Dec. 5, 1967 A. TAILLEUR 3,355,811

CONTAINER GAGING APPARATUS

Filed Oct. 23, 1964 2 Sheets-Sheet 1

Fig. 1

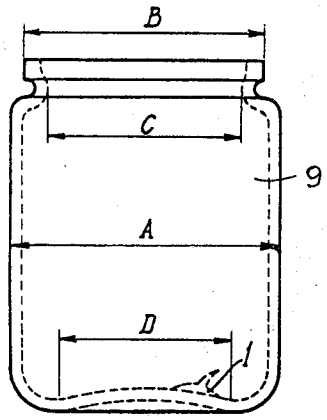


Fig. 2

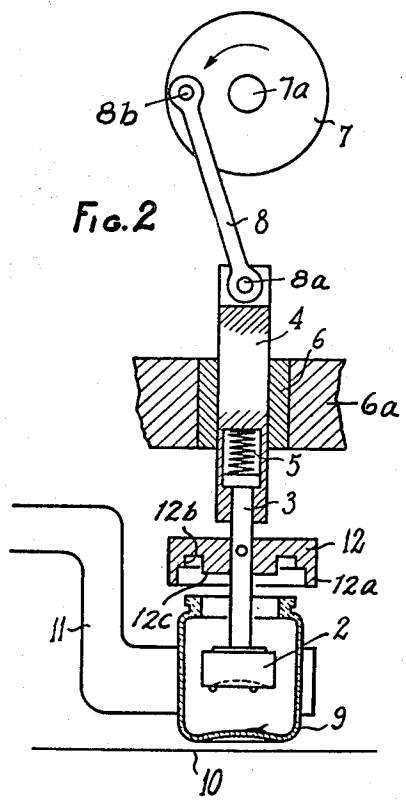


Fig. 3

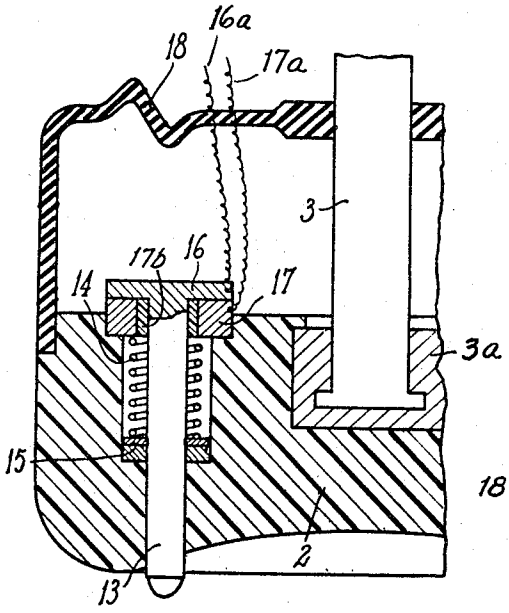
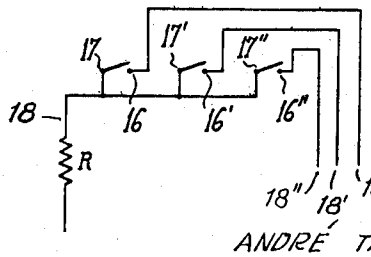


Fig. 4



Inventor

ANDRÉ TAILLEUR

By

Bauer and Seymour

Attorneys

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CONTAINER GAGING APPARATUS

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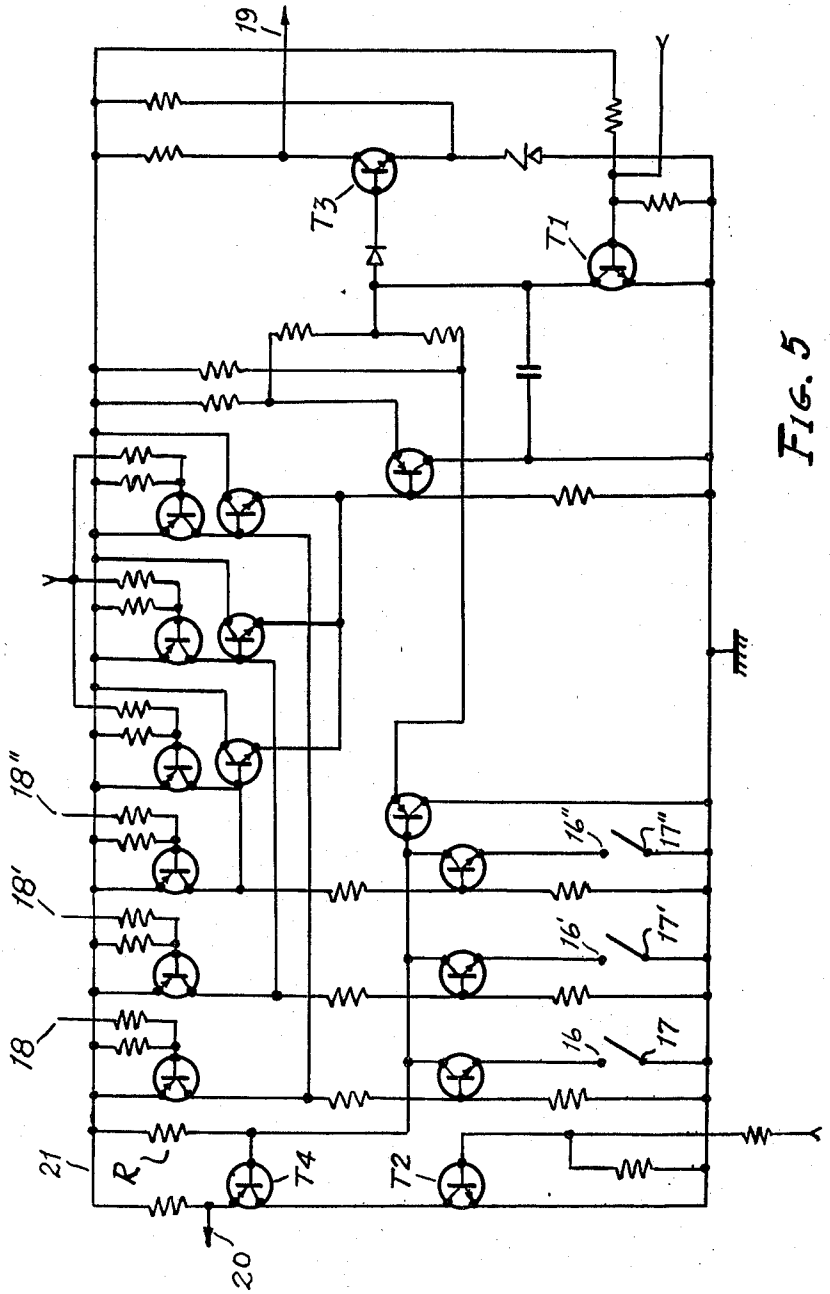

FIG. 5

INVENTOR

ANDRÉ TAILLEUR

BY Cowen and Seymour

ATTORNEYS

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CONTAINER GAGING APPARATUS

André Tailleur, Paris, France, assignor to Compagnie de Saint-Gobain, Neuilly-sur-Seine, France

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12 Claims. (Cl. 33—174)

This invention relates to a method of and an apparatus for the detection of defects or imperfections in hollow containers such as bottles and jars, particularly of glass.

In the fabrication of glass jars it sometimes happens that projections or "needles" of glass are left on the interior surface thereof. These needles are especially undesirable where the containers are to receive edible materials, medicines, or other articles or substances which are to be taken internally, since the needles may become broken off and taken with the contained food or medicine and thus have harmful effects upon the consumer.

The present invention has for its chief object the provision of a method and apparatus for detecting the presence of such needles, as well as other surface imperfections of containers, and the initiation of a signal which will enable a defective container to be manually or automatically removed from a production line for discardment or reprocessing.

Another object is to provide a method and apparatus which enables the testing of a container, at one and the same time, for the presence of the aforesaid needles as well as deviations of dimensions of the container from predetermined and pre-set standards, and which in response to the presence of imperfections affords a positive signal which may be utilized to discard the defective container.

Another object is to provide an apparatus which while relatively simple, provides a reliable and positive signal in the case of a defective container only.

Other objects and advantages will become clear to those skilled in the art, after a study of the following detailed description.

The invention comprehends a rigid plunger or base together with means for introducing it through the mouth of the container and into contact with the bottom or other surface area thereof. The bottom surface of the plunger is shaped to normally contact the interior bottom surface of the container and which, in the absence of defects or distortions in shape, fits closely into surface contact with the container. The plunger or base carries a plurality of feelers slidable in uniformly-spaced apertures therein. These feelers are normally spring-urged outwardly of the gaging surface of the base, so that when the base is urged into full area contact with the corresponding surface of the container, the feelers are displaced inwardly with respect to the base, and a signal, or absence of a signal makes it known that the container is normal and usable.

However when, due to the presence of one or more of the aforesaid needles or other surface defects in the container, the base is prevented from full area contact with the container, the feelers are not fully displaced and another, or different kind of signal is produced indicating that the container is defective and should be discarded or returned for reprocessing.

The invention thus enables, not only the detection of needles, but also other roughness or irregularities and

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surface defects in containers. It also enables the detection of discrete foreign objects which may be therein.

Furthermore, the invention enables the detection and control of other imperfections because, when the container does not conform to pre-set shape, standards, or dimensions as, for example, excessive thickness, surface deformations, etc., the plunger is stopped short of full normal descent and a corresponding signal is obtained.

In the drawing showing one embodiment:

FIGURE 1 shows a container having an internal defect in the form of one of the aforesaid needles;

FIGURE 2 is a vertical axial section showing schematically the assembled instrument;

FIGURE 3 depicts to a scale enlarged over that of FIGURE 2, a portion of the plunger and one of the feelers carried thereby;

FIGURE 4 is a simplified diagram showing the circuit connections of the feelers; and

FIGURE 5 is a diagram showing a circuit for controlling and operating the tester.

FIGURE 1 shows by way of example one type of container to be tested for defects and having therein, as indicated at 1, a needle or sliver which renders the container objectionable and subject to discard. The dimensions A, B, C and D, indicated upon this figure are among those which the instrument is capable of gaging or testing in addition to its function of detecting imperfections in the bottom wall of the container.

Referring to FIGURES 2 and 3, the plunger includes a rigid base 2 which is adapted to be inserted into the container or receptacle. This base is fixed to the lower end of a central vertical stem 3. A portion of the frame of the instrument is indicated at 6*a* and has a bushing 6 with aperture shaped to receive a slide 4 for a smooth guided vertical reciprocation therein. The lower end of the slide is apertured to receive the headed upper end of stem 3. A coil spring 5 within the aperture, bears against the head of the stem and urges it downwardly to the limiting position shown upon FIGURE 2.

The upper end of slide 4 is slotted to receive the lower end of a pitman 8. A pivot pin 8*a* passes through aligned bearing openings in the slotted portion of the slide and the pitman. The upper end of the pitman is pivoted at 8*b* to a crank 7 fixed with shaft 7*a* journaled in bearings not shown.

Thus in a manner obvious from inspection of FIGURE 2, rotation of shaft 7*a* by a source of power not shown, causes a vertical reciprocation of base 2. Normally, slide 4 and stem 3 reciprocate as a unit. But when stem 3, for any reason, is prevented from a full stroke in descent, its head slides upwardly in and with respect to slide 4, against the urge of spring 5.

Referring more particularly to FIGURE 3, body 2 is shown to have a shape and size, in plan, which enables it to pass freely into container 9 to be tested. This body may be of synthetic plastic material. As shown, its lower surface is shaped complementary to the inner surface of the base of the jar, container or receptacle 9, so that when the base of the container has no needles or other surface imperfections such as would require it to be discarded, body 2 may descend into full surface contact with the container.

Body 2 carries a number of feelers 13 which may be alike and similarly mounted. As shown, feeler 13 fits a vertical bore in and adjacent the periphery of base 2.

At its upper end the bore is counterbored to accommodate a coil spring **14** which abuts at its top against a washer or contact element **17** fixed with base **2** in any suitable way. At its lower end the spring engages a guide washer **15** slidably fitting the counterbore and fixed with feeler **13**. Head **16** and washer **17** are of electrically conductive material and are normally in contact due to the action of the spring. A bushing **17***b* of dielectric material insulates the stem of feeler **13** from washer **17**. Leads **16***a* and **17***a* extend from head **16** and washer **17**, respectively, and are electrically connected when the head and washer are in contact as shown upon FIGURE 3. When feeler **13** is pressed upwardly however, against the urge of spring **14**, connection between the leads is interrupted. A boot **18** of rubber or other flexible impervious material, fits about the top of body **2** and about stem **3** to protect the feeler mechanisms and electrical contacts.

Stem **3** has a gage cap fixed thereto. The cap has a cavity in its lower surface, shaped accurately complemental to the normal form of the upper end of the jars or containers to be tested. As is clear from inspection of FIGURES 1 and 2, the cavity is so shaped that if dimension A, FIGURE 1, of the jar is accurate, the outer circumferential skirt portion **12***a* of the cap will fit down smoothly over and about the upper body portion of the jar and thus determines that the diameter or geometrical outline or contour thereof is accurate. The upper portion of the cavity has a reduced diameter indicated at **12***b*, closely equal to that of the outside diameter or contour of the top rim of the jar. Hence if the aforesaid upper portion of the cavity fits down accurately over the top rim of the jar, the latter is known to be acceptable in dimension B, FIGURE 1, and coaxial of the body of the jar. The cavity of cap **12** has a cylindrical or regularly-shaped geometrical protrusion **12***c* extending centrally downwardly and sized for an accurate gaging fit within the neck of the jar, so that it acts to gage dimension C, FIGURE 1. The bottom surface of base **2** is, as shown, complemental to that of the upper or inner surface of the bottom of the jar. Consequently if dimension D, FIGURE 1, is correct in a jar under test, the base will fit down accurately over and into surface contact with the bottom of the jar. But if there are one or more needles or other surface imperfections present, base **2** will be held thereby out of its normal lowermost position and feelers **13** will not be pressed upwardly but will remain in the position shown upon FIGURE 3.

However, assuming a normal accurate and acceptable jar, without imperfections, cap **12** is so positioned on stem **3** with respect to base **2**, that when the base fits down accurately into contact with the interior surface of the jar's bottom, the cap also accurately fits down over and about the upper end thereof. In such a case the feelers **13** are pressed upwardly so that head **16** of each is separated from its washer **17**. It is contemplated that base **2** may have three of these feeler assemblies spaced 120° equiangularly about the axis of stem **3**. Of course the invention is not limited to any particular number of these feelers.

If a jar is being gaged which is inaccurate in any of the dimensions noted, or which is out of regular shape or design, or has one or more needles **1** or other roughness or inaccuracies in its bottom, or in which a foreign object has accidentally lodged, stem **3** is prevented from a full downward stroke, either by cap **12** or by base **2**, or both. In such cases stem **3** will slide upwardly in and with respect to slide **4** as the latter descends to its lowermost position. It will be understood that the invention is not limited to use with cylindrical jars. It may, for example, have equal utility in the testing of jars which are generally square or of other shape in cross section. So long as base **2** and cap **12** are accurately shaped and co-located, and have the proper rotational position about the common axis of the slide, stem and base, so that the latter may freely enter a jar of acceptable form and dimensions, the invention is useful for containers of any regular geometrical form in horizontal section.

FIGURE 4 shows schematically a circuit diagram of the principal of operation of the tester. It has been previously stated that the instrument may include three feeler assemblies like the one shown upon FIGURE 3. The three are identified at **16**, **17**; **16′**, **17′** and **16″**, **17″**. It will be noted that each of the contacts **17**, **17′** and **17″** are connected with a common lead **18**, in series with a resistance R. Each contact **16**, **16′**, **16″** is connected with a respective one of the leads **18**, **18′** and **18″**. By means not shown, these leads are connected simultaneously with the common lead through resistance R at the instant that slide **4** is in its lowermost position.

FIGURE 5 shows a circuit diagram for controlling and operating the tester. When the tester is used to test containers for food or other edible products, it is of paramount importance that all defective containers are detected and rejected. The diagram of FIG. 5 provides therefore means by which the testing circuits are controlled before each testing operation and an alarm signal actuated if the circuits are defective while all containers are eliminated as long as the apparatus has not been repaired. During the controlling operation transistor T_1 is blocked. A positive electric impulse is then fed successively through leads **18**, **18′**, **18″**. If contacts **17**, **17′**, **17″** are closed, transistor T_3 cannot become conductive. If however one of leads **17**, **17′**, **17″** is open when the impulse is fed, which would mean that the tester is defective, transistor T_3 will become conductive and the impulse will be transmitted by lead **19**. This impulse is used to activate means (not shown) which will simultaneously give the alarm and reject all tested containers.

During the actual testing operation both transistors T_1 and T_2 are saturated. The controlling circuit is unoperative. An impulse is then fed simultaneously over all leads **18**, **18′**, **18″**. If one or more of contacts **17**, **17′**, **17″** is not opened, which would mean that the container tested is defective, transistor T_4 becomes conductive and an impulse will be transmitted through lead **20**.

The operation will be clear from the foregoing description. The containers are presented in sequence to the instrument, for example by a conveyor belt **10**, FIGURE 2. At the instant that each container is accurately disposed in vertical alignment with and beneath base **2**, it is gripped between a pair of movable arms or jaws one of which is identified at **11**, FIGURE 2, and thereby raised slightly. The container is thus momentarily fixed and immobilized. Practically instantaneously thereafter, a rotation is imparted to shaft **7***a* while the position of the feelers and the condition of the circuit is rapidly tested while base **2** moves downwardly to fit over the bottom of the container. If the tester is defective for some reason, the container is immediately discarded and the alarm is sounded. If however the tester is operative, and the container free of defects, base **2** fits down accurately over the bottom thereof and cap **12** fits down accurately over the mouth thereof. All three feelers such as **13**, are raised and all contacts **16**, **17**; **16′**, **17′** and **16″**, **17″** are opened.

An impulse is then fed to leads **18**, **18′**, **18″**. If the impulse is transmitted through lead **20**, which would mean that one at least of the feelers has not been raised, the container is defective and the impulse activates means (not shown) by which the container is ejected. If the container is free of defects the impulse is not transmitted through lead **20** and the ejecting means are not activated.

Many variations, modifications and substitutions of equivalents will occur to those skilled in the art, after a study of the foregoing disclosure. For example, by providing stem **3** and slide **4** with electrical contacts closed by and in response to upward movement of the stem in and relatively to the slide, the instrument may be useful for gaging the dimensions A, B and C, FIGURE 1. Base **2** and the portion of stem **3** below the cap might then be omitted. The aforesaid contact would be included in an

external circuit including signal means, or means automatically expelling the defective container from the production line, in response to closure of the contacts. Thus the disclosure should be taken in an illustrative rather than a limiting sense.

Stem 3 and base 2 can be either rigidly connected one to another or base 2 can be allowed to freely take a variable inclination in order to come into surface contact with an inclined bottom of a container. The yielding connection between stem 3 and base 2 can be obtained by connecting them through a packing of some flexible material such as rubber (3a on FIGURE 3) or with a ball joint provided between stem 3 and base 2. Containers having slightly inclined bottoms which are not dangerous and quite usable in most cases are not detected and rejected by this arrangement.

In the claims, the term "conductive" means electrically conductive. Terms such as "vertical," "downwardly," etc., as used in the claims are for convenience and clarity only and are not to be interpreted as limiting the invention to use in any particular angular position. For example, it is clear that slide 4 may reciprocate horizontally so long as each container is momentarily fixed in a corresponding position for testing.

Having now fully disclosed the invention, what I claim and desire to secure by Letters Patent is:

1. In an instrument for testing hollow containers for imperfections, a frame, a slide mounted in said frame for guided translation along a fixed path, a stem carried by said slide for reciprocation as a unit therewith and for translation along said path with respect thereto, spring means urging said stem into an extended limiting position with respect to said slide, a base fixed with the distal end of said stem and having a test surface complemental to and for contact with an area of the container to be tested, feelers movably carried by said base and projecting from said test surface, and circuit closer means carried by said base and connected with said feelers for actuation thereby in response to movement of said feelers with respect to said base.

2. The instrument of claim 1, a cap fixed with said stem in position to fit over and gage the mouth of the container simultaneously with contact of said test surface of said base, with the area of the container tested thereby.

3. In an instrument for gaging and testing a hollow container for imperfections, a solid base for insertion through the mouth of the container and having a lower gaging surface shaped for surface contact with the interior bottom surface of the container, feeler pins fitting bores spaced in said base for sliding between a first limiting position wherein one end of each pin projects from said gaging surface, and a second position wherein said one end is substantially flush with said gaging surface, means carried by said base and yieldingly urging each pin into said first position, a conductive head fixed with the other end of each pin, contact elements fixed with said base to be engaged by said head when a pin is in first position only, and first and second electrical leads connected with and extending from said head and contact element respectively, said bores having counterbores, said contact elements each comprising a washer having a dielectric bushing and closing said counterbore, each pin being slidable through said bushing and having a fixed abutment in said counterbore, said yielding means comprising a spring in said counterbore and acting between said washer and said abutment to urge said pin into first position, sliding of said pin to second position separating said head from said washer.

4. In an instrument for gaging and testing a hollow container for imperfections, a solid base for insertion through the mouth of the container and having a lower gaging surface shaped for surface contact with the interior bottom surface of the container, feeler pins fitting bores spaced in said base for sliding between a first limiting position wherein one end of each pin projects from said gaging surface, and a second position wherein said one end is substantially flush with said gaging surface, means carried by said base and yieldingly urging each pin into said first position, a conductive head fixed with the other end of each pin, contact elements fixed with said base to be engaged by said head when a pin is in first position only, and first and second electrical leads connected with and extending from said head and contact element respectively, a frame, a slide having a longitudinal axis and mounted in said frame for guided reciprocation in and along said axis, a stem having its upper end mounted in a bore in said slide for translation relatively thereto along said axis, and carrying said base at its lower end, a spring urging said stem to a limiting position outwardly of and with respect to said slide, and means connected with said slide to reciprocate said slide and base as a unit to contact said gaging surface with the bottom of the container.

5. The instrument of claim 4, means yieldably connecting said slide and said base to permit said base to alter its inclination to enter into surface contact with the bottom of a container.

6. In an instrument for gaging and testing a hollow container for imperfections, a solid base for insertion through the mouth of the container and having a lower gaging surface shaped for surface contact with the interior bottom surface of the container, feeler pins fitting bores spaced in said base for sliding between a first limiting position wherein one end of each pin projects from said gaging surface, and a second position wherein said one end is substantially flush with said gaging surface, means carried by said base and yieldingly urging each pin into said first position, a conductive head fixed with the other end of each pin, contact elements fixed with said base to be engaged by said head when a pin is in first position only, and first and second electrical leads connected with and extending from said head and contact element respectively, and a gaging cap fixed with said stem above and in predetermined spaced relation with said base, said cap being constructed and arranged to fit down over, about and within the mouth portion of a perfect container only, when said base is in gaging contact with the container.

7. In an instrument for testing a hollow container for imperfection, a solid base having a central axis of symmetry and a lower test surface generally normal to said axis and shaped for surface contact with the bottom of the container, a plurality of feeler pins each mounted for sliding in and along a respective one of a plurality of bores in said base parallel with and equiangularly spaced about said central axis, adjacent the periphery of said base, means individually urging each said pin into a first limiting outward position wherein the lower end of each said pin protrudes from said test surface, a plurality of circuit closers carried by said base and connected with a respective one of said feeler pins for closing and opening by and in response to movement of a respective pin into and out of said first position, signal means, and a circuit including said signal means and said circuit closers, in parallel.

8. The method of testing a hollow container for surface imperfections, comprising, urging with yielding force toward contact with an area of the container to be tested, a gage element having a gaging surface shaped complementary to the container surface to be tested, feeding an electric impulse simultaneously through a circuit including switches each under control of a feeler protruding from the gage surface, when said gage element contacts said container, opening the circuit only by and in response to movement of all feelers due to full area contact between the gage surface and the surface to be tested, and testing the circuit before the gage element contacts the container, by feeding an electric impulse successively

through each switch to activate alarm means if the gage is defective.

9. An instrument for testing hollow containers for imperfections which comprises supporting means adapted to align a container in testing position, a testing head having a testing surface conforming accurately in shape and alignment with the surface to be tested, means to bring the testing surface and the surface to be tested together while maintaining their alignment, a plurality of spaced, displaceable feeler means adapted to signal the mating of the testing surface and the surface tested, projecting from the testing surface under spring pressure and wholly retractable within the surface, and signaling means associated with the feeler means to signal proper and improper mating of said surfaces.

10. An instrument according to claim **9** in which the testing head is mounted on a movable support, and gauging means are mounted on the support for testing the container at its neck.

11. An instrument according to claim **9** in which the head is provided with at least three displaceable plungers.

12. An instrument according to claim **10** in which the movable support is a jointed shaft, parts of which are telescopically connected under spring pressure.

References Cited

UNITED STATES PATENTS

2,578,573	12/1951	Mills	209—88
2,582,494	1/1952	Lorenz	209—88
2,960,223	11/1960	Fauth	209—88
3,024,905	3/1962	Casler et al.	209—88 X
3,032,192	5/1962	Uhlig	209—88
3,067,872	12/1962	Fouse et al.	209—88 X
3,080,659	3/1963	Wolford	209—88 X
3,089,593	5/1963	Honnert	209—82

M. HENSON WOOD, JR., *Primary Examiner.*

ALLEN N. KNOWLES, *Examiner.*