Sept. 11, 1962 C. J. GAHLINGER 3,053,211

MEANS FOR INFLATING LAMINATED SHEETS

Filed July 31, 1959 2 Sheets-Sheet 1

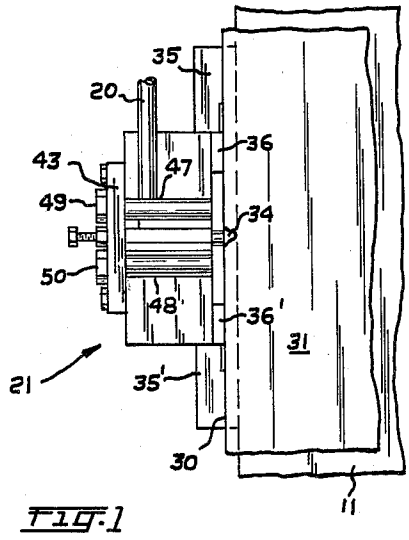


FIG. 1

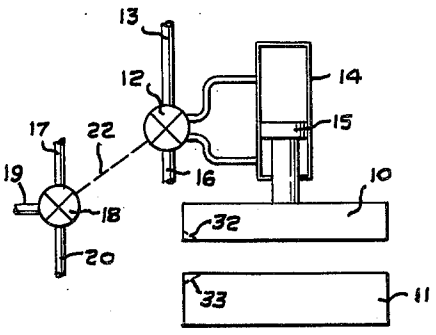


FIG. 1A

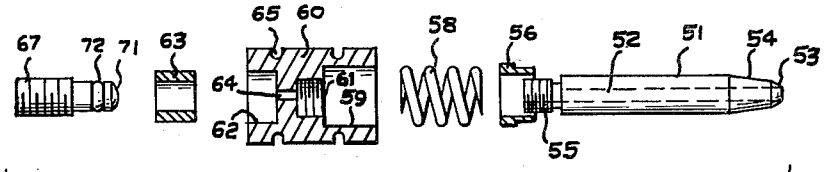


FIG. 6

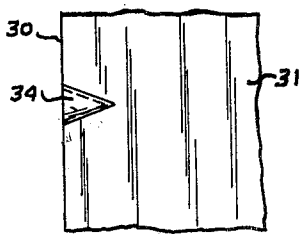


FIG. 2

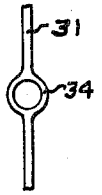


FIG. 3

INVENTOR
CLARENCE J. GAHLINGER

BY Glenn & Jackson
ATTORNEYS

Sept. 11, 1962 C. J. GAHLINGER 3,053,211

MEANS FOR INFLATING LAMINATED SHEETS

Filed July 31, 1959 2 Sheets-Sheet 2

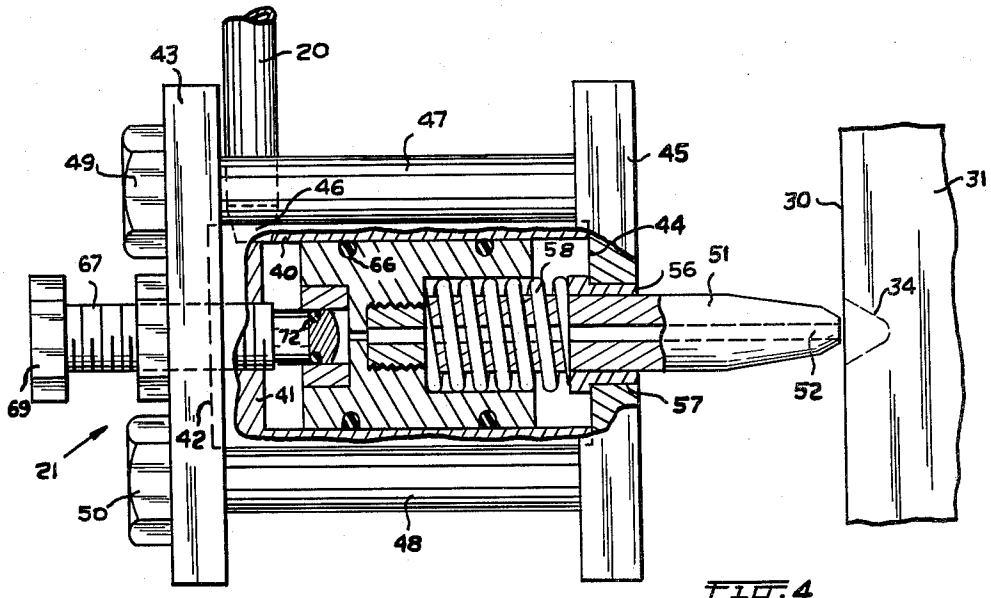


FIG. 4

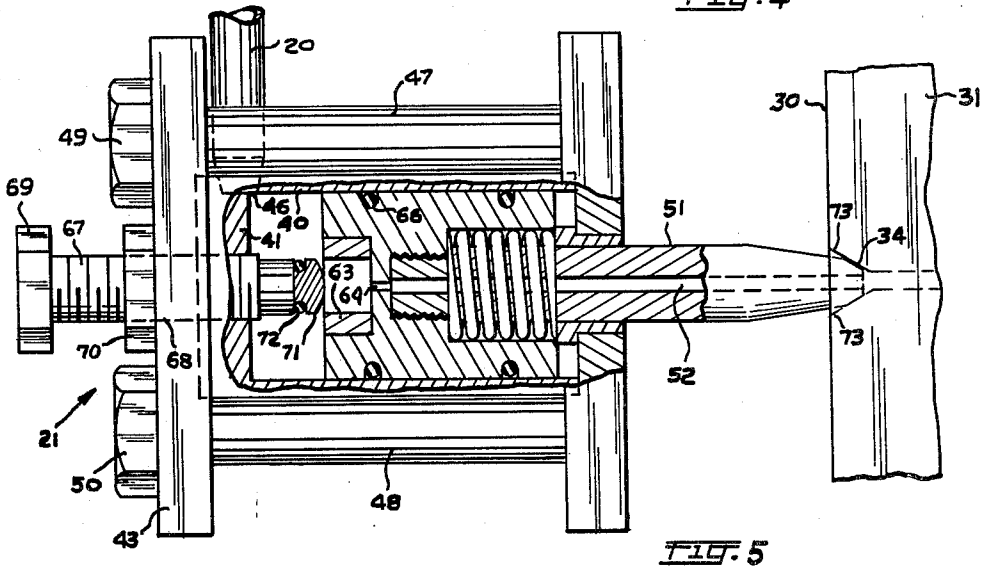


FIG. 5

INVENTOR

CLARENCE J. GAHLINGER

BY Glenn & Jackson

ATTORNEYS

United States Patent Office

3,053,211

Patented Sept. 11, 1962

3,053,211

MEANS FOR INFLATING LAMINATED SHEETS

Clarence J. Gahlinger, Valley Station, Ky., assignor to Reynolds Metals Company, Richmond, Va., a corporation of Delaware

Filed July 31, 1959, Ser. No. 830,819

5 Claims. (Cl. 113—44)

This invention relates to an improved apparatus for use in the inflating of laminated sheets or the like, which are to be confined on a suitable press during the inflation of the sheet.

In the manufacture of passageway panels formed of laminated metal sheet, aluminum being a particularly suitable metal for this purpose, various problems have been encountered which tend to reduce the rate of production of inflated sheets. For example, such panels normally include a laminated sheet construction having an intermediate weaker section, or unbonded pattern, between the outer sheet surfaces and to which pattern or section an inflating fluid under high pressure is supplied in a controlled manner. At the time when this fluid is supplied, the panel is confined within a press structure cooperating with the panel so as to permit controlled expansion of that panel upon either of two sides, or upon both sides simultaneously. For the purpose of supplying this inflating fluid, a separate member, commonly called an inflation needle, is brought to the edge of the confined sheet at a selected point where communication with the unbonded pattern or weaker section may be established, is attached in substantially leak-proof relation to the sheet, and after functioning to inflate the sheet, is then disconnected therefrom. When this usage of the inflation needle involves manual positioning and operation of the same, the rate of production of inflated panels is relatively slow and the large and expensive press structure is not employed at its full capacity.

An object of the present invention is to provide an improved combination of apparatus including a press and an inflating needle construction operable automatically and at a relatively high rate of production.

Another object is to provide an improved inflation needle assembly for inflating laminated sheets.

A further object is to provide an improved inflation needle in which the inflating fluid serves to move the needle into contact with the article to be inflated thereby, and without entailing leakage of that fluid.

Still a further object is to provide an inflation needle assembly which may be readily adjusted to regulate the position of the needle at which inflation occurs.

Other objects and advantages will become apparent as the description proceeds and when considered in conjunction with the accompanying drawings in which:

FIG. 1 is a plan view showing a panel resting on the lower platen of a press and with the inflating needle in position for entry into the panel.

FIG. 1A is a diagrammatic view illustrating one arrangement of valve control linking the operations of the press and needle shown in FIG. 1.

FIG. 2 is a fragmentary plan view of the edge of a panel prepared for insertion into the press.

FIG. 3 is an end view of the panel seen in FIG. 2.

FIG. 4 is a partial sectional view to a larger scale of the improved inflation needle construction prior to engagement with the edge of the panel.

FIG. 5 is a view of the needle of FIG. 4 at the conclusion of the inflating of the panel, and

FIG. 6 is an exploded view of certain interior parts of the inflation needle structure.

In accordance with the invention, a hollow and reciprocable inflating needle which can move between a first position which is out of contact with a sheet held in a press and a second position which is in fluid-tight contact with a sheet held in that press, is provided. The fluid which is to serve the inflating function also serves to move the needle from the first to second positions. The flow of fluid to and from the needle is controlled by a suitable valve, the actuation of which preferably, but not necessarily, is made dependent upon the actuation of the press structure as it confines and releases the sheet held within that press.

Referring now to FIGS. 1 and 1A, any conventional inflating press having an upper platen 10 and a lower platen 11 may be employed with the invention, it being understood that such platens are adapted initially to confine the laminated panel along only certain areas thereof so that the panel may be thereafter inflated to form a final product which is expanded on either side, or on both sides, all as known in the prior art. Moreover, as is also known, a platen of the press, here shown as the upper platen 10, is suitably actuated by controlled movement of a valve, such as a four-way valve 12, so as to direct a high pressure fluid from a supply line 13 to either end of a cylinder 14 having a piston 15 therein. The cylinder is vented by the valve into a low pressure return line 16, and movement of the piston in that cylinder produces a corresponding movement of the upper platen.

As a part of the invention, a separate inflation fluid system which, for example, may be a high pressure water system, is used, and may conveniently include a supply line 17 controlled by a three-way valve 18 from which extends a low pressure return line 19 and a connecting line 20 through which fluid may pass to and from the needle housing structure indicated generally at 21. As a feature of the invention, valve 18 may be operated automatically in conjunction with the operation of valve 12 employing any conventional linkage arrangement as indicated generally by the dotted line 22. That is, when valve 12 is shifted under control of the operator of the press, valve 18 is subsequently shifted in dependence upon the movement of valve 12 and following confinement of the sheet between the platens. Many forms of such interlocking valve movement mechanisms are known, such as hydraulic, mechanical, and electrical types and thus being conventional, require no illustration. It will, however, be further understood that in its broader aspects, the invention is not limited to the interlocked control since, if desired, valve 18 may be operated independently of the valve 12.

As best seen in FIG. 1, the edge 30 of the laminated sheet 31 is positioned outboard of the edges of platens 10 and 11 so that the reciprocable inflation needle may securely engage with that sheet without interference with those platens. Preferably, suitable recesses 32 and 33 are formed at the inner faces of those platens to encompass a pre-shaped edge of the sheet as seen in FIGS. 2 and 3. The edge of the sheet, as will be understood, is first shaped by any suitable means and method to form a generally conically shaped hollow bulge 34, the apex of which communicates with the aforementioned unbonded pattern or weaker section between the outer faces of the laminated sheet. When positioned between the platens in registered relation with the recesses thereof the axis of the hollow bulge 34 of the sheet is also in register with the axis of the reciprocable inflating needle now to be described.

Referring to FIG. 4 which shows a first position of the needle, it will be seen that the housing structure 21 is compact and is assembled in a sturdy arrangement capable of withstanding high fluid pressures in the order of 3000 p.s.i. The housing is adapted for rigid mounting adjacent to and preferably upon one of the press platens as by means of mounting blocks 35, 35^1 and spacers 36, 36^1 (FIG. 1) serving to maintain the axis of the needle

in alignment with the axis of the bulged opening in the edge of the sheet.

The housing may conveniently comprise a cylinder block of stainless steel bored to provide a cylinder wall **40** and with an open end facing toward the press and with a centrally apertured bottom **41** at the other end. At its outer side the bottom of the cylinder block fits within a recess **42** in an elongated centrally apertured back plate **43**. Similarly, at its open end the cylinder block fits within a recess **44** of a centrally apertured elongated forward plate **45**. At one side adjacent the bottom **41**, the cylinder block is provided with an aperture **46** connecting with conduit **20** and may conveniently be arranged to provide a throttling action upon high pressure fluid entering the cylinder. By means of a plurality of massive bolts **47**, **48** having threaded ends engaging in the plate **45** and with heads **49**, **50** pressing against plate **43**, the housing may be assembled as a unit for mounting upon blocks **35**, **35**[1] following the placement of the internal units shown in FIG. 6 within the cylinder.

The hollow elongated cylindrical needle **51** may be formed of stainless steel and have a passage **52** therethrough with a diameter for example, of 0.125 inch. At its forward end the needle preferably has a first taper **53** of about 30° from the needle axis merging into a second taper **54** of about 10° from that axis. At its rearward end the needle is threaded as shown at **55**. Surrounding the needle is a T bushing **56** of bronze adapted to fit into the aperture **57** of plate **45** (FIG. 4) and to seal the open end of the cylinder block. This bushing serves to guide the needle as the latter reciprocates. Bearing against the inner face of the bushing and in surrounding relation to the needle is a strong compression spring **58** adapted to be housed in a recess **59** within the piston **60**.

This piston also may be of stainless steel having a threaded portion **61** for connecting the needle thereto. On its opposite face the piston may have another recess **62** for mounting therein a hollow brass bushing **63** which travels with the piston at all times. Joining the two recesses of the piston is a passage **64** preferably of smaller diameter, for example, about 0.070 inch, than the passage **52** of the needle, thus to give a throttling action upon high pressure fluid entering that needle. On its circumference the piston is provided with one or more recesses **65** to contain O-ring seals **66** cooperating with the cylinder wall.

As a significant feature, the stroke of the piston and the point at which passage of the fluid occurs from the cylinder into the needle, are made dependent upon the setting of a regulating means which may be adjusted from the exterior of the housing. This may comprise a threaded member **67** adjustably projecting through an aperture **68** in the rearward plate **43** and terminating at its outer end in a head **69** and with a lock nut **70** engaging against that plate.

At its inner end the member **67** has a rounded surface **71** adjacent which an O-ring seal **72** is mounted for cooperation with the inner surface of the bushing **63**. Upon being assembled, as shown in FIG. 4, the rounded end of this member projects well into the bushing carried by the piston and thus acts to guide the piston as it moves under the influence of the incoming inflating fluid. Likewise, as the piston is retracted by spring **58** during the venting operation, the end of this member helps to center and guide the piston in its retracting movement.

Considering now the invention in a cycle of operation, it will be understood that the press operator first places the laminated sheet **31** with its pre-shaped bulged edge portion **34**, in proper position upon platen **11**. Thereafter, he promptly causes valve **12** to be actuated and to bring the press platens together confining the edge portion of the sheet in recesses **32** and **33**. At this time the inflation needle is in its first position as seen in FIG. 4. Promptly after the press platens confine the sheet, valve **18** is actuated, serving to connect conduits **17** and **20** whereupon inflating fluid under high pressure enters the cylinder through aperture **46**. Thereafter, piston **60** moves to the right carrying the beveled end of needle **51** into contact with the inner surface of the bulged portion **34** of the sheet and as that sheet portion settles into the recesses **32** and **33**, a tight engagement of the beveled surfaces of the needle with the sheet takes place, as indicated at **73** (FIG. 5).

As noted in FIGS. 4 and 5, no inflating fluid passes into the needle until bushing **63** uncovers the edge of the rounded end **71** of the regulating means. As this occurs, inflating fluid then flows smoothly into the needle through the throttling passage **64** in the piston. It will be noted particularly that only a small further movement of the piston and therefore of the needle, will normally occur after the end of the regulating means is uncovered. However, if it is desired to sink the needle deeper into the bulge of the sheet at any time, or to use it with sheets having different overhang from the edge of the platen, this may readily be done by adjusting the setting of the member **67** and the lock nut **70**.

As piston **60** moves to the right and into its second position shown in FIG. 5, spring **58** becomes fully compressed. Following the complete inflation of the sheet, a predetermined resisting pressure will be exerted upon piston **15** by platen **10**, or a predetermined length of time will have elapsed depending upon the particular conventional control being employed. At this point the system will operate automatically to reverse the setting of valve **18** followed by a reversing of the setting of valve **12** to release the inflated sheet from confinement in the press.

As this occurs, the compressed spring **58** becomes effective to move piston **60** from its second to its first position. At the beginning of this movement the spring in forcing the piston ahead of it forces fluid outwardly through aperture **46** and into return line **19** and fluid still remaining in needle **51** and in the inflated sheet passage may also vent in this manner. However, as soon as the piston moves far enough to cover the rounded end of regulating member **67**, any fluid still in the needle is trapped and is permitted to trickle out of the open end of that needle. Nevertheless, as piston **60** continues its movement to the first position shown in FIG. 4 and after having covered the end **71** of the regulating member, it serves to evacuate the cylinder sufficiently for the next cycle of operation. Due to the small size of the passage **52** in the needle only a small quantity of fluid is lost in venting and suitable make-up means may be employed to keep the inflation fluid system at operating capacity. It will be appreciated that if the regulating member **67** were not present, leakage of fluid would occur during the entire retracting movement of the piston.

After platen **10** is retracted, the system is then ready for the next cycle of operation and another sheet is then placed in the press and the same described steps of operation ensue.

Having thus described a preferred embodiment of the invention it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the true spirit and scope of the invention and it is intended therefore, in the appended claims to cover all such equivalent variations and modifications.

What is claimed is:

1. A laminated sheet inflating means including a housing rigidly mounted adjacent a press in which a sheet is to be inflated, an expansible chamber within said housing, a piston reciprocably disposed within said chamber and having a sealing recess at one face thereof and an aperture extending from said recess to the second face thereof, a hollow needle attached to the second face of said piston and having a sheet-contacting end projecting outwardly of

said housing, said needle having an aperture axially thereof and connected to the aperture in said piston, means for supplying fluid to and exhausting fluid from said chamber at said one face of said piston, a fluid flow controlling member projecting into the chamber at said one face of said piston, said member having a head portion adapted to engage in sealing relation with said recess and to prevent passage of fluid to said needle as said piston occupies a retracted first position and to be uncovered by said recess and to permit passage of fluid to said needle as said piston moves to an extended second position under the influence of fluid supplied to said chamber at said one face of said piston, said piston being arranged to carry said sheet-contacting end of said needle into engagement with said sheet during movement of said piston from said first to second positions of said piston, and a piston-retracting means disposed within said housing at the second face of said piston and adapted jointly to move said needle out of contact with said sheet and to bring said piston recess into sealing engagement with said member as fluid is exhausted from said chamber at said one face of said piston.

2. An inflating means as defined in claim 1 wherein said member is adjustably mounted upon said housing for movement axially of said piston thereby to vary the amount of piston movement required to uncover said head portion when said piston is moving towards its extended position and required to engage said recess in sealing relation to said head portion when said piston is moving toward its retracted position.

3. An inflating means as defined in claim 1 wherein the aperture within said piston has a smaller cross-section than the aperture in said needle thereby to throttle fluid passing to said needle.

4. An inflating means as defined in claim 1 wherein said piston-retracting means comprises a compression spring.

5 An inflating means as defined in claim 1 wherein said head portion of said member comprises a convex surface acting as a guide to said piston as said head portion engages in sealing relation with said recess during the movement of said piston to its retracted position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,498,275	Johnson	Feb. 21, 1950
2,949,875	Adams	Aug. 23, 1960

FOREIGN PATENTS

815,492	Great Britain	June 24, 1959