

Aug. 4, 1959

H. C. FOSTER
GAGING DEVICE

2,897,964

Filed April 9, 1958

4 Sheets-Sheet 1

FIG. 1

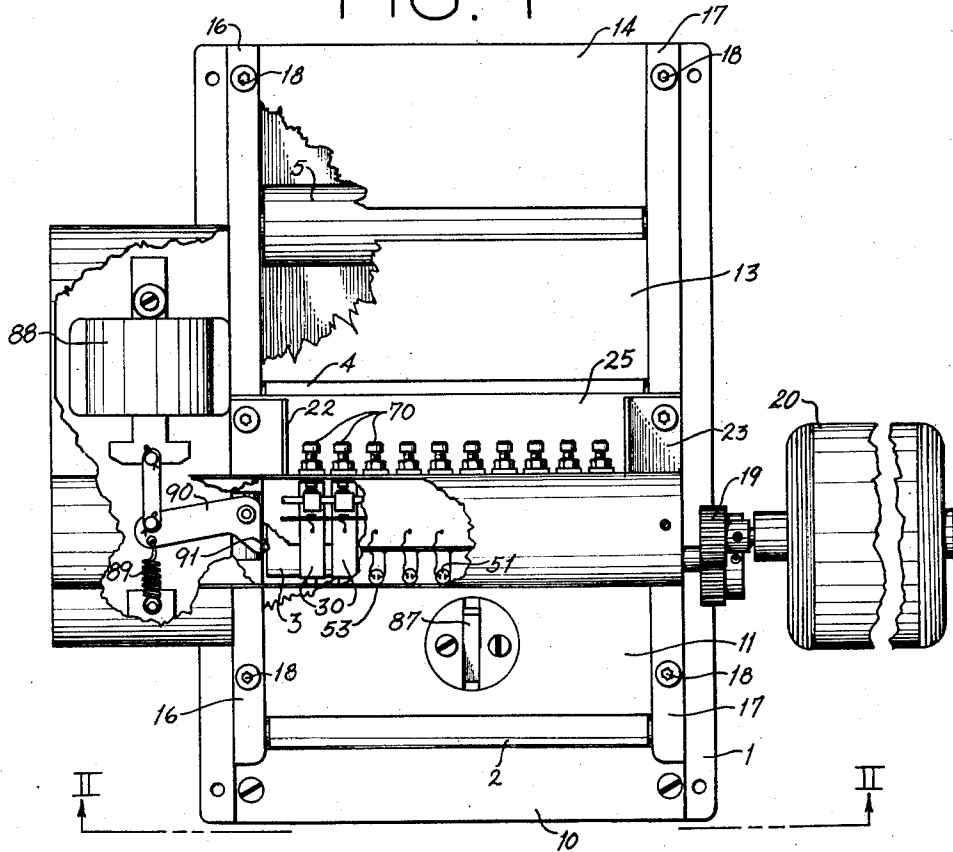
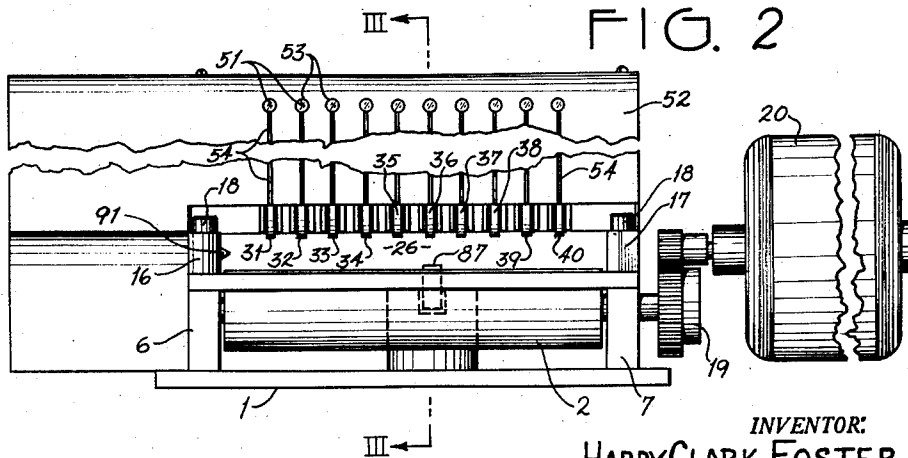


FIG. 2



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FIG. 3

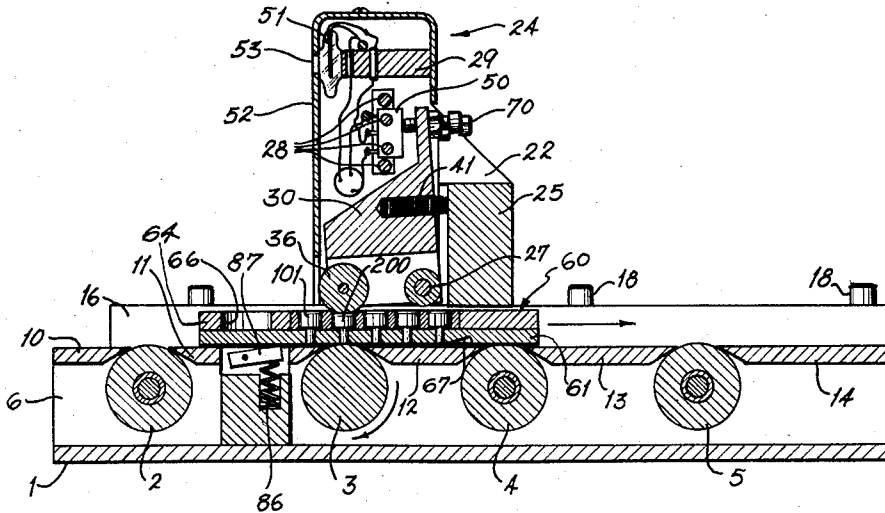
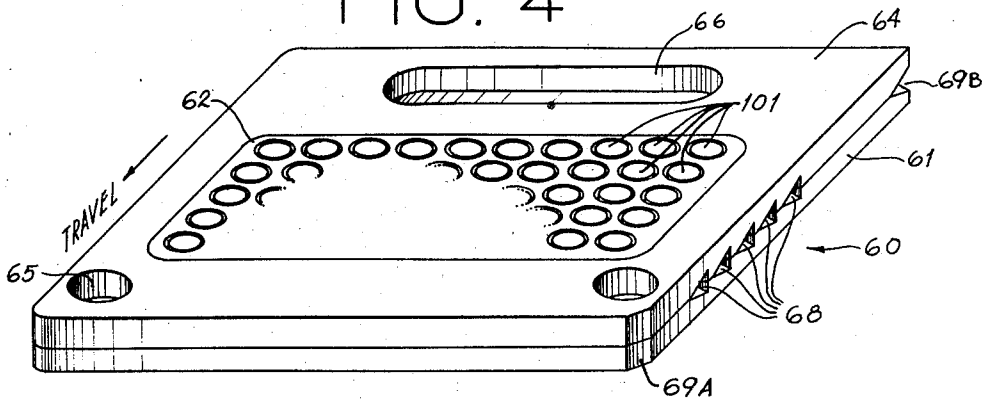


FIG. 4



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FIG. 6

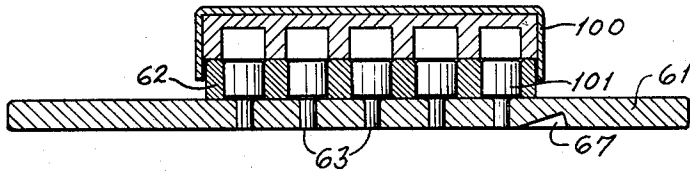


FIG. 5

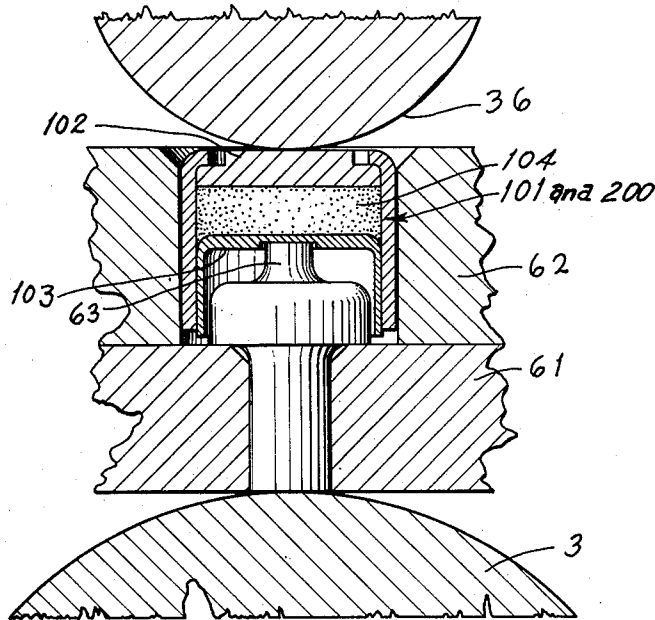
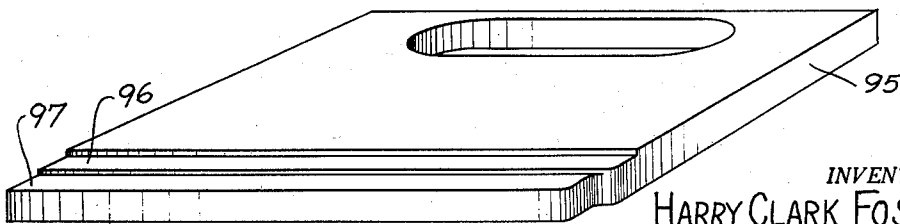


FIG. 7



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2,897,964

GAGING DEVICE

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Application April 9, 1958, Serial No. 727,420

13 Claims. (Cl. 209—71)

This invention relates to apparatus for gaging articles being manufactured and particularly to a device and method for gaging the charge content by variation in dimensions and thereby automatically checking explosive components such as the primers for cartridge cases.

In the manufacture of cartridge cases charged with a powder propellant and specifically in the manufacture of explosive cartridges for actuating ejection devices such as devices for ejecting stores and personnel from aircraft, substantial uniformity of the components is desired. In cartridges of this type an insufficient primer charge is likely to produce an actuating force below the minimum required and therefore may cause failure of ejection. For various devices of this type it has been found that for optimum performance the primer must have a certain charge content and that as a reliable indication of the presence of the necessary charge the primers of a particular construction should have a minimum height at least corresponding to the charge.

Therefore, one object of this invention is to gage the charge content of primers automatically and with speed and safety;

Another object is to provide a gaging machine adapted for handling relatively large groups of primers safely in such a way as to identify defective primers and to insure that all primers of the group are inspected; and

A still further object is to provide an improved and efficient apparatus for reliably inspecting an article for acceptability of a dimension above a minimum tolerance and for accomplishing this result with speed and precision.

Still another object is to accomplish both inspection and transference of a full complement of satisfactory articles for packaging.

Other objects and advantages of the invention described herein will become apparent from the description when taken with the accompanying drawing wherein:

Fig. 1 is a plan view of a preferred embodiment with parts broken away to show various details with clarity;

Fig. 2 is an elevational view on line II—II of Figure 1 showing the device looking from the inlet side in the direction in which the articles to be inspected are to be passed through the gaging device;

Fig. 3 is a side elevational view taken on line III—III of Figure 2 with, however, a transfer plate containing primers shown passing through the device;

Fig. 4 is an enlarged perspective view showing the test or transfer plate assembly loaded with a group of primers;

Fig. 5 is an enlarged cross sectional view of an individual primer semi-diagrammatically shown in the assembled gage fixture between the gage rolls in the position at which testing of the primer occurs;

Fig. 6 is an enlarged cross sectional view showing the gage fixture with the frame plate removed and also showing an inverted packing tray from whence the primers to be tested have been transferred to the receiver platform;

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Fig. 7 is a perspective view showing a suitable gage fixture for the gaging device of this invention; and

Fig. 8 is a diagrammatic view showing a basic part of the electrical circuit of this embodiment.

In accordance with this invention primers are put into a special gage fixture in relatively large groups segregated from each other for safety and this fixture, adapted for convenient loading and unloading, is passed through a bite or window of the inspection mechanism at which individual gaging feeler responsive to a deficiency in the height of a primer energize an indicator corresponding to the particular primer found deficient while at the same time preventing passage of the fixture through the mechanism permitting only retraction of the fixture for replacement of the defective article with an acceptable one. Passage is automatic and uninterrupted when all primers are satisfactory. This is all done without handling the primers either individually, which would be slow and costly, or in bulk, which would be unsafe. While the invention here described and shown is an embodiment for testing primers, it may be applied to many different types of articles arranged and packaged in a suitable array such as rows and columns all oriented with respect to each other. It is especially useful for gaging mass produced articles where the problem of inspection and doing this with safety and orientation is critical because of the accuracy required and the type of article involved and where rapid testing is to be made and it is desired that such orientation be maintained with each article, the various features of which are to be ascertained in this device and other testing devices. The special fixture and associated mechanism will be better understood from a specific embodiment.

With reference to Figures 1-3, the device, generally speaking, includes a supporting plate 1 with side bars 6 and 7 carrying a driven back-up or anvil roll 3, a drive motor 20, a test bridge 24 carrying a suitable gage arrangement for cooperation with roll 3 for detection of variations in the parts carried by a special testing receptacle of gage fixture 60. Journaled in side bars 6 and 7 on plate 1 is not only roll 3, but also conveyor rolls 2, 4 and 5 and across both of the bars there are mounted transversely extending bed plates 10, 11, 12, 13 and 14 spaced from each other so as to provide for protrusion of the rolls. All of these are free rolling except roll 3 which is driven through a suitable gear train 19 at desired speed by electric motor 20. Mounted over the bed plates adjacent their ends are the inspection chute side bars 16 and 17. These are fastened together with the bed plates 10, 11, 12, 13 and 14 and the side guide bars 6 and 7 to the supporting plate 1 by any suitable fastening means such as the stud bolts 18. Included are a back limit latch 87 and an automatic forward stop dog 90 the latter of which is released by solenoid 88 in the event of a defect detection.

Spanning the space between the guide bars 16 and 17 is a test bridge supporting cross bar 25 with supporting up-rights 22 and 23 at its ends, cross rods 28 supporting double throw switches 50 with their spacers, and insulating cross block 29 providing support for the associated wiring and for the indicator neon glow lamps 51. The test bridge assembly is provided with a cover 52 which on the entry side of the mechanism facing the operator has a plurality of indicator apertures 53 aligned with the individual indicator lamps 51. To further assist the operator, the front of the cover 52 is provided with a series of vertical guide stripes 54 each of a readily followed color extending from an individual indicator opening 53 in the direction of the column of primers which corresponds to the action of the particular indicator lamp 51 involved.

Mounted on pivot rod 27 are a series of gaging bell crank levers 30 which are equal in number to the number of columns of primers in the test fixture 60. As shown in Figure 3, levers 30 carry on one arm of each one of the feeler rolls 31, 32, 33, 34, 35, 36, 37, 38, 39 and 40 the number of which correspond to the number of columns of primers 101 carried in the test fixture as shown in Figure 4. The other arm of levers 30 carries adjustable contact actuator screw 70. The feeler roll of each gage lever 30 is biased toward anvil roll 3 by one of the gaging arm springs 41 acting between cross bar 25 and levers 30.

With reference to Figures 3, 4 and 6, there is shown the gage fixture 60 of this invention. Although it could be made as a single piece, it is made in two main separable parts so that one part, in this embodiment the lower part, can be used alone as a manual transfer plate to gather and return the group of primers being tested from and to the trays in which the primers are packed and handled apart from this invention. As shown, the fixture includes a bottom plate 61 to which there is fixed a perforated plate forming a receiver platform 62 and to which there are staked a series of gaging anvils 63 each of which protrudes centrally into a corresponding orifice of platform 62. There is also a top frame plate 64 which can be dropped around the platform to place plate 64 detachably against plate 61. Anvils 63 are so set in bottom plate 61 that the top surface of each, upon which surface the articles to be tested are to rest, is accurately positioned with respect to the bottom surface of the transfer or bottom plate 61. The function of frame plate 62 is to merely complete the height needed for testing and it fills in for this purpose, but is a part removed to permit the transfer operation shown in Figure 6 where inversion of the transfer plate 61 and the tray 100 and transfer of the primers 101 has occurred. Frame plate 62, for convenience of handling has various finger holes such as the leading pull holes 65 and the trailing hole 66.

The plates which constitute the fixture 60 are provided with various side notches 69A, 68 and 69B for the special purpose of controlling the feeding. The bottom plate 61 is also provided with a directional control notch 67 on its underside for coaction with a plate latch 87.

The side of each of the plates 61 and 64 may be provided with half of the notches; and the notches 68 are equal in number to the number of rows of articles in the receiver platform 62 for coaction with the end 91 of a stop dog or pawl lever 90.

When the upper and lower plates 64 and 61 of the fixture are put together for handling in testing, the notch halves in each plate complement each other to form the whole notches shown in Figure 4 which otherwise would be difficult to form. Dog 90 is normally held by spring 89 so as to force its end 91 into the side of the fixture unless the solenoid 88 is energized to maintain the pawl sear 91 out of the inspection chute 26 so as to permit the gaging fixtures 60 to pass through.

These side notches together with the end or sear 91 form a ratchet and pawl arrangement because of the slope of the notches which permit rearward movement of the fixtures with respect to the pawl tip or sear 91, but interfere with forward movement in the event the tip is engaged with any one of the notches. The leading and trailing side notch sections 69A and 69B are provided to cooperate with the pawl 91 and allow only motor 20 to feed and prevent other feeding of the fixtures 60. It will be appreciated that when any of the feeler wheels 31-40 drop into hole 66, the device will act as if a series of defective primers have been encountered and will cause the sear tip 91 to slam into the side of a fixture and cause the motor 20 to stop driving the anvil roll 3. Notch section 69B of the preceding fixture acts together with notch section 69A of the next fixture to form a

complete notch; and when the sear 91 strikes section 69A the next fixture 60 fed into the device is positively stopped so as to require reactivation of the starter button 80 before the next fixture is picked up by roll 3 and carried into the inspection window. This arrangement prevents the operator from forcing the fixtures in one after another at a speed different from that at which the device is designed to operate properly and also provides an interval in which fixtures may be loaded for entry and unloaded after delivery with tested primers.

It will be understood that, if continuous operation is desired, the trailing finger hole 66 may be omitted and a tongue and groove or other suitable lock joint offering no discontinuity may be provided between fixtures so that adjacent gaging fixtures are held together in chain fashion and are carried through by the roll drive until a bad primer is encountered. In this event, as before, drive ceases, the operator can pull back on a fixture awaiting admission and with respect to the retracted fixture in process proceeds to remove and replace the defective article. Operation as before is renewed by the starter button 80.

In the event of a defective primer, only enough retraction of fixture 60 is permitted as is necessary to uncover the array of primers, since complete retraction is prevented by plate latch 87 which is biased by spring 86 to fall into notch 67 properly positioned in plate 61 for this purpose.

By the arrangement of this invention there is accomplished gaging for the presence of a minimum charge by gaging of the overall thickness or "bridge height" of the various components of a primer 101 including the primer button 102, the foil 103 and the intervening charge 104 as these are all assembled in the completed and dried primer. The minimum height is correlated with a certain minimum charge 104 by testing beforehand; and, based upon this calibrating information, the apparatus of this invention is adjusted so that the rejection point of height is at the desired critical minimum charge weight. This may vary for different primers. To facilitate calibration and operation a set-up gage 95 may be used as auxiliary equipment with various heights in two steps 96 and 97 representing the "go" and "no-go" limits of operation, respectively, of screws 70.

In operation, a 100% inspection is obtained of a large number of primers carried in the gage fixtures in row and column arrangement of receiving orifices from which only 100% satisfactory primers are directly transferred into packaging trays. Defective primers must be replaced.

Gaging of each primer 101 occurs between the anvil roll 3 and a particular feeler roll, such as feeler roll 36 as shown in Figure 3, acting under the bias of spring 41. During gaging each primer is supported by resting upon the top of an anvil pin 63 centrally located in the bottom of each orifice in the bottom supporting plate 61. The supporting end of each pin is surface ground to the same height. The assembled fixture 60 including frame plate 64 is of such thickness as to make its top surface about 0.005 of an inch higher than the predetermined level of the top or button 102 of a primer as the primer is supported upon the pins 63, provided the primer has a satisfactory minimum charge.

The fixture is loaded with primers to be tested by first removing the frame plate 64 and inverting the bottom plate 61 over a tray 100 containing untested primers in rows and columns corresponding to the row and column arrangement of the receiver platform 62 of the fixture, after which plate 61 with the container held against it is turned back right-side-up as shown in Figure 6. The tray is lifted off leaving the primers in the cavities of the fixture.

The loaded fixture is adapted to be passed over roll 3 through the arrangement of movable gage probes adapted for actuating one or more of the battery of indicators 51.

in the event of detection of one or more defective primers. The gaging pass is defined by (1) the motor driven anvil roll 3 which also acts as a gaging fixture roller support and drive and (2) by the battery of individual gaging wheels. According to the specific embodiment shown the driven roller 3 carries the gaging fixture 60 under ten free rolling gaging wheels 31-40. These are mounted upon arms of the battery of spring loaded bell crank levers 30 which operate suitable control switches, such as the battery of small switches 50, through adjustable fingers 70 at a suitable lever ratio such as a ratio of 2 to 1 at a suitable gaging wheel pressure upon each primer, such as a pressure from about 1/2 to about 3/4 of a pound. The switches control not only a corresponding number of signal lamps each of which upon lighting up indicate the location of defective primers, but also motor 20 to cause halting of drive roll 3 and solenoid 88 to block fixture 60 when a defective primer is reached.

With this arrangement a gage fixture may be slightly warped without affecting the accuracy of gaging since the vertically movable gage wheels are located directly above the rotatably driven but vertically fixed fixture supporting roller 3 which in turn projects slightly above the adjacent bed plates 11 and 12 of the apparatus only enough to permit teetering of the passing fixtures 60 with respect to roll 3 and the gage wheels, and thereby avoid false readings due to any lack of flatness in the fixtures, but not so much as to cause excessive pitching and false readings on this account. In this connection, the span across the three rolls 2, 3 and 4 is more than the length of fixture 60 so as to permit the teetering. Rolls 2, 4 and 5 are idlers for conveyance.

Operation according to this invention is started when the operator places the gage fixture 60 on roll 2 of the inspection chute 26. Thus fed into the entry side it is pushed forward over roll 3 as far as it will go until it strikes the stop dog tip 91. At this position the plate latch 87 falls into the notch 67 of the fixture, so that the fixture cannot be retracted. This prevents inadvertent withdrawal of it and acceptance of an untested assortment of the primers. At this point, the fixture rests on the driven anvil roll 3 and the preceding adjacent entry roll 2 and leaves its leading edge in the bite or test chute window thereby raising the gaging arm rolls 31-40 turning off all warning lights and closing series of contacts 73 of the electrical starter circuit (Figure 8).

When switch 80 is closed, pawl 91 is withdrawn and motor 20 energizes roller 3 to carry the plate 60 under the testing rollers and through the chute provided all the primers are of at least minimum charge height. Upon delivery of the fixture containing only acceptable primers, motor 20 stops and the fixture can be removed for further handling involving detachment of the frame plate 64 to place the entire group of acceptable primers 101 in the tray 100.

If, however, an underweight primer 200 as shown in Figure 3 comes under a gaging wheel, such as wheel 36, for example, switch 50 undergoes an opening of its contact 71X and motor 20 stops because of release of coil 72X and opening of series contactor 73X. The corresponding contact 75X is closed and corresponding indicator light 51X is flashed to notify the operator of the presence of primer 200 and identify the defective primer. As part of the same action contactor 81 opens to deenergize solenoid 88 and sear 91 of dog 90 impelled by spring 89 falls into a notch 68 and stops forward motion. The fixture must then be pulled back manually, but only far enough as permitted by latch 87 to allow replacement of the defective primer by a good one. When the primers meet the minimum specification, contact finger 70 is adjusted so as to leave each of the battery of switches 50 in a position at which contacts 71 to the holding coils 72 for contacts 73 are closed. The fixture 60 can then resume its journey through the apparatus upon closure of the starter button 80. Because of the

solenoid operated stop dog 90 it is not possible to push the fixture 60 containing defective primer 200 through the chute so as to force any row containing a defective primer or lacking a primer beyond the gaging wheels. Thus, it is not possible to either withdraw the fixture, once it is inserted, so as to circumvent testing, or to force the fixture through the device in disregard of the defective conditions encountered.

It is to be understood that the foregoing is subject to various changes in modification by those skilled in the art without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In combination, a receptacle member for carrying in accurate disposition with reference to one side of said member at least one array of articles accessible from at least the opposite side of said member, and a probing device for said articles comprising a frame, including a conveyor chute, said member being adapted for passage through said chute, said frame having mounted thereon on one side of said chute gage anvil means engageable with respect to said one side of said member as it passes with said array along said chute, a battery of gage feeler means mounted on said frame on the other side of said chute opposite said anvil means in spaced movable relationship with respect to said anvil means and engageable on said accessible side with respect to said articles for detecting departure of said articles from a predetermined minimum dimension, means for indicating the presence of a defective article upon its detection by said feeler means, forward stop means on said frame engageable with cooperating means on said receptacle member for preventing substantial passage of said array including a defective article beyond said battery of feeler means while permitting retraction of said receptacle member, motivator means for rendering said stop means inoperative, gage control means responsive to said feeler means for energizing said motivating means and said indicator means in alternation, rearward stop means normally engageable with mating means on said receptacle member for allowing unhindered passage of said receptacle member and only limited retraction sufficient to the extent necessary to withdraw said member and to uncover said array of articles, whereby upon detection of a defective article said control means automatically energizes said indicator means and causes said forward stop means to simultaneously prevent further passage of said receptacle member while said rearward stop means renders said receptacle member capable of being retracted sufficiently to permit removal of said defective article and replacement of it with an acceptable one as a condition precedent to disengagement of said forward stop means from said receptacle member and further progress of the receptacle member to completion of said passage.

2. The combination of claim 1 wherein the receptacle member is a plate of substantial length in the direction of chute length and wherein the probing device includes support means adjacent the entry and delivery side of said anvil means and wherein the anvil means projects slightly beyond said support means toward said feeler means so as to substantially nullify any inaccuracy because of warpage of said plate along said length not in excess of said slight amount of projection.

3. The combination of claim 1 wherein the receptacle member has a transverse row and longitudinal column arrangement of means for receiving and accurately supporting a series of articles, wherein each row consists of an array of articles corresponding in number to the battery of feeler means, and wherein the means on said receptacle member for cooperation with said forward stop means correspond to the number of rows.

4. The combination of claim 1 including driving means for the anvil member, master control means operable for starting said drive means at will and simultaneously energizing the motivating means and an automatic stop-

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ping and deenergizing means overriding said master control means and wherein said anvil means is a drivable member adapted to move the receptacle member forwardly in its passage through the chute at a speed coordinated with the operation of the feeler means and gage control means.

5 5. The combination of claim 4 wherein the receptacle member has a transverse row and longitudinal column arrangement of means for receiving and accurately supporting a series of articles, wherein each row consists of an array of articles corresponding in number to the battery of feeler means, and wherein the means on said receptacle member for cooperation with said forward stop means correspond to the number of rows.

10 6. The combination of claim 5 wherein the receptacle member is a plate of substantial length in the direction of chute length and wherein the probing device includes support means adjacent the entry and delivery side of said anvil means and wherein the anvil means projects slightly beyond said support means toward said feeler means so as to substantially nullify any inaccuracy because of warpage of said plate along said length not in excess of said slight amount of projection.

15 7. In combination, a portable receptacle member for carrying in accurate disposition with reference to one side of said member at least one row of charged articles exposed on and accessible from the opposite side of said member, and a charge gaging device for said carried articles comprising a frame, including a conveyor chute, said member being adapted for passage through said chute, said frame having mounted thereon on one side of said chute gage anvil means engageable with respect to said one side of said member as it passes with said row along said chute, a battery of gage feeler means mounted opposite said anvil means on said frame on the other side of said chute in spaced movable relationship with respect to said anvil means and engageable on said accessible side with respect to said articles for detecting departure of said articles from a predetermined minimum charge, means for indicating the presence of a defective article upon detection thereof by said feeler means, forward stop means on said frame engageable with cooperating means on said receptacle member for preventing substantial passage of said row including a defective article beyond said battery of feeler means while permitting unlimited retraction of said receptacle member, motivator means for rendering said stop means inoperative, gage control means responsive to said feeler means for energizing said motivating means and said indicator means in alternation, rearward stop means normally engageable with mating means on said receptacle member positioned for allowing unhindered passage of said receptacle member and only limited retraction sufficient to the extent necessary to withdraw said member and to uncover said array of articles, whereby upon detection of a defective article said control means automatically energizes said indicator means and causes said forward stop means to simultaneously prevent further passage of said receptacle member while said rearward stop means renders said receptacle member capable of being retracted only sufficiently to permit removal of said defective article and replacement of it with an acceptable one as a condition precedent to disengagement of said forward stop means from said receptacle member and further progress of the receptacle member to completion of said passage.

65 8. The combination of claim 7 including driving means for the anvil member, master control means operable for starting said drive means at will and simultaneously energizing the motivating means and an automatic stopping and deenergizing means overriding said master control means and wherein said anvil means is a drivable member adapted to move the receptacle member forwardly in its passage through the chute at a speed coordinated with the operation of the feeler means and gage control means.

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9. In combination a portable receptacle member with perforations for carrying in accurate disposition with reference to one side of said member at least one array of charged primers exposed on and accessible from the opposite side of said member and a charge gaging device for said primers comprising a frame including a conveyor chute, said member being adapted for one-way passage through said chute, said frame having mounted thereon on one side of said chute a gage anvil roll engageable in driving relationship with respect to said one side of said member passing along said chute, a battery of gage feeler rolls mounted opposite said anvil roll on said frame on the other side of said chute in spaced movable relationship with respect to said anvil roll and engageable on said accessible side with respect to said primers for detecting departure of said primers from a predetermined minimum charge, an electric motor for driving said anvil roll, means for visibly indicating the presence and location of a defective primer responsive to detection by said feeler rolls, pawl means on said frame yieldably urged into a mating ratchet notch on said receptacle member for preventing substantial passage of said array including a defective primer beyond said battery of feeler rolls while permitting retraction of said receptacle member, solenoid means for normally holding said pawl means out of engagement with said notch, a master control switch operable for starting said drive motor at will and simultaneously energizing the solenoid means, electric gage control means responsive to the position of said feeler rolls for energizing said solenoid means and said indicator means in alternation, a series of switches in series circuit with said master control switch and corresponding to said array of primers for automatically stopping said motor and deenergizing said solenoid means, a latch means on said frame normally urged into engagement with a mating notch on said receptacle member positioned for allowing unhindered passage of said receptacle member with limited retraction on detection sufficient to the extent necessary to withdraw said member and to uncover said array of primers, whereby upon detection of a defective primer said driving anvil roll is stopped and said indicator means is energized to denote the presence and location of said primer and said pawl means is caused to simultaneously prevent further passage of said receptacle member unless said defective primer is removed and replaced with an acceptable one and the master switch operated.

40 10. The combination of claim 9 wherein the receptacle member is a recessed plate of substantial length in the direction of chute length and has a row and column arrangement of means including said recesses for receiving and accurately supporting a series of primers, wherein each row consists of a transversely extending array of primers corresponding in number to the number of columns and also to the number of feeler rolls and the ratchet notches correspond to the number of rows, and wherein the frame also includes in said chute support means adjacent the entry and delivery sides of the anvil roll, said anvil roll projecting slightly beyond said support means toward said feeler rolls so as to substantially nullify any inaccuracy in gaging because of warpage of said plate along said length with the limits of said slight amount of projection.

45 11. The combination of claim 10 wherein the indicator means are lamps arranged to correspond to the arrangement of articles in the receptacle member.

50 12. The combination of claim 7 including a plurality of receptacle members arranged in a column and wherein each trailing receptacle member is detachably locked to preceding member in transit in said gaging device.

55 13. The combination of claim 12 wherein the member is a plate and wherein locking is provided by a single tongue-and-groove joint operably engageable and disengageable in a direction normal to the plate surface.