the upper end of each plunger and extending downwardly to terminate into a trigger type grip, whereby said gaging device may be held by hand and the plunger depressed by pressure on said trigger grip from a finger of said hand, each plunger being depressed to clear its respective gage prior to receiving a workpiece.

7. The device set forth in claim 5, wherein the axes of said arms are arrayed equi-angularly about their common junction whereby each arm alternatively serves as a pistol type grip, each arm being interchangeable with each other arm; and second means for depressing each plunger of each arm being trigger-shaped for pressure engagement of an index finger of an operator.

8. The device set forth in claim 5, wherein said dial gage comprises: a needle revolvable by said actuating plunger; a dial face having first markings delimiting predetermined minimum and maximum tolerance ranges, and a basic size marking between said tolerance ranges; a revolvable bezel secured to said dial; a crystal in said bezel having second markings delimiting predetermined minimum and maximum tolerance ranges as a function of said first mentioned markings; and third markings on said crystal delimiting predetermined minimum and maximum tolerance ranges as a function of said first mentioned markings, whereby said markings on said crystal may be aligned with respect to the said needle on said dial face to provide consecutive tolerance ranges within which said needle must come to rest if a workpiece is acceptable.

9. The device set forth in claim 5, wherein said dial gage comprises: a needle revolvable by said actuating plunger; a dial face having first markings delimiting a predetermined tolerance range, a bezel rotatably secured to said dial; a crystal in said bezel; markings on said crystal delimiting predetermined tolerance ranges as functions of said first mentioned tolerance range, whereby said markings on said crystal may be aligned with respect to the said needle at rest within said first mentioned tolerance range to provide consecutive tolerance ranges within which said needle must come to rest if a workpiece is acceptable.

10. A thread gaging device comprising: a body having a plurality of opposed pairs of arms extending radially therefrom; a gage adjustably secured to the end of each arm and projecting outwardly therefrom; a plunger housed in and passing through each pair of arms to extend outwardly beyond each end, said plungers being axially reciprocable and having spring means to automatically center said plungers; a pair of inclined planes on each plunger directed inwardly and downwardly toward the center of the plunger; a dial gage secured to said body; means extending inwardly from said dial gage into said body to alternately contact each inclined plane responsive to the axial direction of movement of each plunger; and a dial needle operably connected to said means, whereby consecutive axial movement of each plunger responsive to consecutive threaded engagement of a workpiece on each gage actuates said means to rotate said needle.

11. A thread gaging device comprising: a cruciform body, a gage adjustably secured to the end of each arm of the body and projecting outwardly therefrom; a plunger housed in each pair of axially aligned arms to extend outwardly beyond each end thereof; spring means to pre-position each plunger and to return each plunger thereto after displacement therefrom; a dial gage secured to said body; a reciprocable dial gage actuating finger extending inwardly into said body normal to said plungers and adapted to cause rotation of a dial gage needle; inclined surfaces on said plungers; and means secured to said finger adapted to alternately engage said surfaces, whereby axial movement of either plunger will impart axial movement to said finger.

12. The device set forth in claim 11, wherein each of said plungers is provided with a pair of opposed inwardly and downwardly directed inclined surfaces at its center; said means comprising a pair of feelers, one for each pair of inclined surfaces, each of said feelers being acted upon alternately by each inclined surface of its respective pair of inclined surfaces to axially reciprocate said finger.

13. A thread gaging device comprising: a body; a plurality of gages secured to said body to project outwardly therefrom; a resilient plunger adjacent each gage and depressible by a workpiece sequentially received by each gage; and a dial gage secured to said body to indicate the amount each plunger is depressed by said workpiece, said dial gage including a needle revolvable by said resilient plungers; a dial face having first markings delimiting a predetermined tolerance range; a bezel rotatably secured to said dial; a crystal in said bezel; markings on said crystal delimiting a plurality of predetermined tolerance ranges as a function of said first mentioned tolerance range, whereby said markings on said crystal may be aligned with respect to the said needle at rest within said first mentioned tolerance range to provide consecutive tolerance ranges in which said needle may come to rest if a workpiece is acceptable.

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