

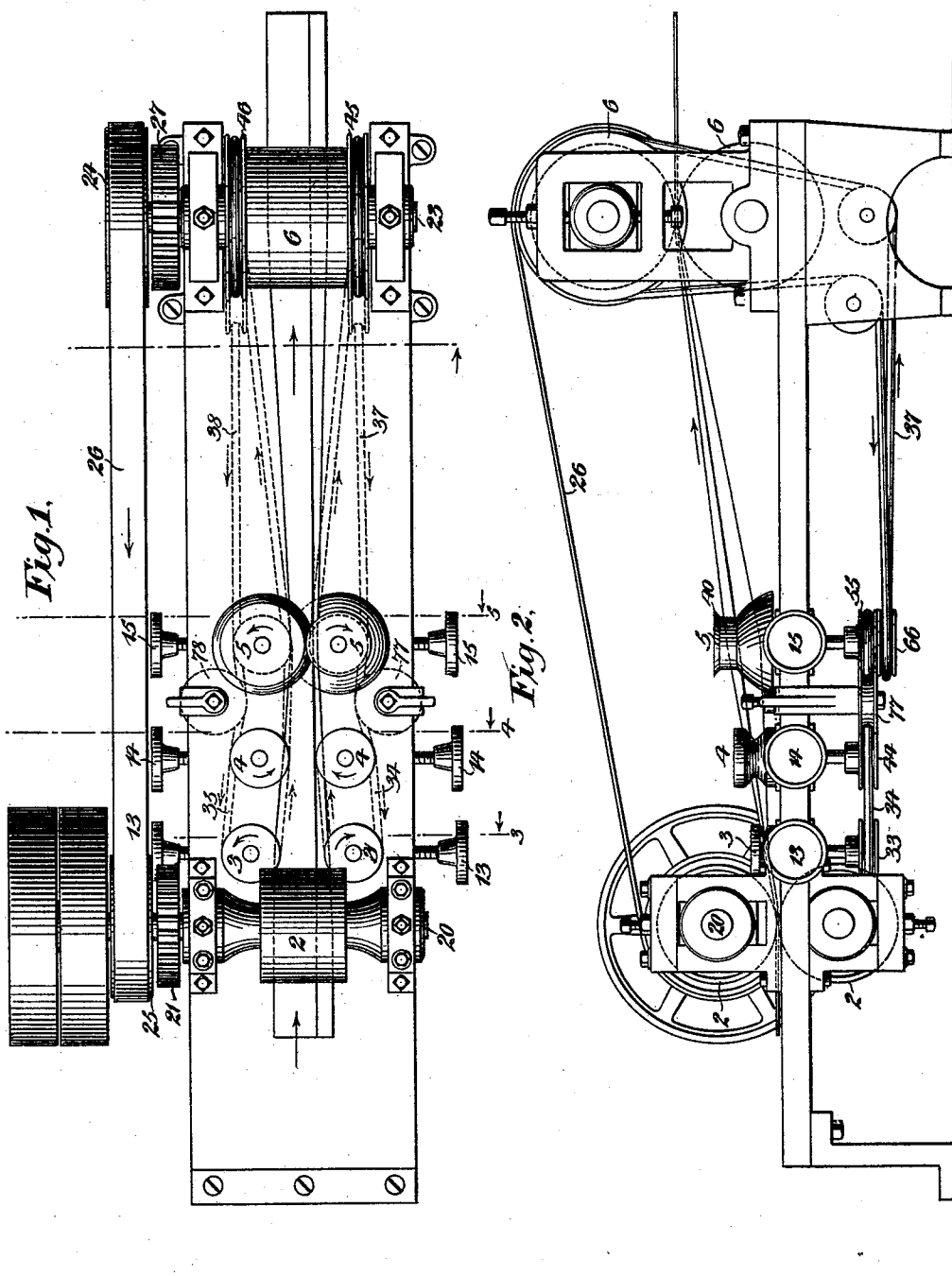
(No Model.)

4 Sheets—Sheet 1.

H. S. MUNSON.
MACHINE FOR REFOLDING PAPER TUBES.

No. 583,072.

Patented May 25, 1897.



Witnesses:
Edward Thorpe.
Gustav

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By
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(No Model.)

4 Sheets—Sheet 2.

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Fig. 3.

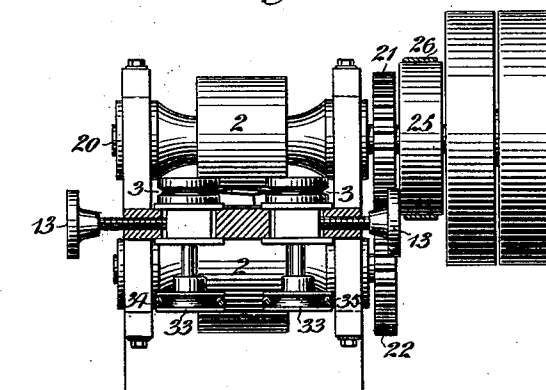


Fig. 4.

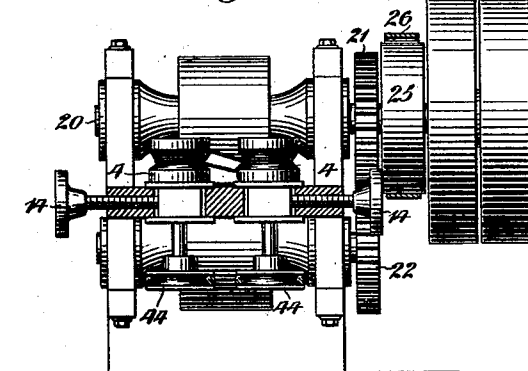
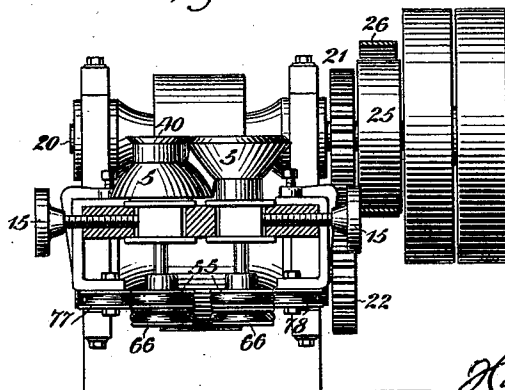


Fig. 5.



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Fig. 6.

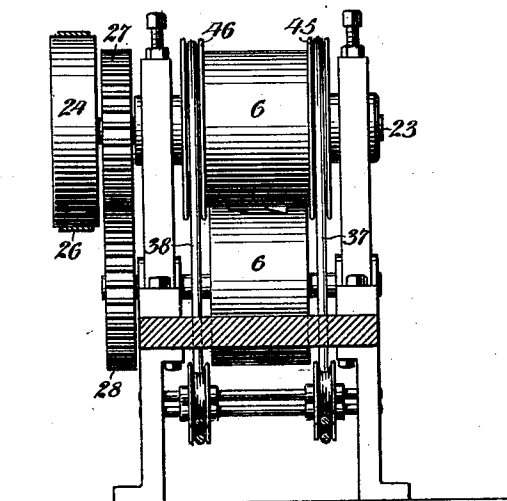
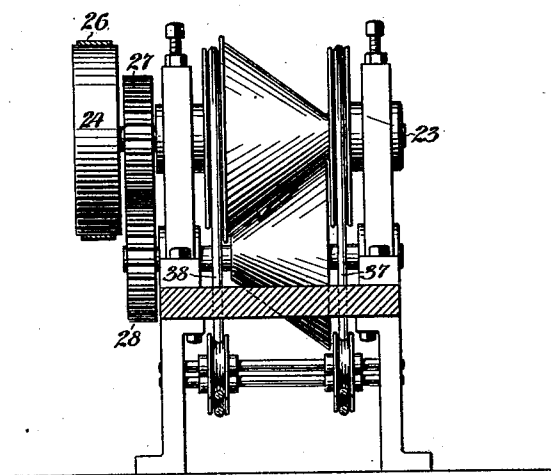


Fig. 7.



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Fig. 8.

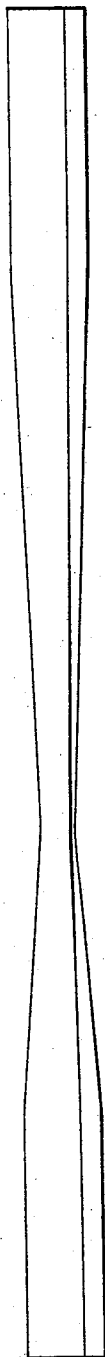


Fig. 9.



Fig. 10.

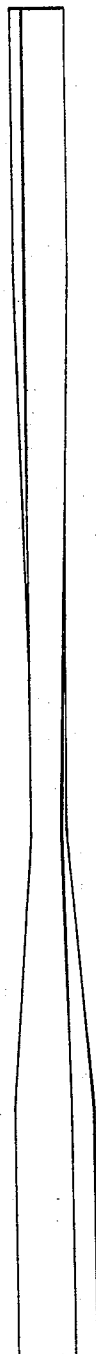
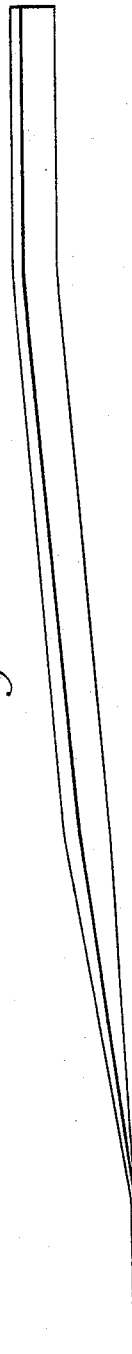


Fig. 11.



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UNITED STATES PATENT OFFICE.

HARVEY S. MUNSON, OF NEW HAVEN, CONNECTICUT.

MACHINE FOR REFOLDING PAPER TUBES.

SPECIFICATION forming part of Letters Patent No. 583,072, dated May 25, 1897.

Application filed April 19, 1893. Serial No. 470,952. (No model.)

To all whom it may concern:

Be it known that I, HARVEY S. MUNSON, a citizen of the United States, residing at New Haven, county of New Haven, and State of Connecticut, have invented certain new and useful Improvements in Machines for Refolding Paper Tubes, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of this invention is the mechanical performance of the operation of preliminary folding, or, as it is sometimes called, "refolding" or "breaking back" the once-folded seams, and folding or bending the creased, indented, or embossed lines constituting the other or blind and unfolded seams, by which seams the four sides of the box-tubes are united, so as to be opened up into substantially rectangular form in cross-section for use, said tubes being formed from flat blanks suitably creased longitudinally for such folding and having their free edges lapped and secured together to constitute tubes capable of being collapsed or rendered flat for purposes of storage or shipment and of being opened up by bending them upon their folding-lines, so as to attain a substantially rectangular or hollow form suitable for the reception within them of contents, such as a slide.

Of the said four sides the broader ones are hereinafter referred to as the "top" and "bottom" and the narrow ones as the "sides," so as to enable their ready distinction from each other, and it is to be understood that ordinarily several of these blanks are associated together during the refolding operation and are afterward cut apart by transverse severance.

In the ordinary course of their manufacture, whether performed by hand or by machinery, the flat blanks of paper, cardboard, or similar suitable material are first properly creased longitudinally upon their lines of ultimate fold, and then have their outside or free edges united to each other by a lapped seam, usually secured by glue, which converts the blank into a collapsed tube. From this manipulation and in this condition it will be obvious that the material has been once folded or bent upon itself along the lines of two (the outermost) of its seams, and that these two

seams will have been pressed flatwise to the greatest degree, thus leaving the other two seams necessary to the formation of a rectangular tube simply embossed, creased, or indented for folding, but unfolded. In manipulating this collapsed tube so as to convert it into a rectangular tube for the reception of its contents the indicated lines for the unfolded seams will exert the greater resistance, for the reason that they will then receive their first folding operation; and consequently where such box-tubes are opened up to be packed with their contents by the aid of mechanical devices this resistance in the unfolded seams will present a difficulty in and obstruction to that operation, which subjects the manufacturing packers to additional cost in the delay and otherwise during such packing manipulation. If, however, during the manufacture of the tube all of its uniting-seams are once folded or bent upon themselves, they will be equally susceptible to such subsequent manipulation as must ultimately be given to them in converting the flattened tube into a hollow tube for or reception of contents, and hence when so treated they will be capable of easy manipulation during the packing operation. This manipulation of the uniting-seams is a refolding operation upon the creased or otherwise indicated folding-lines of the tube, and especially of the blind or unfolded seams called "refolding" or "breaking back," which imparts to all of its four seams the same manipulation—that is, in forming the flat tube the material is bent upon itself along the line of two of its seams, and then, through the refolding operation upon the tube, the material is so manipulated as to fold or bend it upon itself along the line of its two remaining or unfolded seams, although in the case of the once-folded seams they are broken back or refolded. Thus each seam is bent, weakened, or manipulated in substantially the same manner, by which it results that all of the parts of the tube may be easily moved under uniform resistance in transforming it from a flat into a tubular form, thus capacitating the tube to be dealt with by mechanisms or by hand in the packing operation without any of its seams offering undue resistance thereto.

The invention consists, broadly, in a means for folding, refolding, or breaking back a flat-

tened or collapsed box-tube composed of cardboard or similar material properly creased, embossed, or indented on its longitudinal folding-lines by passing the same between moving sides or walls, whereby each tube is gradually contracted widthwise or opened up to rectangular form in cross-section and then is gradually extended and again collapsed, being thus so manipulated by moving on its folding-lines as to render it uniformly supple, flexible, or limp.

The invention includes moving upsetting-rollers in one of its forms, and embraces, in coöperative combination with such upsetting-rollers, both feeding and drawing rollers. It also embraces modifications and constructions of parts, all of which features of invention are fully hereinafter described, and pointed out in the claims.

Practical embodiments of these improvements are illustrated in the accompanying drawings.

In the drawings section-lines mark the plane in which an illustration is made, the reference-number for the line indicates the figure which embodies the view, and the arrow-head connected with each section-line points the direction in which the picture is seen. Feathered arrows show the direction of movement of the parts with which each is associated, and like reference-characters designate corresponding parts.

Figure 1 is a plan view of a machine for performing a refolding operation upon tubular blanks designed as the outer part or envelop of a box. Fig. 2 is a side elevation thereof. Fig. 3 is a cross-sectional elevation on the line 3 of Fig. 1, showing more particularly the upsetting-rollers 3 3 as seen looking toward the receiving end of the machine. Fig. 4 is a similar view on the line 4 of Fig. 1, showing more particularly the upsetting-rollers 4 4 as seen looking at the receiving end of the machine. Fig. 5 is a similar view on the line 5 of Fig. 1, showing more particularly the upsetting-rollers 5 5 as seen looking at the receiving end of the machine. Fig. 6 is a similar view on the line 6 of Fig. 1, showing more particularly the drawing-rollers 6 6 as seen looking at the delivery end of the machine. Fig. 7 is a view similar to that shown in Fig. 6, but illustrating a modification of the drawing-rollers. Figs. 8 and 9 are respectively plan and side elevations of a long tube or a series of connected short tubes in different stages of the operation of refolding the same as performed by the mechanism shown in Figs. 1 to 6. Figs. 10 and 11 are similar views of a tube as manipulated by the use of the modified drawing-rollers shown in Fig. 7.

In order to aid a ready understanding of these improvements, the general construction and arrangement of parts and their driving mechanisms in a preferred form herein illustrated will first be described and then their operation will be explained. The machine

shown embodies a pair of horizontal feeding-rollers 2 2, mounted upon suitable axes in journals supported by the bed at the feeding end of the machine, and a pair of drawing-rollers 6 6, similarly supported at the delivery end of the machine, both feeding and drawing rollers being preferably sufficiently near to cause each pair to frictionally move the tube. Between these feeding and drawing rollers are pairs of upsetting-rollers arranged upon vertical or suitable axes. The first pair 3 3, placed slightly in advance of the feeding-rollers 2 2, have grooved peripheries adapted to receive, guide, and control the outermost edges or folded seams of two folds of the flat tube. The second pair 4 4 are likewise grooved, but the grooves are so shaped as to support and act not only upon the outermost edges thereof but bear upon the narrower sides of the tube when the same has been partially opened, so as to separate its top and bottom. Throughout their main portion the peripheries of the third pair 5 5 are conical, but they may be modified so as to become conoidal, in either form acting to support and control the tube upon its top and bottom or widest parts, or their shape may be such as to bear upon all sides of the tube, the tube during its passage through these rollers being in or nearly in a refolded condition. The uppermost of the feeding-rollers 2 2 is in this case upon the main driving-shaft 20, and the pair of these rollers 2 2 are geared together, so as to revolve in unison by means of spur-wheels 21 22. The uppermost of the pair of drawing-rollers 6 6 is mounted upon a shaft 23, that carries a pulley 24, whereby motion is transmitted to it from the driving-shaft 20 by means of a pulley 25 thereon and a driving-belt 26, running over said pulleys 24 25.

The drawing-rollers 6 6 are geared together by means of spur-wheels 27 28, by which they are driven in unison. The pairs of upsetting-rollers 3 3, 4 4, 5 5 are respectively provided with grooved driving-pulleys 33 33, 44 44, and 55 55, around which run driving-bands 34 35, whereby said rollers are driven in unison, said driving-bands being held to duty by grooved tightening-pulleys 77 78, and the whole series of upsetting-rollers are driven in unison with the feeding and drawing rollers by means of driving-bands 37 38, that run around grooved pulleys 66 on the shafts of the upsetting-rollers 5 5 and over grooved driving-pulleys 45 46 on the shaft 23 and intermediate grooved guiding-pulleys.

The feeding-rollers and drawing-rollers are adjustable vertically by means of sliding boxes and adjusting-screws, as shown, and the respective pairs of upsetting-rollers 3 3, 4 4, 5 5 are adjustable to and from each other by means of sliding boxes and adjusting-screws 13 13, 14 14, and 15 15, which adjustment of the upsetting-rollers is for two purposes—primarily, to adjust the respective rollers with respect to each other in order that the refolding operation may be perfectly performed by

each set, and, secondarily, for the purpose of moving said rollers to the degree necessary to enable the machine to operate upon different widths and thicknesses of collapsed tubes.

The double adjustment of the feeding-rollers 2 2 is, primarily, to enable the same to be adjusted correctly with respect to the first pair of upsetting-rollers 3 3, and, secondarily, to suit the thickness of the collapsed tube due to the material composing it, and the adjustment of the drawing-rollers 6 6 is for the latter purpose.

Single tubes of a box length or preferably of a length suitable for the construction of many boxes, in which case the short lengths are subsequently separated by transverse cuts, are fed either by hand or by a feeding mechanism, such as the machine in which flat blanks are converted into collapsed tubes, and thus they are directed in their flat or collapsed condition when their plies approximately form a line between the feeding-rollers 2 2. These rollers advance the tube to the nip of and between the upsetting-rollers 3 3, the grooves of which are either shaped to exactly receive the outer edges of the collapsed tube or adjusted toward each other, so as to not only receive its edges, but very slightly compress the tube, thus opening or allowing the flattened tube to open to a slight extent, as shown in Fig. 3. As the tube advances from these upsetting-rollers 3 3 its leading end, slightly opened by the action of the rollers 3 3 or by its own inherent expansive action, passes to the nip of and between the upsetting-rollers 4 4, the grooves of which are so shaped and related as to still further open the tube, (see Fig. 4,) the conical shape and extent of the recesses in said rollers being preferably such as to cause the narrower sides of the hollow tube to be largely or fully supported, as shown. By considering this Fig. 4 and the open condition which the tube then has with respect to its almost flat condition (shown in Fig. 3) it will be observed that the pressing action of the upsetting-rollers 3 3 has caused the tube to gradually change its shape in cross-section and converted the leading end of what was an almost flat tube into approximately rhomboidal shape, which is the form imparted to the tube in passing through the rollers 4 4. As the now well-opened end of the tube enters between and passes through the upsetting-rollers 5 5, the working surface or upper part of one of which is conical, while the working surface or lower part of the other is conoidal, (see Fig. 5,) said rollers press upon the wider portions or top and bottom of the tube, thus causing the tube to be so far refolded as to pass through and beyond the rectangular conformation, as shown in Fig. 5, and again become rhomboidal or approach a collapsed condition in a direction opposite to that which the parts had when the tube entered the machine and having the angles uniting its sides at the folding-lines

reversed. From these upsetting-rollers 5 5 the tube enters between the drawing-rollers 6 6, the surfaces of which are horizontal and parallel and operate to press the tube flat or bring its plies again approximately to a line and deliver the same out of the machine entirely refolded.

It will be observed that the collapsed and the partially-refolded tube in all conditions of shape it has in being distended and refolded will, as it approaches each of the pairs of upsetting-rollers, be readily received between the same by reason of the flaring guide their circular form presents for the leading end of the tube, and hence that each pair of upsetting-rollers will not only readily receive the tube, but truly and effectively act upon it to progressively open the same by bending it upon its creased or otherwise indicated lines.

It will be understood from a consideration of Figs. 8 and 9, which show the varying condition of the parts of the tube from its collapsed state through its changes in being refolded and its return to the collapsed condition, that the sides, top, and bottom of the tube all move laterally upon their uniting-seams, which, acting as hinges, thus become bent and rebent, and hence rendered equally supple, during which operation the course of the tube is somewhat serpentine or twist-like, the moving walls of the die acting to contract the flattened tube gradually at its narrow sides and widening it in a direction at right angles to its top and bottom sides or plies and then gradually widening it in the direction of its narrow sides and gradually contracting it in a direction at right angles to its top and bottom sides or plies to again flatten it. Three pairs of such rollers, as shown, have been found practically and perfectly effective, but the operation may be performed by a less number, or in cases of some material be facilitated by using a greater number of these upsetting-rollers.

In the case of the rollers 4 4, as their operating or active surfaces are the angular ones that bear upon the narrow sides of the tube, it is apparent that they might be mere cones and still operate, but it is preferred to provide them with the shoulders at the termination of the active conical portion. In the case of the rollers 5 5 their conical and conoidal portions are the active parts of these rollers, and hence their circular portions or straight sides, which are shown as extensions of the conical and conoidal portions that are active upon the top and bottom plies or broad sides of the tube, might be omitted, as they are not essential, but it is preferable to have these straight portions in order to secure a perfect operation and a high rapidity thereof, and these portions when straight may form the angle of contact of the corners of the tube or be slightly conical, so as to entirely bear upon the narrow sides of the tube, and the conical or conoidal portions of these rollers may, if desired, be of the same shape—that is, may

be conical or conoidal—but having one conoidal, as shown, is desirable, since curving it outwardly imparts, by inwardly bending the top or bottom of the tube, an overfolding of the formerly-unfolded seams.

As shown, the box-tube when refolded into the condition which appears in Fig. 5 tends by its resiliency to recover or collapse into its former condition, so that as it enters between the drawing-rollers 6 6 it is pressed flat or returned into its first collapsed condition after having been folded in an opposite direction, as we have seen, by the upsetting-rollers. Thus all of the seams in the tube have received a complete refolding, whereby each of the seams is rendered equally limp or supple, thus enabling the tube to be readily opened from a flat to a rectangular or hollow condition to receive its contents.

By substituting for the drawing-rollers 6 6 a pair of conical rollers 7 7 on horizontal shafts, as shown in Fig. 7, or by setting the rollers 6 6 on oblique shafts, which would be their equivalent, the tube may be pressed flat as it emerges from the machine by a continuation of the movement of its parts in the same direction in which they are moved by the refolding-rollers 5 5, as will be apparent.

When the refolding is all in one direction, as will be the case in using the oblique rollers 7 7, the varying condition of the parts of the tube will be substantially as is shown in Figs. 10 and 11, the outermost seams or those which were completely doubled in the collapsed and non-refolded tube becoming the innermost or opened-out seams when the refolded tube is again collapsed. It may now be remarked that though it is advantageous and hence preferred to use the drawing-rollers 6 6 or 7 7 or some equivalent therefor these are not essential, as the refolding operation is accomplished before these rollers are reached, and their function is to restore the collapsed condition of the tube.

The collapsed tube might also be fed to the upsetting-rollers by hand, aided or not by a guide, but it is preferable that a guide should be used and that the same should be feeding-rollers. It will be apparent that the upsetting-rollers may be increased, so as to progressively move the plies of the tube laterally through all of its course, whether that course be partially in one direction and partially in the other, as is indicated in Figs. 8 and 9, or wholly in one direction, as is indicated in Figs. 11 and 12.

It is desirable to positively confine the passing tube in its proper relation to some of the upsetting-rollers, and for this purpose there is added thereto an overhanging rim 40, which thus affords an abutment against which rests one doubled edge or seam of the tube. This is not essential, but a convenient and useful means, aiding the rapid operation of the mechanisms. The mode of driving the upsetting-rollers may be gearing, by which they would

be positively driven, although the belts and pulleys are preferred.

What is claimed is—

1. As a means for refolding or breaking back a flat tube of cardboard previously creased longitudinally, a series of positively-driven rollers arranged in pairs to form a die with moving walls through which the tube is passed and which gradually changes its shape in cross-section from approximately a line at its entering end to a rhomboidal, then rectangular, then rhomboidal again, with the angles reversed from or in the same direction as the previous ones, and then approximately a line, substantially as described.

2. As a means for refolding or breaking back a flat tube of cardboard previously creased longitudinally, a die having moving walls or sides through which the tube is passed and which gradually changes its shape in cross-section from approximately a line to rhomboidal, then rectangular, then rhomboidal again with angles reversed from or in the same direction as the previous ones, and then approximately a line, substantially as described.

3. As a means for refolding or breaking back a flat tube of cardboard previously creased longitudinally, a die having moving walls or sides and contracting the tube at its narrow sides from the entrance end of the die and widening it in a direction at right angles to its top and bottom sides, and then gradually widening it, in the direction of the narrow sides of the tube and gradually contracting it in a direction at right angles to its top and bottom sides, substantially as described.

4. As a means for refolding or breaking back a flat cardboard tube previously creased longitudinally with folding-lines near its opposite edges, a die composed of a series of pairs of driven rollers arranged to gradually press the edges of the flat tube toward each other bending it gradually on its creased lines, and then flattening said tube again by pressing the top and bottom sides together, bending it sharply on the creased lines, substantially as described.

5. As a means for refolding or breaking back a flat cardboard tube, the opposite sides of which have been previously creased longitudinally with folding-lines near its opposite edges, a die composed of a series of pairs of driven rollers arranged to gradually press the edges of the flat tube toward each other bending it gradually on the said creased lines, a pair of rollers, each engaging the tube on opposite sides of the creased lines and having a groove for the edge of the tube, and rollers engaging the sides of the tube and pressing it flat, bending it abruptly on the creased lines on which it was last bent, substantially as described.

6. As a means for refolding or breaking back a flat cardboard tube, the opposite sides of which have been previously creased longi-

itudinally near opposite edges, a die having four moving sides extending gradually around the longitudinal axis of the die, two of said sides at the entrance being close together, and two separated, and the two separated ones gradually approaching, and the two close together gradually separating until the die is of rectangular form, and then the two previously-separated ones approaching and the two formerly close together separating again to the normal width, substantially as described.

7. As a means for refolding or breaking back a substantially flat tube of cardboard previously creased longitudinally, a means for compressing the tube consisting of moving walls carrying the tube between them and operating to contract the tube widthwise and thus open it into a hollow or tubular form until in cross-section it is rectangular or rhomboidal, and then contract the same into a flattened tube, whereby its uniting-seams are bent and thus rendered limp or supple, substantially as described.

8. In a mechanism for refolding paper tubes the combination of two or more pairs of rollers whereof the bearing-surfaces of the respective pairs are so correlated that a flattened box-tube is, in passing through them, opened up and its seams folded so as to render them supple, or limp, substantially as described.

9. In a mechanism for refolding paper tubes, the same consisting of pairs of rollers, the pressing or feeding surfaces of which are so related as to cause the sides, top and bottom of a tube passed through them to move laterally upon the seams uniting them whereby said seams are rendered limp or supple, substantially as described.

10. A mechanism for refolding paper tubes, the same consisting of two or more pairs of upsetting-rollers, the peripheries of which are shaped so as to not only compress the tube but move its plies laterally and thus bend its seams to render the same limp or supple, substantially as described.

11. In a mechanism for refolding paper tubes the combination of two or more pairs of upsetting-rollers, the peripheries whereof are so shaped as to compress the tube and respectively to progressively move its plies laterally and cause their uniting-seams to be bent and thus rendered limp or supple, substantially as described.

12. In a mechanism for refolding paper tubes the combination with two or more pairs of upsetting-rollers whose peripheries are shaped so as to compress a paper tube and move its plies laterally upon its uniting-seams, of a pair of feeding-rollers, substantially as described.

13. In a mechanism for refolding paper tubes, the combination with two or more pairs of upsetting-rollers whose peripheries are shaped so as to compress a paper tube and move its plies laterally upon its uniting-seams, of a pair of drawing-rollers, substantially as described.

14. In a mechanism for refolding paper tubes, the combination with two or more pairs of upsetting-rollers whose peripheries are shaped so as to compress a paper tube and move its plies laterally upon its uniting-seams, of a pair of feeding-rollers, and a pair of drawing-rollers, substantially as described.

15. In a mechanism for refolding paper tubes, the combination with two or more pairs of upsetting-rollers whose peripheries are shaped so as to compress a paper tube and move its plies laterally upon its uniting-seams, of a pair of feeding-rollers, and a pair of oblique drawing-rollers, substantially as described.

16. In a mechanism for refolding paper tubes the combination of two or more pairs of adjustable upsetting-rollers the peripheries whereof are so shaped as to compress the tube and respectively to progressively move its plies laterally and cause their uniting-seams to be bent and thus rendered limp or supple, substantially as described.

17. In a mechanism for refolding paper tubes, the combination with two or more pairs of adjustable upsetting-rollers whose peripheries are shaped so as to compress a paper tube and move its plies laterally upon its uniting-seams, of a pair of adjustable feeding-rollers, substantially as described.

18. In a mechanism for refolding paper tubes, the combination with two or more pairs of adjustable upsetting-rollers whose peripheries are shaped so as to compress a paper tube, and move its plies laterally upon its uniting-seams, of a pair of adjustable drawing-rollers, substantially as described.

19. In a mechanism for refolding paper tubes, the combination with two or more pairs of adjustable upsetting-rollers whose peripheries are shaped so as to compress a paper tube and move its plies laterally upon its uniting-seams, of a pair of adjustable feeding-rollers, and a pair of adjustable drawing-rollers, substantially as described.

20. In a machine for refolding paper tubes, one or more of the pairs of upsetting-rollers constructed in conoidal form suited to bear upon the top and bottom plies of the tube and with extensions that form seats for two of the seams of the tube, substantially as described.

21. In a machine for refolding paper tubes, one or more of the pairs of upsetting-rollers constructed in conoidal form suited to bear upon the top and bottom plies of the tube and with extensions that are suited to bear upon the sides or narrower plies of the tube, substantially as described.

22. In a machine for refolding paper tubes, one or more of the pairs of upsetting-rollers constructed in conoidal form so as to not only bear upon the top and bottom plies of the tube but to press the same inwardly, substantially as described.

23. In a machine for refolding paper tubes, one or more of the pairs of upsetting-rollers

constructed in conoidal form suited to bear
upon the top and bottom plies of the tube
with extensions that form seats for two of the
seams of the tube, and with an overhanging
5 rim as 40, that confines the passing tube in
place, substantially as described.

In testimony whereof I have hereunto set

my hand in the presence of two subscribing
witnesses.

HARVEY S. MUNSON.

Witnesses:

G. M. BORST,

W. H. KENNEDY.