

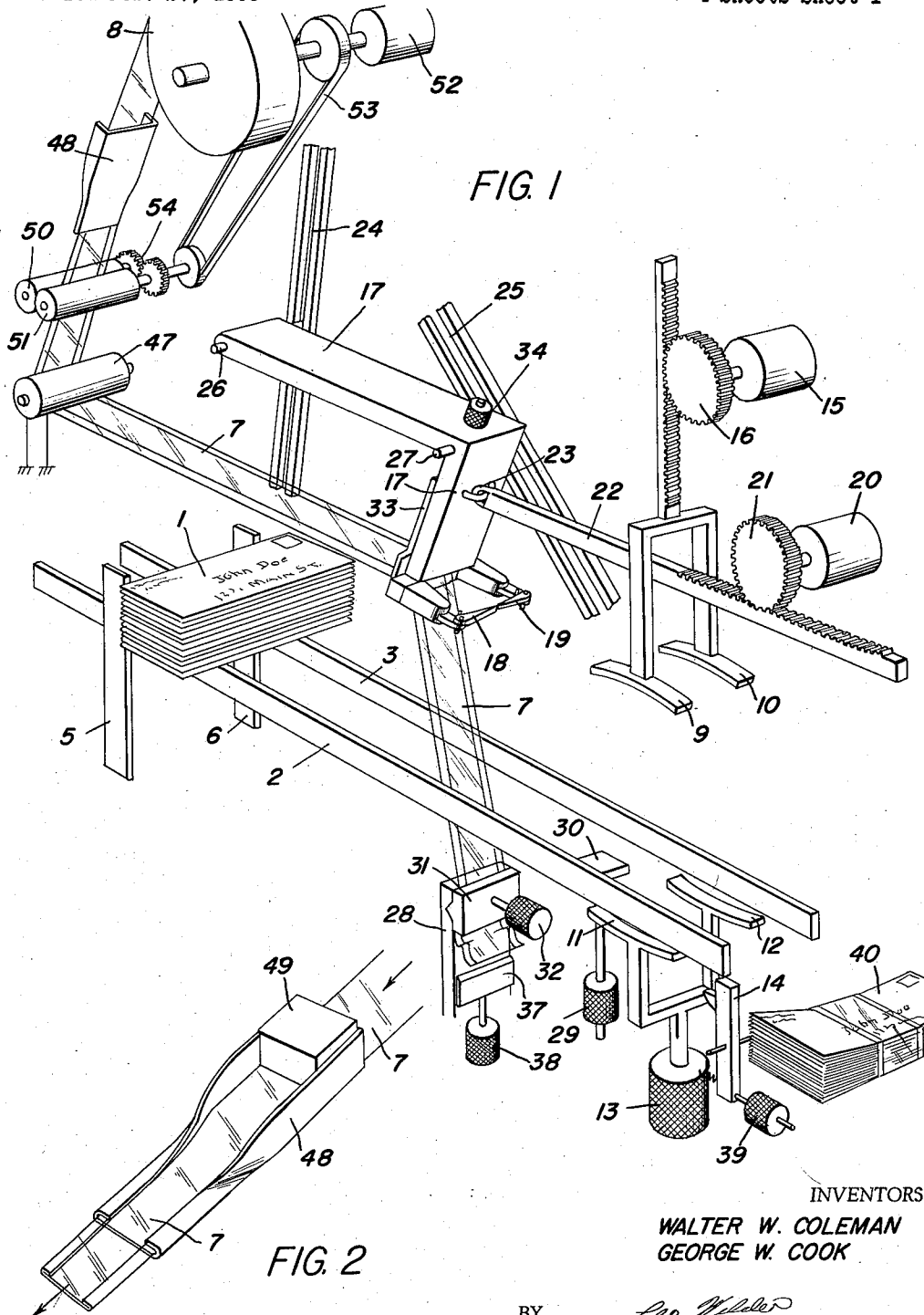
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W. W. COLEMAN ET AL
BANDING MACHINE AND METHOD

2,982,063

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4 Sheets-Sheet 1



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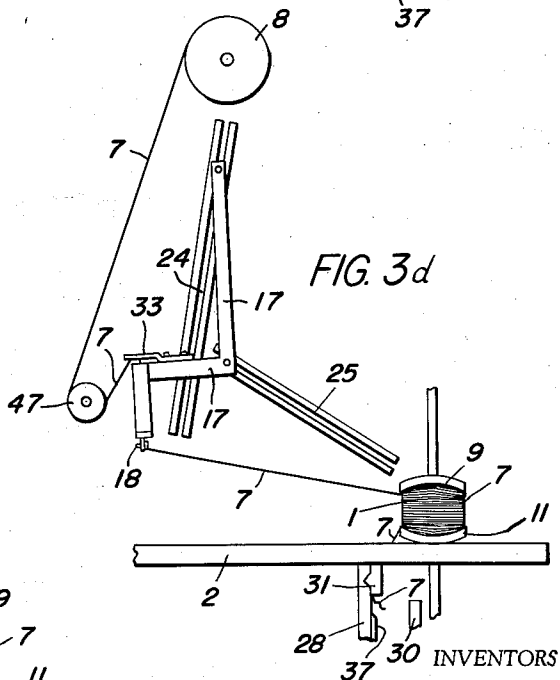
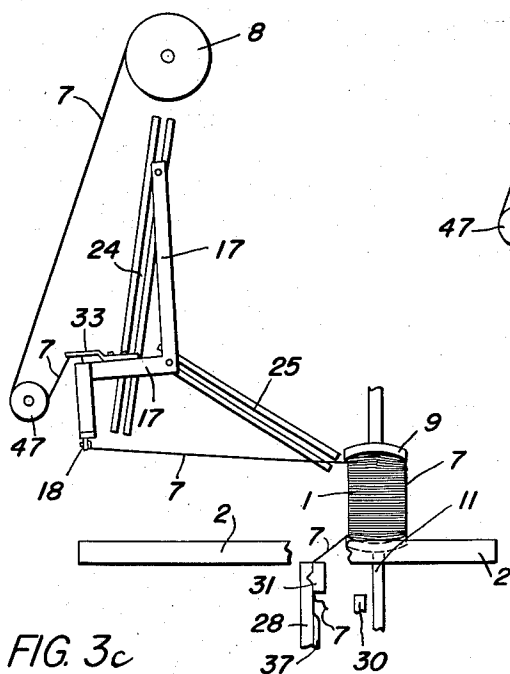
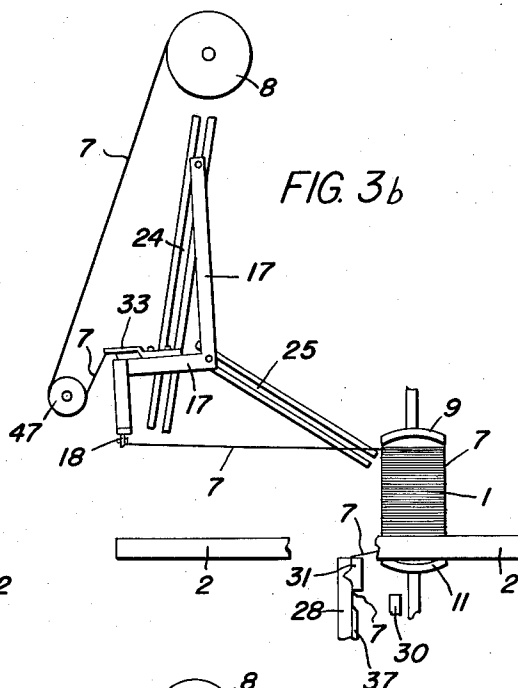
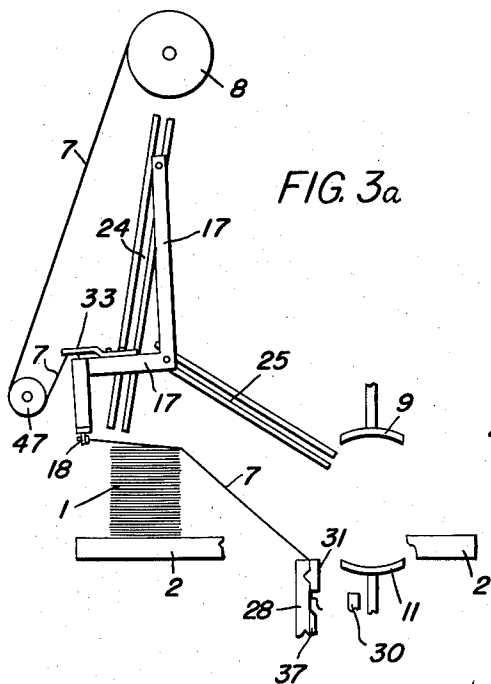
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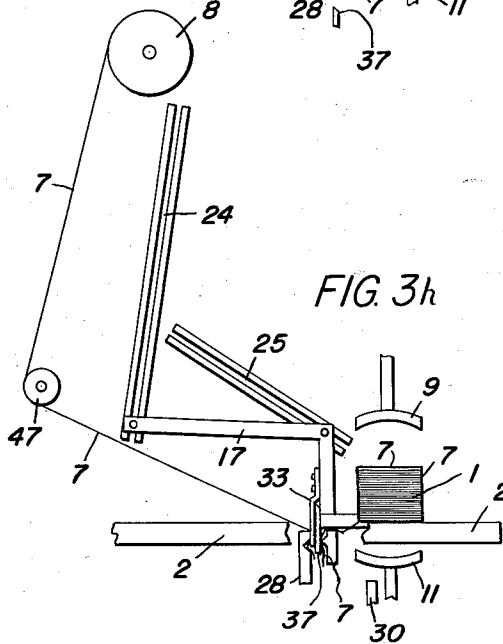
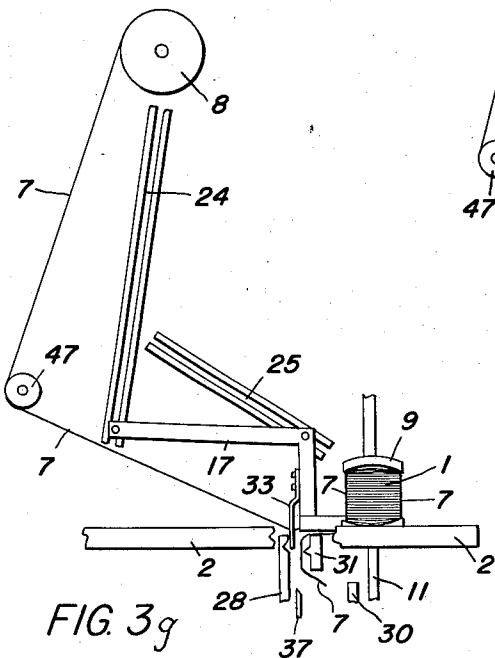
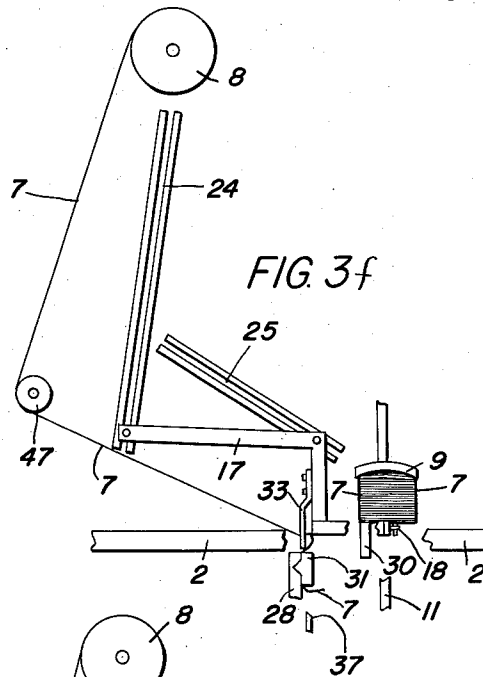
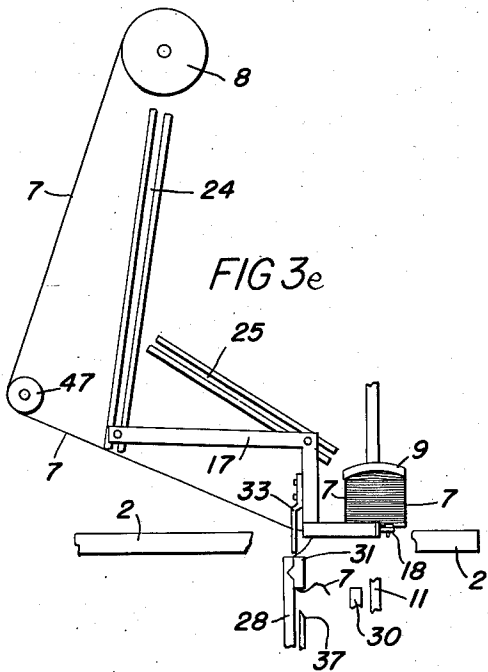
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4 Sheets-Sheet 3



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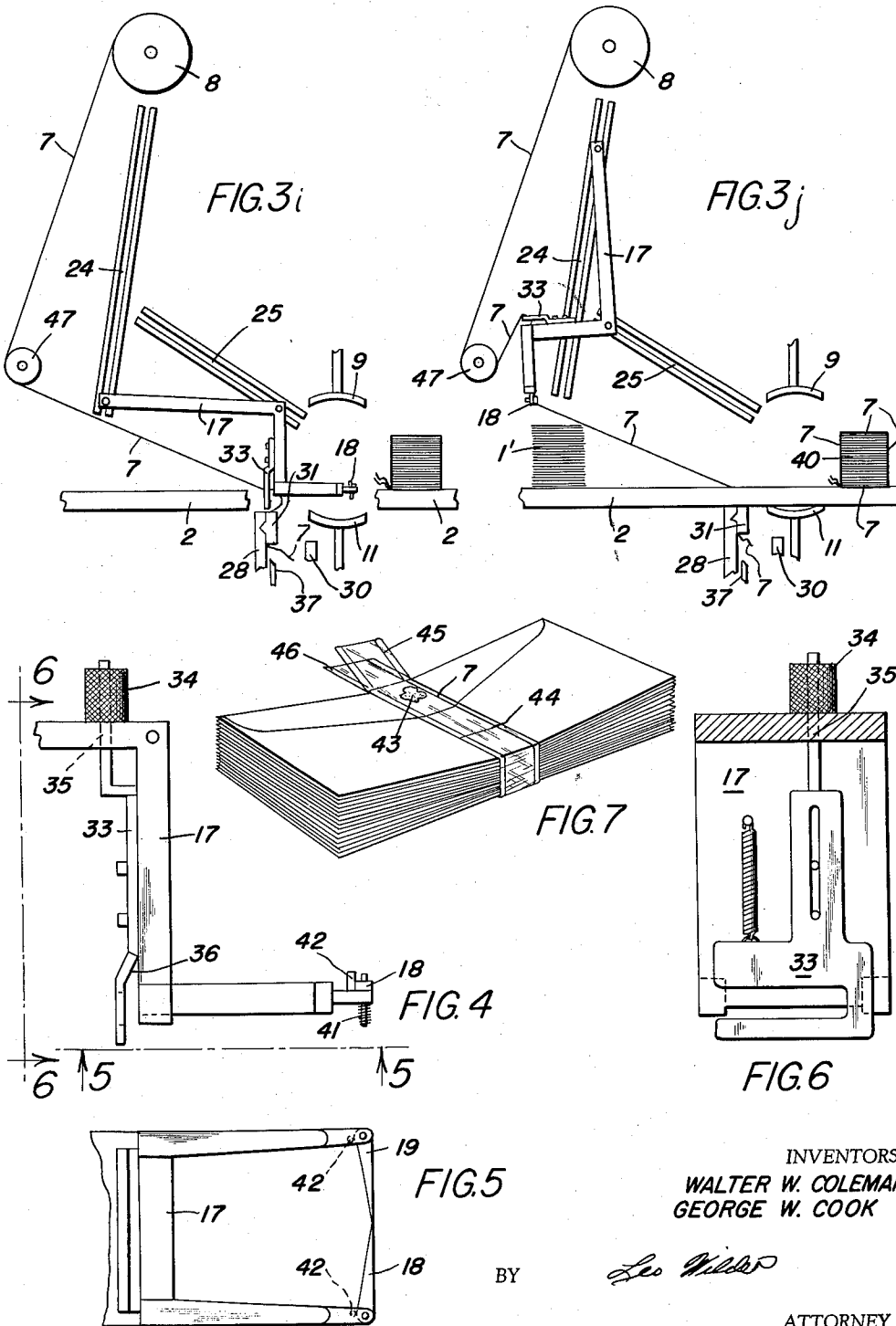
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1

2,982,063

BANDING MACHINE AND METHOD

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8 Claims. (Cl. 53—3)

This invention relates to a banding machine, and more particularly to a banding machine adapted to band packages of mail.

In handling pieces of mail sent from one city to another, the post office commonly forms the mail into packages of mail heading for the same destination, so that they may be more easily handled. This is done manually by a clerk who bunches the mail and then ties each package together with string.

This procedure is wasteful of time and labor, and the packages so formed frequently come apart, necessitating repackaging of the mail. Further, a clerk at the destination city is required to cut the string to untie the packages, so the mail can be distributed to the proper postal routes. This also is wasteful of time and labor.

A machine constructed in accordance with the invention provides for the automatic banding of bunches of mail in such a way that the packages of mail cannot come apart unintentionally, but they can be very easily disassembled when required.

Accordingly, it is an object of this invention to provide an improved method of banding packages.

It is a further object of this invention to provide a machine which bands mail so that the package so formed cannot come apart unintentionally, but easily comes apart when required.

These and other objects and advantages of the invention will be brought out more fully in the following descriptions of an illustrative embodiment thereof, when considered in connection with the accompanying drawings, in which:

Fig. 1 is a general view of the operative parts of a machine constructed in accordance with the invention.

Fig. 2 is a view of a device for strengthening tape used in the machine of Fig. 1.

Figs. 3a-j taken together illustrate the step-by-step operation of the machine of Fig. 1.

Fig. 4 is a side view of a tape handling device used in the machine of Fig. 1.

Fig. 5 is a plan view of the tape handling device shown in Fig. 4.

Fig. 6 is a rear view of the tape handling device shown in Fig. 4.

Fig. 7 is an illustration of a package of mail processed by the machine of Fig. 1.

Referring to Fig. 1, there is shown a general view of a mail banding machine. The mail 1 travels along two supporting bars 2 and 3, motivated by pusher bars 5 and 6.

During the mail's travel along the supporting bars 2 and 3 it contacts a strip of cellophane tape 7 and pulls it along with it, the tape feeding off spool 8. The forward motion of the mail 1 thus effects the wrapping of tape 7 around three sides of the stack of mail 1 (top, bottom and front) by the time the mail 1 reaches a position on supporting bars 2 and 3 between the upper compressor bars 9 and 10 and the lower compressor bars

2

11 and 12. When the mail 1 reaches this point, solenoid 13 raises the lower compressor bars 11 and 12, which are then locked in their upper position by latch 14. Upper compressor bars 9 and 10 are then lowered on the mail, being driven by motor 15 through gear 16. After compression of the mail, one side remains to be banded. That is accomplished by the operation of the pusher arm 17, with its two fingers 18 and 19. Motor 20, acting through gear 21 drives bar 22 which is attached to pusher arm 17 at link 23. Pusher arm 17 slides forward on its tracks 24 and 25. Two identical tracks on the opposite side of the pusher arm are not shown, but rollers 26 and 27 are adapted to fit into them.

As the pusher arm 17 comes forward, it carries a loop of the cellophane tape underneath the compressed mail, making three thicknesses of cellophane at the bottom of the package, the third thickness being that part of the tape returning to clamp 28. As the three thicknesses are thus held, solenoid 29 drives heating element 30 up to contact the cellophane for two seconds, just long enough to weld the three thicknesses together. After two seconds, solenoid 29 retracts, the jaw 31 of clamp 28 opens, actuated by solenoid 32, and a tongue 33 attached to the rear face of pusher arm 17 slides into the opening between clamp 28 and jaw 31, pushing the cellophane with it.

A clearer view of the tongue is shown in Figs. 4 and 6, which show that it is driven by solenoid 34 through rod 35. The back surface of tongue 33 is curved at 36, forming an anvil upon which the cellophane is cut.

Referring again to Fig. 1, knife 37 does the cutting of the cellophane, while the tongue 33 is between clamp 28 and jaw 31, actuated by solenoid 38.

At this time solenoid 39 is actuated, releasing latch 14, and permitting the lower compressor bars 11 and 12 to be lowered. Motor 15 also actuates gear 16 to raise upper compressor bars 9 and 10. Then pusher bars 5 and 6 continue on their way down supporting bars 2 and 3 to present the packaged mail 40 at the output of the machine. In the meantime jaw 31 has closed, holding the end of the cellophane cut by knife 37, and pusher arm 17 retracts to its upper position, operated by gear 21 and motor 20. The fingers 18 and 19 are arranged to straighten out when the pusher arm 17 is retracted as shown in Fig. 5. This enables the fingers to get around the cellophane weld when they are retracted. When the weld is cleared, springs 41 urge the fingers back to their positions against pins 42, which prevent further backward movement of the fingers 18 and 19.

Fig. 7 shows the reverse side of a banded package of mail with a strip of tape 7 around it. The weld is visible at 43, and the line at 44 indicates the termination of the zone of triple thickness between there and the weld 43. The two ends 45 and 46 of the tape are left sticking out of the package and a gentle tug on these two ends will easily break the weld 43 and open the package. However, as long as the ends 45 and 46 are not pulled, the stress on the tape 7 is in tension, and cellophane has a high tensile strength. When the ends are pulled, however, the stress is in shear, and cellophane has a low shearing strength. Thus the package will survive very rough treatment, as long as the ends 45 and 46 are not pulled.

Referring now to Fig. 3, the operation of the banding machine is shown in each of its several steps. Reference numerals refer to those in Fig. 1. Fig. 3a shows spool 8 feeding tape 7 past slack take-up roller 47 through the slot in tongue 33 past pusher fingers 18 and 19 and into clamp 28. The mail 1 is shown moving forward on supporting bar 2. Fig. 3a shows the mail just as it touches the tape and starts to pull it forward off spool 8.

3

In Fig. 3b, the mail has progressed to a point between the upper and lower compressor bars 9 and 11, automatically banding three sides itself by its forward movement.

In Fig. 3c, the lower compressor bars have risen, preparing for full compression of the mail.

In Fig. 3d, full compression has occurred, with the upper compressor bars being lowered. All this time, the pusher arm 17 has been in its upward position.

In Fig. 3e, the pusher arm has been brought down and forward on its tracks 24 and 25, pushing cellophane strip 7 under the mail with pusher fingers 18 and 19.

In Fig. 3f, while the mail is compressed and the cellophane is wrapped around all four sides with a triple thickness on the bottom, heating element 30 has risen and is applying pressure and heat to the triple thickness, thereby welding the cellophane together.

In Fig. 3g, jaw 31 of the clamp 28 has opened, and tongue 33 has slid in, carrying the cellophane tape 7 with it.

In Fig. 3h, knife 37 has been raised and has cut through the cellophane tape 7 against the curved surface of the tongue 33. The upper and lower compressor bars 9 and 11 have also been retracted since the welding operation had been completed in the previous step.

In Fig. 3i, the tongue 33 has retracted, jaw 31 has closed on the end of the cellophane strip 7 just cut by knife 37, and the banded package of mail 40 is ready for removal.

In Fig. 3j, the pusher arm 17 has been retracted and a new stack of mail 1' is ready to be banded.

It will be understood by those skilled in the art that the sequential operation of the machine may be controlled mechanically by cams or electrically by relays, or by any other suitable means. Likewise, a single motor may be used to furnish power for all the operations with suitable clutching and gearing means. Other equivalent substitutions could also be made within the spirit of the invention by those skilled in the art.

Referring again to Fig. 1, the tape strengthening operation will now be described. As the plain cellophane strip feeds off spool 8, it passes through a tap strengthener, shown in more detail in Fig. 2. It consists of a shell 48 with a block 49 inside. As the cellophane passes into the strengthener, it is positioned and centered by passing through the narrow slit formed between shell 48 and the block 49. As the cellophane passes further along, the edges are brought up and folded back over the rest of the cellophane strip. Then this folded strip 7 passes through the rollers 50 and 51 (shown in Fig. 1) driven by motor 52 through belt 53 and gears 54. The gearing ratio is such that tape is fed through the rollers 50 and 51 at the same rate as it comes off the spool 8. The effect of the rollers is to crease the folded edges of the tape 7 so that the folded edges will not spring back straight. The tape then passes over slack take-up roller 47 and on to the pusher arm 17. The speed of motor 52 may conveniently be controlled by the position of the slack take-up roller 47, so that no backlash can occur. The effect of the folding operation is to make the tape twice as thick at the edges, and to remove any irregularities on the edge of the tape. The folded edge is perfectly even and smooth, whereas the tape fed off the spool may have tiny notches in the edges, giving rise to shear stresses when the tape is put in tension.

It will, of course, be clear to one skilled in the art that paper may be strengthened in the same way, and also that a thread or the like may be inserted in each of the folded edges to make them even stronger.

It will also be appreciated that a package may be wrapped with a plurality of bands instead of a single one as described herein.

4

Having thus described an exemplary embodiment thereof, what we desire to claim as our invention is:

1. The method of banding a stack of substantially flat, flexible articles to provide for easy disassembly but high resistance to accidental stresses comprising; banding the articles with cellophane tape, forming a triple thickness of said tape on one side in which two thicknesses are formed by each end of said tape, and fastening said triple thickness together to allow for disassembly by pulling the ends.

2. Apparatus for banding a plurality of objects together with banding material, comprising; means for transporting a group of articles to be banded so the forward motion of said group causes said banding material to band all but one side of said group, means for banding said one side by sliding a loop of the banding material between the group to be banded and a portion of the banding material adjacent to one of the other sides, and means for sealing said banding material at said loop.

3. Apparatus for banding together a stack of articles with banding material, comprising; means for holding the stack motionless, means for surrounding the stack with banding material on all but one side, means for pushing a loop of banding material over said one side and on around said stack under the band already surrounding said stack, and means for sealing said banding material around said stack.

4. Apparatus for banding a plurality of articles together comprising; a supply of banding material, means for grasping the free end of the material, means for conveying the articles so as to intercept and carry said banding material which thereby surrounds the articles on all but one side, means for banding said one side, means for forming a loop in the banding material adjacent that banding said one side, means for pushing said loop between the articles and the said grasping means thereby forming a triple thickness of banding material of which one said thickness is the end section held by said grasping means, and means for fastening the thicknesses of the banding material together at one point on the triple thickness.

5. In a banding machine having a supply of banding material for banding a group of articles the combination comprising; means for grasping the free end of the banding material, means for moving the group of articles to be banded to form a first loop of banding material around the group, means operative upon the forming of said loop for stopping the motion of the group to be banded, means for forming a second loop in the material adjacent to the first loop, means for pushing the second loop between the group of articles and the means for grasping the free end of the material, means for sealing the banding material at a point on the second loop near the free end of banding material, means for releasing the grip of said grasping means on the free end of the material, means for severing said banding material between said second loop and the supply of banding material, and means for actuating the grasping means to grasp the new free end of banding material formed by the severance.

6. In a banding machine having a supply of banding material for banding a group of articles, the combination comprising; means for dispensing the banding material in a continuous strip, means for strengthening the banding material by folding over its edges, means for gripping the free end of the banding material, means for forming a loop of banding material around a group of articles to be banded, means for tucking a second loop of banding material between a part of said first loop and the group of articles to be banded, means for sealing the first loop at a point where the second loop is tucked under it, means for severing the banding material banding said group from said supply, and means for causing the new free end of banding material so formed to be gripped by said gripping means.

5

7. The combination described in claim 6 where the banding material is cellophane tape and said means for sealing applies heat to the banding material sufficient to weld the cellophane together.

8. The method of banding a unit of grouped articles comprising: providing a conveyor for said articles having a predetermined path of motion, providing a continuous supply of flexible banding material having an end portion adjacent to said conveyor in such orientation that said end portion intercepts said path of motion, conveying said articles to intercept and carry said end portion of said banding material, thereby causing said banding material to surround said grouped articles on all sides but one side, surrounding said one side with a portion of said banding material while holding said unit motionless, forming a loop of banding material between said end portion of said banding material and the side portion of said unit banded thereby while holding said unit motionless, thereby forming on that side portion of said unit a triple thickness of banding material of which at least one thickness is said end portion, fastening said

6

triple thickness into an integral seal, thereby forming a banded unit, severing said banded unit from said continuous supply of banding material, thereby creating a new end portion of banding material, and then conveying said banded unit along said path of motion.

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