MACHINE FOR JOINING CORRUGATED PAPER TUBES

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FIG. 1.

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MACHINE FOR JOINING CORRUGATED PAPER TUBES

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This invention relates in general to machines for forming tubes from corrugated paper, and more particularly to machines for forming tubes from double corrugated paper of the type which is the subject matter of an application for United States Letters Patent, Serial No. 470,469, filed Nov. 22, 1954, issued as Patent No. 2,896,692, dated July 28, 1959, by Camillo Villoresi.

A machine for forming tubes from double corrugated paper is described in the applicant's United States Patent No. 2,764,919 which describes a machine which automatically joins into a closed ring sheets of corrugated, double corrugated, and like papers, in order to form tubes for packing purposes. The principal characteristic of the machine shown in that patent consists in that the machine makes the join by means of a butt connection of the edges of the sheet in order to avoid excessive rigidity and ugly thickening along the line of the join, which would be the result of a lap joint.

In contradistinction thereto, it is the object of the present invention to provide a machine which produces packing tubes of corrugated, double corrugated, and like paper sheets, wherein a device is a system of joining the sheets which, while retaining the advantages of the lap joint (a greater joint area and therefore greater joint strength), obviates the disadvantage of a thickening along the line, the join. This new system is applicable only to sheets of corrugated board or paper in which the corrugations are free (that is to say not secured to a flat sheet), and particularly to the sheets of double corrugated paper as described in the aforesaid Villoresi application which, because of its characteristics of elasticity and extensibility, is better suited to the formation of tubes for protecting cylindrical or cylindroidal objects, such as bottles, lamps, and the like.

A packing tube made of the material described in the above-mentioned Villoresi application and having a lap joint adapted to be made by means of the machine according to the present invention forms the subject of the applicant's United States Patent No. 2,764,919 and a method of forming such a tube is described in the applicant's United States Patent No. 2,934,466. The machine according to the present invention is consequently particularly, but not exclusively, adapted to produce a packing tube according to the aforesaid United States Patents No. 2,764,919 and No. 2,934,466.

The machine according to the invention comprises an endless conveyor for feeding sheets of paper through the machine, a device for holding and positioning the sheets of paper, which comprises rollers gripping each sheet of paper and rotating at the same peripheral speed as the speed of advance of the sheet of paper on the conveyor; a flattening device for flattening one edge of each sheet which is disposed immediately after the holding and positioning rollers and comprises a profiled guide and counter-guide which are so shaped, and so cooperate with one another that they flatten one or more corrugations of one margin of the sheet of paper; a device for applying adhesive to the lower face of the flattened margin of each sheet after the flattening device, a bending device for bending the sheet and overlapping the margins in such a manner that the flattened margin adhe-
taken along the line 10—10 of FIGURE 2, illustrating the functions of some parts of a device for bending the sheet and superimposing the edges.

FIGURE 11 is a fragmentary plan view on a smaller scale of the sheet bending device shown in FIGURE 10;

FIGURE 12 is a fragmentary enlarged cross-section taken along the line 12—12 of FIGURE 1;

FIGURE 13 is an enlarged end elevation, partly in cross-section, of the right-hand end of the machine, as viewed in FIGURE 1, some parts being omitted for the sake of greater clarity; and

FIGURE 14 is a fragmentary plan view of the end portion shown in FIGURE 13.

For the purpose of explaining more clearly the functions of the machine according to the invention, the type of joint made by the machine will first be described. As can be seen from FIGURE 3, one edge of the sheet of double corrugated paper (of the type described in the above-mentioned Villoresi application, in which the corrugations run parallel to the join line) is flattened for the purpose of creating a relatively flat and thin surface adapted to have superimposed on it the other edge of the paper, without producing any substantial thickening. This is effected in the machine before the joint is made, in three separate stages:

1. Flattening of one or more corrugations along one edge of the sheet;
2. Folding over a part of the flattened portion to create a fold, portion capable of preventing the separation of the two laminations of which the sheet of corrugated paper is usually composed; and
3. The passage of the edge through two hot knurling surfaces to render the flattened edge uniform and rigid.

After this treatment the edge is ready to receive adhesive and, afterwards, the other edge of the sheet to be superimposed on and joined to it.

The sheets of corrugated paper a, previously cut to size, are introduced horizontally into the hopper 1 (FIGURES 1 and 2) as a stack, the lower sheet of which rests on the plate 2 in which there is a longitudinal groove to house the upper lip of a continuous conveyor chain 4. The hopper 1 is constituted by two horizontal guides 5 and 5' fixed to the plate 2 by bolts 6 and 6', and are adjustable sideways, for the purpose of making them conform to the width of the sheets, by means of slats 7 and 7'. To align the stack of sheets vertically and keep them in place there are provided the angular guides 8, 8' and the flat guides 9, 9' integral with the horizontal guides 5, 5'.

The guides 5, 5' extend beyond the space occupied by the hopper, along the path followed by the sheets, almost as far as an edge flattening unit which will be described subsequently, in order to guide the sheets along the first section of their path through the machine.

The advance of the sheets through the entire operational cycle of the machine is effected by means of the conveyor chain 4, made up of the links 10 (FIGURE 4) and on each of which it is possible to secure a driver 11 selected from a range having different thicknesses and widths suited to the thicknesses and the sizes of the various sheets of paper that may be used. For those reasons drivers 11 must be easily interchangeable. For any one run, drivers are placed on selected links spaced according to the length of the sheets. By varying the distance of drivers 11 apart according to the length of the sheets of paper, the chain 4 feeds the sheets uniformly spaced apart in accordance with their length from the hopper 1 (FIGURE 1) through the aperture 12, and successively through the various operating stations of the machine. The links 10 are grooved on one side and suitably engage a wheel 13, which has teeth disposed to engage the grooves and is keyed on to a shaft 25. A similar toothed wheel 14 keyed on to a shaft 29 also engages the links. The latter shaft is driven through a sprocket wheel 15, mounted on the shaft 29, by a transmission chain 16 directly connected to a motor unit (not shown).

The drivers 11 (FIGURE 4), for the extraction of the sheets from the hopper and for their advance through the machine, have a chamfered inner margin to ensure the extraction of one sheet only at a time from the hopper without damaging the edge of the sheet of paper above that which is about to be extracted. The drivers 11 are rapidly and securely fixed to the links 10 of the chain 4 by means of set screws 18 provided with a recess 19 for engagement by a spring-loaded ball 20 incorporated in each of the links 10 of the chain 4.

The drivers 11 thus mounted on chain 4 may be easily extracted from their seating by pushing up on the lower face of stem 18 with any suitable tool. However, to facilitate such extraction and make it more rapid, the machine has been fitted with an extracting device generally indicated by numeral 21 (FIGURES 1, 4 and 5) which, when actuated by a handle 22, automatically lifts riders 11 by the amount sufficient to disengage them from the fixing ball 20, as the links 10 of the chain 4 pass over the toothed wheel 13. The upper end of the handle 22 engages a cam 23, with inclined cam face, slidable along shaft 25 on which the toothed wheel 13 is mounted. The toothed wheel 13 has mounted on it in line with each tooth and, therefore, with a link 10 of the chain 4, one of several coned members 24, each of which engages a spring-loaded plunger 27. When the lever 22 is rocked to displace the cam 23 to the left in FIGURE 5, each coned member 24 is pushed to the left as it rides over the inclined face of the cam 23, and, in turn, imparts through its conical surface an upward movement to the spring-loaded plunger 27 which will then be exactly in line (FIGURE 4) with the stem 18 of a driver 11 on one link 10 of the conveyor chain 4.

The sheet of paper a, withdrawn from the hopper 1 by one of the drivers 11 (FIGURES 1 and 2) performs the first part of its travel held between the extensions of the guides 5, 5' and kept in position by a cover plate 28, which may be suitably adjusted in height to conform to the particular thickness of the sheet of paper. The guides of hopper 5, 5' are adjusted in such a way as to convey and present the sheet of paper a in a position suitable for the flattening treatment of an edge carried out by the flattening unit which will be described below.

After sheet a emerges from guides 5, 5' and from the cover plate 28, it passes under the control of a roller guide system generally indicated by the numeral 30 (FIGURES 1 and 2), which functions not only to advance the sheet and keep it flat, but also to improve the positioning of the sheet, and in particular to advance the edge to be flattened during the flattening stage.

This system of rollers 30 (FIGURES 6 and 7) consists of two parallel shafts 31 and 32 on which are fixed rollers 33, 33' and 34, 34', respectively (FIGURE 2). The rollers are adjustable along the axis of the respective shafts 31 and 32 for the purpose of adapting them to the width of the sheet of paper. In particular, the roller 33 (FIGURE 7) must always be positioned very close to the flattening drivers which will be described below.

The shafts 31 and 32 are driven (FIGURES 1 and 2) through sprockets 35 and 37 connected by a chain 36, a sprocket 38, and a chain 39, the latter being suitably coupled to the drive for the machine, in such a way that the rollers 33, 33' and 34, 34' revolve at a circumferential equal to the speed of movement of the sheets as carried by the conveyor, and serves to insure continuous movement of the sheets of the machine through the flattening stage.

The shafts 31 and 32 are suitably mounted at their ends on brackets 40, 40' which, in turn (FIGURE 6) are mounted in an adjustable manner, by means of a hinge 41 and a spring 42 on the frame 2 of the machine. By adjusting screws 43, 43', the height of rollers 33, 33' and 34, 34' may be adjusted to the thickness of corrugated paper and to vary the degree of pressure of the rollers themselves on both sides of the sheet. This permits the precision of alignment of the sheet to the exact
position it ought to occupy when it enters the devices which flatten the edge.

The flattening of the edge is effected by the passage of the sheet between a profiled guide or rider 44 (FIGURES 6, 7, 8 and 8a) and a profiled guide 45, which are arranged to progressively spread and flatten the two corrugations near the edge of the sheet. A scroll 46 simultaneously folds over the marginal half corrugation to form the folded portion and a pair of hot knurling rollers 47, 47' then engage the flattened margin and further straighten and stiffen the edge by impressing on it a minute transverse corrugation. It is important that the corrugated sheet reaches the flattening unit in a position such as to present to the guide 44 (FIGURE 7) the exact point where the spreading of the corrugations is to take place. In practice, such a point is represented by the last row but two or but three, according to the width of flattened edge desired.

The exact positioning of the sheet is determined, as has been said, by the accurate adjustment of the guides 5, 5', of hopper 1 and of the rollers 33, 33', 34, 34' (FIGURE 2). The guide 44 extends in the shape of a blade up to the roller 33 (FIGURES 6 and 7) where it enters into the row preselected for the spreading of the corrugations which must be flattened for the formation of the edge. It is obvious that the roller 33, which must be located very close to guide 44, must hold the sheet firmly at this point so that guide 44 penetrates definitely into the desired row and also assists in advancing the sheet against the friction produced by the passage between the guides 44, scroll 46, and the counter-guide 45.

The profiled guides 44, 45 and scroll 46 are fixed in an adjustable manner by means of screws passing through slots 44', 45' and 46', respectively (FIGURE 7), to an extension of a bracket 48 (FIGURE 6) on which are mounted the hot knurling rollers 47, 47'. This allows of the entire flattening unit consisting of the guides 44, 45, scroll 46, and by the knurling rollers 47 and 47' to be formed as a unit, which can be displaced in a direction transverse to the machine. The bracket 48 (FIGURE 8) is mounted on a slide 49 slideable along a slide-way 50, and controlled by a screw 51 having a knob 52. The flattening unit can thus be adjusted so as to conform to the various widths of the sheets, without disturbing the relative positions of the flattening elements 44, 45, 46, 47 and 47'.

The guide 44, as has been stated, has its leading end in the shape of a blade with the lower edge shaped as shown in FIGURE 6 to facilitate its entry between the corrugations of the sheet in order to effect the spreading of the corrugations which must be flattened. From this end the guide widens gradually until it becomes a flat horizontal blade at the point where the sheet of paper leaves it. On the other hand, the counter-guide 45, which has to cooperate accurately with the guide 44, is formed in such a way that it presents at the point of entry of the sheet a channel 45'' (FIGURE 8a) between two ridges which together conform to the shape of a corrugation of the sheet. This channel 45'' and the ridges gradually decrease in depth until the counter-guide 45 assumes the flat shape at the point of exit of the sheet. The edge 44'' of guide 44 faces the channel 45'' of the counter-guide 45 and the longitudinal position of the guide 44 with respect to the counter-guide 45 is such that part 44'' and groove 45'' are tapered in parallel relationship with the guides where both the guide and the counter-guide 45 become flat, at which point the sheet issues from them.

Similarly, the scroll 46 (FIGURE 8a) is suitably profiled in such a way as to present a channel 46'' at the point of entry of the sheet to receive the marginal half corrugation formed by the flattening mechanism. The width of the channel diminishes gradually until it disappears at the point where the half corrugation is folded back against the sheet and the flat part of the underlying counter-guide 45. Thus, scroll 46 and guide 45 cooperate with each other to fold and flatten the margin.

The hot knurling rollers 47 and 47', through which the edge of the corrugated sheet passes, immediately after having been flattened by the guides 44, 45 and scroll 46, are hollow and in each (FIGURE 6) there is a ring-shaped electric heating element 53 and 53'. The rollers 47, 47' are fixed on one end of hollow shafts 54 and 54', respectively, suitably mounted on the bracket 48. On the said shafts 54 and 54' are mounted cylindrical toothed wheels 55 and 55' (FIGURE 8) engaging each other, which are coupled by means of a suitable mechanical transmission (not shown), to the main drive of the machine, in such a way that rollers 47 and 47' turn at a peripheral speed equal to the translational speed of the sheets. The electrical conductors 56 and 56' (FIGURE 6) extend through the hollow shafts 54 and 54' to annular commutators 57 and 57' (FIGURE 8), respectively, mounted on the other end of the shafts 54 and 54' to supply current from any convenient source to the electric resistances 53 and 53' during the rotation of the rollers 47 and 47'. Metal discs 58 or 58' (FIGURE 6) suitably fixed by means of screws, enclose the hollow parts of rollers 47 and 47', respectively, in which the resistances 53, 53' are mounted.

The periphery of each of the rollers 47, 47' is cut with small straight teeth which mesh to impress into the edge of the sheet of paper a fine knurling serving to make the edge rigid and uniform.

After the flattening stage the sheet passes immediately through the adhesive application stage, during which the edge receives a layer of liquid adhesive on its lower face. The adhesive application unit (FIGURES 1 and 2) is of conventional design and comprises a container 60 which holds the adhesive, within which operates a rotatable disc 61 which, carrying a small quantity of adhesive on its peripheral face, deposits a film of it by contact on the lower edge of the sheet of paper a. The rotatable disc 61 is mounted on the same shaft as a wheel 61a which is frictionally engaged by a drive wheel 61 driven in any suitable manner by the main drive of the machine.

The adhesive application unit is fixed to a soleplate 62, which is mounted between the guides 63, 63' for adjustment across the machine and is fixed by means of screws 64 and 64'.

The position of the adhesive applying disc 61 can thus be adjusted to conform to the width of the sheet of paper.

An important function, which begins with the edge knurling stage and lasts until the sheet of paper is folded in the form of a tube, is that discharged by a guide 65 (FIGURE 3). The guide 65 (FIGURE 9) consists of a long metal bar, the lower edge 65 which is suitably profiled so as to penetrate between two corrugations of the sheet of paper a to hold the sheet itself during its transfer from the edge knurling phase to the tube folding stage of the sheet. This prevents any lateral displacement of the sheet, which is particularly important during the knurling and adhesive application phases, as the sheet must be in perfect register during these phases. The guide 65 is provided with an extension 67 with slots 68 for the adjustment of its height relative to a hot metal core 69 (FIGURE 2) which will be described below.

After the application of the adhesive, the sheet undergoes a gradual folding of the side edges in helical scrolls 70 and 70' (FIGURES 2 and 11) and around small bars 71 and 71' which are pivotally mounted on a fixed part so that they can be placed in the most suitable position to help in the folding operation of the sheet around the flattening unit, the flattening unit is arranged along the longitudinal center line of the machine and the sheet passes under it.

The hot core 69, which is detachable to permit re-
placement by similar cores of various sizes for producing tubes of various diameters is fixed at one end by means of screws 72 (FIGURES 1 and 2) to a supporting bridge 73 and is free along all the remainder of its length, which extends as far as the delivery end of the machine.

The free part of the core 69 (FIGURE 10) rests on the drivers 11 fixed to the conveyor chain 4. Internally the core 69 is provided with one or more heating electrical resistances 74, for drying the adhesive inside the tube of paper 8.

The folding of the edges of the sheets of paper begins with the forward movement of the sheet against the helically profiled scrolls 70 and 70' (FIGURES 1 and 2), the entry ends 74", 74" (FIGURE 11) of which cause the gradual and progressive folding of the side edges around the core 69. The bars 71 and 71', the free ends of which extend into the scrolls 70, 70' help in forcing the edges of the sheet into the correct position for producing an accurate overlap of the edges along the joint.

The alignment of the edges in the joining stage is subsequently controlled by a suitable guide assembly which is adapted to produce an accurate overlap of the edges to be glued. This guide assembly consists of a bearer plate 75 (FIGURES 10, 11) arranged in an adjustable manner on top of the scroll 70', and of the guide bar 76 which slidably engages the corrugation which delimits the flattened edge of the sheet. The position of the guide 76 is transversely adjustable by means of slots 77 for fixing the bearer 75 to the scroll 70' and vertically adjustable by means of slots 78 for fixing the guide 76 to the bearer 75. By adjusting the position of the guide 76 the non-flattened edge of the sheet can be accurately lapped over the flattened edge of the sheet in spite of the fact that these edges are extremely flexible.

The scrolls 70 and 70' can be replaced by another similar pair, and their position is adjustable by means of slots 79 and 79' and screws 80 and 80' for fixing them to the frame 2 of the machine. Thus scrolls adapted to produce various sizes of the tubes of paper can be inserted and their convergence adjusted to make the bending of the edges of the sheet more or less gradual, as desired.

At the end of the travel between the scrolls 70, 70', the sheet of paper, now bent into a tube and with its edges superimposed but with the adhesive still wet, is received under a hot pressure bar 81 (FIGURE 1) and between lateral guides 82, 82' (FIGURE 2) where the adhesive dries within a space of time determined by the length of the pressure bar 81, by the speed of advance of the tubes and by the temperature of the pressure bar 81 and of the hot core 69.

The spacing of the lateral guides 82 and 82', arranged one on each side of the core 69 and below the pressure bar 81, by means of the slots 83 and 83' and locking screws 84, 84' which secure the guides to the frame 2, conforms to the various diameters of the tubes to be produced. To facilitate the entry of the tubes of paper between the guides 83 and 83', especially larger tubes in which the sides of the tube are wider than the radius of curvature of the core 69, the guides 83 and 83' are profiled so as to diverge at 85, 85' at the entry end (FIGURE 2) and are profiled in the shape of an arc of a circle 86, 86' (FIGURE 12) on the interior faces in contact with the tubes. The radius of curvature of the faces 86 and 86' corresponds to the radius of curvature of the sides of the core 69, in such a way that it is possible, by adjusting the distance between the guides 82 and 82' and the core 69 and arranging the guides 82 and 82' to converge slightly towards the delivery, to obtain a gradual compression of the corrugations of the tubes in the zones constrained between the core 69 and the guides 82 and 82'.

The pressure bar 81 (FIGURE 12) has a cavity 87 within which are housed tubular electrical resistances 88 and a closing plate 89. The resistances 88, together with the resistances 74 of the core 69 produce the heat necessary for setting the adhesive. The pressure bar 81 and a block of insulating material 90 are secured on a bar-carrying block 91 by bolts 92 and the block 91 is supported by lifting screws 93 and 93' (FIGURES 1 and 13) and nuts 94 and 94' (FIGURE 12). The screws 93 and 93' (FIGURES 12 and 13) are supported by brackets 95 and 95' and are rotated by helical gears 96 which engage with worms 97 keyed on a shaft 98, which can be rotated by a hand-wheel 99. The shaft 98 extends from the bracket 95 to the bracket 95' permitting the simultaneous rotation of the screws 93 and 93'. Obviously, more than two screws similar to 93 and 93' and corresponding brackets similar to 95 and 95' may be employed if the length of the pressure bar 81 requires it, such a length depending on the speed of production desired, on the type of adhesive used and on the temperature which can be obtained with the resistances used.

For the purpose of facilitating the advance of the tubes of paper, especially when they are made with types of paper which have insufficient stiffness to stand up to the pushing action of the drivers 11 against the appreciable friction between the travelling tubes and the bottom of the stationary pressure bar 81, the machine is provided with a continuous steel band 100 (FIGURE 1) rotatable around the unit formed by the pressure bar 81 and the bar-bearing block 91 (FIGURES 12 and 13), on pulleys 101 and 101' to pull the tubes 102 and 102' in the desired direction and at the same speed of advance as the tubes, it assists in advancing the tubes at the point of their entry under the pressure bar 81 and along the whole of their travel under the bar.

The pulley 101 (FIGURE 13) is the one which drives the strip 100. It is keyed on a shaft 102 which is suitably mounted on the overhanging brackets 103 and 103' (FIGURE 14) which are fixed to the bar-carrying block 91. On the shaft 102 (FIGURE 13) there is mounted a sprocket which is driven, through a chain 105, a sprocket 106, a gear 107, by a gear 108 mounted on the shaft 29 already described.

At the other end of the continuous ribbon 100, the pulley is loose and is mounted in a resilient manner to give strip 100 the desired tension. The springing is obtained by mounting the bearings 109, 109' (FIGURE 14) of the shaft 110 supporting the pulley 101 slidably in bosses 111 and 111' fixed to the bar-bearing block 91 and provided respectively with compression springs 112 and 112' and load adjusting screws 113 and 113'.

After passing through the adhesive drying stage under the pressure bar 81, the tubes continue their travel towards the delivery end of the machine threaded on the core 69 and fed by the drivers 11 of the conveyor chain 4. As each driver 11 (FIGURE 13) begins to descend below the frame 2 following the curvature of the toothed wheel 14, it tends to cleave the edge of the tube where it engages it. To avoid this, the machine has been provided with a roller 114 with a knurled surface having a peripheral speed greater than the translation speed of the tubes and arranged at a suitable distance from the end of the travel of the chain 4. The purpose of this roller is to make the tube advance rapidly keeping away from driver 11 before the latter begins its descent on the toothed wheel 14, and to eject it off the frame 2 onto a suitable delivery conveyor or into a collecting box.

The expelling roller 114 (FIGURE 13) is mounted on a shaft 115 driven through a sprocket 116, a chain 117 and a sprocket 118 by the gear 120 described.

In front or behind the expelling roller 114 a conventional metering device can be mounted for counting the number of tubes produced by the machine.

What is claimed is:
1. In a machine for forming packing tubes from sheets of paper having generally parallel rows of corrugations and opposite margins generally parallel to said rows; a device for flattening one of the margins of each sheet com-
prising a pair of cooperating profiled guides having an entry end and an exit end, one of the guides having at the entry end two crests and a depression therebetween and the other having a peak mating with said depression whereby the guides between them conform to one of the corrugations of a sheet, said crests and peaks diminishing gradually toward said exit end, and the guides having opposed flat surfaces at said exit end.

2. A flattening device as described in claim 1, having a folding device adapted to engage and fold an outer portion of the margin to be flattened as said margin passes between said profiled guides, and to complete folding said portion to a flat position at said exit end.

3. In a machine for forming packing tubes from sheets of paper having generally parallel rows of corrugations and opposite margins generally parallel to said rows; a device for flattening and stiffening one of said margins of each sheet comprising a pair of profiled guides having an entry end and an exit end, said guides at said entry end being shaped to conform to a corrugation of the sheet and having opposing flat surfaces at the exit end, and being shaped and disposed to gradually flatten a marginal corrugation as a sheet passes from said entry end to said exit end, and a pair of knurling rollers adapted to engage the flattened margin of a sheet emerging from said exit end and to impart a lightly knurled configuration to said margin.

4. A machine, for forming packing tubes from sheets of corrugated paper having generally parallel rows of corrugations and opposite margins generally parallel to said rows, comprising: a flattening device having an entry end of a contour conforming to at least one of said corrugations and a flat exit end, and being adapted to engage one of said margins of each sheet and open out and remove at least one of the corrugations thereof thereby reducing the engaged margin to flat sheet form; a first guide adapted to guide the margin to be flattened into a predetermined position with respect to said flattening device; means for applying adhesive to the flattened margin of each sheet; a bending device adapted to form each sheet into a tube with the flattened margin overlapping and adhering to the opposite margin; a second guide adapted to prevent lateral displacement of the sheets as they pass from said flattening device to said bending device; a third guide adapted to establish a predetermined amount of overlap between the opposite margins of a sheet as the sheet passed through said bending device; a continuously travelling conveyor adapted to feed said sheets in succession through said first guide, said flattening device, said second guide, and said bending device, said conveyor being composed of links and including a plurality of removable and interchangeable drive members each adapted to engage a sheet, each drive member having a stem and each link having a recess for receiving the stem of any one of said drive members, and each link having a spring-loaded ball engageable with a stem disposed in its recess for securing the stem therein; and a device adapted to disengage said drive members from said links and comprising a rotating wheel, a plurality of plungers movable radially outward on said wheel and engageable with the stems of said drive members to disengage the stems from said recesses, a plurality of spring loaded cone members adapted to move said plungers radially outward, a cam adapted to engage said cone members to move said plungers radially outward, and manual control means for engaging and disengaging said cam with said cone members.

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