

April 19, 1938.

R. M. BERGSTEIN

2,114,625

METHOD OF FORMING CONTAINERS

Filed May 1, 1937

4 Sheets-Sheet 1

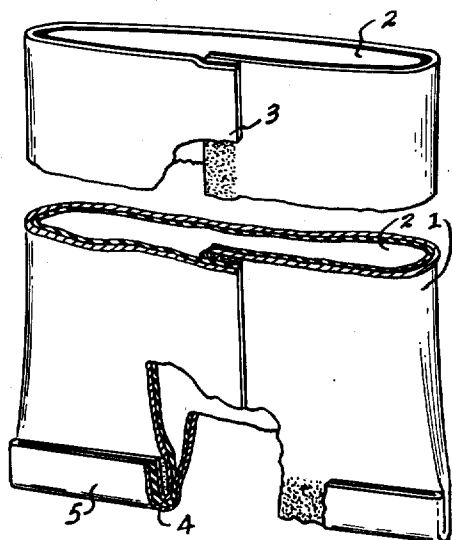


FIG. 1.

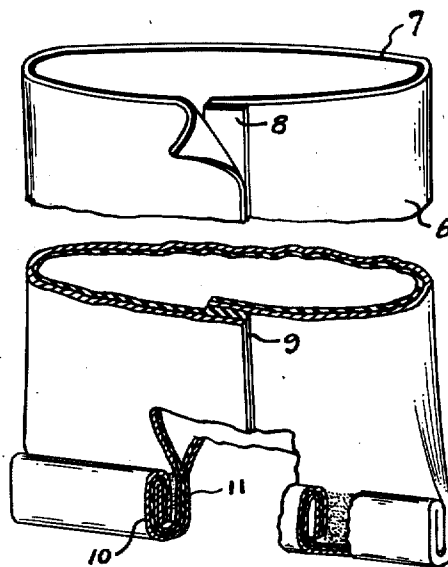


FIG. 2.

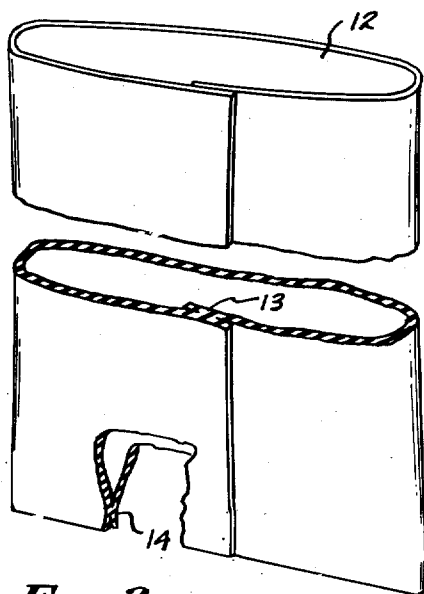


FIG. 3.

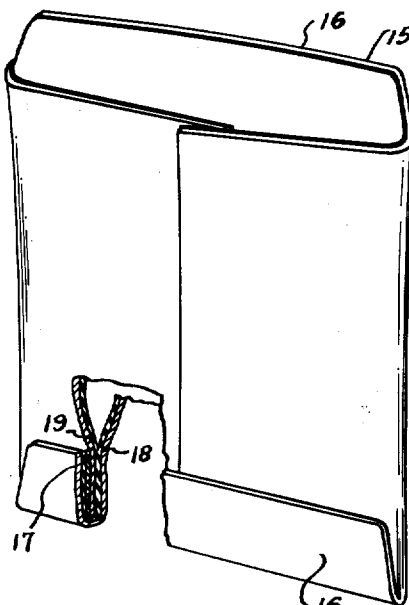


FIG. 4.

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4 Sheets-Sheet 2

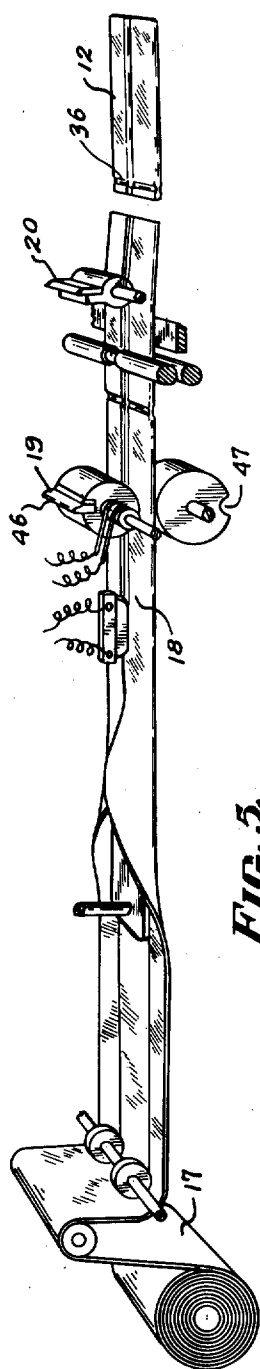


FIG. 5.

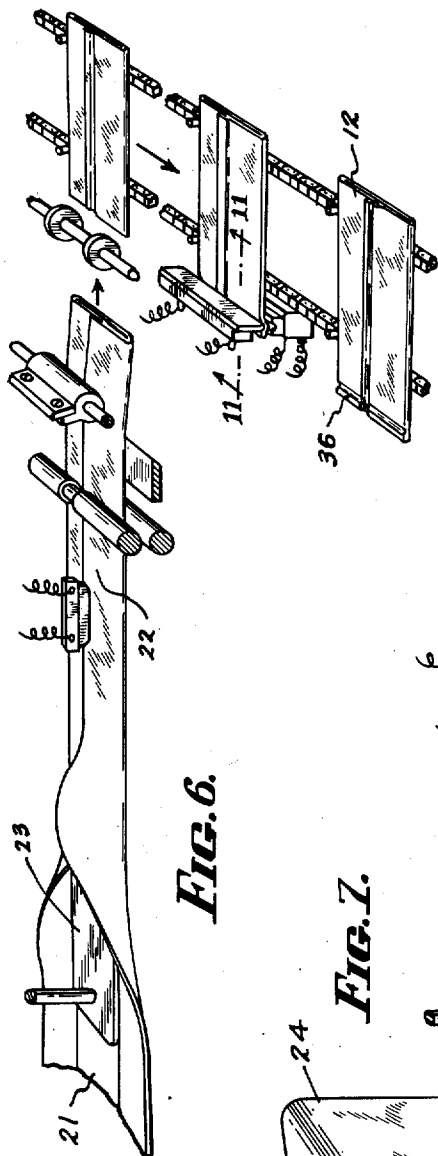


FIG. 6.

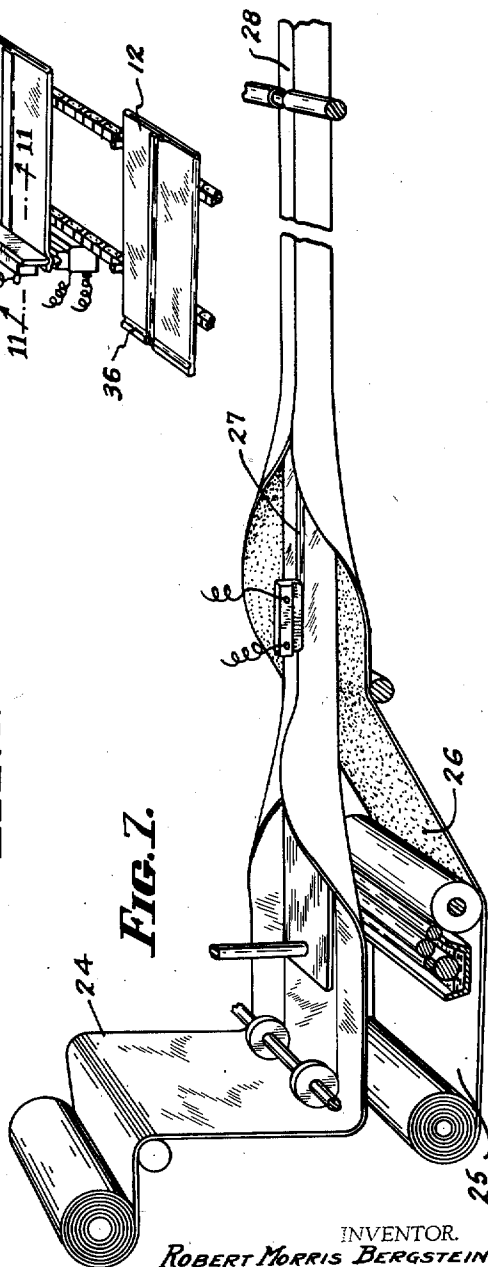


FIG. 7.

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4 Sheets-Sheet 3

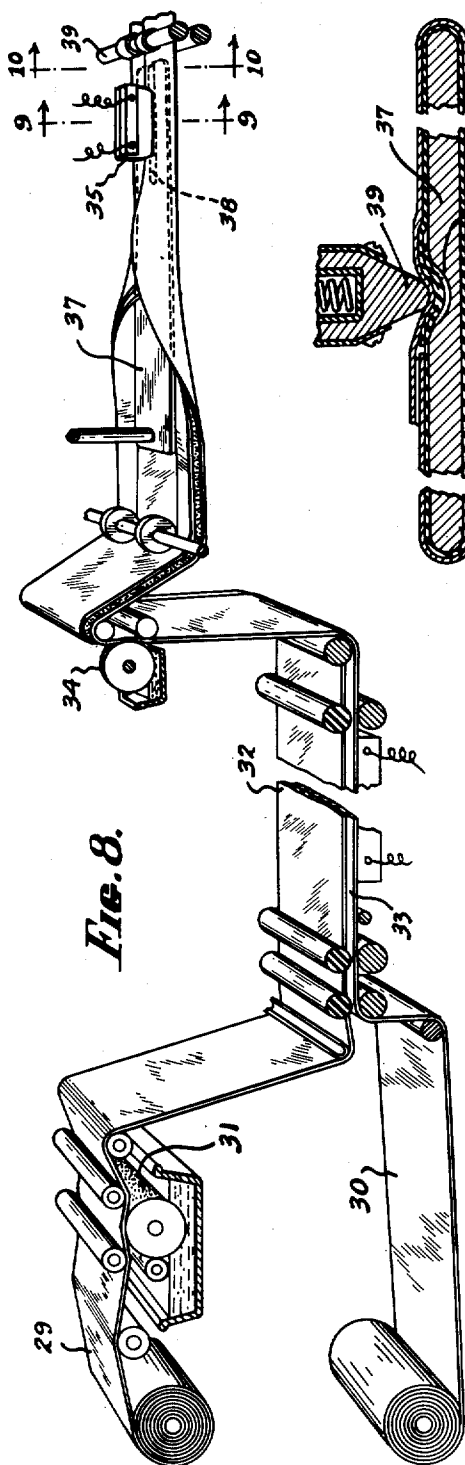


Fig. 8.

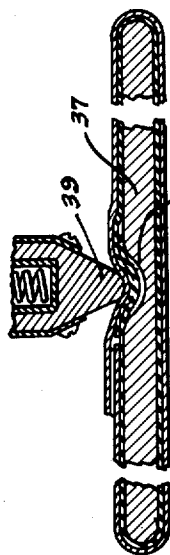


Fig. 9.

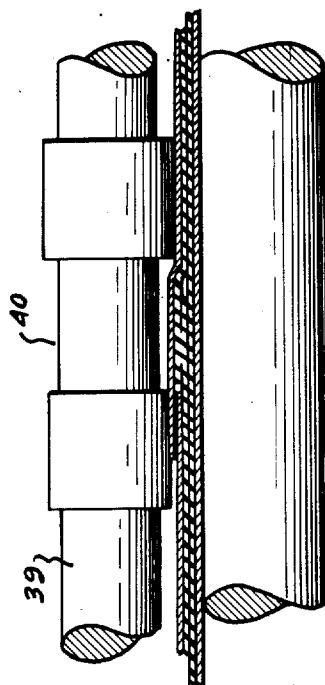


Fig. 10.

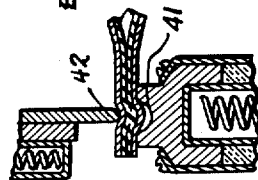


Fig. 11.

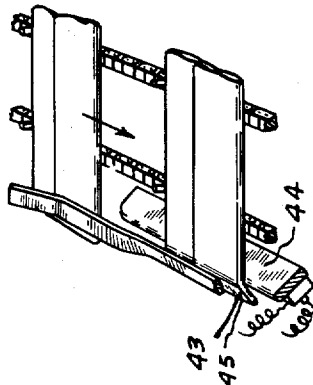


Fig. 12.

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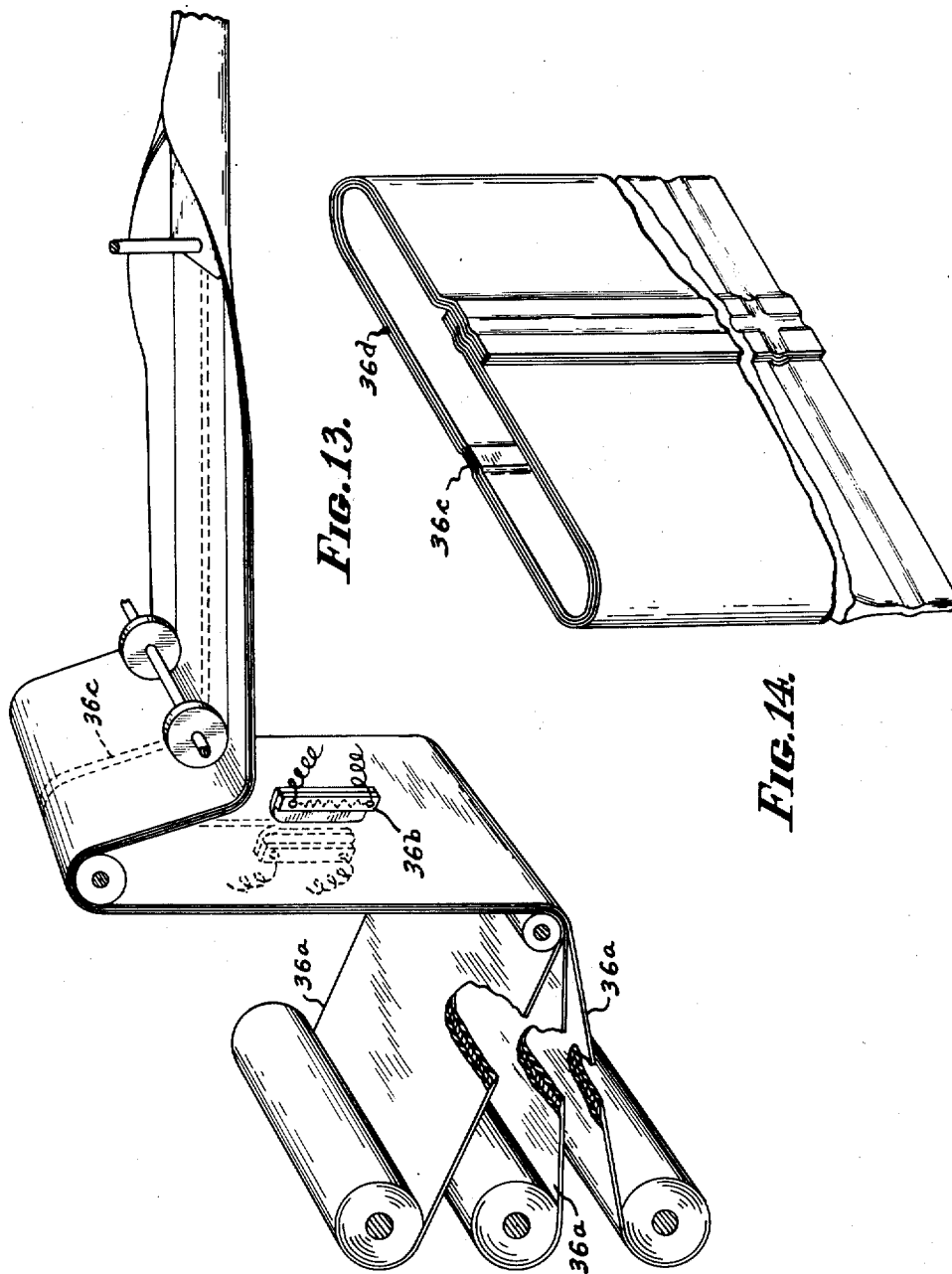
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,114,625

METHOD OF FORMING CONTAINERS

Robert Morris Bergstein, Cincinnati, Ohio, assignor to Edna May Bergstein and himself, as trustees

Application May 1, 1937, Serial No. 140,261

21 Claims. (Cl. 93—35)

This application is a continuation in part of three applications hitherto filed by me, to wit Serial No. 43,570 for Bags made of fusible material to be sealed by heat, filed October 4, 1935, Serial No. 66,650 for Packaging structure and method of making the same, filed March 2, 1936, and Serial No. 92,706 for Mechanism for forming containers, filed July 27, 1936.

My invention relates to methods of forming tubular bags of materials which are substantially impermeable to gases or liquids. It has heretofore been a most difficult problem to provide an end closure in any type of tubular bag which would be a sufficiently tight closure to prevent fine powder from sifting through, much less being sufficiently tight to prevent the penetration of gases or liquids through the end seam closure, an accomplishment not hitherto attained.

By my method, as presented herein, seams are accomplished which are liquid-tight and gas-tight which results in a finished bag the seams of which are as impermeable as the material itself from which the bag is made, the bag therefore being capable of ready adaptation to liquid and gas-tight packaging of various articles and liquids, such as oils, or milk, etc.

In my application Serial No. 43,570 filed October 4, 1935, I have described a method of making a bag particularly when made of material whose inside surface at least is relatively impermeable, and capable of being reactivated, as by heat.

One of the main objects in my development is to provide a package which can be used for satisfactorily carrying liquids, such as oils and milks and other liquids, and can also be used for packing, primarily, food products, by first evacuating the air from such containers by means of filling such container with an inert gas, such as carbon dioxide, and thereafter filling such container with the contents, thus resulting in a container being filled with the contents plus an inert gas, minus air, the oxygen in which being largely responsible for the deterioration of foods. It will be obvious that contents thus protected will have a protection similar to that offered by a vacuumized tin or glass container, at a fraction of the cost of such containers.

Among other materials which I employ in connection with my packaging development are materials which are very impermeable to gas and liquid and moisture penetration and in addition are heat fusible in and of themselves, without the necessity of using a separate heat fusible

medium for the seams. Such materials when impermeable and of a flexible nature and light in weight, are practical for use in inexpensive packaging of commodities. Their great advantage lies in making possible a rapid, inexpensive, tightly sealed closure.

Such a material which I have found very advantageous is a thin rubber composition such as rubber hydrochloride, of which a type is sold under the name "Pliofilm". Other materials highly impermeable, and thin and heat fusible are, however, available. These materials are very costly in relation to paper, glassine, and other flexible sheets, hence economy dictates use of these materials in very thin form, often approximately only one-thousandth of an inch in thickness. Because of this extreme thinness these materials are flimsy, and therefore difficult to handle in the making of bags, as well as in the subsequent filling and sealing of the bags, and the bags further are not dependably strong enough to carry the contents in transportation and handling.

To form an air or liquid-tight bag of such material as "Pliofilm" by itself is a difficult operation, since a tiny speck of dust in the bag making apparatus is likely to puncture it. Also incident to such material is a rapid softening under heat so that attempts to seal it by heat fusion attenuates the portions being heated so as to cause a weakened condition or an incipient break in the material.

Accordingly, it is one of the objects of the present invention to protect and reinforce the web of thin heat fusible material, by means of additional reinforcement to produce a bag that will carry the contents as dependably as ordinary commercial bags of paper or like materials, and in addition which will facilitate the manufacture thereof. By my method the feeding of the bag forming materials can be facilitated, and the application of heat can be done through the heavier material, thus avoiding any excessive pressure by cushioning, and—where pressure is used—to prevent crushing or attenuating the freshly heat-softened heat-fusible material.

It is another object of the invention to provide a bag or package containing a bag, which bag has internally thereof a complete integral surface at joints as well as other portions, of heat fusible material, which is flexible, and all seams of said internal member being fused by heat, which bag has all the strength which is required due to the reinforcement of heavier and

less expensive covering material, preferably of usual bag forming paper.

The improvements and advantages resulting from such a structure include the following:

(a) Because of its relatively greater cost a fusible material of highly resistant nature to gas and liquid penetration such as "Pliofilm", which I use as an example, is preferably used in its thinnest form. By introducing the exterior reinforcing ply of paper it is thereby possible to make use of such a material or sheeting in a thinner form than would otherwise be practical.

(b) Due to its flexible nature such material is extremely susceptible to puncturing or rupturing while it is being drawn through the bag machine, so that the outer reinforcing ply offers protection to the fusible film during the course of manufacture of bags therefrom.

(c) The application of heat to a seam formed of such material causes the heated portion to become very plastic during the time of fusing, increasing its normal susceptibility to puncturing or distortion, and by the introduction of an exterior reinforcing ply the heat can be applied through the exterior ply, effectively preventing such distortions or punctures.

(d) I have discovered that in applying heat to fuse such material the mere contact of the portions to be fused alone is all that is required and that further pressure is not necessary.

In my application Ser. No. 92,706 above referred to I have described a method of forming the lengthwise and crosswise seals in the container structures by deforming or deflecting the lapped portions to be fused together without applying pressure to them, thus obtaining a perfect contact without compressing the material between two walls, and pressing upon it in this way. Then by applying heat I am able to obtain a fused joint which is as perfect as can be obtained, and I do not disrupt the joined films of layers which are very fragile when hot. Among other things this sealing practice greatly facilitates feeding a strip or strings of material in lapped form over a forming plate, and heat sealing it or them where lapped without causing any adherence to the forming plate because the fused portions are not in contact with the forming plate where they are in fused condition.

Among other advantages, my novel sealing practice is of particular benefit in forming the lengthwise seam. In forming the tube if an ordinary forming plate were used, and the material with the heat-sealable interior surface were formed around it, the application of heat to the lapped seamed portion would naturally cause the heat-softened under surface of the seam portion to become distorted by its contact with the forming plate, causing to adhere to it and furthermore causing injury to the under surface. By my method the freshly heat softened under surface of the lengthwise seam portion does not press against the forming plate, but is actually floating over a narrow recess provided in the forming plate, yet at the same time positive contact between the plies of the lapped seam portion is assured, providing a uniform and dependable seam.

I have not attempted to show mechanism for carrying out my method except somewhat diagrammatically, and make reference to my applications for patent aforesaid for a showing of the same. It is essential to my particular practice in deflecting a zone of the material where it is being

fused to provide devices which will accomplish this, although from a process point of view the practice could be a hand-process, as will be evident.

In the drawings, Figure 1 illustrates a bag formed of a sheet of material coated on one side only, and formed into tubular structure.

Figure 2 is a bag with a sheet as above except with a marginal coating of heat-fusible material on the opposite surface, to permit the lengthwise seam to be fused, and the bottoms folded prior to applying heat.

Figure 3 is a bag formed of a completely fusible sheet, both its lengthwise and transverse seams fused.

Figure 4 is a standard type of bag with its bottom folded back and pasted down in the customary manner, but in addition thereto providing a heat fused seam to effect a direct facial juncture of opposite interior wall surfaces.

Figure 5 illustrates tubing drawn from a continuous ply or web, drawn and fused into tubular form, with transverse seams provided at stated intervals by rotating heated member, said transverse seams being formed prior to severing the tube into bag lengths.

Figure 6 shows the tubes severed into bag lengths prior to the fushion of the bottom seam.

Figure 7 illustrates a tube formed of fusible material, the lengthwise seam being first fused, and then a paper backing being introduced around the already fused inner tube, said outer backing tube being secured around the inner tube by a flexible adhesive prior to severing into bag lengths.

Figure 8 shows a heat plastic material and an outer backing material such as paper combined by a flexible adhesive in offset relation, thereafter formed into tubular shape.

Figure 9 is a detail of the former plate showing the groove and also the projecting heating member.

Figure 10 is a detail of the draw-roll, showing provision made for omitting any pressure on the freshly heat-fused seam portion.

Figure 11 illustrates a stationary tongue and groove heating element through which the bag bottoms pass, taken on line 11-11 of Fig. 6.

Figure 12 illustrates an alternative method of causing curvature in the end of the bag by bending the projecting end by a guide, and applying heat while so deflected or bent.

Figure 13 is a diagrammatic view showing a method using plural sheets with heat fusible surfaces.

Figure 14 is a bag made of such sheets.

Figure 1 illustrates a bag 1 whose interior surface 2 only is fusible and relatively impermeable, the longitudinal seam 3 of which has been joined adhesively. A leak-proof bottom joint 4 has thereafter been formed by direct fusion of the opposite interior wall surfaces, thereafter the bottom portion has been folded back upon the body of the bag, as at 5, and secured thereto adhesively.

Figure 2 is a bag 6 made from a sheet of material that has a fusible impermeable, inner surface 7, and one marginal edge thereof of the opposite surface is likewise relatively impermeable and heat fusible as at 8, the lengthwise seam 9 having been formed by lapping and then fusing the opposite lateral edges thereof. After being severed to desired lengths the end closure has been formed by first folding the end of the

bag back upon the body of the bag, and then refolding this folded end, as at 10, said final fold being secured by adhesive and thereafter heat has been applied to form a juncture of opposite

interial wall surfaces, as at 11.

Figure 3 shows a bag 12 made of completely fusible material, such as "Pliofilm", with both its lengthwise and transverse seams 13 and 14 formed by direct fusion.

Figure 4 illustrates a type of bag 15 made with a flap 16 extension at both ends, one such extension having been folded back upon the body of the bag and pasted thereto, as at 17, and thereafter heat having been applied to cause a direct facial juncture of opposite interial wall surfaces as at 18 and 19.

From the foregoing illustration it will be apparent that my method of forming an end joint or seam is adapted to a wide variety of bags. It is adapted as a closure for any type of tubular structure having a material whose interior surface is capable of reactivation by external means, by heat or pressure, or a combination of heat and pressure. Since the only portion of the interior which are effected by my closure are the particular opposite wall portions which are to be joined face to face, it is possible to form my closure if these portions alone are capable of reactivation, without reference to the remaining wall portions of the tubular structure. Among other materials I contemplate to use for example are cellulosic materials like cellulose nitrate coated with thermoplastic materials like synthetic resin and the like. Various types of coated glassine papers, or any flexible sheet whose interior surface is lined or coated at the portion or portions to be seamed are readily adaptable to my method of obtaining a direct facial juncture of opposite interior surfaces to make a leak-proof and air-tight joint. It will be noted that there is not more than a single thickness of material intervening between the two opposite faces which are to be joined to form the bottom seam, so the bottom seam which produces the desired air-tight and liquid-tight closure, is formed, in all these illustrations, by joining directly face to face the interior opposite wall surfaces, and by this method there are no refolded or intruding portions to cause gaps or pinholes between these surfaces, so that as a result my seam has the desired tightness. The end portion of the bag can be foldably manipulated, with adhesive introduced between the folded portion if desired, either before or after the application of my method to obtain the desired facially joining seam, but the adhesive securing of the folded portions does not act as a seal, it being necessary to fuse the inner faces of the bag.

Figure 5 illustrates material, 17, taken from a supply roll, drawn into tubular shape around the former, the opposite edges of the material thereby being overlapped and secured to form a tubular structure as at 18, then a timed heating means 19 transverse the tube forms end closure seams at desired intervals, and thereafter a cut-off knife 20 is applied to sever into desired lengths, the cut-off knife of course synchronized with the timed bottom seam fusing means, so that the separate cut lengths have one end open and the other end closed.

In Figure 6 the material 21 is taken from a supply roll as in Figure 5, and formed into tubular condition 22 around a forming plate 23, and it is thereafter severed into desired bag lengths prior to having the bottom seam formed.

Figure 7 illustrates my device for carrying out my method for making the reinforced multi-ply bag in one way. In this illustration a fusible film or supply 24, such as "Pliofilm" for example, is drawn from a supply roll, and the opposite edges overlapped around a former, in tubular condition. Simultaneously one or more plies 25 of other material such as paper are withdrawn from another supply roll, adhesive introduced upon one surface thereof as at 26 to bind it to the "Pliofilm" and then it is formed around the same former, after the longitudinal seam 27 of the heat plastic film has been fused. The outer reinforcing ply or plies of paper or similar material may be of any desired width, so that the opposite edges thereof either overlap to form a separate outer seam in the now combined tubular structure as at 28. As to certain aspects of my invention it is not material if this is varied and the width of paper may be such as to just meet but without overlapping as the adhesive between the surfaces of the plies will hold the outer ply in position without the need for a separate overlapping seam on the outer ply. Or, if desired, the outer ply could be of a width that the two edges thereof do not meet when folded around the inner heat fusible tubular structure, thereby leaving a portion of the inner heat fusible structure exposed, if desired.

Figure 8 illustrates an alternative and preferred means of accomplishing a plural-ply or reinforced bag. In this case, heat fusible material 29 of any desired width is drawn from a supply roll, and at the same time paper or other flexible material 30 of a corresponding width is drawn from another supply roll, adhesive introduced therebetween, as at 31, and the surfaces of the two materials thereafter united in offset relation, so that a margin of the heat fusible material 32 projects on one side of the now combined web, and a margin of the paper or backing material 33 projects on the opposite side of the now combined web. In combining in this manner it is preferable to control the adhesive so that it does not become applied to the extending marginal portion of the heat fusible material, which might interfere with the proper heat fusion later of this surface.

The combined web is now brought over or around the forming plate and the opposite edges thereof overlapped, the extending margin of the backing material 33 being lapped over on the corresponding edge of the backing material, on the outside of the tubular structure, with the extending margin 32 of the heat fusible material being lapped under the corresponding opposite edge of the fusible material of the interior of the tubular structure. Prior to forming into tubular condition adhesive is introduced between the overlapping edges of the backing material as at 34, and these are overlapped around the former and adhesively secured, and then heat is applied to penetrate through the outer or backing material to cause a fusion of the overlapped edges of the heat fusible material on the interior of the bag as at 35. In my reinforced bag the adhesive is preferably of a permanently flexible nature like rubber latex, that does not become brittle when dry. After the reinforced bag has been formed into tubular condition the bottom is formed in any of the number of ways described above for the other types of bags, as for example, making the transverse seams 36 by the application of heat at desired intervals prior to severing into bag lengths, or the reinforced tube may be cut into desired

bag length sections and thereafter the bottom seam formed, etc. In this reinforced bag my same desired type of leak-proof bottom closure can readily be effected, by reactivating a desired transverse portion of the tubular structure; outside heat can readily be made to penetrate the backing material or materials, and cause a fusion between opposite faces of the interior heat fusible material. Particular attention is called to the fact that there are no reentrant folds in this bag, as any reentrant folds would introduce the backing material between the opposite faces of the bag interior, and would make it impossible to obtain a tight end joint, by causing a gap that would occur in the opposite interior wall surfaces at the termination of these reentrant or refolded portions. As previously pointed out, my reinforced bag comprises an inner ply all seams of which are formed by fusion of surfaces of the inner ply to each other, so that said seams are completely independent of any seams that may be formed by the outer ply or plies, and in no case do the outer ply or plies intervene between the seams of the inner ply. The structures of Figures 7 and 8 are superior to those of the earlier figures in this respect because there is nothing whatever that lies in the lengthwise seam but the heat fusible material itself.

In my reinforced bag the outer ply or plies may be made of heat-fusible material or material which is heat fusible on the interior surface at least. In this case the plies may be joined by forming heat seams between the surfaces thereof, in addition to or instead of joining said plies adhesively, prior to being formed into tubular condition, or incidental to forming into tubular condition. In this event also, the application of heat will tend to unite all the lapped plies over the longitudinal seam portion, in addition to fusing together the lapped seam portions of the inner ply, and when heat is caused to penetrate through the outer plies to join desired transverse zones of the inner ply, to effect my end joint, it will also have a tendency to unite the outer plies to each other and to unite the ply surrounding the inner ply to the outer surface thereof. If all the plies of my plural ply bag have thermoplastic surfaces it will not be necessary to combine the plies in offset relation, because when opposite edges overlap to form the lengthwise seam the result will be to bring thermoplastic surfaces together in either case, which can be fused. In my preferred method of forming the plural-ply bag however, the lateral edges of the interior ply are joined to form the lengthwise seam, as explained above, and in either case the end seams or joints to effect closure on my plural ply bag is made by uniting opposite wall portions of the interior ply, without outer ply material intervening therebetween.

I find one great difficulty in making bags from material in which the several plies are all of heat fusible material, such as "Pliofilm" sheets, or sheets of glassine with coatings of heat fusible material, because these are slippery and it is not practical to hold them in alignment in drawing them over a former. Also it is not practical to attempt to adhesively join these sheets previous to drawing them over the former because adhesive does not take effect readily on the surfaces of such material. Hence it is my practice, as I draw the several sheets 36a along, as indicated in Figure 13, to apply a heating element 36b to the assembly of sheets at a point where all of the sheets are assembled together and still flat with

the result of fusing a line or zone 36c, or several lines or zones in the material, or rows of fused portions, thus holding the sheets against relative shifting with relation to each other, and making it simple to draw them around the standard former plate in making up the tubular structure.

The result of this practice is to provide a line of juncture 36c between the several plies, as in the bag of Figure 14, which holds the several plies together in the finished bag 36d, a matter of considerable importance, because it facilitates opening of the bag during the filling operation so that the contents will be lodged within the inner layer of the composite structure.

There is no necessity in such a bag for an offset relation of plies, since the application of heat will fuse all superimposed plies together, leaving no avenue of ingress or egress of air or moisture.

In Figure 9 I have shown my preferred forming plate 37, having a groove 38 therein. Instead of a groove a slot entirely through the forming plate would serve the purpose equally well. As illustrated, there is positioned an element 39 projecting partially into this groove or slot, so that one co-acting member (the edges of the groove) serves as a support adjacent the seam area, while the other co-acting member (the element 39) causes a deflection in the overlapped edges to produce a tension therebetween, and while so deflected heat is applied.

This is a feature of great importance, which I would like to explain in some detail. In producing a tubular structure a forming plate of some shape around which to form the material is almost essential, in order to make a tube accurately. In cases where the longitudinal seam is to be secured by heat however, the forming plate is absolutely essential, because even if it were possible to accurately fold opposite edges of the material to accurately overlap and form a flat tube without any plate or former therebetween, the application of heat would not only cause a fusion between the overlapped edges forming the seam portion, but would cause the under side of the seam portion to become fused to the opposite wall of the tubular structure, thereby making a tubular structure that it would be impossible to open or use. In other words, if the longitudinal seam of a tubular structure is to be secured by heat, the forming plate serves not only as a guiding means around which to fold the opposite edges and secure the seam, but also to prevent the heat which is applied to the overlapped seam portion at the same time causing the opposite interior surfaces of the tube itself to cling together in an unusable mass.

It can also be seen from the above that if a former or plate of the usual type is used, the under surface of the seam portion would have a tendency to cling to or drag against the surface of the former itself, causing a distortion or injury to the freshly softened surfaces. I have discovered that by having this channel or groove in the forming plate, substantially parallel to and underlying the overlapped material edges which are to be joined and a corresponding member to deflect these overlapped edges partially into the groove or channel, I am able to obtain a perfect longitudinal joint. First of all, there is no corresponding meeting surface to the projecting member, so that the seam portion is not squeezed, but the overlapping edges are held merely by the tension of the materials themselves, assuring contact without pressure, so that the application of

heat makes a perfect seal between the two overlapping surfaces. Secondly the under surface of the freshly heat softened seam portion is floating, not dragging against the forming plate, so that the under surface of the seam is not disrupted, so that there is no break in the continuity of the under surface of the heated thermoplastic material. It is possible, as an alternative, to have a raised or projecting member on the forming plate, and a corresponding groove or channel supporting means on the opposite side of the seam portion, but the method just described of having a groove or channel in the forming plate is my preferred one.

In Figure 10 I have illustrated in detail the draw-roll 39, which is used to move the tubular structure forward after the longitudinal seam has been formed therein. The draw-roll incorporates a groove 40 therein, positioned so that there is no pressure on the seam portion. Instead of a groove I could with equal facility use two or more rolls, properly spaced so that they did not engage the seam portion. My purpose of course in drawing the tube by engaging surfaces other than the seam portion, is to prevent disrupting or injury to the freshly heat softened heat portion by pressing upon it.

In Figure 11 I have illustrated means for accomplishing my method for deflecting a transverse zone across the end of the tubular structure, to form an end joint or seam therein. In this illustration there is a channel or groove 41 with a member 42 projecting partially into it, which acts on a transverse portion of a tubular structure which passes therebetween to deflect it from its normal plane, and while so deflected heat is applied through the member 42.

Figure 12 illustrates another method of causing a deflection to form an end joint in a tubular structure, and in this case the end 43 is guided around a rail 44 to form the desired curvature or deflection 45 and of course while so deflected heat is applied. In causing curvature or deflection by my method to form an end joint or seam in a bag, whether I employ means which are stationary relative to each other or which are moving relative to each other, it is an important common feature that there are not members located on opposite sides of the bag surface which press on the bag surface towards each other, but the curvature is obtained either by guiding into deflected position, or by having a projection which presses from one side only, and a corresponding supporting means only adjacent on the opposite side of the bag so that positive pressure which might disrupt the freshly heat softened interior surfaces is avoided.

In regard to means moving relative to each other, referred to previously above, it might be pointed out that the rotating means, for example, as illustrated in Figure 5, are best provided with corresponding raised and depressed portions 46 and 47, to effect a curvature in the tubular structure as the corresponding portions act on the tubular structure passing therebetween.

In regard to the lengthwise seam I am able to cause a line of fusion in a limited zone lengthwise of the tube as it is being drawn over the forming plate, without substantial pressure, but which is a complete juncture of the lapped portions of the inner surfaces without pin holes or interrupted spaces where fusion has failed to take place.

While it is of particular advantage to seal the lengthwise seam of the tube while it is moving, a stationary apparatus consisting of a channeled

board and a hand or automatic heated tool to form the depression would serve the purpose.

According to my practice automatic machinery can be provided which makes the heat seal very rapidly in the lapped tubular structure about the forming plate, as described in my co-pending machine application above referred to.

Ordinarily I will form the lengthwise seam prior to severing into desired bag length sections, but by my method it is equally possible to form lengthwise seams in a flat cut-to-length blank. My preferred method of forming a tubular structure is prior to severing into desired sections, and I may also form the cross-wise seam by timed heating means, prior to severing into lengths. When the tube is formed, there are no refolded layers of material intervening between the opposite faces of the walls which are united to form the end closure seam; this is an important requirement of my method. The end of the tubular structure can be foldably manipulated (either before or after my end closure joint is formed) in any manner either with or without the application of adhesive means to retain such folds.

Thus an important feature of my method is that a face to face juncture of entire opposite interior wall surfaces be formed, providing an end closing seam which is air-tight and liquid-tight, since it is an integrally formed portion of the interior surface of the bag itself.

As a result a bag is produced which after being filled with contents and thereafter a seam formed across the open mouth of the top thereof in the same manner, provides the contents with the complete protection of an essentially integrated interior surface.

Because I have failed to illustrate alternative ways of practicing my novel method I do not wish to indicate any limitation in the claims that follow, in which I have expressed the invention inherent in the examples given, whether the examples are followed in the particular fashion noted or not.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:—

1. A step in the method of forming a plural ply bag which comprises forming a tube of paper about a ply of thin heat fusible flexible material with the edges of the tube of paper and the inner ply respectively, in offset overlapped relation and forming joints in the overlapped edges of the paper and the ply of heat fusible material by first adhesively joining said overlapped edges of the paper and then exposing the overlapped edges of the ply of heat fusible material to sufficient heat passing through the paper to cause fusing of the joint in said heat fusible material.

2. A method of forming a plural ply bag which consists of forming a tube of paper about a ply of thin heat fusible flexible material, folding the edges of the tube of paper and the inner ply respectively in overlapped relation extending in spaced parallel alignment longitudinally of the tube and adhesively securing the overlapped edges of the paper and heating the paper sufficiently to cause fusion of the overlapped edges of the inner ply whereby there is formed within the outer ply a unitary inner ply with no portion of the outer ply interposed in the seams thereof, and applying heat transverse the bag at the bottom thereof to form a heat sealed hermetic closure for the bag bottom.

3. A method of forming a plural ply bag which

consists of forming a tube of paper about a ply of thin heat fusible flexible material with the edges of the tube of paper and the inner ply respectively in overlapped relation extending in spaced parallel alignment longitudinally of the tube and adhesively securing the overlapped edges of the paper and heating the paper sufficiently to cause fusion of the overlapped edges of the inner ply whereby there is formed within the outer ply a unitary inner ply with no portion of the outer ply interposed in the seams thereof, and then forming a sealed bottom in the inner ply therein, by heating the outer surface of the paper adjacent the bottom edge of the bag, and thereafter folding over the plies of paper and thin flexible material to reinforce the bottom closure of the bag.

4. A method for forming a fused seam in a tube wherein the inner surface, at least, is heat fusible, which consists in continuously drawing the material and guiding the edges into overlapping registry, curving the portion in overlapped registry by engaging said overlapped edges from one side only and applying heat to the curved portion to form a closed seam while it is in curved position.

5. A method for fusing seams in a tube formed of heat fusible material, having overlapping edges which consists in curving a zone in said overlapping edges by engaging said zone from one side only, and while said material is being moved, and while in curved condition, applying heat to the curved portion to bring about a fusion between said overlapping edges.

6. A method of forming a seam in a bag made of heat fusible material which consists in curving that portion of the bag wherein the seam is to be formed to impart tension to the overlying portions and applying heat to said curved portion and providing a clearance space below the convex side thereof.

7. A method of forming a seam in a bag in which the bag lining is heat fusible, which consists in curving that portion of the bag wherein the seam is to be formed, and applying heat to said curved portion while retaining tension by pressing on said curved portion from one side only.

8. The method of making bags of sheet material having at least a heat fusible inner surface which consists in continuously forming the web into tubular shape, imparting movement to said tube longitudinally of the same, severing said tube into tubes of predetermined length, and deflecting a transverse zone adjacent the end of said tube by pressing on said zone from one side only and supporting the edges of said zone on the opposite side, and applying heat to said zone while so deflected to cause fusion of the heat fusible inner surfaces of the bags.

9. The method of making the material for bags of flexible sheet material having a heat fusible lining which consists in continuously feeding a ply of flexible material into offset contact with a ply of lining material, causing the plies to adhere in a web with a border of the sheet material on one edge of the web and a border of lining on the other exposed, and forming the web into a continuous tube with the border of sheet material contacting sheet material and the border of lining material contacting with lining material, and thereafter forming bags of the tubular web, by pressing a portion of said contacting lining material from one side only and supporting the edges of said portion from the other

side to cause a curvature therein and while so curved applying heat to said portion to form a fused longitudinal seam, and forming transverse seams by pressing a transverse portion from one side only, supporting the edges of said portion from the other side to cause a curvature transverse said tube and while so curved applying heat to form a fused transverse seam between opposite interior surfaces of said tube.

10. A method of forming a closed seam between two moving flexible sheets of material which are heat fusible on one surface at least which consists in directing the moving sheets into contact with their heat fusible surfaces in superposed position, curving the moving sheets after said surfaces have contacted while supporting the sheets along a line adjacent only to the curved portion and continuously applying heat to the curved portion of the flexible sheet as it moves along.

11. A method of forming a closed seam between two moving flexible sheets of material which are heat fusible on one surface at least which consists in directing the moving sheets into contact with their heat fusible surfaces in superposed position, curving the moving sheets after the lining faces have contacted while supporting the sheets along a line adjacent but not at the curved portion and continuously applying heat to the curved portion of the flexible sheet as it moves along, said curved formation extending substantially in the direction of movement of the sheets.

12. A method of making a plural-ply bag, the inner ply of which at least is composed of relatively impermeable material, which consists of joining overlapped seam portions of the inner ply in the presence of heat to form an inner tubular structure, without interposing the outer ply in the seam portion of the inner ply, and thereafter effecting a direct joining of opposite wall portions of the inner ply in a zone transverse the tube by causing a penetration of heat from the outside through to the said zone of the inner ply.

13. A method of making a multi-ply tube the interior ply of which at least has heat-sealable surfaces, consisting in positioning said ply so that a lateral margin thereof projects beyond the edge of other plies and forming said plies into tubular condition wherein said projecting margin is lapped under the opposite edge portion of said interior ply and thereafter joining said lapped portions together by heat, and thereafter uniting a transverse zone at an end of such combined tubular structure by the application of heat through the outer plies to fuse the opposing wall surfaces of said inner ply face to face.

14. A method of forming heat-sealed joints in a bag made of flexible material having thermoplastic surfaces consisting in bringing opposite surfaces into positive facial contact with one another by curving same in a narrow zone extending in a substantially straight line and while in said curved contacted relationship causing heat to be applied to said zone, a clearance space being provided adjoining the convex side of said zone.

15. In a method of making bags from plural ply material the surfaces of which at least, are heat fusible, the steps of drawing the plural plies from a supply, applying heat to fuse the plies together in a zone lengthwise of the sheets, and then drawing the plies to tubular form about a former plate, and securing a lengthwise seam

therein by means of heat, as a continuous operation.

16. In a method of making bags from plural ply material the surfaces of which at least, are heat fusible, the steps of drawing the plural plies from a supply, applying heat to fuse the plies together in a zone lengthwise of the sheets, and then drawing the plies to tubular form about a former plate, and securing a lengthwise seam therein by means of heat, as a continuous operation, and forming bags from sections of said tubular structure without respect to the order of the steps by severing the tubular portion and applying heat in a crosswise zone at one end of each section.

17. A method of forming a tube from material having overlapped heat fusible portions which consists in forming a narrow zone of curvature in said overlapped portions while supporting remaining portions from one side along the edges only of said zone, moving said material and applying heat to said curved zone.

18. A method of forming a seam in overlapped heat fusible sheet portions which consists in placing the overlapped sheet portions under tension by deflecting a narrow zone therein while supporting the sheets adjacent but not at the

said narrow zone, and applying heat to the said zone, while so tensioned.

19. The method of forming a seam in making multi-ply bags which consists in sealing together superimposed thermoplastic plies by means of heat transmitted thereto through an outer ply of non-thermoplastic material united therewith, while simultaneously holding said thermoplastic plies in contact.

20. A method of making a line of juncture between two layers of flexible material having heat fusible surfaces in contiguous relationship, which consists in deflecting a restricted portion of said layers by engaging said portion from one side, and supporting said deflected portion from the other side adjacent only to said portion, and applying heat to said portion while so deflected.

21. A method of making plural ply bags the inner ply of which is heat plastic, which comprises folding said plies into tubular form to bring opposite margins of the inner ply into direct facial contact, applying heat through the outer ply thereto, and uniting opposite walls of the inner ply face to face in a transverse zone by applying heat through the outer ply to said zone.

ROBERT MORRIS BERGSTEIN.

DISCLAIMER

2,114,625.—*Robert Morris Bergstein*, Cincinnati, Ohio. METHOD OF FORMING CONTAINERS. Patent dated April 19, 1938. Disclaimer filed September 16, 1941, by the inventor; the trustees, *Robert Morris Bergstein* and *Frank David Bergstein*, assenting.

Hereby enters this disclaimer to claim 19 of said Letters Patent.

[*Official Gazette* October 7, 1941.]

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