May 3, 1966 M. E. TOBY 3,249,023

METHOD FOR FASTENING SHEET MATERIAL

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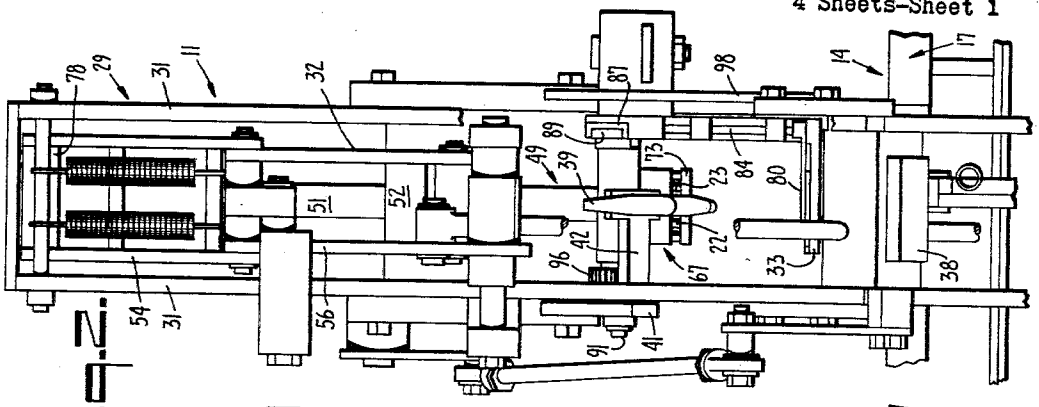


Fig. 2.

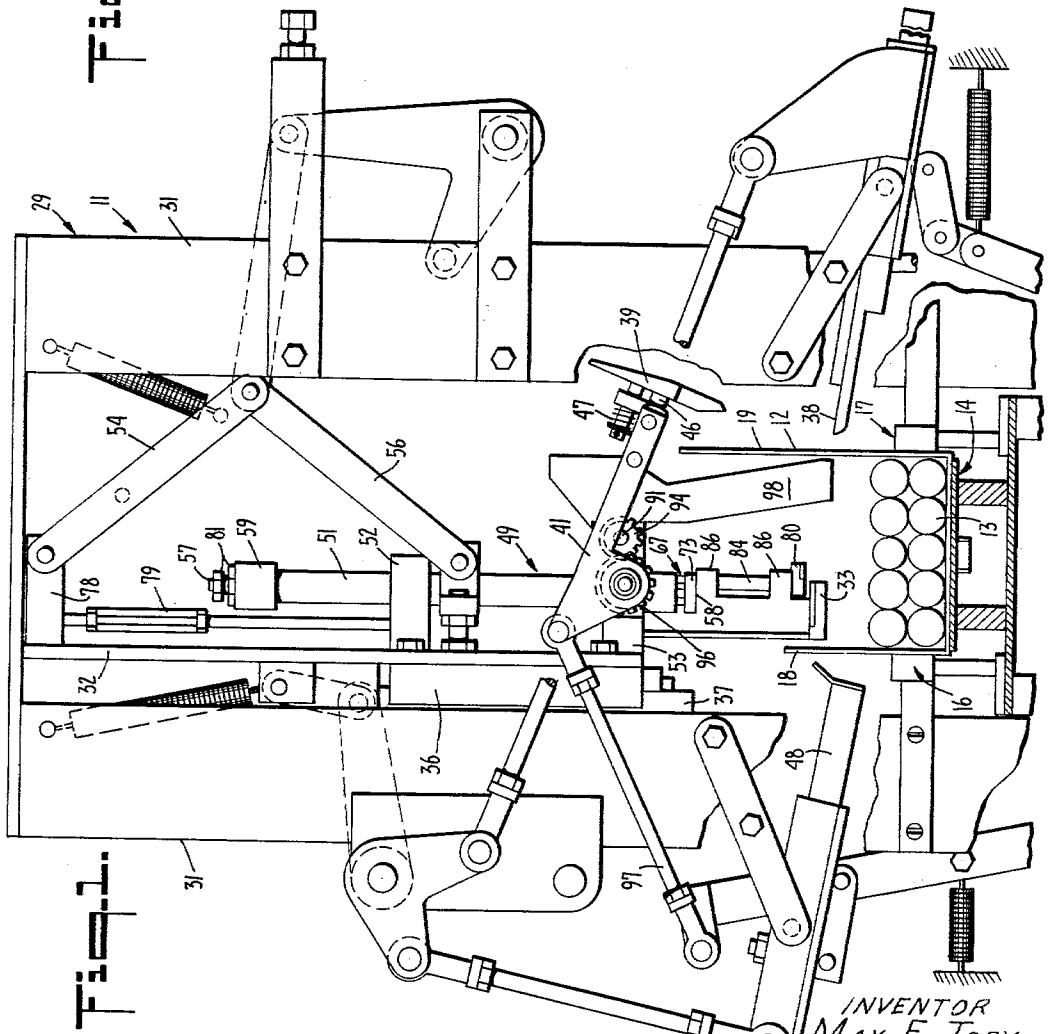


Fig. 1.

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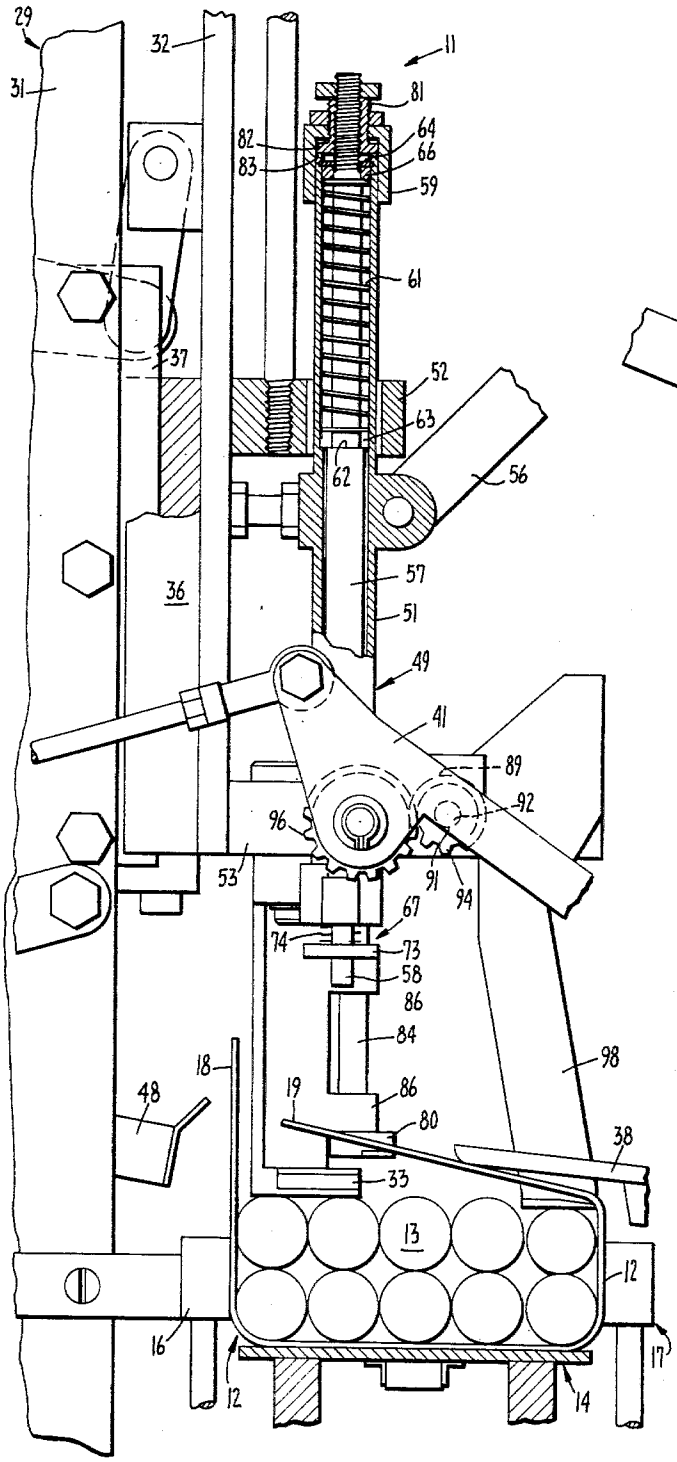


Fig. 3.

Fig. 5.

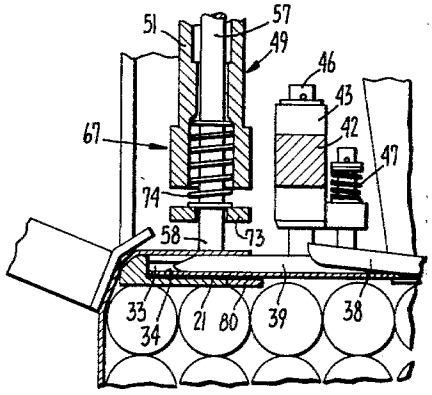
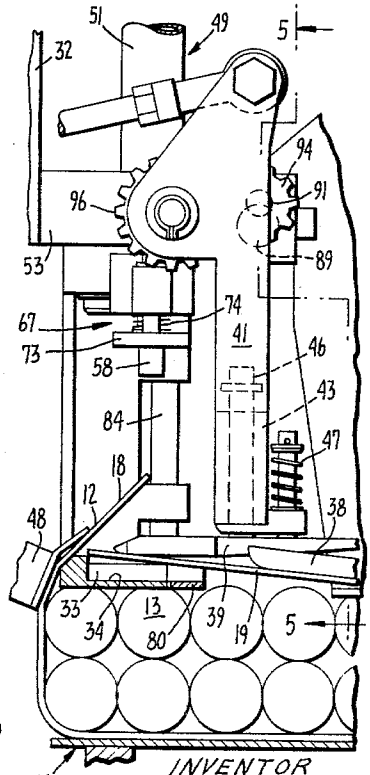


Fig. 4.



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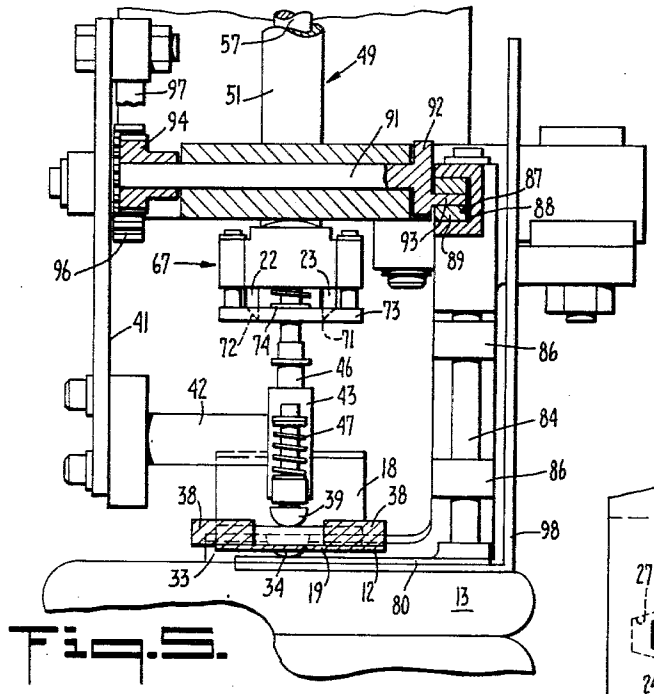


Fig. 5.

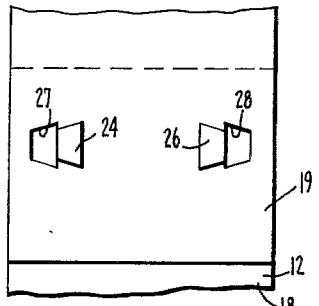


Fig. 13.

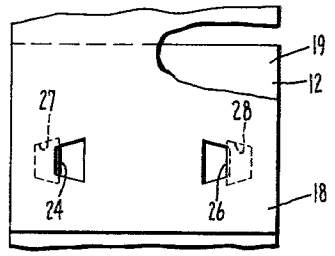


Fig. 12.

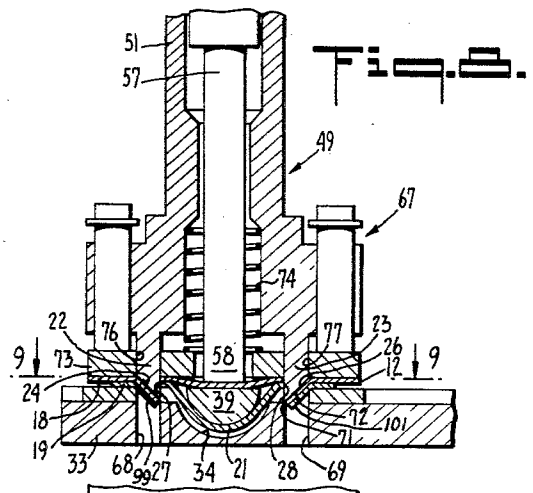


Fig. 8.

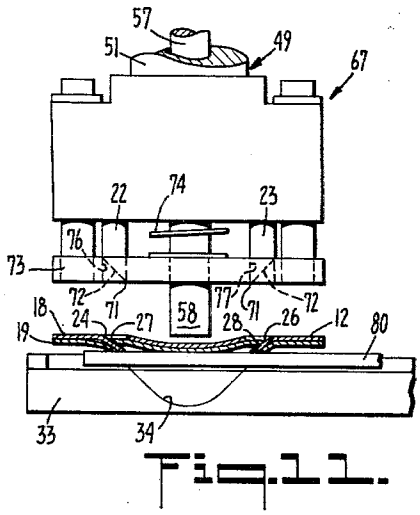


Fig. 11.

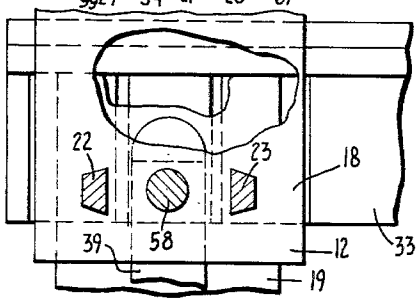


Fig. 9.

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METHOD FOR FASTENING SHEET MATERIAL

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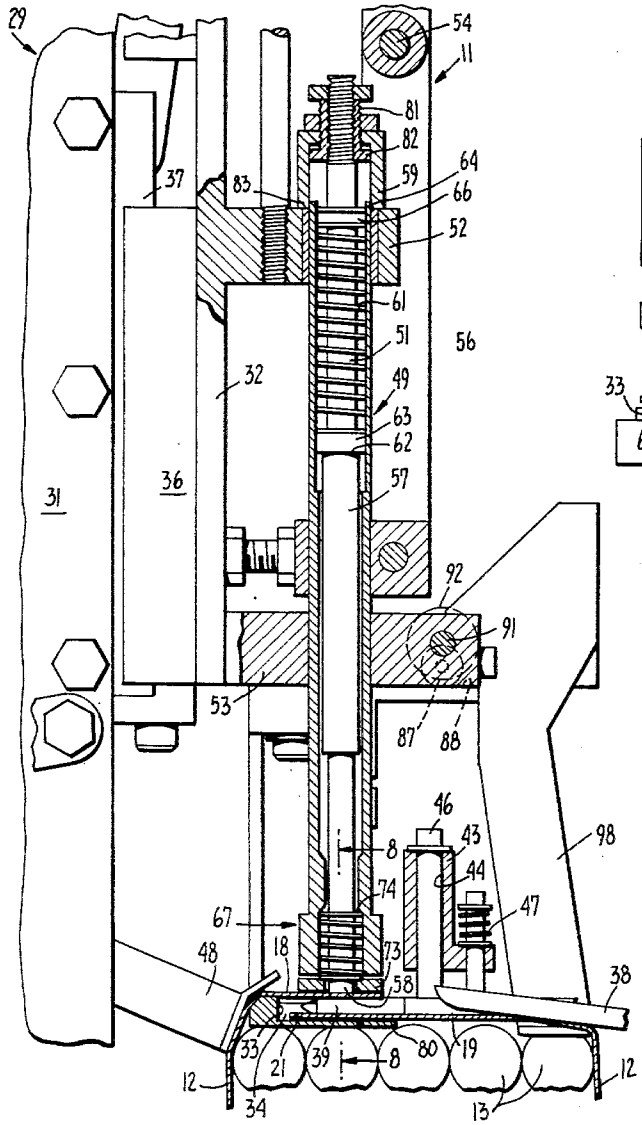


Fig. 7.

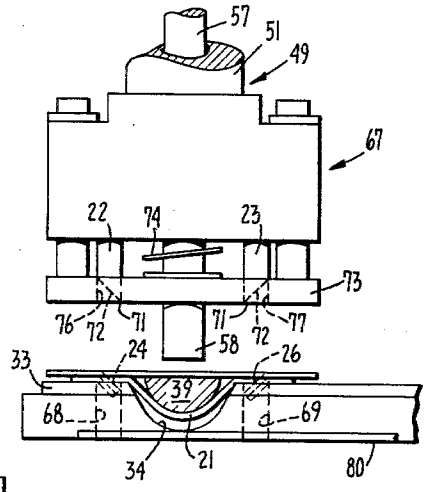


Fig. 10.

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3,249,023

METHOD FOR FASTENING SHEET MATERIAL

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Filed Aug. 13, 1962, Ser. No. 216,681
3 Claims. (Cl. 93—1.1)

This invention relates generally to a method of fastening together two sheets of material, and more particularly is directed towards a method of fastening two overlapping sheets by interlocking adjacent portions of the respective sheets.

In various packaging operations, as for example with food products, it is often required that containers, bands, or similar wrappings be secured around the product. These wrappings are frequently made of paper, cardboard or similar material and the packaging operation generally entails securing together different portions of the wrapping. As particularly respects food packaging, it is often undesirable to use separate fasteners such as staples because of the danger of having them accidentally consumed with the food. The use of glue or similar adhesives is also undesirable in close proximity to food.

The present invention provides a noval method of joining together separate portions of a cardboard or similar wrapping without need for separate fasteners such as staples, adhesives, or the like. In broad terms, the invention involves placing in overlapping relationship two sheets to be fastened together, punching through the sheets to form tabs in one sheet and apertures in the other sheet, and urging the two sheets into interlocking relation by means of the tabs and apertures so provided. The apparatus of the present invention generally includes a die member having a groove in one of its surfaces. Means are provided for forming one of the sheets into the groove to form a temporary deformation whereby the portions of the sheet on either side of the deformation are drawn closer together. With the second sheet overlying the concave portion of such deformation in the first sheet, a punch is used to form two tabs in the second sheet extending respectively through the two apertures punched in the deformed sheet, the two apertures being disposed on each side of the deformation in the aforementioned portions of the first sheet. Means are provided to flatten out the deformed sheet thereby spreading apart the apertures therein and forcing them into interlocking relationship with the tabs.

Accordingly, it is a primary object of the present invention to provide a novel method of joining together sheets of material without the use of separate fasteners such as staples, adhesives, or the like.

Another object of the invention is to provide a method of joining together overlapping flexible sheets of material by creating an interlocking relationship between adjacent portions of the respective sheets.

A further object is to provide a fastening method suitable for securing together portions of a wrapping after the wrapping has been disposed around the product to be wrapped, and which is suitable for use with a conveyor line packaging operation.

Still another object is to provide a method of the character described which is particularly suitable for securing a cardboard band or the like around a package of frankfurters or similar food product.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of the invention which is illustrated in the drawings accompanying and forming part of the specification. It is to be understood, however, that variations in the showing made by the said drawings and description may be adopted within the scope of the invention as set forth in the claims.

FIGURE 1 is a front elevational view of the instant apparatus while in an inoperative position and as viewed from along a conveyor employed to carry products to the apparatus.

FIGURE 2 is a side elevational view of the apparatus illustrated in FIGURE 1.

FIGURE 3 is an enlarged cross sectional elevational view similar to FIGURE 1 but with the apparatus engaging the product in an initial stage of securing a wrapping around the product.

FIGURE 4 is a view similar to FIGURE 3 after the wrapping operation has progressed to a subsequent stage.

FIGURE 5 is a cross sectional view taken along the plane 5—5 of FIGURE 4.

FIGURE 6 is a view similar to FIGURE 4 but after the wrapping operation has progressed to a further stage.

FIGURE 7 is a view similar to FIGURE 6 but at a subsequent stage after the apparatus has punched through the wrapping.

FIGURE 8 is a cross sectional view taken along the plane 8—8 in FIGURE 7.

FIGURE 9 is a cross sectional view taken along the plane 9—9 in FIGURE 8.

FIGURE 10 is a side view similar to FIGURE 8 but after the punches of the apparatus have been withdrawn from the wrappings.

FIGURE 11 is a view similar to FIGURE 10 but after the overlapping portions of the wrapping have been joined together in an interlocking relationship.

FIGURE 12 is a top view of the joined portions of the wrapping after the fastening operation has been completed.

FIGURE 13 is a bottom view of the wrapping illustrated in FIGURE 12.

Referring now to the drawings, there is shown a packaging apparatus 11 that is generally adapted to secure a band wrapping 12 around a product 13. Prior to operation of the apparatus 11, the product 13 is placed on a conveyor assembly 14 with the band 12 positioned around the bottom and sides of the product. The conveyor 14 includes spaced side walls 16 and 17 and is adapted to receive the product with the end flaps 18 and 19 of the band 12 extending substantially vertically upward as is best seen in FIGURE 1. The apparatus 11 folds the flaps 18 and 19 into overlapping relation and forms an interlocking joint therebetween to firmly secure the product for the aforementioned purposes.

As generally regards the formation of the interlocking connection between the flaps 18 and 19, the instant apparatus is adapted to dispose the flap 18 in overlying relation to the flap 19 and then form a longitudinal deformation 21 in the flap 19. The effect of this deformation is to draw closer together the respective portions of the flap 19 on either side of the deformation. After the deformation is formed, two punches 22 and 23 are depressed through the flaps on either side of the deformation. These punches are adapted to form a pair of tabs 24 and 26 in the undeformed flap 18 that extend through apertures 27 and 28 formed in the flap 19. After the punches are removed the deformed flap is flattened out whereby the apertures therein are spread apart from one another to become interlocked with the tabs of the undeformed flap. The foregoing operation will be better understood in conjunction with the following detailed description of the instant apparatus.

The apparatus 11 is seen to include a stationary support frame 29 which has four vertically disposed support members 31, as is best illustrated in FIGURES 1 and 2. A vertically movable carriage 32 is mounted on the frame

29 and has a laterally extending die 33 secured adjacent its lower end. The die 33 is positioned over the conveyor 14 and is downwardly movable with the carriage to rest on the product 13 as shown in FIGURE 3. A groove 34 is provided in the upper surface of the die 33 and extends transversely relative to the length of the conveyor 14. The mounting of the carriage 32 on the frame 29 is preferably accomplished by means of spaced guide flanges 36 extending from the carriage and slidably engaging a guide block 37 secured between two of the frame supports 31, all of which is best illustrated in FIGURES 1, 3 and 7.

Means such as a folding arm 38 is provided to urge the flap 19 into overlying relation with the die 33 and groove 34, as shown in FIGURE 3. The arm 38 is adapted to move laterally from and towards the die 33 to fold the flap 19 around the product 13 and into position on top of the die.

In order to form the aforementioned deformation 21 in the flap 19 a deforming or creaser foot 39 is secured to the carriage 32 and adapted for movement into overlying relation with the die groove 34. The foot 39 is movable vertically downward into the groove 34 to force the flap 19 into the groove to form the deformation 21. In more detail, a connecting arm 41 is pivotally mounted adjacent one end on the carriage 32 and adapted for movement in a plane generally parallel to the length of the groove 34. The foot 39 is slidably mounted adjacent the other end of the arm 41 for movement therewith to its position overlying the groove 34. As shown in FIGURE 5, the arm 41 has a laterally extending portion 42 adjacent its lower end, and a foot housing 43 mounted on the portion 42. As illustrated in FIGURE 7, the housing 43 is seen to include a bore 44 through which a rod 46 is slidably disposed. The creaser foot 39 is secured adjacent the lower end of the rod 46 and thus is adapted for vertical movement relative to the groove 34 when in overlying relation thereto. Spring means 47 serve to keep the creaser foot in a normal raised position out of the groove 34, as is best shown in FIGURES 4 and 5. Means for depressing the creaser foot into the groove to form the deformation 21 in the flap 19 are described below.

Means such as a folding arm 48 is provided to urge the flap 18 into overlying relation with the top of the creaser foot 39, as shown in FIGURES 4 and 6. In FIGURE 6, however, the creaser foot is shown as already having been depressed into the groove 34. The arm 48 operates similarly to the arm 38.

To move the creaser foot downwardly into the groove 34 and to appropriately punch through the flaps 18 and 19 a plunger assembly 49 is mounted on the carriage 32 for vertical movement thereon. More particularly, the assembly 49 includes a vertically disposed tubular shank 51 slidably mounted in bearings 52 and 53 which are rigidly secured to the carriage. The shank 51 is disposed above the die 33 and adapted for vertical movement from and towards the die, and links 54 and 56 serve to impart force to the shank 51 for movement thereof.

A plunger rod 57 is slidably disposed within the shank 51 and has a lower end 58 that normally is extended below the lower end of the shank. As the shank is moved downwardly the rod 57 is carried with it and the rod engages the upper surface of the flap 18 transmitting force through such flap to the creaser foot 39 moving the latter and flap 19 into the groove. Stop means including a cap 59 are secured adjacent the upper end of the plunger rod 57 to determine the extent of its downward movement. More specifically, when the cap 59 abuts downwardly against the bearing 52, as shown in FIGURE 7, the rod is restricted from any further downward movement. Preferably the cap 59 is threadedly secured to the rod 57 whereby it is vertically movable relative thereto. In this manner a fine adjustment can be made with regard to the extent of downward movement of the rod 57.

Spring means 61 serve to couple the rod 57 with the shank 51 and provide for downward movement of the shank relative to the rod after the rod has been stopped in the above described manner. In more detail, an upper annular shoulder 62 is provided on the rod 57, on which rests an annular sleeve 63. An annular portion 64 such a truarc snap ring is secured rigidly within the upper portion of the shank 51. A sleeve 66 is disposed subjacent the portion 64. The spring means 61, preferably comprising a coil compression spring, is then inserted intermediate the sleeves 63 and 66. The spring serves to transmit the downward force on the shank 51 to the plunger rod 57. When the rod 57 is stopped by the cap 59, the spring compresses to allow the shank to continue to move downwardly relative to the rod 57. FIGURE 6 shows the lower end 58 of the plunger rod after the creaser foot has been depressed into the groove 34 and the rod has completed its downward movement.

Secured adjacent the lower end of the shank 51 is a punch assembly 67 for forming the tabs 18 and 19. The assembly includes the aforementioned spaced punches 22 and 23 which are rigidly secured to the shank 51. It is noted that a pair of punch recesses 68 and 69 are provided in the die 33 on each side of the groove 34. The punches 22 and 23 are aligned with the recesses 68 and 69 and are adapted to move downwardly into the recesses. The punches are seen to have confronting inner cutting edges 71 and upwardly and outwardly tapered bottom end surfaces 72. As shown in FIGURE 9, the transverse cross section of the punches is preferably trapezoidal with the sides of the punches tapering outwardly together.

A punch release plate 73 forms a part of the punch assembly 67 and is slidably mounted on the punches for movement relative thereto. Spring means 74 serve to maintain the release plate 73 in a normal position at least as low as the bottoms of the punches. However, when the plate is restricted from downward movement, the spring means 74 allow the punches to slide through apertures 76 and 77 in the plate 73 and punch through the flaps into the punch recesses 68 and 69. When the punches are withdrawn from the recesses the punch release plate serves to hold down the flaps until the punches are raised clear therefrom. The nature of the punching operation and the tabs and apertures thereby formed in the flaps are described in more detail below.

The extent of downward movement of the punches is critical, for if the punches move too far into the punch recesses the tabs formed in the flaps will be sheared completely off as will hereinafter become evident. Consequently, it is necessary to provide adjustable means to stop the punches after they have sufficiently penetrated into the recesses. In FIGURES 1 and 2, the links 54 are shown pivotally secured to a bracket 78, which is movable vertically on the carriage 32. A longitudinally expandable connecting rod 79 is joined between the bracket 78 and the bearing 52, and adjustment of the rod 79 serves to raise and lower the bracket 78. As appears in FIGURE 7, when the links 54 and 56 reach their fully extended vertical position, the shank 51 has been driven downwardly to its fullest extent. Thus, it is seen that vertical adjustment of the bracket 78 controls the amount of downward movement of the shank 51, and hence also the punches 22 and 23 which are rigidly secured to the shank.

After the punches are withdrawn from the die the release plate 73 returns to its normal position relative to the punches. The links 54 and 56 are then actuated by suitable means to raise the end 58 of the plunger rod 57 slightly above the die as shown in FIGURE 10. The apparatus is now set for the final stages of the fastening operation. With the plunger rod raised in the aforementioned manner pressure is released from the creaser foot 39 and it can be slid out from between the flaps 18 and 19.

An expander member 80 is movably secured to the carriage 32 for flattening out the deformation 21 in the flap 19 whereby the two flaps are forced into interlocking relationship. More specifically, the expander 80 extends laterally adjacent the die proximate one end of the groove 34 and is movable into a position below the level of the groove as is shown in FIGURE 4. The expander is movable upwardly from this position to force the bottom deformed flap 19 into the generally flattened position shown in FIG. 11, whereby it becomes interlocked with the flap 18.

The plunger rod portion 58 serves to restrain the flaps from upward movement while the expander is moving upwardly to interlock the two flaps together. The positioning of the plunger rod for this stage of the operation is critical. If the rod is spaced too high above the die it will not adequately restrain the flaps while the expander is moving up. If the plunger rod is not spaced high enough the creaser foot will not be able to slide out from between the flaps. Moreover, the punched tabs in the flaps will not have sufficient clearance to be removed from the die and will be severed off upon expansion or removal of the deformation of the lower flap 19. Accordingly, means are provided for adjusting the extent of upward movement of the plunger rod after the punches are withdrawn. The means for actuating the drive links 54 and 56 are adapted to move the plunger rod up slightly and then hold the rod in that spaced position. The problem then is to provide a fine adjustment for positioning the rod when in that position. An adjustment screw 81 is threadedly secured adjacent the upper end of the rod 57 and has a lower shoulder 82 that is vertically movable relative to the rod. When the shank 51 is moved upwardly by the links 54 and 56 the upper end 83 of the shank abuts against the shoulder 82 thereby forcing the plunger rod 57 upwardly with the shank. When the shank stops moving upwardly, as determined by the means actuating the links 54 and 56, the plunger rod also stops moving. Thus by adjusting the screw 81 relative to the rod 57 the position of the rod when the shank stops moving can be accurately established.

With respect to the means for actuating the expander member 80 and the creaser foot 39, the expander is seen to be secured adjacent the lower end of a rod 84 which is slidably disposed through bearings 86 extending from the carriage 32. A block 87 is secured adjacent the upper end of the rod 84 and has a slot 88, as is best illustrated in FIGURE 5. A roller 89 is horizontally slidable in the slot 88 and is adapted for eccentric rotation to move the block 87 and rod 84 vertically. In more detail, a horizontally disposed shaft 91 has a crank 92 transversely adjacent one end thereof and a pin 93 coupling the crank to the roller 89. When the shaft 91 is rotated the movement of the crank transmits force to the roller causing it to move horizontally in the slot 88 while imparting vertical force to the block 87.

Adjacent the other end of the shaft 91 is a gear 94 which engages another rotary gear 96. The connecting arm 41 for the creaser foot 39 is secured to the gear 96 for rotation therewith, and a drive link 97 couples to the arm 41 for actuation thereof. Thus, it is apparent that the expander and the creaser foot are operated together in order to determine the sequence of their movements. That is, as the drive link 97 forces the arm 41 to pivot, the gear 96 turns the gear 94, which in turn operates the expander through the roller 89. The gear ratio and lever arm lengths can be suitably designed to assure that the creaser foot is extracted from between the flaps just prior to the upward movement of the expander. Conversely, as is shown in the sequence of FIGURES 3 and 4, the expander moves downwardly into position adjacent the die 33 just prior to the creaser foot swinging into overlying relation with the groove 34.

A retaining arm 98 is secured to the carriage 32 and is adapted to seat on the product when the carriage is moved down into operative position. As is best seen in FIGURES 1 and 3, the arm 98 rests firmly on the product to secure it in place during the wrapping operation.

Operation

In operating the apparatus 11 of the present invention, the wrapper band 12 is disposed around the product 13 and placed in the conveyor with the end flaps 18 and 19 of the band extending upwardly as shown in FIGURE 1. The carriage is then moved down to place the die 33 and retaining arm 98 in contact with the product. The folding arm 38 then begins to fold the flap 19 over the die, with the expander member 80 moving downwardly beneath the flap 19. This stage of the operation is depicted in FIGURE 3. Next the creaser foot 39 moves into place over the groove 34 and flap 19, with the folding arm 48 moving the flap 18 over the creaser foot, as shown in FIGURES 4 and 5.

After the flap 18 is positioned over the creaser foot the plunger assembly 49 begins to move downwardly. The plunger rod by engagement of flap 18, forces the creaser foot and flap 19 downwardly into the die groove thereby forming a deformation in the lower flap 19, as shown in FIGURE 6. The cap 59, which as adjustable as previously noted, serves as a stop means to restrict the downward movement of the plunger rod after it has depressed the creaser foot substantially into the die groove. In this manner, the plunger is restrained from forcing the creaser foot against the lower flap 19 with too much force, and distortion or tearing of the lower flap is prevented.

As the shank continues to move downwardly the release plate 73 engages the upper surface of the flap 18 and is restrained from any further downward movement. The punches, however, continue to move down with the shank and slide through the plate 73 to punch the flaps and enter the punch recesses. See FIGURES 7 and 8. As noted above, the extent of downward movement of the punches is determined by adjustment of the bracket 78, to which the links 54 and 56 are coupled.

With regard to the effect of the punches on the flaps, reference is made to FIGURE 8 wherein the punches are shown after being punched through the flaps. As previously noted, a pair of tabs 24 and 26 are formed in the upper flap 18. At the same time a pair of tabs 99 and 101 are formed in the lower flap 19. It is now apparent that should the punches move too far downwardly into the recesses the aforementioned tabs would be completely sheared off from the respective tabs.

The punches are then withdrawn from the die and the shank moved upwardly a sufficient increment of movement to position the plunger rod slightly above the die surface as illustrated in FIGURE 10. The creaser foot is then moved out from the groove and between the two flaps. Next the expander member moves upwardly against the lower flap to flatten out the deformation provided therein, thereby forcing the two flaps into interlocking relationship as shown in FIGURE 11. The plunger assembly 49 is then raised to its inactive position as shown in FIGURE 1.

As more particularly regards the nature of the interlocking of the two flaps, reference is now made to FIGURES 12 and 13, in addition to FIGURES 10 and 11. As shown in FIGURE 10, the tabs 99 and 101 in the lower flap 19 serve in effect to create apertures in the lower flap, these apertures having been previously designated with the numerals 27 and 28. Other than providing these apertures, the tabs 99 and 101 have no operative function. Thus, in FIGURE 10 the tabs 24 and 26 of the upper flap 18 are shown disposed downwardly through the respective apertures in the lower flap 19. When the lower flap is flattened out, as illustrated in FIGURE 11, the portions of the flap adjacent the apertures are spread apart. Consequently, the portion of the flap intermediate the apertures is forced into overlap-

ping relationship with the tabs 24 and 26 of the upper flap. The lower tabs 99 and 101 are merely spread apart. Looking at the bottom of the flaps, as depicted in FIGURE 13, the flaps 24 and 26 are seen to overlap the portion of the lower flap intermediate the apertures therein, as was also apparent in FIGURE 11. Looking at the top of the upper flap 18, as illustrated in FIGURE 12, portions 102 and 193 of the lower flap 19 are visible through the apertures that were also formed in the upper flap. The tabs 24 and 26 are disposed respectively immediately subjacent the portions 102 and 103 of the lower flap.

What is claimed is:

1. In a method for fastening together two portions of sheet material, the steps comprising, forming an elongated resilient deformation in one of the portions thereby drawing closer together the material of said one portion on opposite sides of the deformation, forming a pair of spaced tabs in the other portion, forming a pair of spaced apertures respectively in the said material of the first portion on opposite sides of the deformation, said tabs extending towards each other and towards said deformation, inserting each of the tabs respectively through said apertures while said first portion is deformed, and flattening out said deformation to spread the said material on opposite sides thereof apart and thereby form an interlocking relationship between said tabs and apertures.

2. In a method for fastening together two flexible portions of sheet material, the steps comprising, resiliently depressing a longitudinal deformation in the first of said portions, placing the second portion flat against said first portion and overlying the concave portion of said deformation, punching through said two portions on one side of said deformation to form a first tab in said second portion overlying a first tab in said first portion, punching through said two portions on the other side of said deformation to form a second tab in said second portion overlying a second tab in said first portion, said tabs in each portion extending towards each other and towards said deformation, and flattening out the deformation in said first portion to spread the material of the deformation in the first portion over the tabs in the second portion.

3. In a method for fastening together two portions of sheet material, the steps comprising, placing the two portions in overlapping relation, forming a longitudinal depression in a first of said portions, making a first cut through both said portions substantially parallel to and spaced from said depression, making a pair of spaced cuts through both of said portions extending respectively from the ends of said first cut away from said depression thereby forming a first tab in said second portion overlapping a first tab in said first portion, making a second cut through both said portions substantially parallel to said depression and spaced therefrom oppositely of said first cut, making a second pair of spaced cuts through both said portions extending respectively from the ends of said first cut away from said depression thereby forming a second tab in said second portion overlapping a second tab in said first portion, and flattening out the depression in said first portion to urge the sheet metal thereof intermediate said first and second cuts thereof into overlapping relation with the tabs of said second portion, the tabs of said first portion being laterally displaced by said flattening relative to the tab of said second portion.

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