March 27, 1956 C. R. SEABORNE ET AL 2,739,635

METHOD OF AND APPARATUS FOR MANUFACTURING LOAD RETAINING DOORS

Filed Dec. 15, 1952 3 Sheets-Sheet 1

Fig. 1.

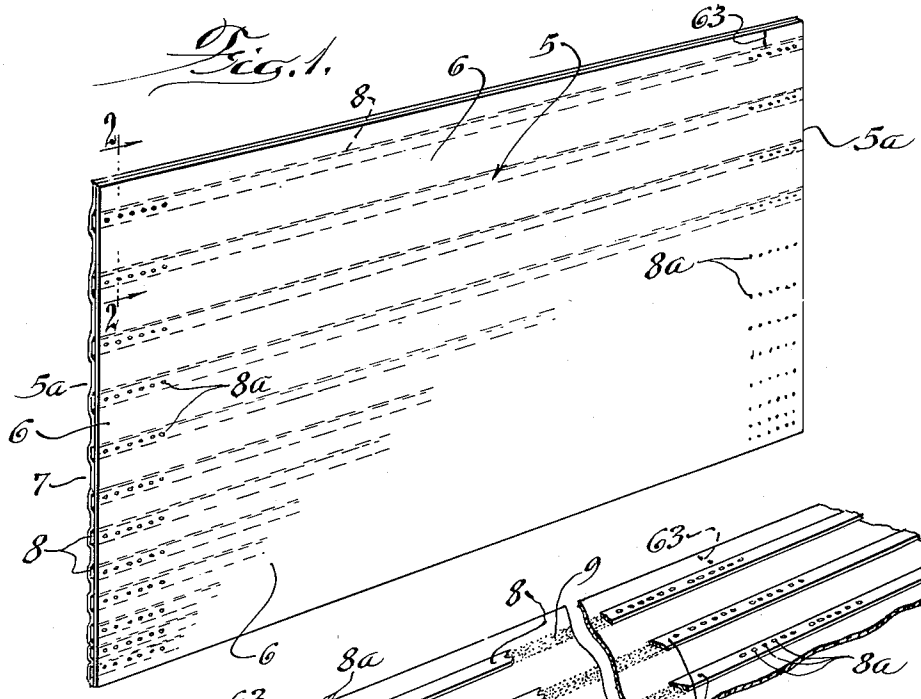

Fig. 4.

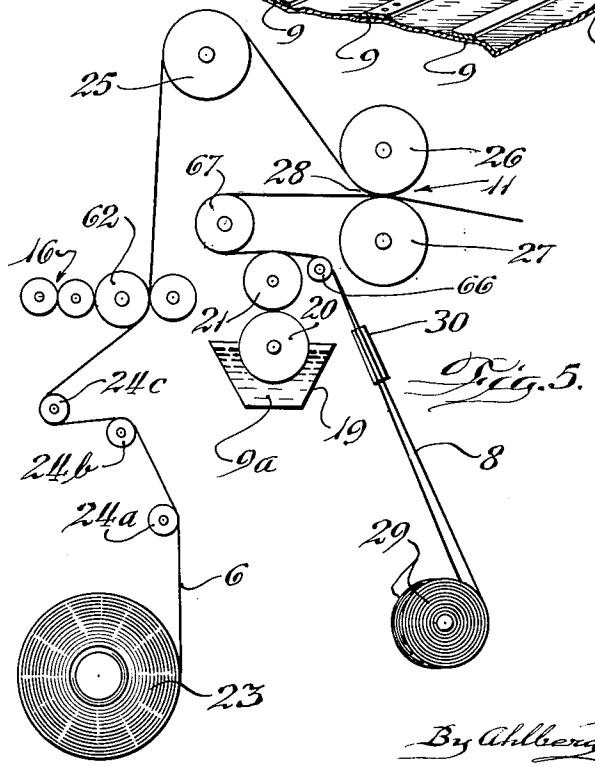

Fig. 5.

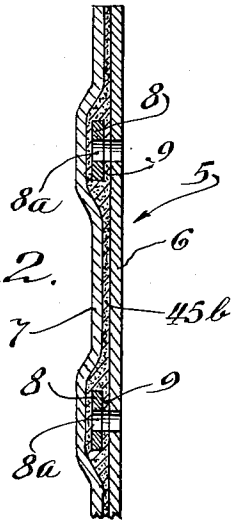

Fig. 2.

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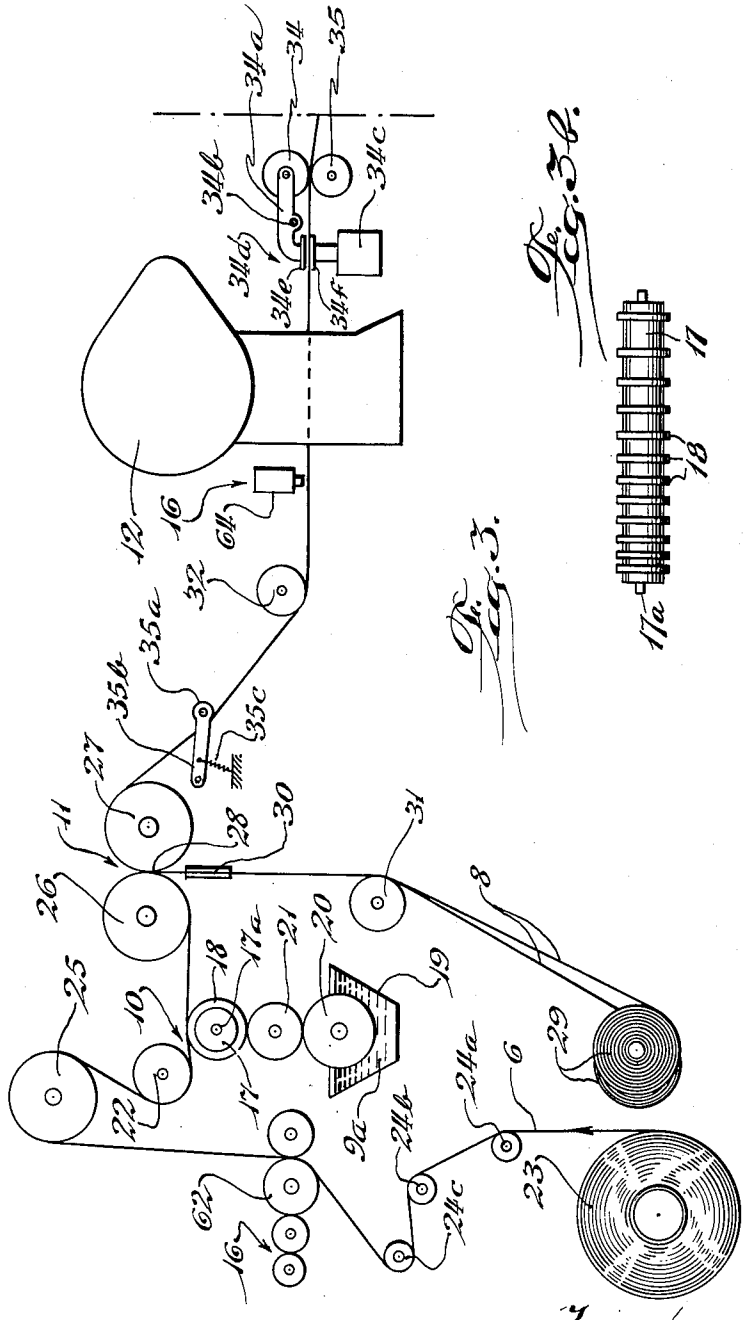

Fig. 3b.

Fig. 3.

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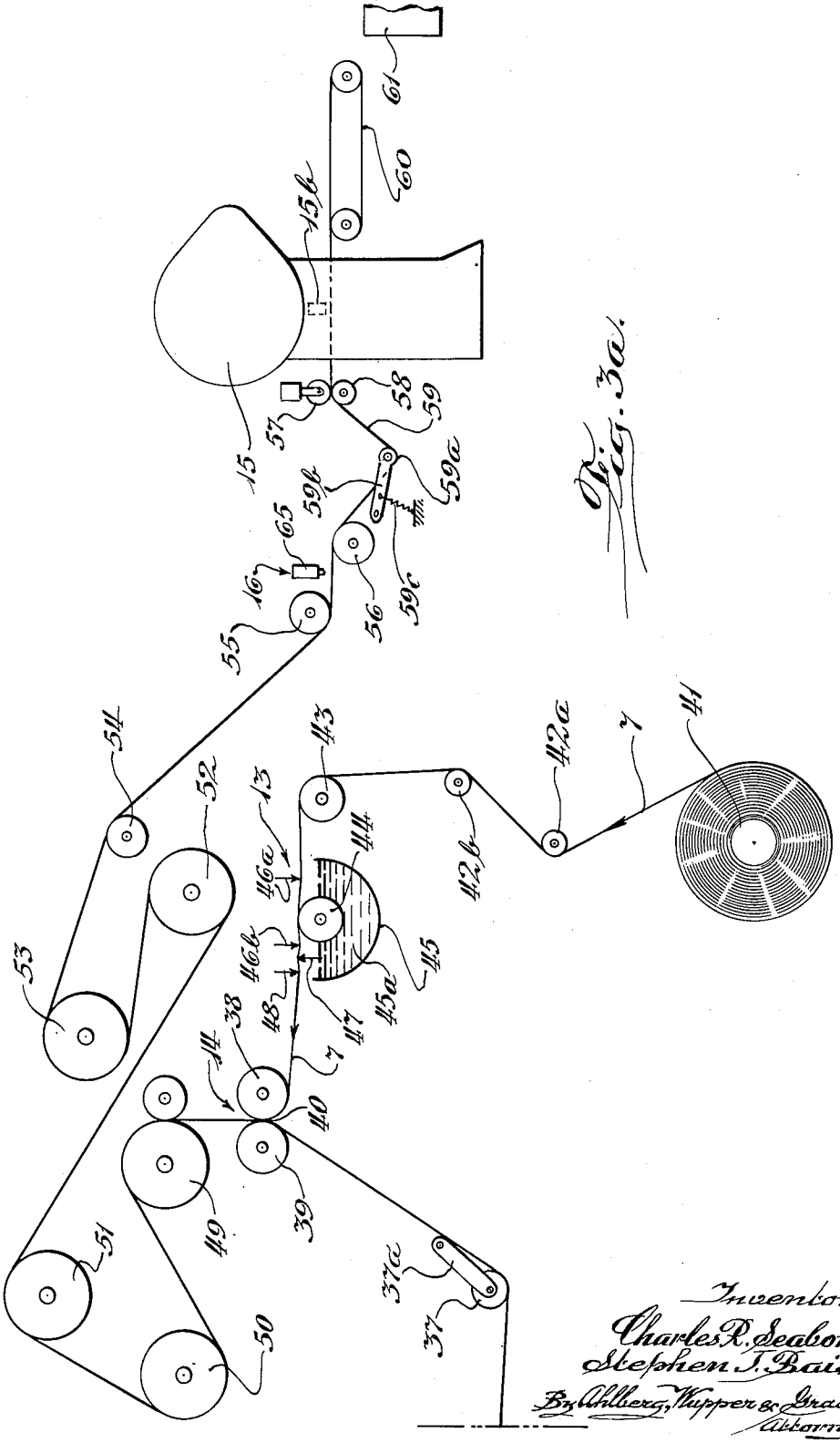

Fig. 3a.

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2,739,635

METHOD OF AND APPARATUS FOR MANUFACTURING LOAD RETAINING DOORS

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Application December 15, 1952, Serial No. 325,992

10 Claims. (Cl. 154—1.6)

The present invention relates to a new and improved method of and apparatus for manufacturing laminated load retaining doors such as are commonly known in the shipping industry as "grain doors."

Examples of prior art load retaining or grain doors are disclosed in the patents to Herbert Corkran, No. 2,116,260, dated May 3, 1938, and John M. Moon, No. 2,310,860, dated February 9, 1943.

Grain doors are intended for but a single use, and in their removal from the vehicle or carrier they are destroyed and thrown away. Therefore, it is of extreme importance that their manufacturing costs be maintained as low as possible consistent with the desired strength characteristics.

The load retaining grain doors to which the manufacturing method and apparatus of this invention relate in general comprise a pair of bonded together plies of impervious fabric material which may be a heavy kraft paper reinforced by cross or transverse metallic straps confined between the plies and bonded thereto. As is now known in this art, the grain doors are installed from the interior of a carrier across the doorway opening thereof by nailing the reinforcing straps to the inner face of the doorway opening frame. Considerable experience has shown that it is preferable that the reinforcing straps be perforated to serve as locations through which the securing nails may be driven and also to permit the installers to use the nails inserted through the perforations as prys to tension nail the strapping. Nailing imperforate strapping has proved to be unsatisfactory because the nails too frequently are driven close to an edge of the strapping thereby weakening it, and sometimes the strapping tears loose under load tension.

It is of course obvious that the strapping and enclosing plies of fabric material may be punched through to provide nail holes adjacent the edges of the grain door. But perforating the grain door in such fashion exposes many nail holes through which the granular material may leak and some granular material is so fine that a considerable quantity of it will pour through small nail openings almost as readily as a liquid.

The copending application of Hollinshead T. Martin filed December 15, 1952, Serial No. 325,981, and entitled "Grain Door" discloses and claims an imperforate composite grain door which provides an adequate number of perforations or holes through one, the inner, ply of fabric material and the strapping to permit nailing the grain door to the doorway opening frame.

It is, therefore, the principal object of the present invention to provide a new and improved method of and apparatus for manufacturing or fabricating a load retaining or grain door having at least two plies of fabric material, such as kraft paper, enclosing a plurality of transverse reinforcing straps in which the straps and one of the plies are selectively perforated and the other ply is completely imperforate, thereby providing an imperforate door.

Another object is to provide a new and improved method of manufacturing such a grain door, which is continuous in its operation and consequently permits of fabrication of grain doors in substantial quantities and at low cost.

Another obejct is to provide a new and improved method of and apparatus for manufacturing a laminated grain door in which the lamination is carried out in two steps and the bonding adhesive is so applied as not to interfere with carrying out the method and not to be deposited on the working parts of the apparatus as to prevent proper operation of the latter.

Other objects and advantages will become apparent from the following description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view of a load retaining or grain door manufactured in accordance with this invention;

Fig. 2 is a greatly enlarged fragmentary cross-sectional view of the load retaining or grain door, taken substantially along the line 2—2 in Fig. 1;

Figs. 3 and 3*a*, taken together, comprise a schematic diagram of the apparatus of this invention on which the door shown in Figs. 1 and 2 is adapted to be fabricated;

Fig. 3*b* is a view illustrating in elevation the ribbed roller of Fig. 3;

Fig. 4 is a perspective view of a fragment of the door after an intermediate step in the method of this invention; and

Fig. 5 is a schematic diagram illustrating a modification of the apparatus shown in Figs. 3 and 3*a* on which a slightly different method of manufacturing the door is practised.

In the following specification the term "grain door" is used to designate the throw away doors used in carriers such as railway cars to retain loads of grains and other like bulk shipped commodities.

A grain door 5 manufactured according to the present invention is generally illustrated in Fig. 1 and comprises an inner sheet or ply of fabric material 6, such as heavy kraft paper, and an outer imperforate sheet or ply 7 which may be and preferably is of the same material. The terms "outer" and "inner" refer to the outside and inside, respectively, of the door as installed in a carrier such as a railway car. Confined between the inner and outer sheets or plies 6 and 7 are a plurality of transverse metallic reinforcing straps 8 which may be made of cold rolled steel. The straps 8 in addition to reinforcing the door 5 also aid in effecting a firm attachment of the door to the doorway opening frame of the railway car or other carrier.

As shown most clearly in Fig. 2, holes 8*a* are formed in the door 5, the holes extending through the inner sheet or ply 6 and each of the straps 8, but not through the outer ply or sheet 7 which, as pointed out, is imperforate so as to prevent the loss of granular material through the holes. These holes 8*a* are positioned adjacent the side marginal edges 5*a* of the door to receive the nails which attach the door to the doorway frame of a railway car or other carrier. Since doorway openings are of varying widths a number of holes 8*a* are provided in horizontal spaced relation inwardly from the door edges 5*a*; thus a few standard width doors 5 are all that need be manufactured for bridging all the known doorway opening sizes. The holes 8*a* are longitudinally centrally located in the reinforcing straps 8 to obtain the greatest strength from the reinforcing straps 8.

The straps 8 are preferably spaced closer together adjacent the lower edge of the door 5 than at the upper edge so as to provide more reinforcing against the confined load at the points where it exerts the greatest pressure (Fig. 1).

The manufacture of grain door 5 presents certain difficult problems, because only the inner sheet 6 and the

reinforcing straps 8 are perforated while the outer sheet 7 is imperforate. In the above mentioned copending application of Hollinshead T. Martin there is disclosed and claimed the method of fabricating by combining the reinforcing straps 8 with the inner sheet 6 and then selectively perforating the combined strap and sheet. The combined and punched sheet and strap are then laminated to the imperforate second sheet 7 and the door is trimmed to the proper size with the nail holes 8*a* at the marginal edges 5*a*. The present invention is concerned with a commercial method of and apparatus for applying the straps 8 to the inner ply 6, selectively perforating the sheet and strapping, then laminating the second sheet 7 to the combined sheet 6 and strapping 8 to enclose the straps, and finally cutting the laminated plies of paper and strapping to the desired doorway width in a continuous process.

In Figs. 3 and 3*a* there is diagrammatically illustrated the improved apparatus on which the grain doors 5 may be manufactured in a substantially continuous process. (For simplicity of illustration the machine frame, the driving mechanism and other conventional mechanisms are not shown.) It has been found that the most efficient method of combining the straps 8 with the inner ply 6 is to coat a number of lines of adhesive on the inner face of the sheet 6 equal to the number of reinforcing straps 8 and then to align the straps 8 with the adhesive lines against which they are pressed in the combining portion of the apparatus. The apparatus illustrated comprises an adhesive applicator 10 for coating longitudinally extending lines of adhesive 9 on a continuously moving web of sheet material. The line coated sheet is then passed to a first laminating means 11 where it is combined with superposed continuous steel straps 8 in the area of the adhesive lines 9.

The laminated sheet 6 and strapping 8 are fed to a punching apparatus 12 which is operated selectively to punch gangs of the holes 8*a* in the laminated strap and sheet material at regularly spaced intervals. After punching, the laminated and punched sheet 6 and strapping 8 are fed to a second laminating mechanism 14 which receives the coated and imperforate sheet material 7 from a second adhesive applicator 13. After passing through combining and cooling rollers, which will be described hereinafter, the laminated product comprising the perforated ply 6 and strapping 8, and the imperforate ply 7 are fed to a shear 15 which cuts the laminated sheet into sections of doorway width through the center of the gangs of punched holes 8*a*, thereby completing the doors 5.

From the foregoing it is obvious that the operations of punching the holes 8*a* and shearing the laminated product into sections of doorway width must be coordinated so that the holes 8*a* are punched at predetermined intervals and that the shearing is done across the centers of the groups of holes 8*a* in order that a proper door be manufactured. To this end synchronizing means 16 are provided for coordinating the operations of various portions of the apparatus. As will be more fully explained hereinafter, the synchronizing means 16 include conventional electronic and mechanical apparatus actuated by photoelectric cells which are triggered by marks on the sheet 6 at points spaced apart a distance equivalent to the desired door width.

The adhesive applicator 10 for coating the lines of adhesive 9 longitudinally of the run of the inner sheet 6 comprises a roll 17 having a number of parallel circumferential axially spaced rubber ribs 18 thereon, the number and spacing of the ribs 18 being governed by the number and vertical spacing of the reinforcing straps 8 (Fig. 1). The roll 17 is carried on a shaft 17*a* to lie parallel to the plane of the sheet 6 as it is passed thereover, the shaft 17*a* being journaled in the machine frame. Adhesive is transferred to the circumferential surface of the ribs 18 by a pickup roll 20 and a doctor roll 21 from a pool of adhesive 9*a* in the pan or container 19.

The adhesive may be one of several suitable types and should be chemically inert, moisture resistant and not subject to deterioration if the doors 5 be stored for any length of time. Asphalt type adhesives satisfy these requirements and may be easily handled. Other suitable adhesives include quick setting starch base adhesives, containing chlorinated phenols and adhesives having a silicate base.

If the adhesive be highly viscous, it may be necessary to heat the pickup roll 20, the doctor roll 21 and the ribbed roll 17. It has also been found preferable to have the circumferential surfaces of the ribs 18 on the roll 17 approximately one-quarter of an inch narrower than the width of the straps 8. Thus a sufficient quantity of adhesive can be coated in lines 9 on the paper, and when the straps 8 are pressed against the sheet to adhere them firmly thereto, little if any adhesive will be squeezed from under the straps to remain on the surface of the sheet 6 not covered by the straps 8. Gumming the parts of the apparatus with adhesive is thereby substantially avoided.

The moving web of the sheet 6 is drawn from a supply roll 23 over guide rolls 24*a*, 24*b*, and 24*c* and through a printer portion 62 of the synchronizing means 16 which prints a series of marks 63 (Figs. 1 and 4) on the outer face of the sheet 6 at spaced intervals equal to the length of the retaining doors 5. As previously noted, the marks 63 are detected by photoelectric cells forming a part of the apparatus coordinating the operation of the punch 12 and shear 15.

After the marks 63 are printed on the moving sheet 6 it travels over a direction reversing roll 25 and under a guide roll 22, the function of the latter being properly to locate the sheet with respect to the ribbed coating roll 17.

After the adhesive lines 9 have been coated on the sheet 6 it passes into a nip defined between a pair of oppositely driven combining rolls 26 and 27, and simultaneously a plurality of flat steel straps 8 also pass into the nip 28, the number of straps and the spacing thereof transversely of the sheet being dictated by the amount of reinforcement required for the door 5 and coinciding exactly with the number and spacing of adhesive lines 9 coated on the sheet. The steel straps 8 are supplied from a plurality of reels 29 and pass over an elongated guide roll 31 and through levelers 30 which also act as guides before entering the nip 28. The levelers 30 remove the curl from the straps 8 so that they lie flat against the sheet 6 to insure a good and permanent bond.

If it has been necessary to heat the adhesive 9*a* before it is applied to the sheet 6, one or both of the combining rolls 26, 27 may be cooled in order to effect a strong bond between the straps 8 and the sheet 6. When a heated adhesive is employed the strap 8 also cools it so that a firm bond is provided.

From the combining rolls 26 and 27 the laminated sheet 6 and straps 8 are drawn under a guide roll 32 and into the punch 12 by pull rolls 34 and 35. In order that suitable tension be always applied to the laminated sheet 6 and strapping 8, a dancer roll 35*a*, carried at the ends of a pair of arms 35*b* pivotally mounted to the machine frame and urged downwardly by tension springs 35*c* connected thereto, rides on the sheet 6 between the combining roll 27 and the guide roll 32.

The punch 12 may be one of several commercially available types and may be operated either intermittently or continuously. In the illustrated apparatus the punch is of the ordinary crank type and is intermittently operated by the synchronizing means 16, the inner sheet and attached strap being fed into the punch 12, stopped, punched, and pulled from the punch by the pull rolls 34 and 35. Preferably the punch 12 forms parallel groups of longitudinally spaced holes 8*a* in the sheet 6

and each of the straps 8, each of the groups containing the holes for the trailing edge of one retaining door and the leading edge of the next retaining door (Fig. 4). In order properly to align the combined sheet 6 and straps 8 in the punch 12, it may be necessary to trim an edge of the sheet and provide an edge guide in the punch 12, and such trimming may be done between the tension guide roll 32 and the punch 12. However, if the inner sheet is properly trimmed in the first instance it has been found that such trimming is unnecessary.

For the purpose of intermittently pulling the sheet 6 and combined straps 8 through the punch 12, the pull roll 34 may be moved toward and away from the cooperating pull roll 35. To accomplish this, the pull roll 34 is carried on a pair of rocker arms 34*a* supported intermediate their ends on pivots 34*b* journaled in the machine frame. The roll 34 is journaled at one end of each arm and the opposite end is mechanically connected to a solenoid means indicated generally at 34*c* which is controlled by the synchronizing means 16 so that the roll 34 is lifted when the combined sheet 6 and straps 8 are stopped during the punching operation. The rocker arms 34*a* also carry braking means 34*d* opposite the roll 34, which is actuated simultaneously with the lifting of the roll 34 by the solenoid 34*c* so that not only is the pulling of the sheet 6 and straps 8 stopped, but the product is positively held during the punching. The brake 34*d* comprises flat plates 34*e* carried on the rocker arms 34*a*, and when the braking means is energized the plates 34*e* are pressed against a sheet supporting surface 34*f* carried on the machine frame. Thus the combined sheet 6 and straps 8 are securely held in the punch 12 through the coaction of the dancer roll 35*a* and the brake means 34*d*, because the dancer roll 35*a* takes up the slack in the combined sheet 6 and straps 8 ahead of the punch 12. This arrangement is important in order to obtain effective punching and overall continuous operation.

After punching, the sheet 6 and straps 8 travel into the second laminating means 14, and a second dancer roll 37 rides on the combined and punched sheet 6 and straps 8 between the pull rolls 34 and 35 and this laminating means 14. This roll 37, carried on arms 37*a*, swingably supported on the machine frame, is adapted to take up slack in the combined sheet 6 and straps 8, and usually the weight of the roll will be sufficient to prevent slack, though if desired a tension spring may be provided as in the case of the dancer roll 35*a*.

The laminating means 14 includes a pair of oppositely driven laminating rolls 38 and 39 defining a nip 40 into which the combined inner sheet 6 and straps 8 travel and are laminated to the outer sheet 7 which has previously been adhesively coated on that surface presented to the straps 8 and sheet 6.

The sheet 7 is fed from a supply roll 41 over tension regulating guide rolls 42*a* and 42*b* and a preconditioning roll 43 to a coating roll 44 which transfers adhesive 45*a* from a pan 45 to one entire face of the sheet 7 to form an adhesive coating 45*b* which firmly bonds the sheet 7 to the straps 8 and the inner face of the sheet 6. The preconditioning roll may be heated if necessary thereby to condition the sheet 7 for the application of the adhesive. Also the coating roll 44 may be heated if the adhesive is highly viscous. The sheet 7 is held in contact with the coating roll by a pair of guides 46*a* and 46*b* positioned on opposite sides of the axis of rotation of the roll 44, and the adhesive is uniformly spread on the sheet 7 by means of an equalizer or doctor blade 47 which rides against the coated surface of the sheet 7. The guide 46*b* and the third guide 48 assure contact of the coated sheet with the blade 47.

In the event that the adhesive is applied while hot, the laminated product after passing through the laminating rolls 38 and 39 passes over cooling rolls 49, 50, 51, 52 and 53, each of the cooling rolls being fabricated from cast iron and driven by suitable means in the well known manner. The product passes from the cooling rolls through guide rolls 54, 55 and 56 to feed rolls 57 and 58 and then into the shear 15.

The shear 15 like the punch 12 may be either intermittent or continuous in operation. In the illustrated apparatus the shear is intermittent in operation, being actuated in response to the control of the synchronizing means 16 as in the case of the punch 12. In view of the intermittent operation of the shear 15, the feed rolls 57 and 58 are also operated in response to the control of the synchronizing means 16 to feed the laminated product into the shear during the latter's nonoperating period and to brake the product during the operating or cutting period of the shear 15. As a result of this intermittent feeding of the product a slack loop 59 is provided between the guide roll 56 and feed rolls 57 and 58. The slack loop is tensioned by a dancer roll 59*a* carried on a pair of arms 59*b* which are held against the laminated product under the force of the tension springs 59*c*.

The shear 15 may be any one of a number of commercially available devices and may include a clamp 15*b* which locks the laminated product in the shear for the cutting operation. The shear cuts off retaining doors 5 of desired width by cutting them through the centers of the parallel groups of holes 8*a* so that half of the holes are in the trailing edge of one door and the other half of these holes are in the leading edge of the next door. The completed doors are carried from the shear by a belt type conveyor 60 and deposited in a receptacle 61.

The synchronizing means, in addition to including the printing unit 62 which prints the mark 63 (Fig. 1) on the outer face of the inner sheet at points spaced apart the requisite distance, includes a photoelectric cell means 64 which is energized by the mark 63 and which is associated with the punch 12 and pull rolls 34 and 35. The photoelectric cell is connected through a control means of a well known type to actuate the punch 12 and to stop the feeding of the sheet 6 and straps 8 by the pull rolls 34 and 35. Upon the completion of the punching operation the mechanism deenergizes the solenoid means 34*c* and the pull rolls 34 and 35 are automatically pressed together to continue feeding the laminated sheet 6 and straps 8 to the punch 12.

A second photoelectric cell means 65 is associated with the shear 15, and it is arranged to be energized by the mark 63; it is included in electronic and mechanical means of a well known type to actuate the shear 15 and to cause the feed rolls 57 and 55 to stop their feeding operation. After the shear has completed cutting the laminated product as above described the feed rolls 57 and 58 are actuated to resume feeding the product to the shear 15 a distance equal to the width of another door 5.

A brief summary of the operation of the apparatus and practice of the method follows: The inner sheet 6 is fed from the supply roll 23 through the printing unit 62 where the marks 63 are printed on the outer face of the sheet 6. This sheet is next coated with the longitudinally extending lines 9 of adhesive by the ribbed roll 17 and passes into the laminating means 11 between the laminating rolls 26 and 27. At the same time a plurality of spaced straps 8 are fed from the strap supply rolls 29 through the strap levelers 30 and between the laminating rolls 26 and 27 where they are bonded to the sheet 6 on the adhesive lines 9. The sheet 6 and combined straps are pulled by the pull rolls 34 and 35 under the dancer roll 35*a* to guide roll 32 through the punch 12. As the printed marks 63 pass under the photoelectric cell means 64 the latter operates the synchronizing mechanism 16 to stop the feeding of the rolls 34 and 35, to energize the brake means 34*d*, and to operate the punch to form the holes 8*a*. After punching, the pull rolls 34 and 35 are moved to their feeding position to draw the punched products from the punch 12.

The punched sheet 6 and straps 8 are pulled under a second dancer roll 37 into the second laminating means

14 and are bonded to the adhesive coated imperforate outer sheet 7 between the laminating rolls 38 and 39. The laminated product is then passed over the driven cooling rolls 49, 50, 51, 52 and 53 and pulled through the guide rolls 55 and 56 by the feed rolls 57 and 58 which are intermittently operated. The laminated product is fed by the rolls 57 and 58 into the shear 15, the latter being actuated by the energization of the photoelectric cell means 65 in response to its detecting one of the printed marks 63. During the shearing operation the feed rolls 57 and 58 are stopped but are started as soon as a retaining door 5 has been cut from the leading end of the laminated product. As the doors are cut off, they are drawn from the shear 15 by the continuously moving conveyor 60 and deposited in the receptacle 61 for bundling and shipping.

A modification of the apparatus illustrated in Figs. 3 and 3*a* is shown in Fig. 5, wherein the adhesive instead of being coated in lines on one face of the sheet 6 is coated on the straps 8. In Fig. 5 those parts of the apparatus which are similar to the corresponding parts shown in Fig. 3 are given the same reference characters. Thus, the sheet 6 is fed from the supply roll 23 through the printer portion 62 of the synchronizing means 16 and over the direction reversing roll 25 to the nip 28 of the laminating rolls 26 and 27 which are shown in a slightly different position than in Fig. 3.

The strapping 8 is fed from the supply roll 29 through the levelers 30 and over a guide roll 66 and around a second guide roll 67 which also reverses its direction so that it properly may be fed to the laminating means 11. The rolls 66 and 67 are located on opposite sides of the coating roll 21 which picks up adhesive from the heated roller 20 which turns in the pool of adhesive 9*a* in the container 19. The rolls 66 and 67 maintain proper contact of the straps 8 against the coating roller 21 so that one face of each of the straps is continuously coated with the proper quantity of adhesive.

The coated straps are firmly bonded to the sheet 6 in the laminating means 11 and then are pulled by the rolls 34 and 35 to the punch 12. The remainder of the apparatus is the same as or similar to that already described, and the remainder of the process is carried out in the same manner. It will be observed that in this modification of the process the adhesive instead of being coated in lines on the sheet 6 is coated in similar lines on each of the straps 8 which are pressed against the sheet 6.

By either of these processes only so much of the adhesive is applied either to the sheet 6 or to the straps 8 as is necessary firmly to bond the straps to the sheet, and, therefore, no excess quantity of adhesive lies on the sheet 6 between the straps which might gum up the laminating, heating and guide rolls of the apparatus or the punch 12.

It will be appreciated that the process and the apparatus described are effective to manufacture a laminated retaining door of the type shown in Fig. 1 which comprises an imperforate sheet bonded to a perforated sheet and reinforced by perforated straps, the product being an imperforate load retaining door which may easily be nailed in place in a shipping vehicle such as a railway car.

While two embodiments of the method and apparatus constituting this invention have been shown and described, it will be apparent that numerous modifications and variations thereof may be made without departing from the underlying principles of the invention. It is therefore, desired by the following claims to include within the scope of the invention all such variations and modifications by which substantially the results of this invention may be obtained through the use of substantially the same or equivalent means.

What is claimed as new and desired to be secured by United States Letters Patent is:

1. A method of continuously manufacturing load retaining doors comprising the steps of feeding a sheet material and a number of parallel spaced reinforcing straps to extend longitudinally of the sheet material, applying spaced lines of adhesive to one of the adjacent faces of the sheet material and the reinforcing straps, pressing the sheet material and the reinforcing straps together so that the adhesive bonds the straps to the sheet material, punching holes through the combined straps and sheet material, and bonding an imperforate sheet material to the combined and punched straps and sheet material over the punched holes.

2. A method of continuously manufacturing load retaining doors comprising the steps of feeding a sheet material and a number of parallel spaced reinforcing straps to extend longitudinally of the sheet material, applying spaced lines of adhesive approximately the width of the straps to one of the adjacent faces of the sheet material and the reinforcing straps, pressing the sheet material and the reinforcing straps together so that the adhesive bonds the straps to the sheet material, punching holes through the combined straps and sheet material, and bonding an imperforate sheet material to the combined and punched straps and sheet material over the punched holes.

3. A method of continuously manufacturing load retaining doors comprising the steps of feeding a first web of sheet material and a number of parallel spaced ribbons of reinforcing straps to extend longitudinally of the sheet material, applying spaced lines of adhesive approximately the width of the straps to one of the adjacent faces of the sheet material and the reinforcing straps, pressing the sheet material and the reinforcing straps together so that the adhesive bonds the straps to the sheet material, punching parallel and longitudinally spaced groups of holes through the combined straps and sheet material, feeding a second and imperforate web of sheet material longitudinally of the combined and punched straps and first web of sheet material, bonding the second web to the first web and straps to enclose the straps therebetween, and cutting the resulting laminated product transversely through approximately the center of the groups of holes to produce the load retaining doors.

4. A method of manufacturing load retaining doors comprising the steps of applying longitudinally extending spaced lines of adhesive to a sheet material, applying flat reinforcing straps to the adhesive lined sheet material longitudinally of the material and on the lines of adhesive, punching holes through the combined straps and sheet material, and laminating an imperforate sheet material to the combined and punched straps and sheet material over the punched holes.

5. A method of manufacturing metal strap reinforced load retaining doors comprising the steps of applying longitudinally extending spaced lines of adhesive to a sheet material, the lines of adhesive being approximately strap width, pressing flat reinforcing straps against the adhesive lined sheet material longitudinally of the material and on the lines of adhesive, punching holes through the combined straps and sheet material, and laminating an imperforate sheet material to the combined and punched straps and sheet material to enclose the straps between the sheets.

6. A method of manufacturing load retaining reinforcing doors comprising the steps of applying adhesive to a number of spaced parallel reinforcing straps, pressing the adhesive coated reinforcing straps against a sheet material longitudinally thereof to bond the straps to the sheet material, punching holes through the combined straps and sheet material, and laminating an imperforate sheet material to the combined and punched straps and sheet material to enclose the straps between the sheets.

7. An apparatus for manufacturing metal strap reinforced load retaining doors comprising means adapted to supply a first web of sheet material, means adapted to supply a number of spaced parallel reinforcing straps

longitudinally of the sheet material so as to bring a face of the strap against a face of the sheet material, means coating lines of adhesive on one of the faces of sheet material and straps, laminating rollers pressing the straps and sheet material together to bond the straps to the sheet material, a punch for forming transversely spaced parallel groups of holes in the combined straps and sheet material, drive means for feeding the combined strap and sheet material through said punch, means adapted to supply a second and imperforate web of sheet material, means coating adhesive on one face of the second web, laminating rollers pressing the coated face of the second web to the combined straps and first web to enclose the straps between the webs, a shearing means for transversely cutting the combined webs and straps through approximately the center of the groups of holes into sections of door width, second drive means for feeding the combined webs and straps through the shearing means, and synchronizing means controlling the operation of all of said drive means, said punch and said shearing means.

8. An apparatus for manufacturing metal strap reinforced load retaining doors comprising means adapted to supply a first web of sheet material, means adapted to supply a number of spaced parallel reinforcing straps longitudinally of the sheet material so as to bring a face of each strap against a face of the sheet material, means coating lines of adhesive on one of the faces of the sheet material and the straps, driven laminating rollers pressing the straps and sheet material together to bond the straps to the sheet material, an intermittently operating punch for forming transversely spaced parallel groups of holes in the combined straps and sheet material, intermittently operating drive means for feeding the combined strap and sheet material through said punch and stopping its movement during operation of said punch, means adapted to supply a second and imperforate web of sheet material, means coating adhesive on one face of the second web, laminating rollers pressing the coated face of the second web to the combined straps and first web to enclose the straps between the webs, an intermittently operating shearing means for transversely cutting the combined webs and straps through approximately the centers of the groups of holes into sections of door width, second intermittently operating drive means for feeding the combined webs and straps through the shearing means and stopping the movement thereof during operation of said shearing means, and synchronizing means controlling the operation of all said intermittently operating means.

9. An apparatus for manufacturing metal strap reinforced load retaining doors comprising means adapted to supply a first web of sheet material, means coating narrow lines of adhesive on one face of the sheet material, means adapted to supply a number of spaced parallel reinforcing straps longitudinally of the sheet material so as to bring a face of each strap against a face of the sheet material on the lines of adhesive, laminating rollers pressing the straps and sheet material together to bond the straps to the sheet material, a punch for forming transversely spaced parallel groups of holes in the combined straps and sheet material, means adapted to supply a second and imperforate web of sheet material, means coating adhesive on one face of the second web, laminating rollers pressing the coated face of the second web to the combined straps and first web to enclose the straps between the webs, and shearing means for transversely cutting the combined webs and straps through approximately the centers of the groups of holes into sections of door width.

10. An apparatus for manufacturing metal strap reinforced load retaining doors comprising means adapted to supply a first web of sheet material, means adapted to supply a number of spaced parallel reinforcing straps longitudinally of the sheet material so as to bring a face of each strap against a face of the sheet material, means coating lines of adhesive on one face of each strap, laminating rollers pressing the straps and sheet material together to bond the straps to the sheet material, a punch for punching transversely spaced parallel groups of holes in the combined straps and sheet material, means adapted to supply a second and imperforate web of sheet material, means coating adhesive on one face of the second web, laminating rollers pressing the coated face of the second web to the combined straps and first web to enclose the straps between the webs, and shearing means for transversely cutting the combined webs and straps through approximately the centers of the groups of holes into sections of door width.

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