May 22, 1962 P. MOLLA 3,035,498

MACHINE FOR JOINING CORRUGATED PAPER TUBES

Filed Jan. 28, 1959 9 Sheets-Sheet 1

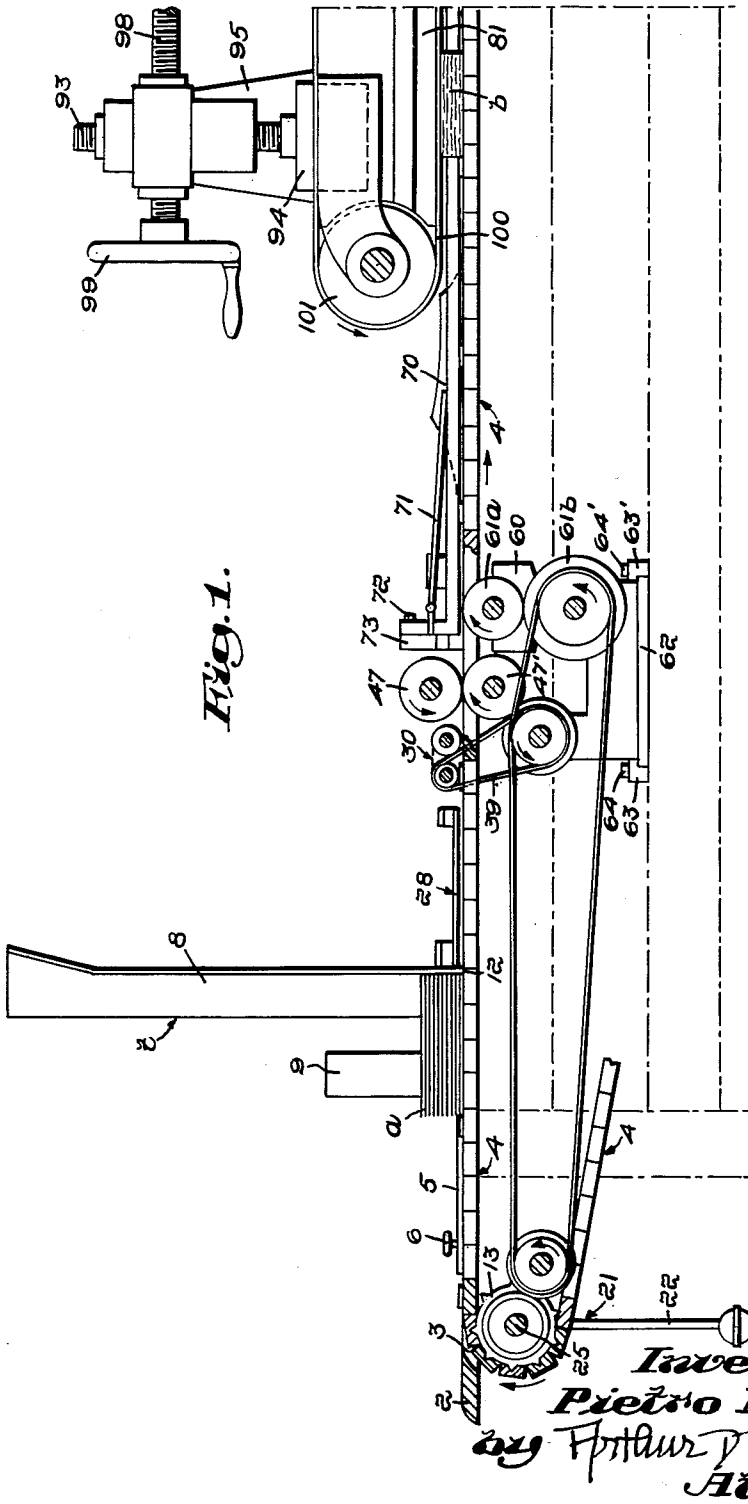


Fig. 1.

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MACHINE FOR JOINING CORRUGATED PAPER TUBES

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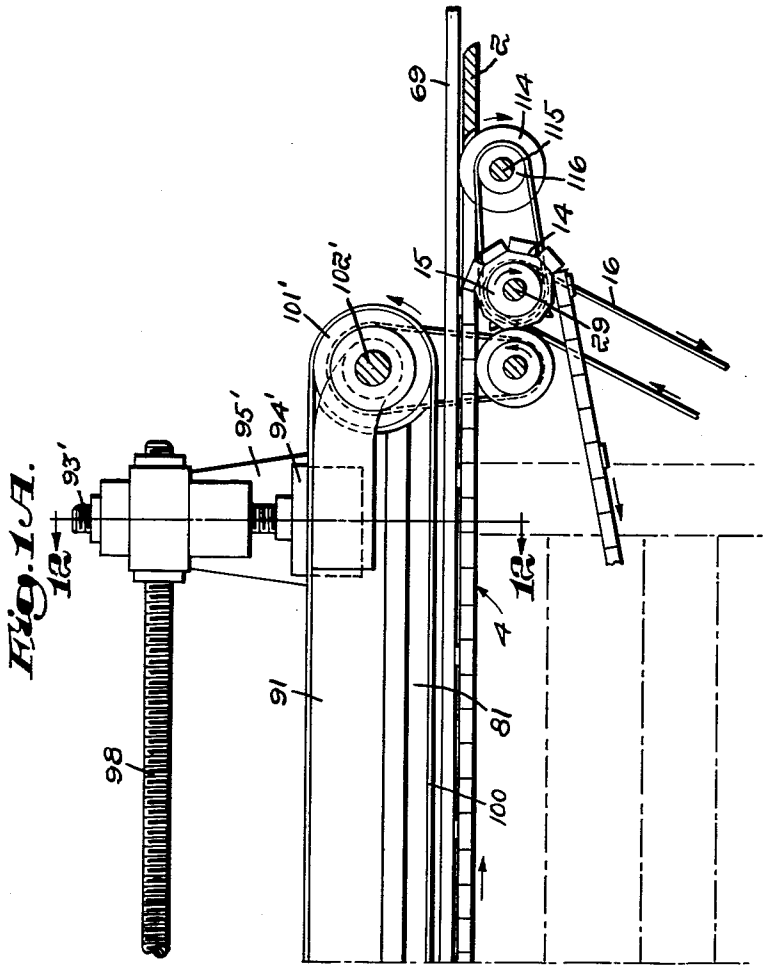


Fig. 1A.

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MACHINE FOR JOINING CORRUGATED PAPER TUBES

Filed Jan. 28, 1959 9 Sheets-Sheet 3

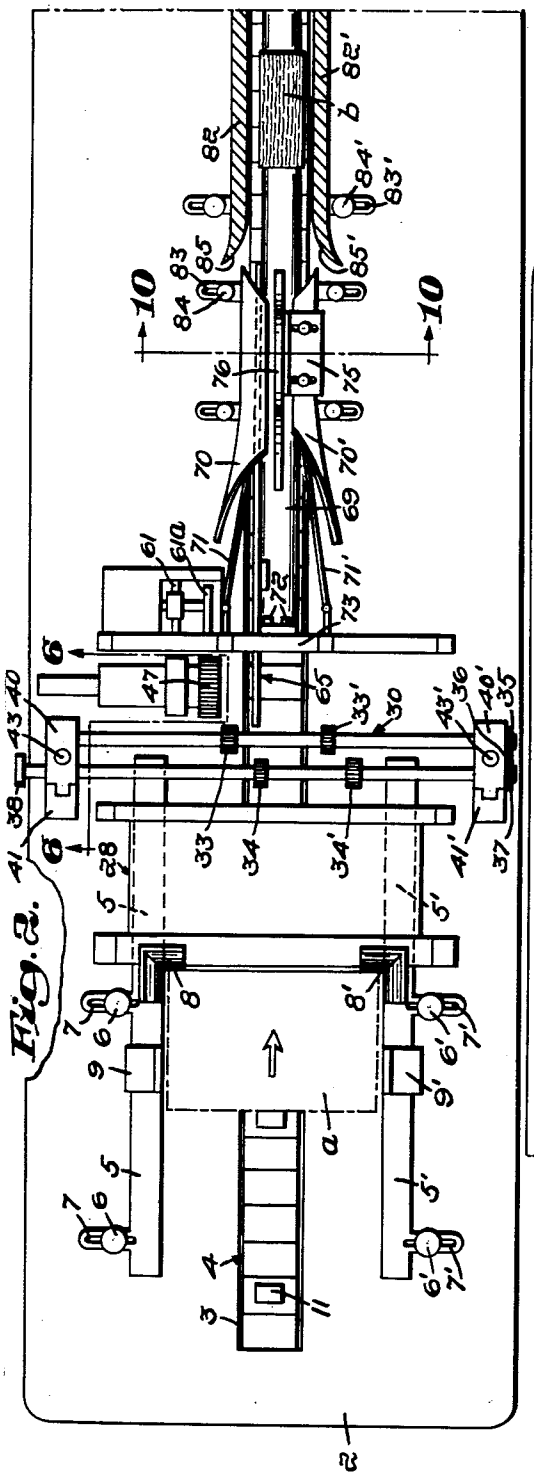


Fig. 2.

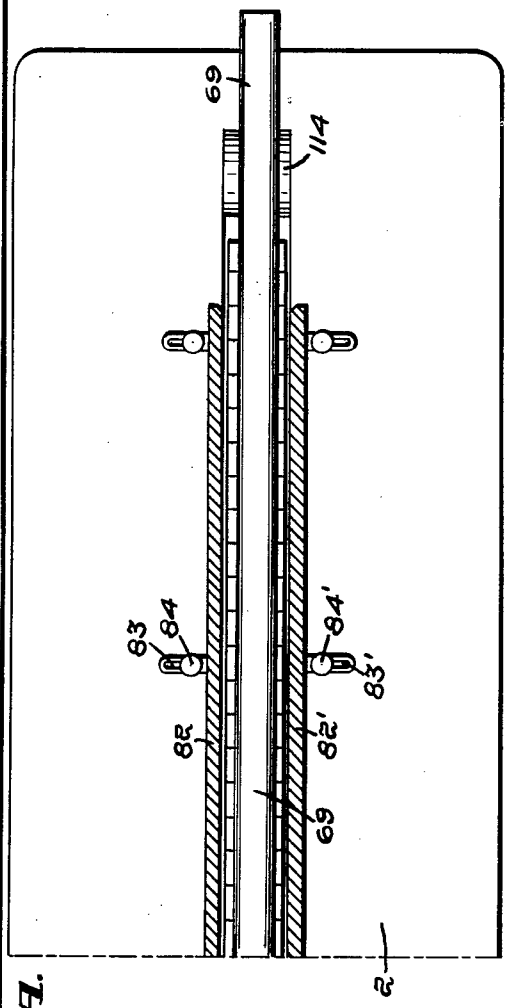


Fig. 2A.

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MACHINE FOR JOINING CORRUGATED PAPER TUBES

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Fig. 3.

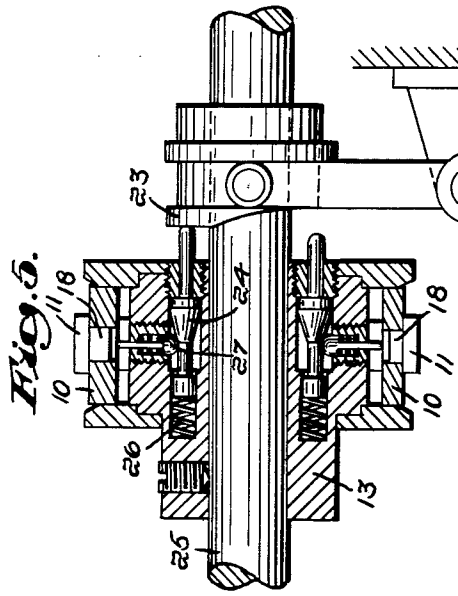


Fig. 4.

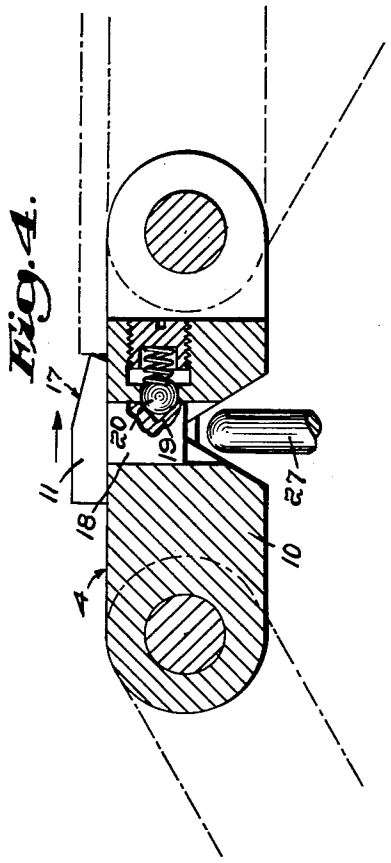
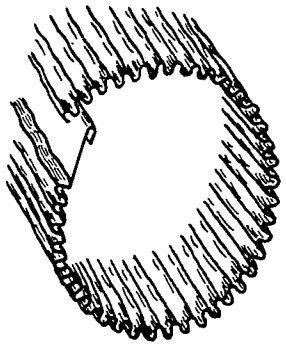


Fig. 5.



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MACHINE FOR JOINING CORRUGATED PAPER TUBES

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Fig. 6.

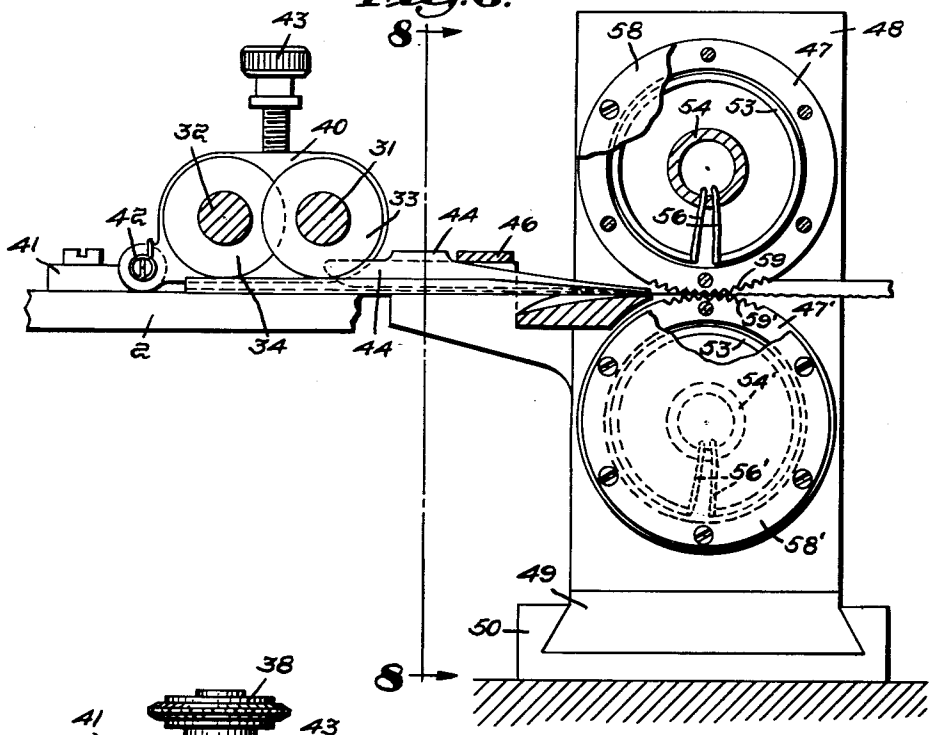
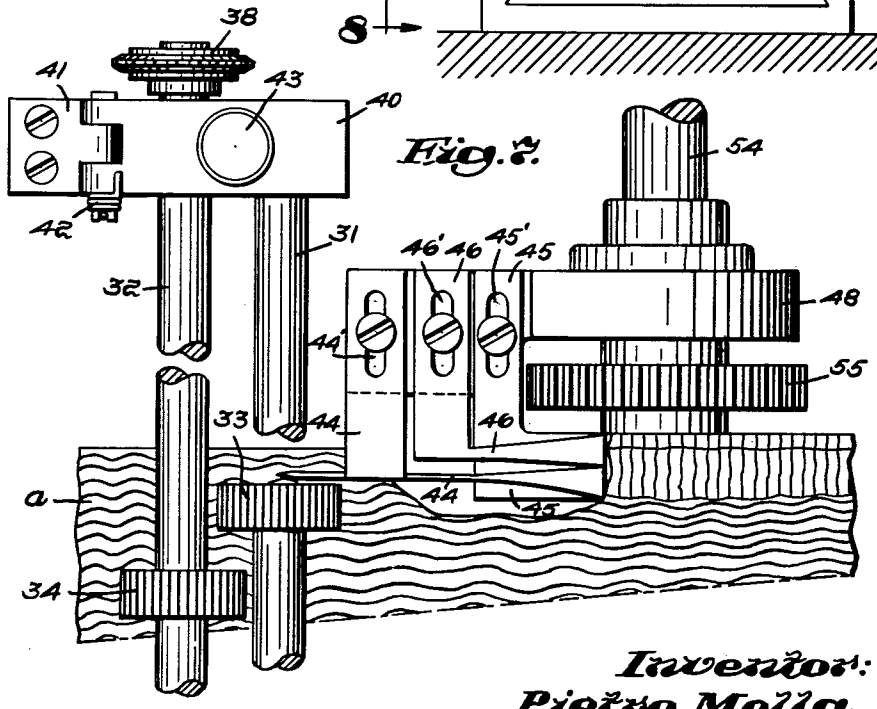


Fig. 7.



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MACHINE FOR JOINING CORRUGATED PAPER TUBES

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Fig. 8.

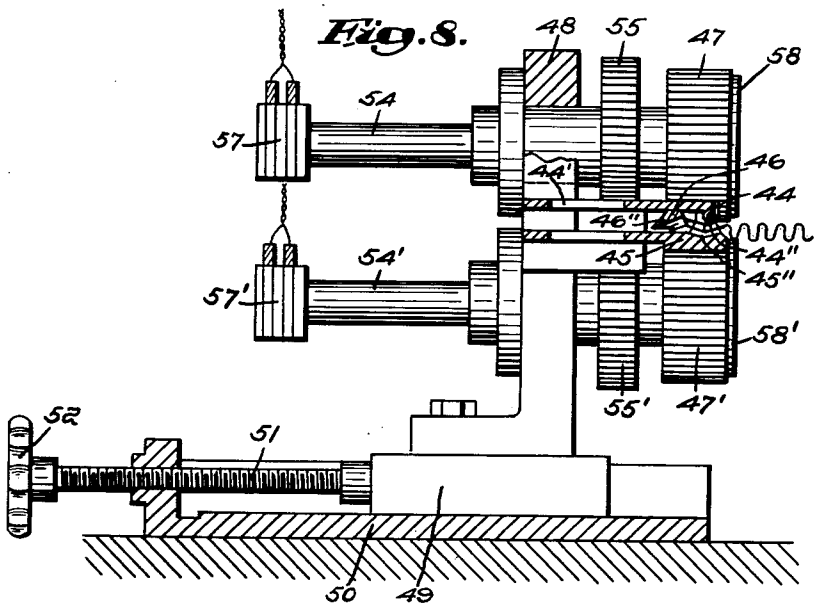


Fig. 8a.

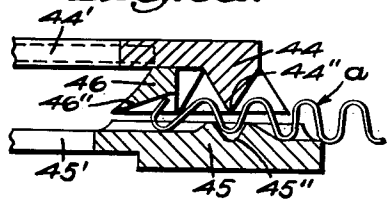
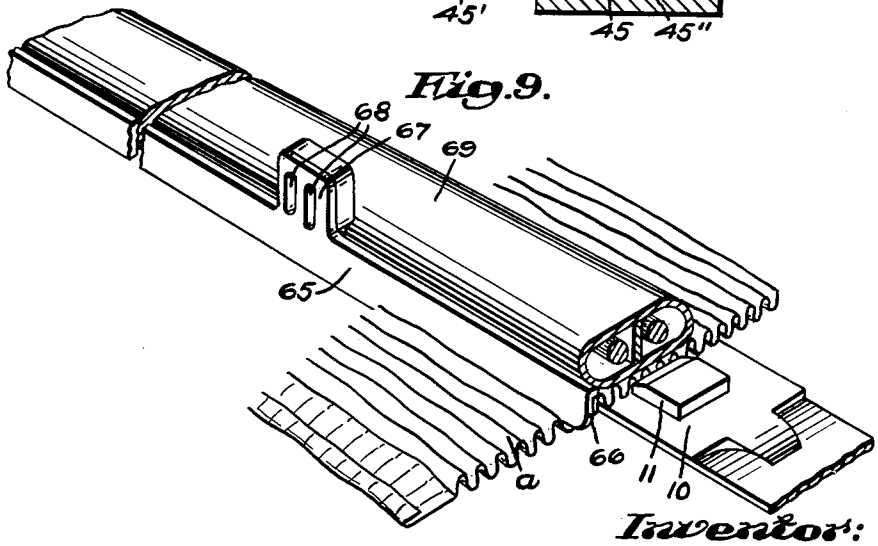


Fig. 9.



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May 22, 1962 P. MOLLA 3,035,498

MACHINE FOR JOINING CORRUGATED PAPER TUBES

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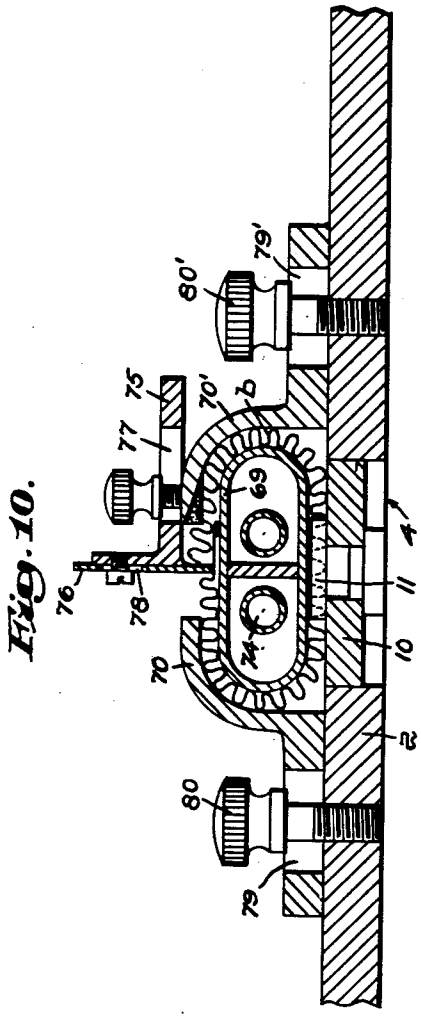


Fig. 10.

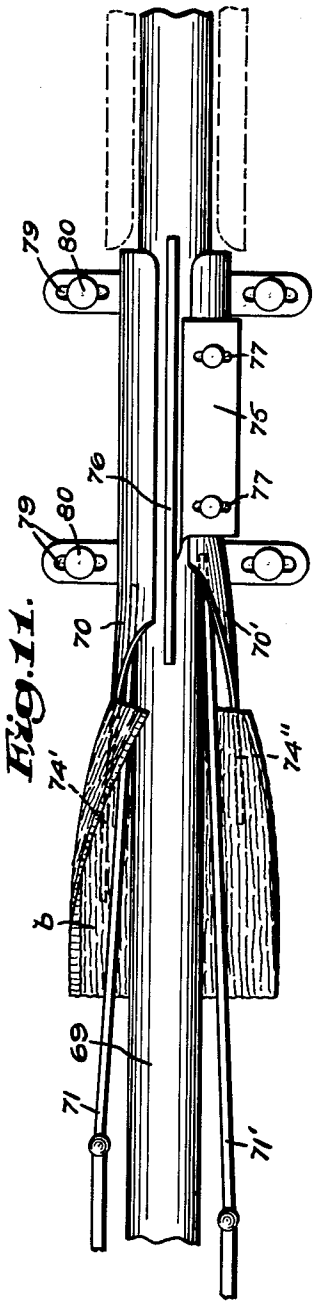


Fig. 11.

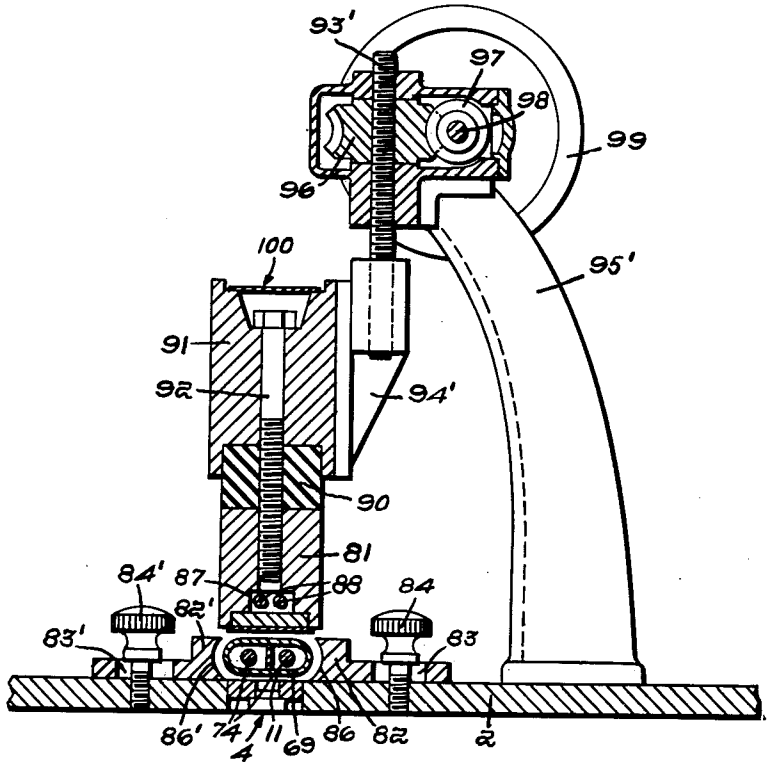
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MACHINE FOR JOINING CORRUGATED PAPER TUBES

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Fig. 12.



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MACHINE FOR JOINING CORRUGATED PAPER TUBES

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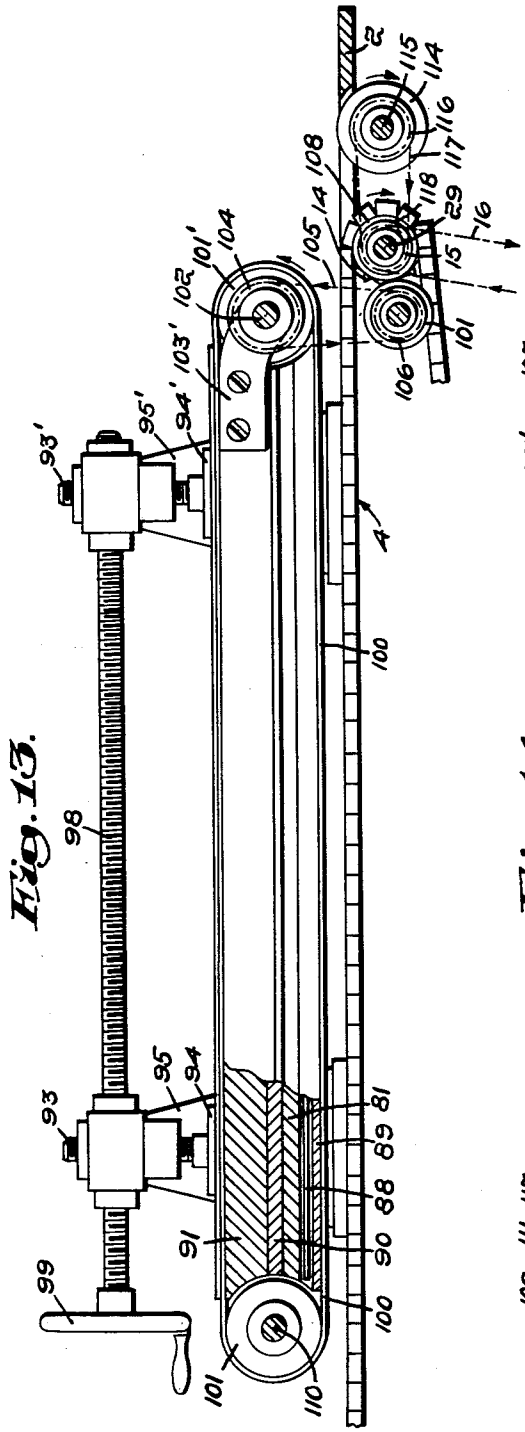


Fig. 13.

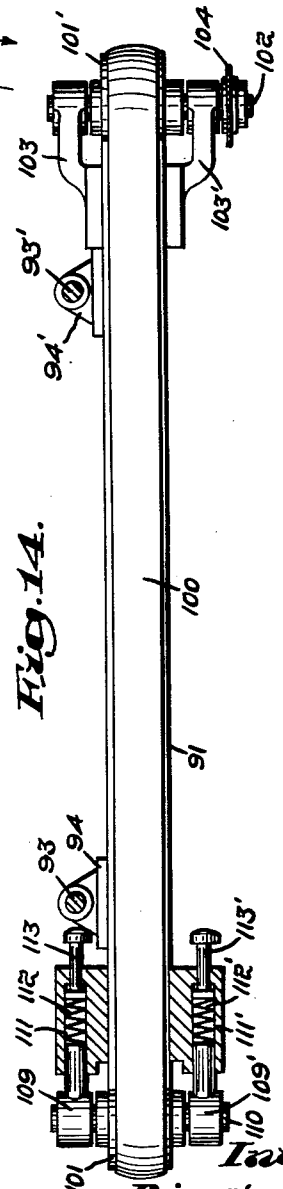


Fig. 14.

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United States Patent Office 3,035,498 Patented May 22, 1962

3,035,498

MACHINE FOR JOINING CORRUGATED PAPER TUBES

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Filed Jan. 28, 1959, Ser. No. 789,697
Claims priority, application Italy Feb. 4, 1958
4 Claims. (Cl. 93—77)

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 invention according to 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 join line, 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 papers with the aid of 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 of 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 device 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, which device is after the flattening device, a bending device for bending the sheet and overlapping the margins in such a manner that the flattened margin adheres to the unflattened margin, a guide which extends parallel to the direction of advance of the sheet between the flattening device and the bending device and which prevents lateral displacements of the sheets of paper when passing from the flattening device to the bending device, and a second guide provided in the portion of the bending device in which the two margins are overlapped and arranged to ensure the exact overlapping of the two margins.

Where the sheet of paper is formed of two superimposed layers, the machine is preferably provided with a device for folding a portion at the edge of the flattened margin in order to prevent the separation of the two layers, which device comprises a guide and a counter guide, between which the edge of the margin passes, preferably simultaneously with the passage of the remainder of the margin between the guide and the counter-guide flattening the margin.

The machine may also be provided with a device for knurling the flattened edge for the purpose of stiffening the same and rendering it uniform, which device comprises a pair of hot knurling rollers, through which the margin is passed immediately after being flattened.

A further improvement consists in equipping a machine according to the invention with a series of interchangeable drivers adapted to be applied at pre-selected intervals to chain links of the conveyor, and serving to extract sheets from a hopper and feed them through the various stages of the machine, which drivers are each provided with a stem for engaging in a link and having a recess for engagement by a spring-loaded ball provided in the link which permits rapid application of the driver to a pre-selected link and equally rapid extraction of the same therefrom with the aid of a special device for facilitating the interchange of the drivers when changing the sizes of the packing tubes or the thickness of the corrugated or double corrugated paper used.

A paper tube forming machine in accordance with the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

FIGURES 1 and 1*a* together represent a diagrammatic side elevation, partly in cross-section, of one form of machine constructed according to the invention;

FIGURES 2 and 2*a* are plan views, partly in cross-section, of the machine illustrated in FIGURE 1, in which, however, one entire device has been omitted in order to make the illustration clearer;

FIGURE 3 is a fragmentary perspective view of a paper tube just prior to completion of the joint by the machine;

FIGURE 4 is a fragmentary cross-section, somewhat enlarged, of one link of the chain, for feeding the sheets, incorporating a driver mounted therein;

FIGURE 5 is a fragmentary cross-section, somewhat enlarged, of a device for the rapid extraction of the drivers from the conveyor chain;

FIGURE 6 is a fragmentary cross-section, somewhat enlarged, taken along line 6—6 of FIGURE 2;

FIGURE 7 is a plan of the group of devices, for flattening the edge, shown in FIGURE 6, the knurling rollers being omitted to permit of a clearer drawing;

FIGURE 8 is a cross-section taken along line 8—8 of FIGURE 6;

FIGURE 8*a* is an enlarged fragmentary cross-section taken in the region of the profiled guides illustrated in FIGURE 8;

FIGURE 9 is an enlarged framentary perspective view of the guide for holding the sheet of paper from the stage in which the edge is knurled to the stage in which the sheet is bent into a tube;

FIGURE 10 is an enlarged fragmentary cross-section,

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 flattening 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 doubled 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, for 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 lap 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 slots **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, 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 the bottom and successively 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 a stem **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 has a return spring **26** and 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 related 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 betwen the extensions of the guides **5**, **5'** and kept in position by a cover plate **28**, which may be suitably adjusted in height to confnrm 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 under 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 hold and 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 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 conform 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 8*a*) and a profiled guide **45**, are shaped to progressively spread and flatten the two corrugations nearest the edge of the sheet. A scroll **46** simultaneously folds over the marginal half corrugation to form the folded over 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 knurling.

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'** and **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** slidable 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 two 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 8*a*) 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 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 to the point where both the guide **44** and the counter-guide **45** become flat, at which point the sheet issues from them.

Similarly, the scroll **46** (FIGURE 8*a*) 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 of the sheet. This channel **46''** thereafter 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 face of the edge of the sheet of paper *a*. The rotatable disc **61** is mounted on the same shaft as a wheel **61***a* 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 2). The guide **65** (FIGURE 9) consists of a long metal bar, the lower edge **66** of 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 flattened annular section core **69**. The core **69** 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 *b*.

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 *b* 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**, to conform 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'** to permit of 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'**. As the strip **100** rotates in the same 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 chafe 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 feeding 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 shaft **29** already 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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