June 28, 1927. A. M. BATES 1,634,067

PROCESS AND APPARATUS FOR FORMING TUBES

Filed Jan. 19, 1925 4 Sheets-Sheet 1

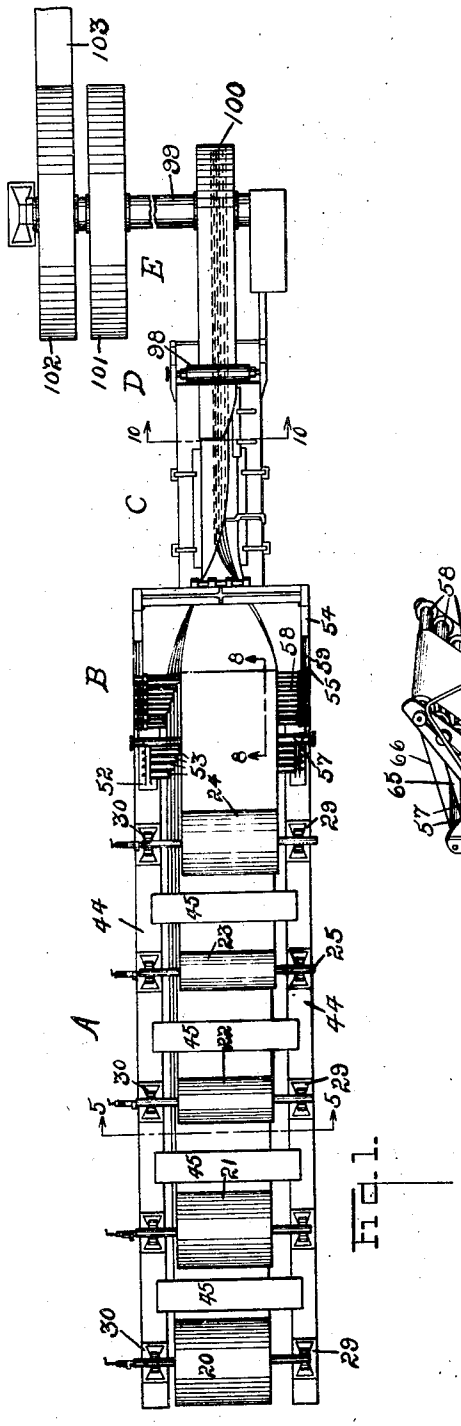


Fig. 1.

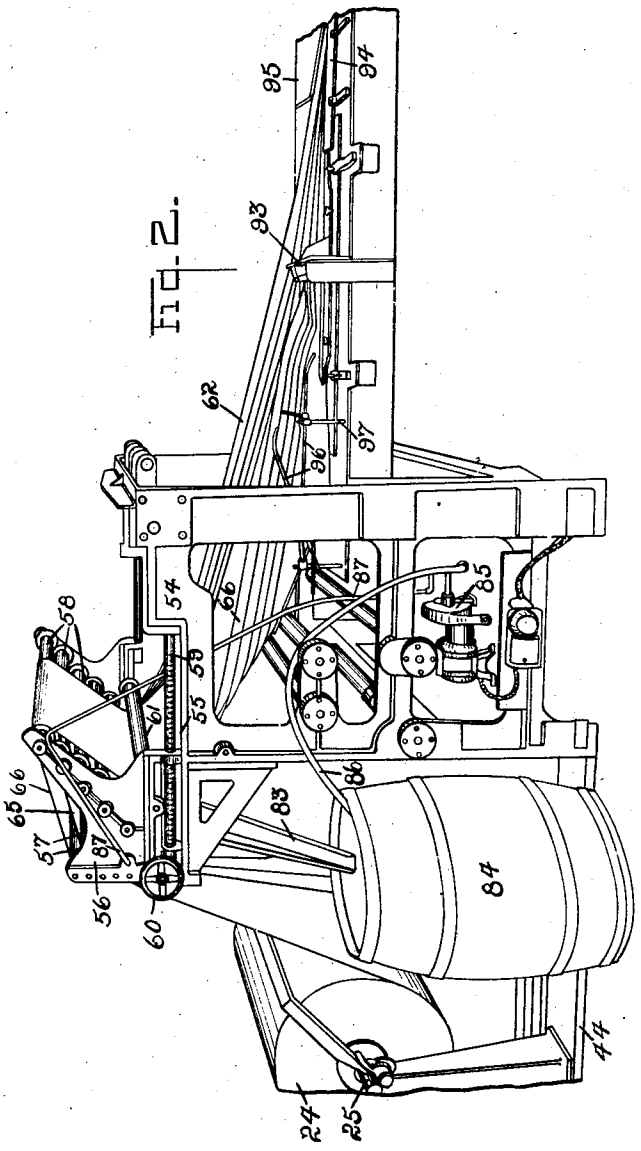


Fig. 2.

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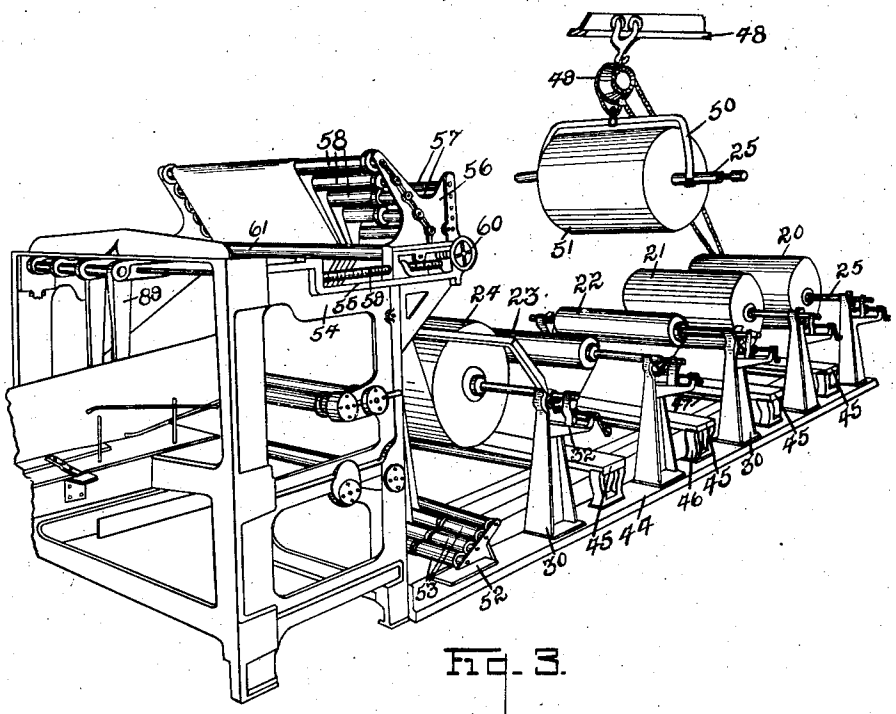


Fig. 3.

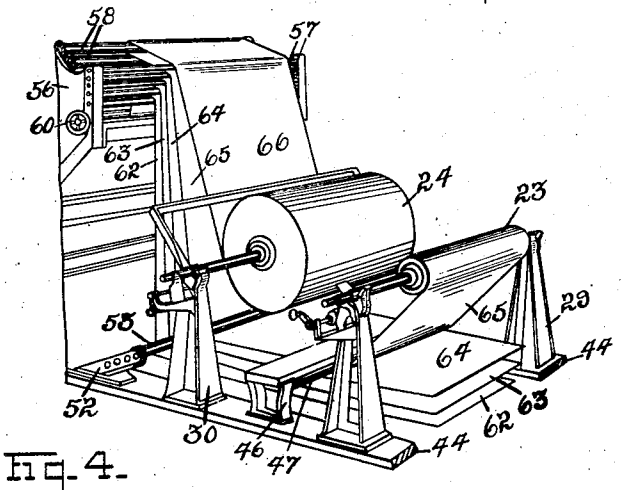


Fig. 4.

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PROCESS AND APPARATUS FOR FORMING TUBES

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FIG. 6.

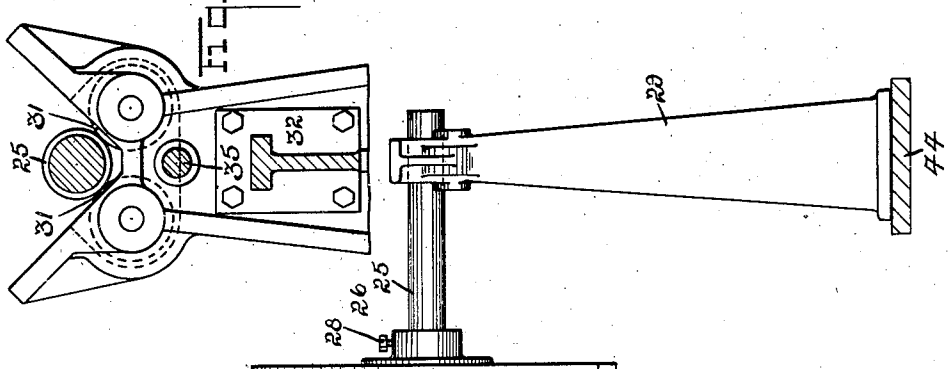


FIG. 5.

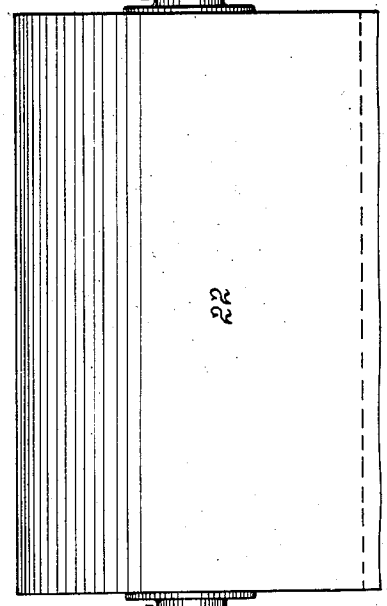
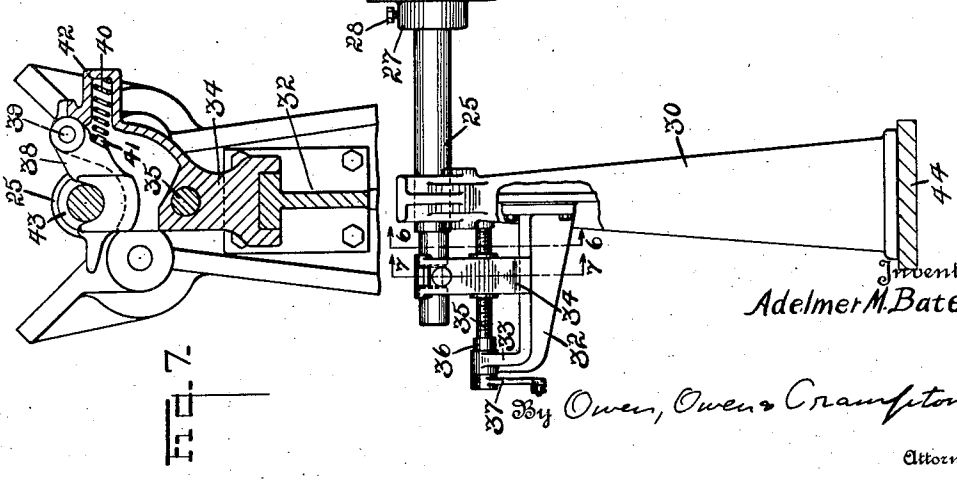


FIG. 7.



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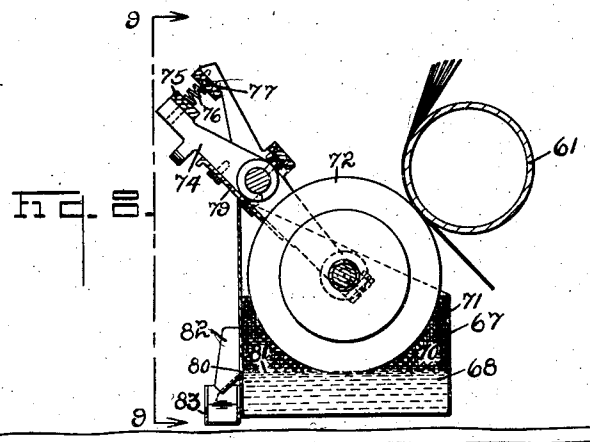


FIG. 8.

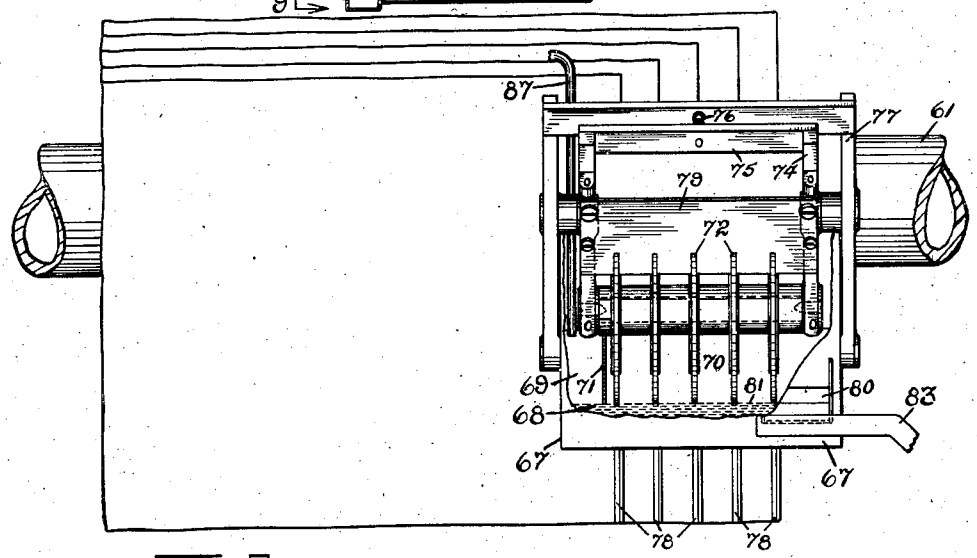


FIG. 9.

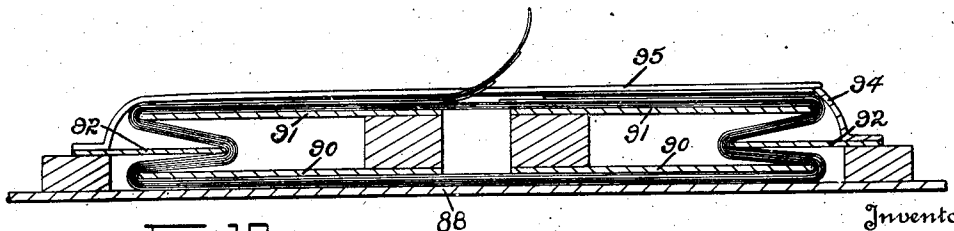


FIG. 10.

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UNITED STATES PATENT OFFICE.

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PROCESS AND APPARATUS FOR FORMING TUBES.

Application filed January 19, 1925. Serial No. 3,438.

This invention relates to a process and apparatus for forming tubes.

The object of the invention is to provide a process and apparatus by means of which a plurality of strips may be progressively formed into a plurality of nested tubes. The particulars of the invention and further objects thereof will appear as the description proceeds.

In the accompanying drawings forming a part of this specification, Figure 1 is a plan view of apparatus embodying the invention; Fig. 2 is a perspective view of a portion of one side of the apparatus; Figs. 3 and 4 are perspective views of portions of the other side of the apparatus; Fig. 5 is a vertical section on the line 5—5 of Fig. 1; Figs. 6 and 7 are sections on the lines 6—6 and 7—7 of Fig. 5; Fig. 8 is a section of a portion of the apparatus, the plane of the section being indicated by the line 8—8 in Fig. 1; Fig. 9 is a rear elevation of the portions of the apparatus shown in Fig. 8 with parts broken away; Fig. 10 is a partial section taken substantially on the line 10—10 of Fig. 1.

The apparatus for forming tubing herein disclosed comprises means for receiving rolls of tubing and feeding them out, this portion of the machine being generally indicated by the letter A. From this portion of the machine the strips are drawn over and through guiding and adhesive-applying means B and through folding means C by drawing and feeding means D, from which the folded tube passes to coiling and storing means E.

The invention contemplates the use of a plurality of strips originally wound into rolls. In the embodiment of the invention herein disclosed five such strips are used at a time, the rolls from which they are taken being indicated as 20, 21, 22, 23 and 24. Each of these rolls is supported on a shaft 25. There are collars 26 and 27 on the shaft at the two ends of the roll and these collars are held in fixed position by set screws 28, so that the roll is held firmly in position upon the shaft.

The shaft is mounted upon pedestals 29 and 30, the upper ends of such pedestals being provided with anti-friction wheels 31 upon which the shaft rests. A bracket 32 is attached to the outer side of the pedestal 30 and has an up-turned end 33. A slide 34 is mounted for reciprocation upon bracket 32. A rod 35 is threaded through the slide 34 and passes through the up-turned end 33 of bracket 32. Rod 35 is held against longitudinal movement through up-turned end 33 by a collar 36 and crank 37, the crank serving as means for turning the rod to adjust the slide when desired.

A catch 38 is mounted upon a pivot 39 suitably fixed in slide 34. A coiled spring 40 has one end surrounding a stud 41 on catch member 38 and the other end within a socket 42 in slide 34. This spring normally presses the catch member upward. The shaft is provided with a groove 43 adapted to receive catch 38. By this means the longitudinal position of the shaft in relation to pedestal 30 is fixed in accordance with the adjustment of slide 34.

The pedestals 29 and 30 rest upon sills 44. Between each pair of adjacent rolls there is a runway platform 45 mounted upon brackets 46 which rest upon the sills. This allows the workmen to pass across the machine between any pair of the stock rolls. Beneath each runway platform there is a guide roller 47 which guides the strip from the roller in the rear thereof, as the strip passes forward to the tube-forming devices.

An overhead track 48 is provided over the shaft supports. A carrier 49 movable along this track, carries member 50 attached to a shaft 25 having thereon a stock roll 51 adapted to be positioned upon a pair of supports 29 and 30, when the roll previously supported thereby is exhausted.

In front of the stock roll supports, upon sills 44, there are brackets 52 carrying guide rolls 53 to which the strips pass from the four rear stock rolls. In front of the sills 44 there rises a frame 54 having a slideway 55. Upon this slideway there rests guide roll brackets 56 carrying rear guide rolls 57 and front guide rolls 58. Above the slideway 55 there is a fixed adjusting bar 59 lengthwise of which bracket 56 is moved by an adjusting wheel 60. Brackets 56 likewise carry a final guide roll 61.

As will be seen from an inspection of the drawings, the strip from stock roll 20 passes beneath the roller 47 on the under side of the adjacent runway platform 45 and beneath the strips fed from the other stock rolls to the lowest one of the guide rolls 53, and from there over the lowest ones of guide rolls 57 and 58. Strips 63, 64 and 65, from stock rolls 21, 22 and 23 follow a substan-

tially similar path, each successive one passing underneath the successively higher roll 53 and over the successively higher rolls 57 and 58. Strip 66, from stock roll 24, passes directly upward over the highest rolls 57 and 58 and downward beneath the final guide roller 61, sheets 65, 64, 63 and 62 passing therebeneath in the order named. As will be seen, the several guide rolls guide the strips forward through separate paths until they reach the final roll 61, where they are brought into contact with each other for the first time.

As clearly disclosed in Figs. 8 and 9, there is a tank 67 positioned in the rear of guide roll 61 and adapted to contain a suitable adhesive 68. The tank is adapted to receive a supply of adhesive in its left end 69, as viewed in Fig. 9. The adhesive in the main body 70 of the tank is separated from that in end 69 by a screen 71 which prevents the passage, into the main body of the tank, of any coarse particles or stiffened portions of adhesive.

Adhesive applying means is mounted in the main body of the tank and comprises a series of discs 72 rotatably mounted upon a rod 73, which in turn is mounted in the ends of adjusting levers 74. A bar 75 connects the rear ends of levers 74, and a spring 76, between bar 75 and a fixed bar 77, normally presses the rear ends of the levers downward and thereby raises the discs against the strips passing beneath guide roll 61. The discs contact the surface of the adhesive in the tank and each disc applies a streak 78 of the adhesive to one edge of a strip of material passing beneath guide roll 61. It is preferable to apply the adhesive a short distance from the edge of the strip, as shown in Fig. 9, so that, when the two edges of the respective strips are pressed together, the adhesive will not be pressed out beyond the edge of the strip. A scraper plate or doctor 79 is provided for scraping off any excess adhesive which may adhere to the edges of the discs.

An overflow aperture 80 is provided in the side of tank 67 near its right end. During normal operation, the adhesive 68 rises to a level 81 slightly above the lower edge of aperture 80, and so flows out through such aperture. An overflow spout 82 is provided which guides the overflowing adhesive into a spout 83, which in turn leads into a reservoir 84 of adhesive. A pump 85 is provided for drawing adhesive through pipe 86 from near the bottom of reservoir 84 and forcing it through pipe 87 into the receiving end of tank 67.

In front of and beneath guide roll 61, there is a folding table 88. Supports 89, attached in a suitable manner to frame 54, support internal folding plates or runways. In the device shown, these internal plates include a lower runway 90 and an upper runway 91 for each side of the tube. Attached to each side of the folding table there is a gusset-forming plate 92 which projects between the said upper and lower folding plates or runways, and in that manner side folds or gussets are formed in the tube. A bracket 93 may be used for any necessary support of internal folding plates or guides.

At the front end of the folding table there is a narrow top plate 94 for confining the fold on one side of the tube, while broad top plate 95 completes the folding down of the upper flaps into position to complete the tube. Additional guide rods 96 may be supported on brackets 97 and used for guiding the material wherever necessary.

In front of the folding table there is the feeding device, including rollers 98, the upper one only of which is shown. These rollers are actuated by any suitable mechanism, which it is not necessary to show or describe, and operate to draw the strips from the stock rolls past the guide rolls and through the folding means and feed it forward to the coiling and storing means.

In front of these feed rolls there is a storage shaft 99 about which the completed tube is received and coiled, as shown at 100. After a coil has been completed, it may be moved over towards the other end of the shaft and two completed coils 101, 102 are shown. The completed tube will be led away from any of the stored coils, as indicated at 103, to any desired means for treating the tubing, such as a cutting or printing device.

In the operation of the device, a plurality of rolls of material, preferably paper, are mounted upon a number of shafts 25, the collars 26 and 27 being so adjusted that each roll will be the proper distance from groove 43. The requisite number of stock rolls, five in the device disclosed, are mounted upon the supports and adjusted so that catches 38 will enter the grooves 43 of the several shafts. Cranks 37 are operated so that the rolls will be out of alignment, with roll 20 nearest to support 30, roll 24 nearest support 29, and the intermediate rolls in intermediate positions. Strips are then led forward from the various stock rolls beneath and over the proper guide rolls to the folding device. The location of the stock rolls results in a stepped relation of the strips when they are superposed.

As will be readily apparent, the several strips do not come in contact with each other until they reach the final guide roll where adhesive is applied, and thereafter the material is fed through the folding device without bending about any transverse axis in such a manner as to produce a material movement of the strips with respect to each other longitudinally thereof. It may be noted that when the edges of the strips to

which adhesive has been applied are folded upward and inward, the inner strip 66 is bent about the shortest axis, so that the distance apart of the applied streaks of adhesive is increased by this bending operation. Furthermore, the bending upward and inward of the sides of the strip to which adhesive is applied is completed before the adhesive comes in contact with any of the uncoated edges united, and, therefore, there is no necessary movement of the strips laterally with respect to each other after the two edges of any strip are united by adhesive.

When the stock upon any of the shafts 25 is exhausted, another shaft 25 carrying a supply roll properly positioned thereon is moved over the exhausted shaft and lowered onto the supports. The end of the strip forming the new stock roll is secured to the end of the strip from the exhausted roll, and thus a continuous tube can be formed without any break where the various stock rolls are exhausted.

A quantity of adhesive in excess of that used is introduced into tank 67, so that there is a constant overflow of adhesive from the surface of the pool in the tank. Rotation of the discs impels the surface of the pool towards the side of the tank in which the overflow opening is situated, so that any bubbles or other surface imperfections are piled up against that side of the tank and are carried off by the overflow. It may be noted also, that any lumps or excess of adhesive scraped from the discs by the scraper plate or doctor fall on the surface of the pool towards the side from which the overflow is drawn. The fresh supply drawn from near the bottom of storage receptacle 84, does not contain surface imperfections, and any other imperfections are strained out by screen 71. The result of these provisions is that the discs run in uniform adhesive, and the applied streaks of adhesive are continuous and uniform in quantity and quality. This is particularly advantageous where a comparatively narrow streak of adhesive is applied along the edge of each strip of material, as any imperfection might result in an imperfect seam. Further, it is highly desirable, where there are a plurality of closely adjacent seams, such as shown in this disclosure, that each seam shall be comparatively narrow and uniform.

While one embodiment of the invention has been described in some detail, it will be understood that various modifications may be made within the scope of the invention as defined in the appended claims.

What I claim is:

1. The method of making tubes, which consists in mounting rotatably a plurality of rolls of material, drawing a sheet from each roll, superposing the sheets and folding them so as to form a tube and when one roll is exhausted, replacing it with another roll and securing the end of the sheet in the replacing roll to the sheet in the exhausted roll so that the tube may be continuous.

2. A process of making a multi-ply tube, which consists in mounting rotatably, in a row extending from a folding and tube-forming apparatus, a plurality of rolls of material, drawing a sheet from each roll to said apparatus, each sheet being passed beneath such of said rolls as are between the source of the sheet and said apparatus, continuing the operation until one of the rolls is exhausted and then lowering from above a fresh roll into the place previously occupied by the exhausted roll.

3. In apparatus for forming a multi-ply tube, a plurality of shafts, each adapted to support a roll of material, means to support said shafts in substantially parallel relation and separate means to adjust each shaft in its supports.

4. In apparatus for forming a multi-ply tube, a plurality of similar shafts, each adapted to support a roll of material and each having a groove near one end, a plurality of similar supports for said shafts adapted to hold said shafts in parallel relation and an adjustable member connected with the support for each shaft and adapted to enter a groove in the shaft mounted in the associated support.

5. In tube forming apparatus, a shaft having a groove in one end and adapted to support a roll of material, upwardly open bearings adapted to support said shaft, means adapted to lower the shaft onto one of the bearings, a guide member mounted adjacent said bearing and adapted to enter said groove, resilient means normally urging said member upward, and a stop for said member normally stopping the upward movement of said member in position to occupy said groove when the shaft is in properly adjusted longitudinal position and resting on said bearings.

6. In apparatus for forming multi-ply tubing, a device adapted to receive a plurality of sheets of material in superposed stepped relation and form them into a multi-ply tube, a plurality of like supports for rolls of material extending in echelon away from the receiving end of said device, and apparatus for applying adhesive located beneath the path of material from rolls on said supports to said device and on the side of said path towards which the supports are stepped as they approach the device.

7. In apparatus for forming tubes, bearings adapted to support a plurality of roll-carrying shafts in substantially parallel relation, a runway between the bearings for adjacent shafts, and a guide roll beneath each runway adapted to guide material from a roll on an adjacent shaft.

8. Apparatus adapted to receive and operate upon a plurality of superposed sheets of material, means for supporting a plurality of rolls of material with their axes parallel and in a line transverse their axes, extending away from said apparatus, a runway between each pair of adjacent rolls, and means to guide the sheet from each of the rolls, except that nearest to said apparatus, beneath the intervening rolls and runways to said apparatus.

9. In apparatus for forming multi-ply tubes, supports for more than two rolls of material, a final guide roll, intermediate guide rolls arranged to guide sheets from rolls of material mounted on said supports to said final guide roll and maintain the sheets separate until they reach said final guide roll, and folding apparatus arranged to receive the superposed sheets directly from said final guide roll and to fold them into tubular form while still in contact with each other.

10. In apparatus for forming multi-ply tubes, means to feed a plurality of sheets of material into contacting superposed stepped relation to each other against the underside of a guide roller, means to apply adhesive to the stepped edges of the sheets beneath said roller, and means for folding upward and inward the edges of the superposed sheets to form a multi-ply tube.

11. In apparatus for forming multi-ply tubes, a device adapted to receive a plurality of sheets of material in superposed stepped relation and form them into a multi-ply tube, supports for more than two rolls of sheet fabric arranged to support said rolls in alignment with and at successively greater distances from said device, a final guide roll from which the sheets are fed to said device and intermediate guide rolls maintaining the sheets from the several supply rolls separate until they reach the final guide roll.

12. Apparatus in accordance with claim 11, and having the supply roll supports so arranged that the supply rolls will have their axes in substantially the same horizontal plane, and having the intermediate guide rolls so arranged that the sheet from each supply roll is led to said device beneath any intervening supply rolls.

13. Apparatus in accordance with claim 11, and having the intermediate guide rolls arranged to guide the sheet from each supply roll beneath any other supply roll between it and the forming device and to points above the final guide roll and thence downward to the underside of the final guide roll.

14. Apparatus in accordance with claim 11, and having certain of the intermediate guide rolls adapted to guide sheets from the several supply rolls beneath other supply rolls until they have passed under the supply roll nearest to the forming device, and having other guide rolls adapted to guide the sheets upward between the forming device and the supply roll nearest to the forming device and then downward into contact with each other against the lower side of the final guide roll.

15. Apparatus in accordance with claim 11, and having certain of the intermediate guide rolls adapted to guide sheets from the several supply rolls beneath other supply rolls until they have passed under the supply roll nearest to the forming device, and having other guide rolls adapted to guide the sheets upward between the forming device and the supply roll nearest to the forming device and then downward into contact with each other against the lower side of the final guide roll, and means for adjusting the last described intermediate guide rolls and the final guide roll towards and from said forming device.

In testimony whereof, I have hereunto signed my name to this specification.

ADELMER M. BATES.