Aug. 23, 1966 E. M. MURLEY, JR 3,268,318

APPARATUS FOR INSPECTING HOLLOW SYRINGE CARTRIDGES AND THE LIKE

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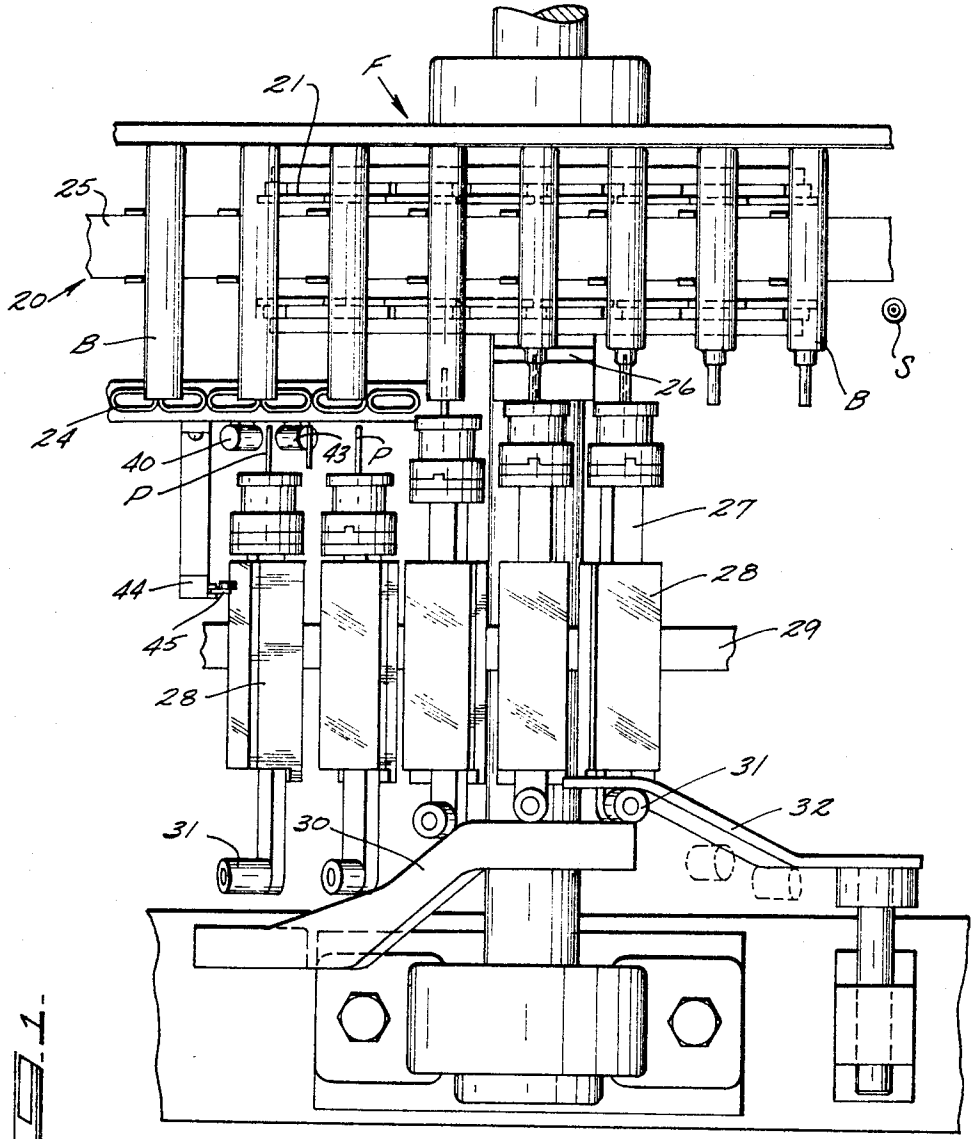


FIG. 1.

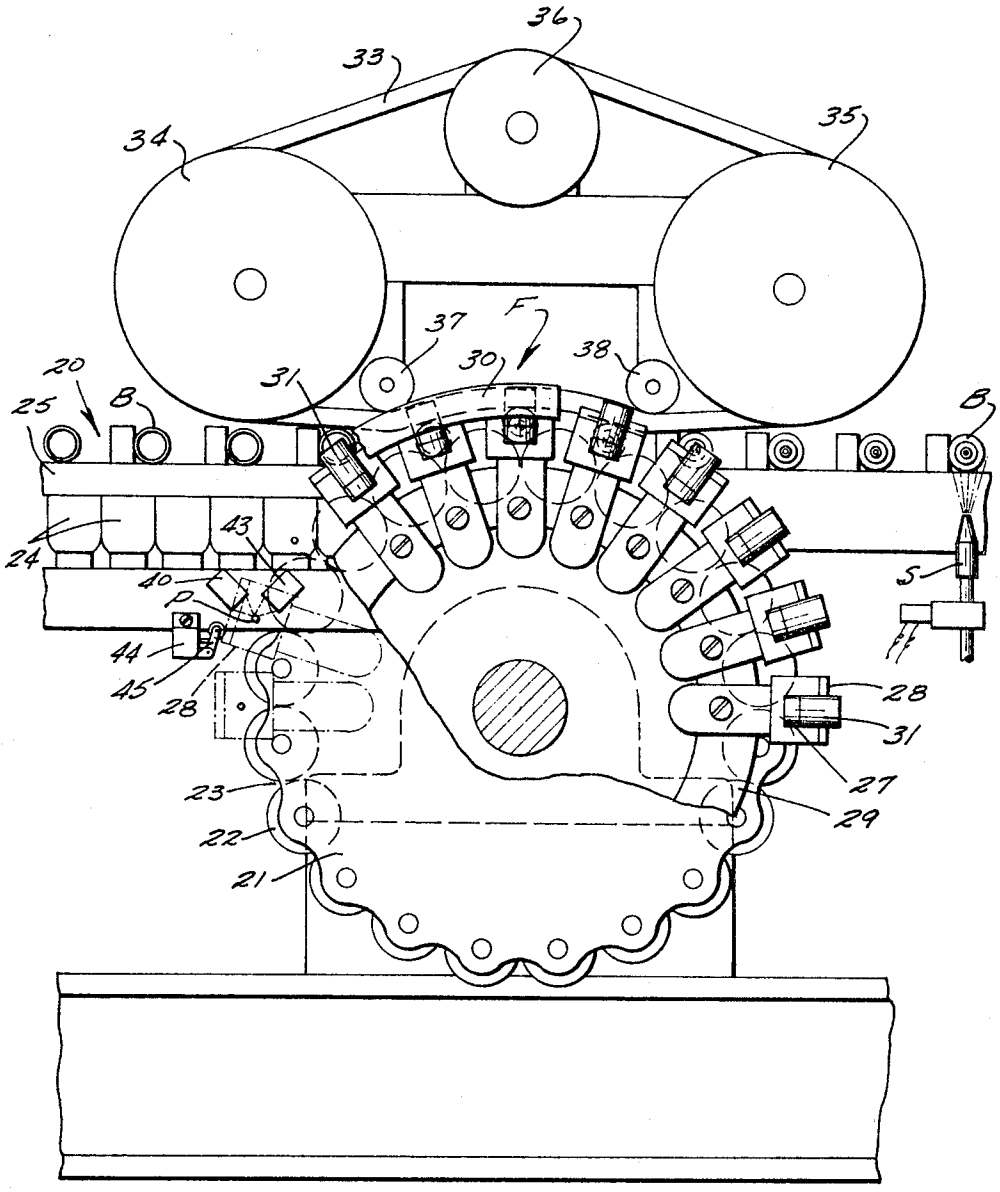
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FIG. 2



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FIG. 3

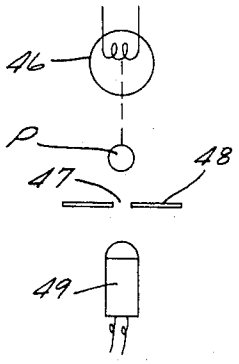


FIG. 4

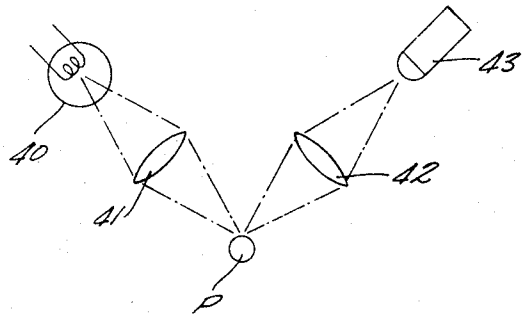


FIG. 5

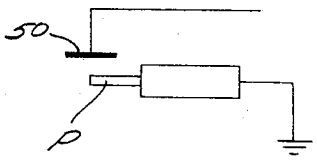


FIG. 6

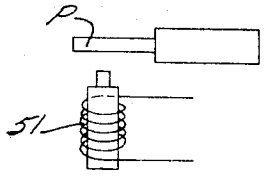


FIG. 7

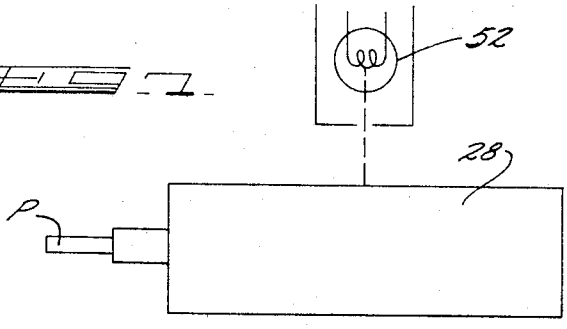
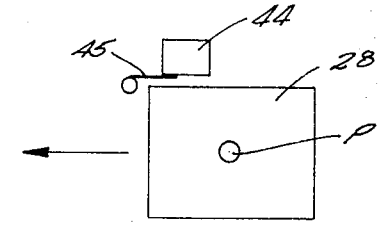
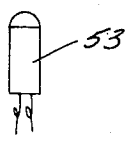


FIG. 8





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FIG 9

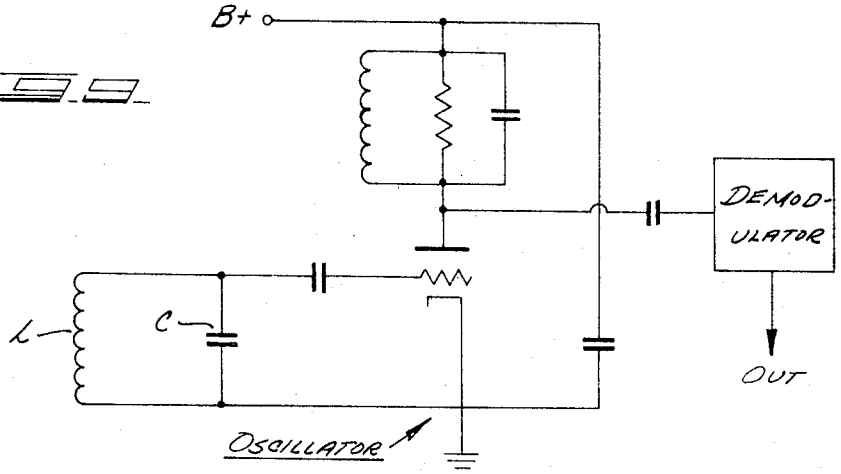


FIG 10

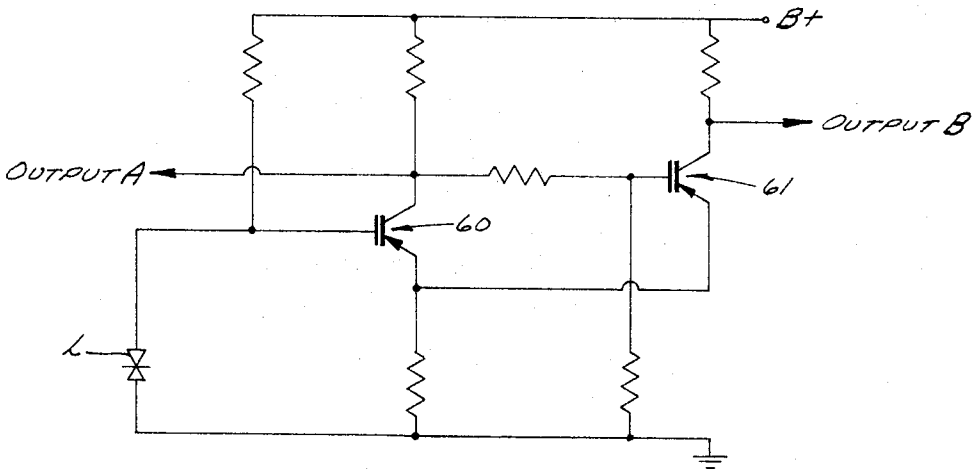
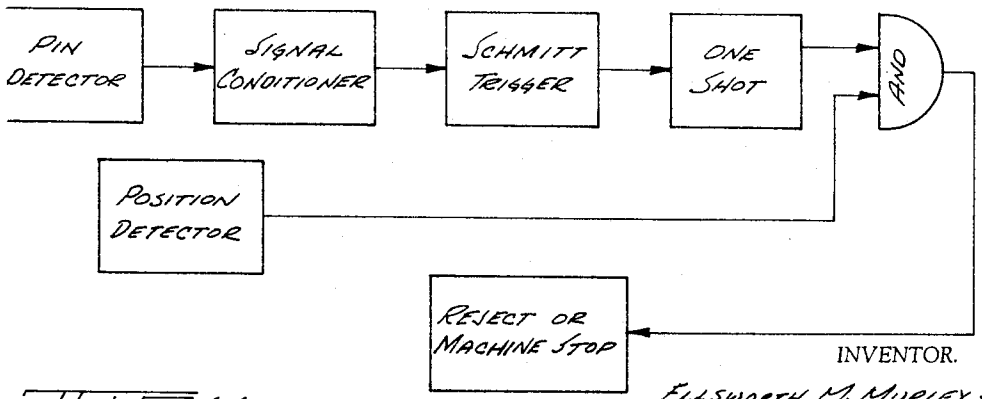


FIG 11



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3,268,318

APPARATUS FOR INSPECTING HOLLOW SYRINGE CARTRIDGES AND THE LIKE

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Filed July 11, 1963, Ser. No. 294,401
7 Claims. (Cl. 65—158)

This invention relates to inspecting hollow syringe cartridges and the like.

In the making of hollow syringe cartridges of the disposable type from a material such as glass, it is conventional to deform one end of a blank over a pin. As shown, for example, in the patent to Koenig 2,738,622, cylindrical blanks are moved continuously through a forming station and a plurality of pins are brought successively into register with the previously heated ends of the blanks and the ends of the blanks are deformed about the pins to form the restricted openings. The size of the openings is very small, on the order of 1/64 of an inch in diameter, and it is therefore desirable to inspect the cartridges to insure that the opening has been formed. One of the most common reasons for failure to form the opening is the breaking of the small pins or the deforming of the pins out of alignment.

It is an object of this invention to provide a method and apparatus for inspecting hollow syringe cartridges and the like to determine the presence of the desired axial opening in the restricted end thereof.

It is a further object of the invention to provide such a method and apparatus which will detect the absence of pins in the forming apparatus.

Basically, the invention comprises inspecting the pins as they move away from the forming zone and back to the forming zone to determine their presence. If one of the pins is not present, a reject signal is created which is used to energize a reject mechanism for rejecting the blanks which normally register with said pin.

In the drawings:

FIG. 1 is a fragmentary plan view of an apparatus embodying the invention.

FIG. 2 is a fragmentary elevational view of the portion of the apparatus shown in FIG. 1.

FIG. 3 is a diagrammatic view of one form of detecting apparatus utilized in the invention.

FIG. 4 is a diagrammatic view of another form of detecting apparatus utilized in the invention.

FIG. 5 is a diagrammatic view of another form of detecting apparatus utilized in the invention.

FIG. 6 is a diagrammatic view of another form of detecting apparatus utilized in the invention.

FIG. 7 is a fragmentary view of a position sensing apparatus utilized in the invention.

FIG. 8 is a diagrammatic view of another form of positioning sensing apparatus utilized in the invention.

FIG. 9 is an electrical circuit utilized with the detecting apparatus shown in FIGS. 5 and 6.

FIG. 10 is an electrical circuit utilized with the detecting apparatus shown in FIGS. 3 and 4.

FIG. 11 is a block diagram of the electronic system utilized in the invention.

The invention is particularly adapted for use in connection with the apparatus such as shown in the patent to Koenig 2,738,622. Referring to FIGS. 1 and 2, such an apparatus comprises a conveyor **20** for supporting and moving hollow glass blanks B in the form of cylindrical tubes successively through a forming zone F. At the forming zone F, the tubes are lifted bodily from the conveyor **20** by a circular elevator **21** having rollers **22** therein which defines pockets **23** into which each blank B is positioned. Prior to entering the elevators **21**, the ends of

the tubes are heated by burners **24** positioned beneath the ends of the tubes and the tubes are rotated during this heating by an endless conveyor **25**.

As the blanks B are elevated to the forming zone F, an endless series of pins P are brought successively into registry with the heated ends of the blanks B and moved axially into the ends of the blanks into position so that when a fixed deforming tool **26** engages the periphery of the end of a blank B, the end of the blank B is deformed into engagement with the pin P. Each pin is then successively retracted and the blank B with the restricted end opening is moved along and deposited once again on the conveyor **20** which moves it to a successive operation.

As shown in FIGS. 1 and 2, each pin P is supported on a pin holder **27** which is movable axially in a body **28** mounted on a rotating member **29**. The pin holders **27** are moved successively into forming position by a fixed cam **30** which engages rollers **31** on the ends of the pin holders **27**. The pin holders **27** are retracted by a second fixed cam **32** which engages the rollers **31** and retracts the pin holders **27**. During the presence of the blanks B in the forming zone F, the blanks are continuously rotated by an endless belt **33** which is trained over pulleys **34**, **35** and driven by a motor driven pulley **36**. The reach of the belt **33** is maintained in engagement with the blanks B by small idler pulleys **37**, **38**.

The apparatus heretofore described is substantially the same as that shown in the aforementioned patent to Koenig 2,738,622, to which reference may be made for details of the apparatus.

In accordance with the invention, a detecting mechanism is provided adjacent the path of the pins P as they are moved away from the forming station and back to the forming station. If a pin P is absent, a reject signal is created and is caused to energize a reject mechanism S in the form of a solenoid operated air valve which directs a jet of air against the blank B that has been in register with the pin holder **27** from which the pin P is missing to reject the blank. The reject signal can also be used to energize a warning signal to indicate that a pin P is missing or to stop the forming machine.

In one form of the invention shown in FIGS. 1, 2 and 4, the pin detector comprises a light source **40** which directs a beam of light through a condensing lens **41** that focuses the beam on a point in the path of the pin P as it returns to the forming station. Normally, the light beam is reflected from the pin P and focused by a condensing lens **42** on a light sensitive element **43**, preferably a double anode silicon photo-resistor element. However, if a pin P is not present, the light beam passes on without reflection. This creates a signal. In order that no false signals will be created, a position detector is provided to condition the circuit with which the light sensitive cell **43** is associated. As shown in FIGS. 1, 2 and 8, the position detector comprises a switch **44** having a switch arm **45** that is engaged by the support **28** as the pin holder **27** approaches the inspecting station. If a signal from the switch **44** and a signal from the light sensitive cell **43** occur simultaneously, then a reject signal is created. This reject signal can be utilized, after appropriate time delay, to energize the reject solenoid air valve S (FIG. 1), energize a warning light, and stop the machine, or any one of these functions.

The block diagram shown in FIG. 11 represents the manner in which the signals from the pin detector and the position detector are combined to produce the reject function. The signal from the pin detector is modified in a signal conditioner such as that shown in FIG. 10, normalized by a Schmitt trigger and converted into a short pulse by a one shot multi-vibrator. This signal is then caused to disable the AND gate. If, however,

there is no light reflected to the light sensitive element 43, there will be no signal applied to the AND gate and the simultaneous signal from the position detector will pass through the AND gate and create a reject signal for rejecting the blank, energizing a warning light or stopping the machine.

In the form of the invention shown in FIG. 3, a light source 46 directs the light beam into the path of the pin P and through an opening 47 in the mask 48 to a light sensitive element 49. The presence of a pin P will interrupt the passage of light to the element 49 creating a signal in the same manner as the detector shown in FIGS. 1, 2 and 4.

The circuit corresponding to the pin detector, signal conditioner, and Schmitt trigger shown in FIG. 11 may be such as is shown in FIG. 10. The circuit shown in FIG. 10 functions in the manner of a well-known Schmitt trigger, namely, so that when the passage of light to light sensitive element L is interrupted, transistor 60 is rendered conductive and transistor 61 is non-conductive. When light is applied to light sensitive element L, transistor 60 is rendered non-conductive and transistor 61 becomes conductive. When the circuit shown in FIG. 10 is used in association with the detector shown in FIG. 3, a reject signal is desired when the passage of light to the light sensitive element L, the reject signal is taken from output A in FIG. 10, that is, when the transistor 60 becomes conductive upon interruption of the passage of light to light sensitive element L. When the detector shown in FIG. 4 is utilized, namely, wherein the pin P reflects light to the light sensitive element L, the reject signal is taken from output B in FIG. 10, that is, when the transistor 61 becomes conductive during passage of light to the light sensitive element.

In the form of the apparatus shown in FIG. 5, the pin P is caused to be part of a capacitor circuit and a capacitor plate 50 is positioned at the inspecting station. The capacitor is connected in a circuit such as shown in FIG. 9, wherein the capacitor is represented by the reference C so that the presence of a pin causes the oscillator to operate at a predetermined frequency. However, if a pin is present, the change in capacitance changes the frequency of the oscillator. The oscillator output is fed through a demodulator circuit which then creates a signal that can be used in connection with the diagram shown in FIG. 11 to inhibit the reject signal.

In the form of the invention shown in FIG. 6, an inductance in the form of a coil 51 is positioned adjacent the pin at the inspecting station. This coil is connected to a circuit such as that shown in FIG. 9 wherein the coil is designated L. Any change in inductance in the coil due to presence of the pin causes a change in frequency of the oscillator which is fed to a demodulator that detects the frequency change.

In any of the previously formed detecting devices represented diagrammatically in FIGS. 3, 4, 5 and 6, the position of the position detector can comprise a light source 52 and light sensitive element 53 so that when the body of the pin holder arrives at the inspecting station, the passage of a light beam from the source 52 to the cell 53 is interrupted. This creates a positioning or conditioning signal which can be used in connection with the apparatus shown in FIG. 11. When the position detector shown in FIG. 7 is utilized, a signal conditioner and Schmitt trigger are incorporated in connection therewith such as in the circuit shown in FIG. 10 and an output signal is derived from output point A.

I claim:

1. In an apparatus for manufacturing hollow syringe cartridges and the like having restricted end openings therein which comprise means for conveying a plurality of blanks to a forming station, a plurality of forming pins, a plurality of pin holders, means for moving said pin holders successively into position at the forming station, means at the forming station for deforming the end of each blank over the end of a pin, the combination comprising

means at an inspection station for inspecting said pins as they move away from the forming station and back to the forming station to determine the presence of a pin,

and means for creating a reject signal when a pin is not present.

2. The combination set forth in claim 1 including conditioning means responsive to the presence of a pin holder for creating said reject signal only when said pin holder is present at said inspection station.

3. In an apparatus for manufacturing hollow syringe cartridges and the like having restricted end openings therein which comprise means for conveying a plurality of blanks to a forming station, a plurality of forming pins, a plurality of pin holders, means for moving said pin holders successively into position at the forming station, means at the forming station for deforming the end of each blank over the end of a pin, the combination comprising

means at an inspection station spaced from the forming station for directing a light beam in the path of said pins,

a light sensitive cell positioned with relation to said light beam so that light reflected from a pin is directed to said cell,

and means responsive to the failure to reflect light to said cell for creating a reject signal.

4. The combination set forth in claim 3 including means for directing a second light beam in the path of said pin holder,

a second light sensitive cell positioned in the path of said second light beam,

and means for creating a conditioning signal in response to interruption of the passage of said second light beam to said second light sensitive cell by a pin holder,

said reject signal means being conditioned by said conditioning signal.

5. In an apparatus for manufacturing hollow syringe cartridges and the like having restricted end openings therein which comprise means for conveying a plurality of blanks to a forming station, a plurality of forming pins, a plurality of pin holders, means for moving said pin holders successively into position at the forming station, means at the forming station for deforming the end of each blank over the end of a pin, the combination comprising

means at an inspection station spaced from the forming station for directing a light beam in the path of said pins,

a light sensitive cell in the normal path of said light beam,

and means for creating a reject signal when the light beam is not interrupted in its passage to said light sensitive cell due to the absence of a pin.

6. In an apparatus for manufacturing hollow syringe cartridges and the like having restricted end openings therein which comprise means for conveying a plurality of blanks to a forming station, a plurality of forming pins, a plurality of pin holders, means for moving said pin holders successively into position at the forming station, means at the forming station for deforming the end of each blank over the end of a pin, the combination comprising

a capacitor plate positioned at an inspection station spaced from the forming station,

a capacitive circuit,

means for connecting said pins in said circuit,

and means for creating a reject signal when the capacitance is not changed due to the absence of a pin.

7. In an apparatus for manufacturing hollow syringe cartridges and the like having restricted end openings therein which comprise means for conveying a plurality of blanks to a forming station, a plurality of forming pins, a plurality of pin holders, means for moving said pin holders successively into position at the forming station, means at the forming station for deforming the end of each blank over the end of a pin, the combination comprising

an inductance positioned at an inspection station spaced from the forming station,

and means for creating a reject signal when said inductance is not changed because of the absence of a pin at said inspection station.

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G. R. MYERS, *Assistant Examiner.*