June 18, 1946. H. GALBER ET AL 2,402,492

COLD PRESSURE GLUING WITHOUT RETAINING CLAMPS

Filed May 13, 1944 2 Sheets-Sheet 1

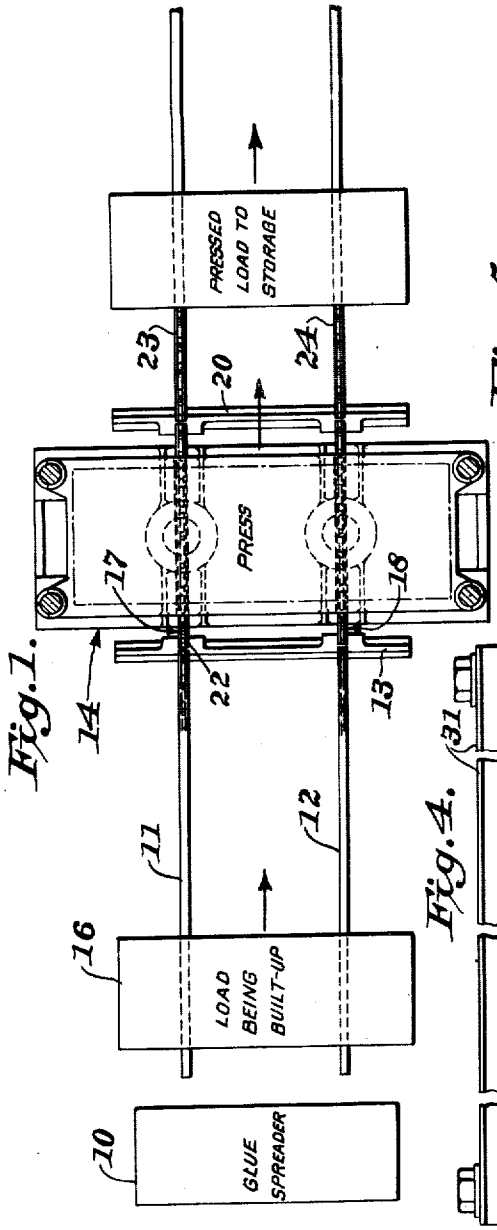



Fig. 1.

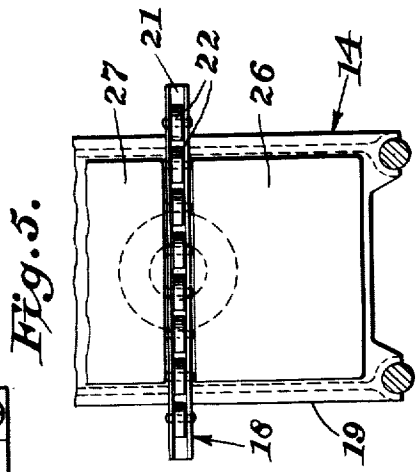



Fig. 5.

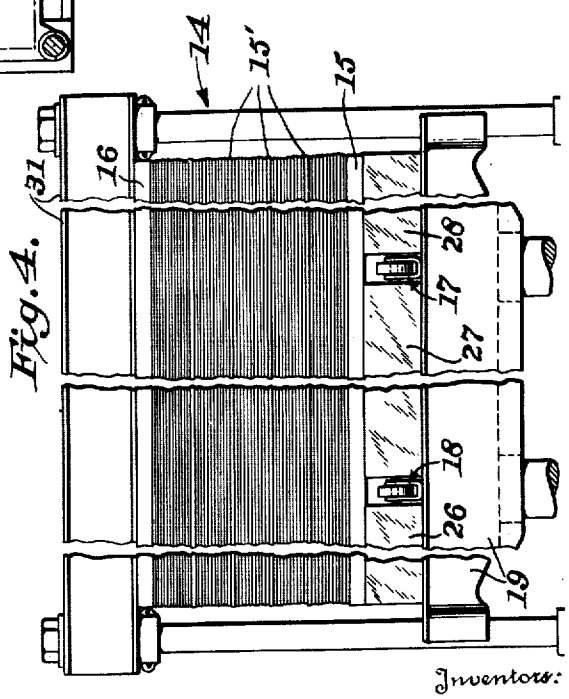



Fig. 4.

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Fig. 3.

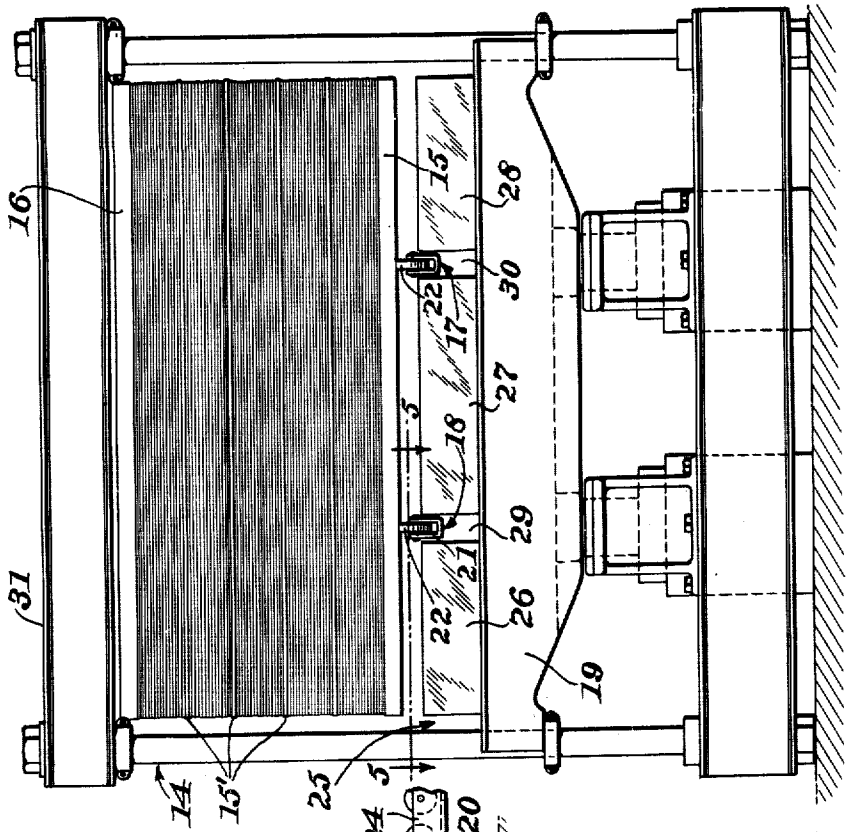
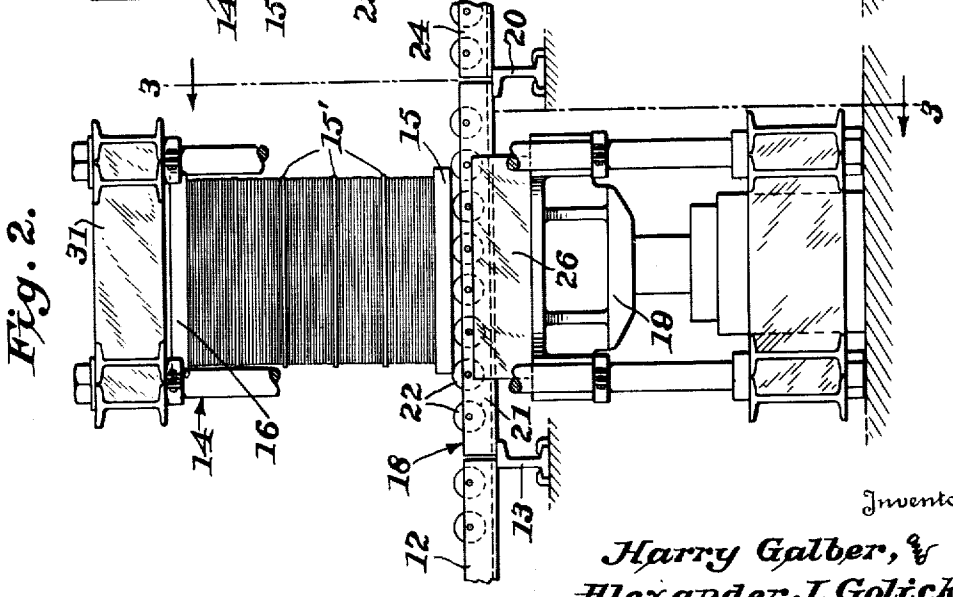



Fig. 2.




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Patented June 18, 1946

2,402,492

# UNITED STATES PATENT OFFICE

2,402,492

## COLD PRESSURE GLUING WITHOUT RETAINING CLAMPS

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Application May 13, 1944, Serial No. 535,484

2 Claims. (Cl. 154—133)

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This invention relates to an improved cold pressure plywood gluing process and to press equipment for carrying out the process.

The cold process of gluing plywood, although partially replaced by recent developments of desirable hot press methods, is still extensively used. As at present practiced, the cold process requires considerable equipment auxiliary to the press and certain difficulties in the product are occasioned by the very use of this equipment. It is the object of the present invention to eliminate this auxiliary equipment, so greatly decreasing original plant costs and upkeep and greatly simplifying manipulative procedure, while at the same time, obtaining a superior product. In order that the accomplishment of the invention may be readily understood, we shall first of all briefly describe the process heretofore used and point out the attendant disadvantages.

In prior practice, a heavy wooden press board, generally about three inches thick, is laid down adjacent the glue spreader and on top of this board is generally laid a smoothly sanded plywood core board or caul about three-quarters of an inch thick. Six to eight inches in height of glued plies of dry veneer are then laid up on top of the core board followed by another three-quarter inch core board, and so on until a pile of a height of about four feet has been built up. This is capped by another three-quarter inch core board followed by another three inch press board.

In the press, platen pressure is transmitted to the press boards through top and bottom series of I beams whose ends project beyond the stack. As soon as the closing action of the press has built up some pressure on the load, the press crew start placing turnbuckle clamps in position between the projecting ends of the upper and lower I beams. The turnbuckle clamps are made of heavy metal and have fittings at each end which hook over the ends of the I beams, these fittings being connected by a heavy turnbuckle. Each turnbuckle with its two clamping fittings weighs about twenty pounds. When the turnbuckles are tightened on the finally compressed stack of plies, they and the I beams tend to maintain to a considerable degree the pressure applied by the press. However, the actual degree to which the individual turnbuckles are tightened has been found by tests to vary widely and rarely, if ever, is the full pressure originally applied by the press platens maintained. With a crew of two experienced men, clamping of the

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stack is completed in from about three to six minutes, whereupon the press is opened, the clamped load moved out. The load is then generally picked up by a crane and carried to a storage room where it remains clamped for at least four hours while the glue is setting up to the point where the gel strength becomes sufficient to permit handling of the panels without injury after the release of pressure.

Of course, further labor is required to unclamp the stacks and return the heavy I beams and turnbuckle clamps to the press for use on other loads. A large stock of these clamps must be carried by a plywood mill, and, as they are heavy and specially made, this item alone often exceeds $10,000 for a single mill. The I beams add a considerable further expense. The heavy usage to which the clamps are subjected necessitates a very considerable maintenance cost for keeping them in first-rate operating condition so that they will work freely and be capable of rapid attachment and release.

Another item of expense is the cost and maintenance of the heavy top and bottom press boards which have to be extremely strong and yet not too heavy for handling. They are usually glued up out of maple or fir stock to provide maximum stiffness and durability without excessive weight. Great stiffness is required because the I beams are spaced on about twelve-inch centers and the press boards must be stiff enough to transmit the pressure satisfactorily not only to the areas in contact with each I beam but also as well as possible over the intervening spaces.

In practice, the press boards are curved, marred and warped by the severe treatment to which they are subjected and a considerable maintenance and replacement item results. Furthermore, since the press boards actually deflect inwardly slightly in the location of each I beam and swell outwardly slightly in the intervening areas, they fail to transmit uniform pressure to the assembled plies and this causes a definite and decidedly objectionable variation in local adhesion, particular in the top and bottom portions of the stack and, worse yet, cause these portions of the stack to be somewhat wavy instead of perfectly flat. This waviness is a serious detriment to sanding the plywood panels, causing a certain amount of rejects and requiring a rather heavy cut to clear up the uneven surfaces.

Another objectionable feature, which hitherto has remained an unsolved problem, is that the system, on account of the crushing and deflect-

ing of the press boards as well as the failure of the turnbuckle clamps to apply fully adequate pressure, limits the application of gluing pressure to an amount which is definitely less than that which is ideal from a quality standpoint even if it were uniformly applied. Thus, it can be seen that aside from the direct expense involved in the first cost of the I beams, turnbuckle clamps and press boards, and maintenance costs, the old system is inadequate from the standpoint of quality of product. The advantages of the hot press method have been recognized as arising in a considerable degree from the elimination of these objectionable features of the cold press system. The present invention eliminates these disadvantages in a manner which will now be described with reference to the accompanying drawings in which,

Figure 1 is a plan view of a cold press installation in accordance with the invention.

Figure 2 is an end elevation of the press which appears in Figure 1, the press being open.

Figure 3 is a section on line 3—3 of Figure 2.

Figure 4 is a view, partly broken away, similar to that of Figure 3, with the press closed, and

Figure 5 is a section on line 5—5 of Figure 3.

Referring to Figures 1 and 2, reference numeral 10 designates a glue spreader at one end of roller tracks 11 and 12 whose other ends terminate on a supporting beam 13 adjacent the press 14. Instead of using a heavy three-quarter inch caul, we start the stack on a thinner press board 15, Figure 3, and omit the caul entirely. The press board may be about two inches thick since in our process we discard the I beams and clamps altogether so that local pressures occasioned thereby are avoided. The bottom press board is placed across the tracks 11 and 12 adjacent the glue spreader and the plywood stack is built thereon, using a three-quarter inch core board 15' about every six or eight inches, and, finally, a cap constituted by another two inch press board 16, Figures 1 to 4. In the figures just mentioned, it will be noted that a pair of roller bars 17 and 18 extend across and above the lower platen 19 in continuation of tracks 11 and 12 and are supported for free upward displacement at one end on the beam 13 and at the other end on a beam 20. These roller bars are constituted by a narrow channel as at 21 and rollers as at 22, Figures 2 and 3. Roller tracks 23 and 24 are disposed in continuation of the bars 17 and 18 at the ends of the latter remote from the tracks 11 and 12.

In accordance with the invention, we arrange on the platen 19 a rigid platform 25 which as here shown includes three solid blocks 26, 27 and 28 having horizontal surfaces in a common plane which lies below the tops of the rollers as at 22. The blocks provide a continuous top surface except where they are spaced apart at 29 and 30 to provide slots slightly wider than the roller bars 17 and 18 so that the latter can be freely received therein. The platform is fixed on the platen and is in effect a part thereof.

The plywood stack built up as above described is rolled into the press opening on the bars 17 and 18 whereupon the lower platen is moved upwardly so that the top surface of the platform 25 will engage the press board 15 and as pressure continues the press board 16 will be forced against the top platen 31 and eventually the roller bars will be engaged by the platen 19 and carried upwardly as indicated in Figure 4.

In the old practice, using Douglas fir, the total



pressure is relatively moderate and is equivalent to between 100 and 150 pounds per square inch of plywood surface. This is actually considerably less than the pressure which Douglas fir will sustain without crushing if the pressure is uniformly applied. Since in our process such uniformity is attained, and although good results are obtainable in the usual pressure range, we prefer to apply substantially higher pressure, close to the crushing strength of the wood, and, in the case of Douglas fir plies, preferably increase the pressure to between approximately 160 and 225 pounds per square inch. The pressure is maintained for from about 5 to 25 minutes depending on factors which will be later mentioned.

Upon completion of the pressing, the pressure is released and the load is moved out of the press onto the tracks 23 and 24 and then is taken to the storage room where it is allowed to stand undisturbed for the usual time, or less. In moving the unconfined stack out of the press and to storage, care is taken to prevent distortion of the plies as by flexing, and to this end the transfer from the press opening to storage is carried out with the stack resting on and maintained in shape by the bottom press board. Distortion being thus prevented, the adhered condition of the plies will be substantially maintained after release of pressure. The standing period will vary with the nature of the glue and other conditions and is normally about four hours, but is usually a little less than the old cold process as our process produces somewhat more rapid setting. After pressing we use no subsequent compression, heat treatment, or other expedient for the improvement of the glue bond, such being unnecessary due to the superior bond which has been formed in the press.

In general summary, our improved cold process comprises cold pressing a stack of glued plies with substantially uniformly distributed pressure over the top and bottom areas of the stack, the pressure being of a magnitude and its interval of application being such that upon removing the pressure, the condition of adherence of the glued plies will be substantially maintained in the unconfined stack, the unconfined stack being removed en masse from pressure without undue distortion thereof and allowed to stand undisturbed until the glue has set and the panels can be handled with safety.

While all of the dispersed fluid glues ordinarily used in the cold process can be used in our modified process, we prefer, when using increased pressure, to also increase the viscosity moderately to prevent the heavier pressure from causing an excessive squeezing out of glue, and to spread a little less glue than formerly. Of course, it will be understood by those familiar with gluing procedure in cold process plywood mills that viscosity of glue, assembly time, quantity spread and applied gluing pressure are interdependent and must be adjusted in proper relation to each other. The modification of conditions provided by our process, and particularly our use of a much more uniform application of increased mechanical gluing pressure, permits corresponding modifications in the other gluing factors. We take advantage of this opportunity to so regulate the conditions as to produce a marked improvement in the quality of the plywood. In the ordinary cold process, the inability of the press boards to stand more than moderate local pressures is a bar to the use of the higher gluing pressures

which we are able to employ. By using a somewhat heavier glue along with increased mechanical pressure, and in conjunction with the marked improvement in uniformity of pressure application which we obtain by eliminating the I beam clamps, we are able to produce decidedly more uniform adhesion with the same amount of glue required in the cold process hitherto used. If conditions require a high order of adhesion, we readily obtain it with a more generous spread, while, if a lower bond strength is permissible, we are able to reduce the spread of glue and in either case produce a decidedly stronger and more uniform adhesion than has been obtained in the regular cold process hitherto.

In other words, our new process escapes the former necessity of wasting a certain amount of glue to overcome unavoidable lack of uniformity in the gluing conditions. In addition, we eliminate considerable labor formerly required to handle the clamps and also eliminate their first cost and maintenance as well as most of the maintenance of the accessory heavy press boards. Our press boards are not only thinner but they last very much longer since they are neither deflected nor crushed by excessive local pressures derived from the I beams and clamps.

Regarding the time which the load is maintained under pressure, this, of course, will vary according to the glue spread and other gluing conditions. A light spread on relatively thin plies and a moderate requirement for glue strength permits a very short pressing of only five minutes or a little more while a heavier spread and a specification calling for a high order of adhesion, as in thick plywood, will require a longer pressing time up to an extreme not ordinarily exceeding 25 minutes. In general, we find that satisfactory plywood can be made by our process with a pressing period of about 15 minutes. It will be seen that this is considerably longer than the press time of the old process but in many mills this does not prove a detriment since a considerable excess of press capacity is frequently available in mills using the regular cold press process. Also, on certain types of production, less press capacity is required. In a given press we avoid the loss of working space hitherto occasioned by the top I beams, the very thick press plates, and top and bottom cauls.

Aside from the many advantages which proceed directly from our main feature of eliminating the use of the cumbersome clamps, there are a number of minor advantages which, in the aggregate, are of considerable importance.

The low and irregular pressure application of the old cold process necessitates the use of a rather thin, sloppy glue to make it easier for the inadequate pressure to obtain contact between the surfaces to be adhered. In our process, this restriction is eliminated and we are able to slightly reduce the water content and increase the viscosity of the glue which not only gives us a notably more uniform positive spread deposit but eliminates splashing during spreading and, in particular, reduces the wipes and displacement of glue during the handling of the plies.

As has been pointed out, our process permits us to use higher mechanical pressure on the plywood and to apply it more uniformly and to maintain it for a somewhat longer period. This is in conjunction with the use of a glue of somewhat higher viscosity, spread at a slightly reduced rate. These conditions combine to produce faster setting of the glue, better adhesion, and flatter



panels. The faster setting is due to the slightly higher viscosity glue containing less water to get rid of. Also, the higher mechanical pressure causes the dry plies to filter off the glue moisture more rapidly. The better adhesion is, of course, the combined result of the more uniform deposit, the longer application of full pressure, and the better contacting of the surfaces to be adhered by the more complete smoothing out of the superficial minute "hills and valleys" on the surfaces of the plies.

All of this, of course, improves the flatness of the plywood since there are less irregularities in the local application of mechanical pressure, the glue water absorption is much more uniform and local areas of distortion and the local crushing of the plies caused in the old cold process by the deflection of the press boards is also done away with. This improvement is immediately noticed by the sander operators in the plywood plants because it is no longer necessary to take heavy cuts to clean up the wavy panels formerly produced at and near the top and bottom of the loads. Thus, not only is the general flatness of the plywood improved, but the former causes for rejections of imperfect panels are also reduced. The combined effect of all these features is a substantial reduction in cost and improvement in quality.

It is most unexpected that a process of this nature should be found commercially practicable, particularly in view of the many years' experience with the cold process clamping method. However, it has not hitherto been recognized that, if a relatively heavy, very uniform application of pressure was continued on the plies for a sufficient time and then they were left undisturbed for several hours, the adsorptive character of the dry veneer plus the filter press action obtained from the uniform pressure was capable of converting the adhesive into a strong enough gel to maintain the plies in contact during the remaining longer period required to dehydrate the glue substance to the point where its strength was sufficient to stand rough handling.

Variations in procedure and equipment are, of course, possible without departure from the following claims. Among such variations, we refer, for example, to the use of non-pressure retaining clamps or carrying clamps which do not confine the stack to retain the pressure applied by the press but are merely convenient expedients which serve as slings for crane transportation of the stack from press to storage. For instance, some mills, in practicing the old cold process, have been accustomed to pick up the stacks and carry them to storage by using two of the pressure retaining clamps as convenient points of attachment for the crane. By a slight modification, this convenient transportation method may still be used without departing from the principles of our invention as set forth in the following claims. It will be readily understood that, by providing two transverse channels for I beams in both the top and bottom platens and inserting therein projecting I beams which substantially fill the slot openings and are the same height as the depth of these slots, the desirable continuous pressing surface is still provided and then the projecting ends of the I beams are available for connection with conventional turn-buckle clamps after the pressing and the clamps thus act as slings to afford secure points of attachment for the crane when the load is moved away to storage. It is pointed out that in such usage it would be impossible for two sets of clamps to retain the

pressure or act as a pressure-applying confinement for the stack. They could not be used for this purpose, even if it was desirable, because two clamps would then have to retain the pressure that in the old process is inadequately retained by three or four times that number. In the old cold process, where the clamps are properly tightened, breakage is frequent and, if the applied stresses were multiplied by three or four, breakage would be inevitable. Therefore, in the appended claims, it will be understood that, where we use the expression "unconfined stack," we mean that the stack is unconfined as to the effective retention of pressing pressure and, where we use the expression "without resorting to the usual pressure retaining clamps," we do not exclude the use of such conveniences as carrying or crane attachment clamps since these are not pressure retaining clamps and could not perform that function.

We claim:

1. The process of making plywood using a cold press and without resorting to the usual pressure retaining clamps, which comprises assembling a stack of dry porous veneer plies with a cold process viscous glue, cold processing the stack under substantially uniformly distributed pressure over substantially every point of the top and bottom areas thereof to initially convert the glue film over its entire surface by the filter press action of the adjacent dry porous plies into a strong



enough gel to maintain the plies in contact upon removal of the pressure, the pressure being close to but not exceeding the crushing strength of the wood and its duration being in the range between about five and about twenty-five minutes, removing the pressure, and moving the released and unconfined stack en masse to another location and allowing it to stand undisturbed until the glue has set.

2. The process of making plywood using a cold press and without resorting to the usual pressure retaining clamps, which comprises assembling a stack of dry porous Douglas fir veneer plies with a cold process viscous glue, cold pressing the stack under substantially uniformly distributed pressure over substantially every point of the top and bottom areas thereof to initially convert the glue film over its entire surface by the filter press action of the adjacent dry porous plies into a strong enough gelt to maintain the plies in contact upon removal of the pressure, the pressure being between approximately 160 to 225 pounds per square inch and its duration being in the range between about five and about twenty-five minutes, removing the pressure, and moving the released and unconfined stack en masse to another location and allowing it to stand undisturbed until the glue has set.

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## Certificate of Correction

Patent No. 2,402,492. June 18, 1946.

HARRY GALBER ET AL.

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows: Column 7, line 26, claim 1, for "processing" read *pressing*; column 8, line 20, claim 2, for "gelt" read *gel*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 10th day of September, A. D. 1946.

[SEAL]

LESLIE FRAZER,
*First Assistant Commissioner of Patents.*

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