March 1, 1960 R. J. DORN 2,926,705

BALL INFLATING AND SEALING METHOD

Filed April 3, 1957

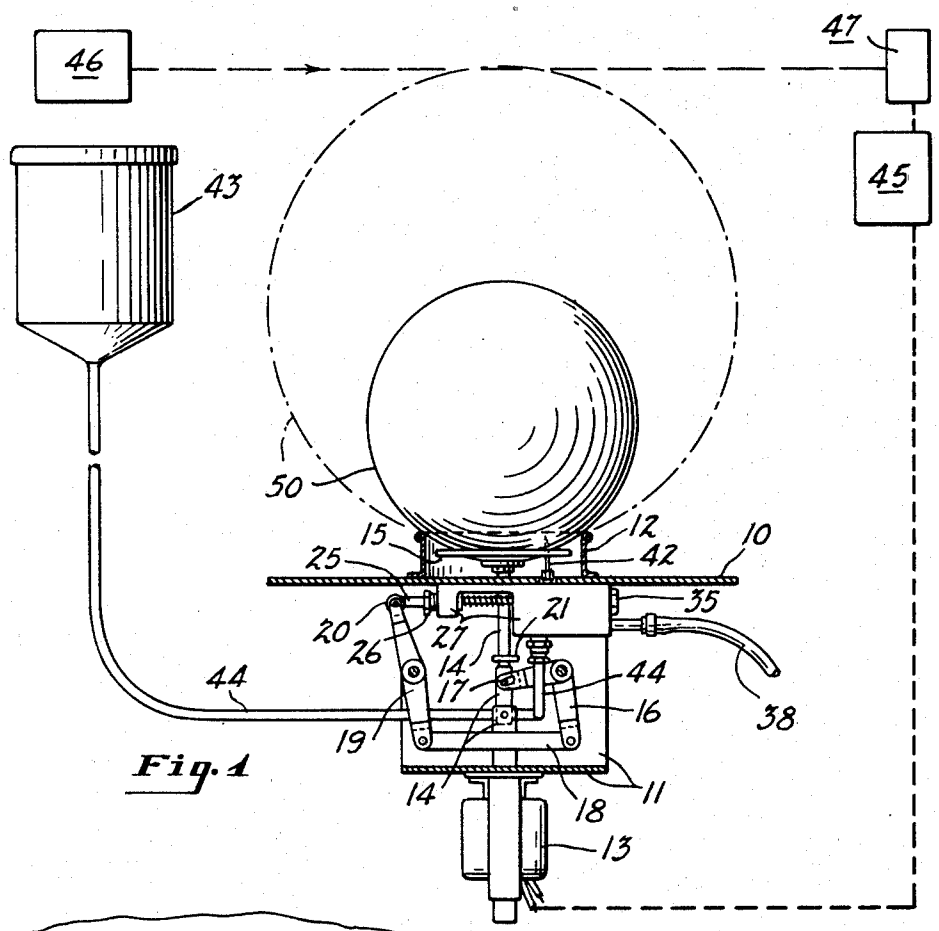


Fig. 1

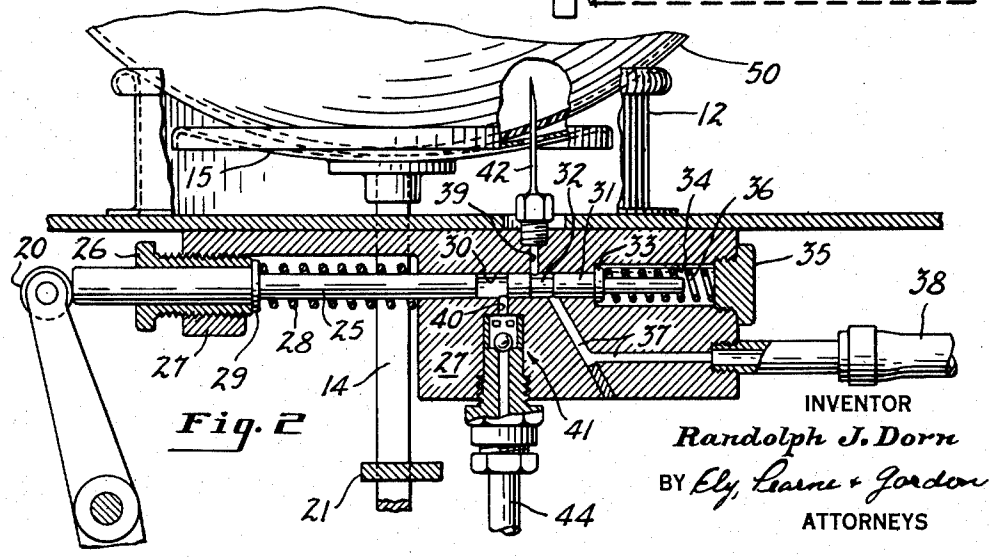


Fig. 2

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BALL INFLATING AND SEALING METHOD

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2 Claims. (Cl. 141—5)

This invention relates to the manufacture of inflated or inflatable hollow articles such as balls and the like.

Articles of the type to which the invention relates have been very economically manufactured to high quality standards by casting or otherwise suitably preliminarily forming the articles as a gas envelope which is thereafter inflated to final size by being filled with a suitable gas such as air before final setting of the material comprising the ball. It is also conceivable that a procedure may be followed in which articles are set in their preliminary form and inflation to final size is accomplished by sufficiently high pressure.

The use of the technique of finally forming the article by inflation following preliminary forming has been narrowly limited by the problem of obtaining adequate sealing of the relatively thin wall of the fully inflated article from which the inflating needle is withdrawn. Attempts have been made to minimize this problem by inflating at an angle, thereby increasing the length of the line of puncture and presumably also increasing sealing effectiveness. In other more elaborately (and costly) applications the problem has been partially met by providing an inwardly extending protuberance on the wall of the article, the protuberance being designed to be penetrated by an inflating needle and affording a relatively long line of puncture. Other more complicated means have been provided, such as compressed elastic members which tend to close tightly on themselves when an inflating needle is drawn from them or special sealant chambers which must be accurately penetrated by the inflating needle.

The general object of the present invention is to accomplish the manufacture of hollow articles, including the final formation thereof by inflation after preliminary forming, in such a way as to enable sealing to be achieved more consistently than has heretofore appeared possible and without the costly and elaborate special valve structures which has heretofore sometimes been provided for this purpose.

The invention is illustrated below in a presently preferred embodiment. It will be understood that this embodiment is illustrated merely by way of example and that many of the details of this example may not be necessary to the invention but are set forth in order to most fully assure the accomplishment of an adequate disclosure.

In the drawings, Figure 1 is an elevation taken partly in cross-section and showing apparatus illustrating the practice of the invention, and Figure 2 is an enlarged cross-sectional detail view of the central portion of the apparatus seen in Figure 1.

In the particular example of the invention which is illustrated, there is provided a table **10** from which depends a frame strap **11** and on which is positioned a collar **12**. Mounted below the strap **11** is a solenoid **13** having associated therewith a solenoid shaft **14** which is adapted in a well-known manner to be axially translated abruptly upwardly when the solenoid is energized and to be axially translated downwardly by gravity when the

solenoid is de-energized. For ready disassembly or partial disassembly, the shaft **14** may comprise sections which are releasably pinned together as shown. A pusher member **15** is fixed on the upper end of the solenoid shaft **14**. The solenoid shaft **14** may be provided with a stop collar **21** which serves to abruptly terminate upward movement of this shaft and the pusher member **15**. A bell crank **16** is connected by a lost-motion pin and slot connection to the shaft **14** as at **17**. The bell crank **16** is connected through a link **18** to a second bell crank **19**. The output end of the bell crank **19** comprises a pusher **20** which engages a reciprocating stem **25**. The stem **25** is received in a plug **26** which is threadedly engaged in a body or housing **27**. The stem **25** is urged outwardly by a spring **28** and its outward movement is limited by a stop shoulder **29**. The limit of this outward movement can be adjusted by adjusting the plug **26** which may have a lock nut (not shown) received on the outside thereof, if desired. The reduced inner end of the stem **25** is received in fluid-tight telescoping relationship within a bore **30** formed in the housing **27**. Also received in this bore in fluid-tight telescoping relationship therewith is a second stem **31** having an annular groove or reduced portion **32** formed therein as shown. The stem **31** is provided with a stop shoulder **33** which seats against the shoulder formed by a counterbore **34**. The stem **31** is urged to an inward position by the spring **36**. The outward movement of the stem **31** is limited by the plug **35** which is threadedly engaged with the body **27**. The amount of outward travel of the stem **31** may be adjusted by adjusting the plug **35**, as will be clear from the drawings. If desired, this plug may be somewhat extended and provided with a lock nut (not shown).

An air passage **37** in the body **27** communicates with an air line **38** which is connected with a source of compressed air (not shown). The passage **37** intersects the bore **30** at a point where it communicates with the annular groove or reduced portion **32** when the stem **31** is in its innermost position, as shown. An exhaust passage **39** also intersects the bore **30** at a point where it communicates with the annular groove or reduced portion **32** when the stem **31** is in its innermost position. The passage **39** is connected to an inflating needle **42**, the base of which is threadedly engaged in the body **27**. The inflating needle **42** protrudes through an opening in the pusher member **15** when the pusher member is in its retracted or lowermost position, as shown.

A third passage **40** communicates with the bore **30** and, through a one-way check valve generally indicated by the reference numeral **41**, the passage **40** also communicates with a line **44** which leads from a solvent reservoir **43**.

The solenoid **13** is energized by being connected to a suitable source of power by a switch **45**. The switch **45** is closed upon interruption of the beam of light extending from a light source **46** to a light-sensing means such as a photoelectric cell **47**, and the switch **45** is opened when interruption of the light beam ceases, all in accordance with familiar practice in the art of light-sensitive controls.

When an air envelope **50** consisting essentially of a resin and non-volatile plasticizer therefor is placed on the collar **12**, the air envelope being in its uninflated condition indicated in solid lines in Figure 1 and the position of the parts being the same as that shown in the figures, the air envelope is penetrated by the inflating needle **42** and inflating air is admitted into the air envelope. When the air envelope has been inflated sufficiently to interrupt the beam of light between the light source **46** and the light-responsive control means **47**, the switch **45** is closed and the solenoid **13** is energized,

causing the pusher 15 to kick upwardly and also through the linkage 16, 18, 19 causing the stem 25 to be shifted to its inner position. Solvent is trapped under pressure within the passage 40 and the communicating portion of the bore 30 since the one-way check valve 41 will not allow this pressure to be relieved back through the line 44. Accordingly, the advance of the stem 25 forces the stem 31 outwardly against the urging of the spring 36. When the stem 31 is sufficiently retracted, a portion of the trapped solvent is relieved through the passage 39 and is ejected through the needle 42. Any partial pressure relief thus effected may momentarily tend to allow the stem 31 to move inwardly, but to the degree that the passage 39 is cut off by the leftmost end of the stem 31 (as it is viewed in the drawings) then to that extent is pressure re-established by the continued inward movement of the stem 25, resulting in continued expressing of solvent through the needle 42 until inward movement of the stem 25 is substantially completed. All of this takes place in a brief interval, but the expressing of solvent through the needle 42 is of sufficient duration to encompass the time during which the end of the needle is being withdrawn from the wall of the air envelope. Since the solvent is deposited in the line of puncture made by the needle and since such depositing occurs at the precise time that the needle is withdrawn from the line of puncture, an unusually effective sealing action is achieved. It will be seen that this is accomplished without providing the air envelopes with inwardly extending protuberances designed to be penetrated by an inflating needle (and necessitating careful alignment with the inflating needle) and without any of the other and even more complicated means heretofore used, such as compressed elastic members which are designed to close tightly on themselves when an inflating needle is withdrawn from them, or special sealant chambers or the like.

The solvent which is ejected by the stem 25 and which is supplied from the reservoir may comprise any suitable solvent for at least one of the two things of which the air envelope essentially consists, namely a resin and a non-volatile plasticizer therefor. In this sense, the non-volatile plasticizer may itself be regarded as a species of solvent and is to be understood as included within the limitation "solvent for at least one of said resin and palsticizer" as used in the appended claims. As an example, in the case of air envelopes comprising vinyl chloride formulations according to procedures familiar to the art, suitable solvents which may be ejected through the needle 42 for sealing purposes include (1) triethylene chloride, (2) methyl isobutyl ketone, (3) isopropyl ether, (4) commercial white gasoline, (5) dioctyl phthalate, (6) unsaturated petroleum hydrocarbon secondary plasticizer ("Dutrex 25," Shell Oil Company), (7) polyvinyl chloride acetate copolymer, vinyl chloride 96%+, less than 4% vinyl acetate, (8) triethylene glycol di-(2-ethyl hexoate), and also combinations of the above, for example (9) equal parts of (5) and (6) above, or (10) equal parts of (5), (7) and (8) above. Other solvents may also be used.

It is believed apparent that the specific example of the invention set forth above may be varied in many details without departing from the scope of the invention. The scope of the invention is defined in the following claims. It should be understood that the term "air" as used in these claims is intended to include any and all gases appropriate to the inflation of hollow articles.

What is claimed is:

1. A manufacturing method for inflating articles each of which comprises an air envelope consisting essentially of a resin and non-volatile plasticizer therefor, comprising the stems of providing a succession of said air envelopes, engaging each of said air envelopes with an inflating needle in wall-penetrating relationship, inflating each air envelope, moving apart relative to each other said inflating needle and each air envelope which it has penetrated to withdraw the inflating needle and establish a condition in which the inflating needle is separated from the air envelope, and expressing solvent for at least one of said resin and plasticizer from the inflating needle and simultaneously contacting and depositing the solvent on the wall throughout the wall penetration while the needle is being so withdrawn, said step of moving apart being carried out in response to attainment of a given degree of inflation by the air envelope.

2. A manufacturing method for inflating articles each of which comprises an air envelope consisting essentially of a resin and non-volatile plasticizer therefor, comprising the steps of providing a succession of said air envelopes, engaging each of said air envelopes with an inflating needle in wall-penetrating relationship, inflating each air envelope, moving apart relative to each other said inflating needle and each air envelope which it has penetrated to withdraw the inflating needle and establish a condition in which the inflating needle is separated from the air envelope, and expressing solvent for at least one of said resin and plasticizer from the inflating needle and simultaneously contacting and depositing the solvent on the wall throughout the wall penetration while the needle is being so withdrawn.

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CERTIFICATE OF CORRECTION

Patent No. 2,926,705 March 1, 1960

Randolph J. Dorn

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 18, for "stems" read -- steps --.

Signed and sealed this 9th day of August 1960.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents