Nov. 22, 1949 N. E. WEEKS 2,489,210

APPARATUS FOR ADHESIVELY UNITING SHEET MATERIALS

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FIG. 1.

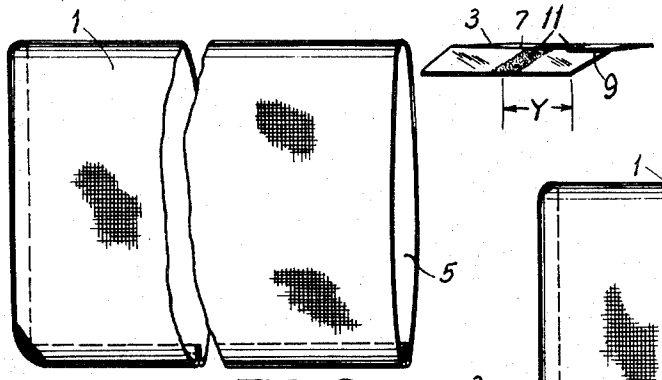


FIG. 4.

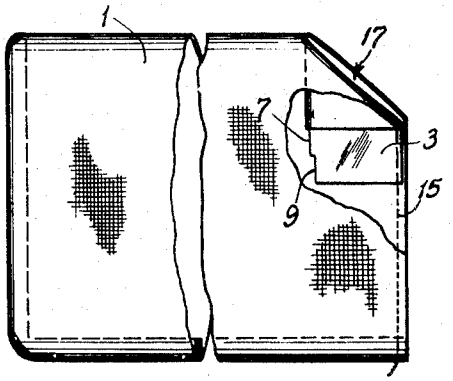


FIG. 2.

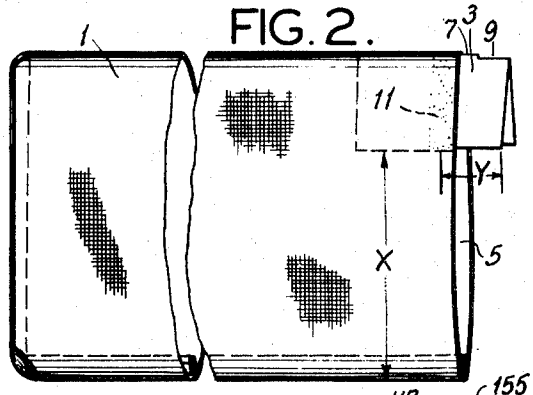
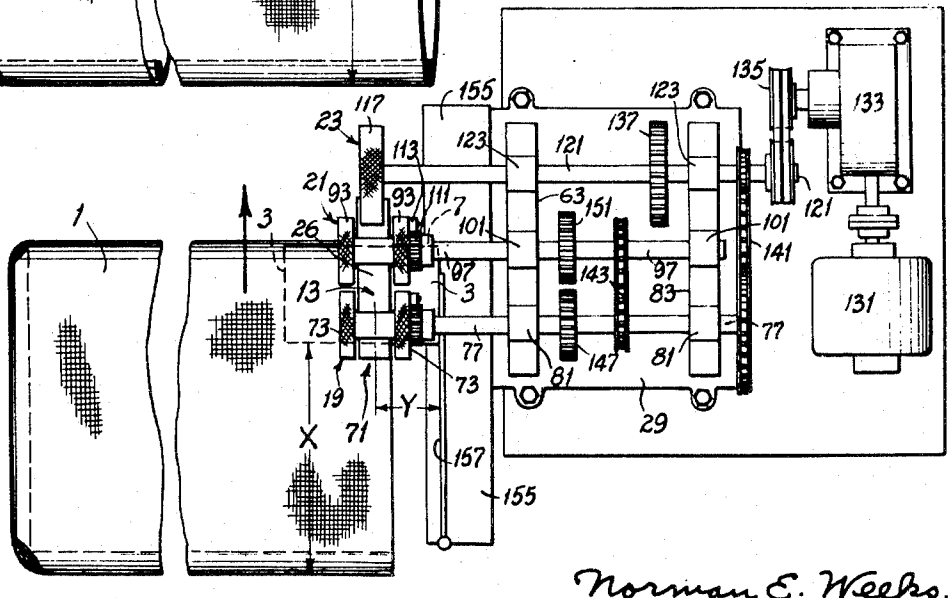


FIG. 3.



Norman E. Weeks,
Inventor.
Haynes and Koenig,
Attorneys.

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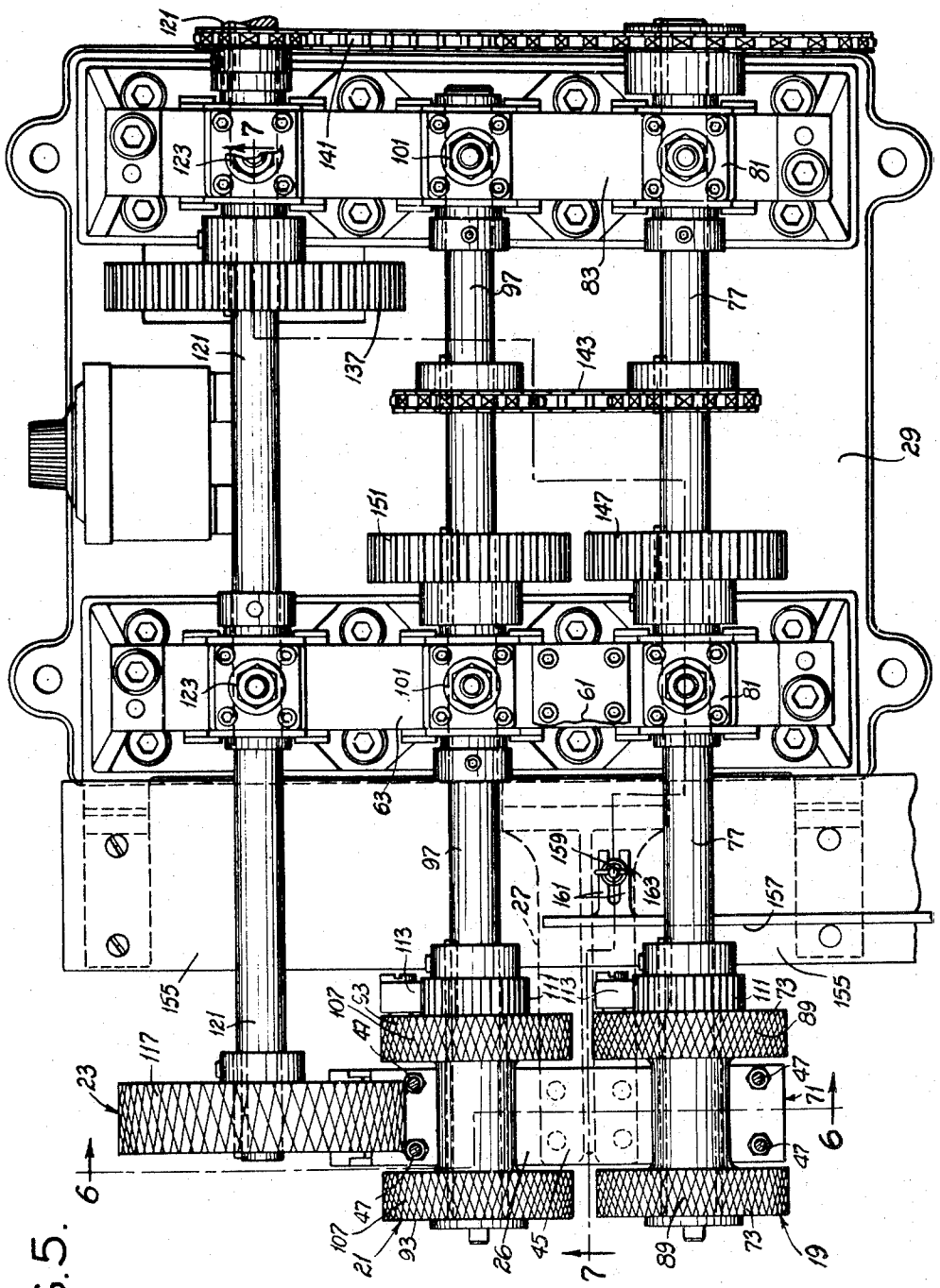


FIG. 5.

Norman E. Weeks,
Inventor.
Haynes and Koenig,
Attorneys.

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FIG. 6.

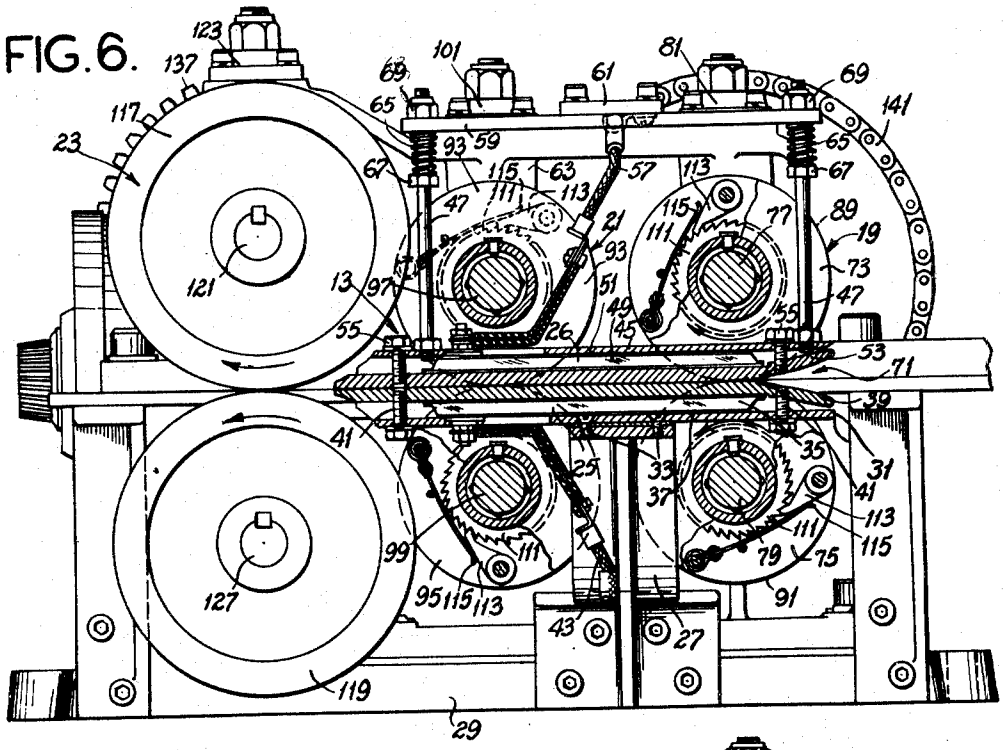
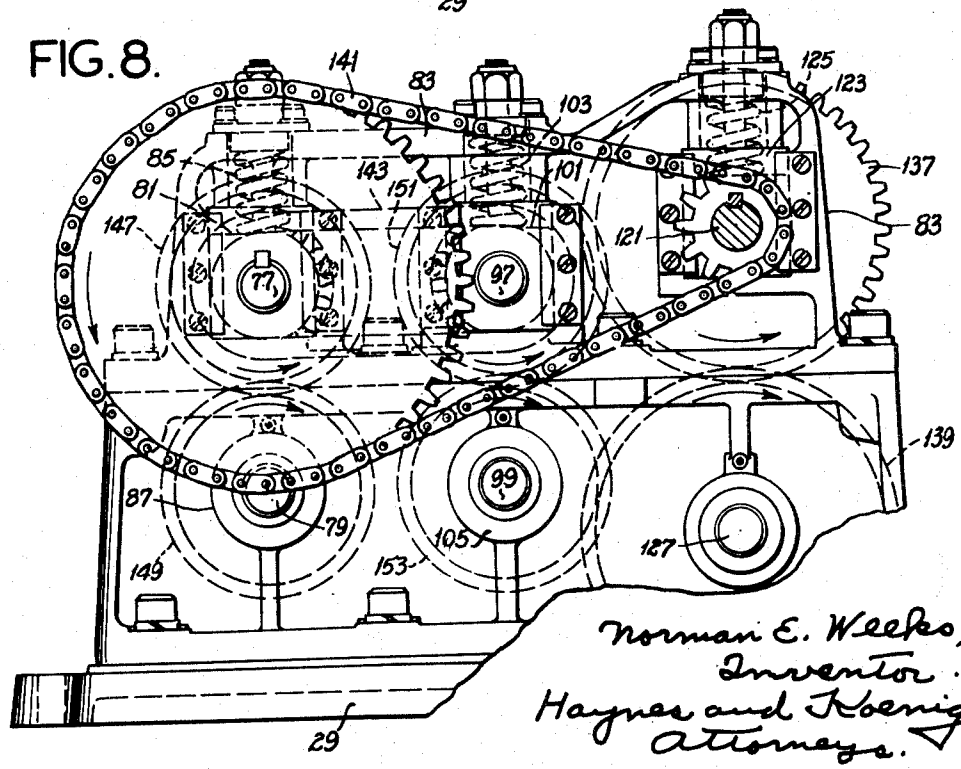


FIG. 8.



Norman E. Weeks,
Inventor.
Haynes and Koenig,
Attorneys.

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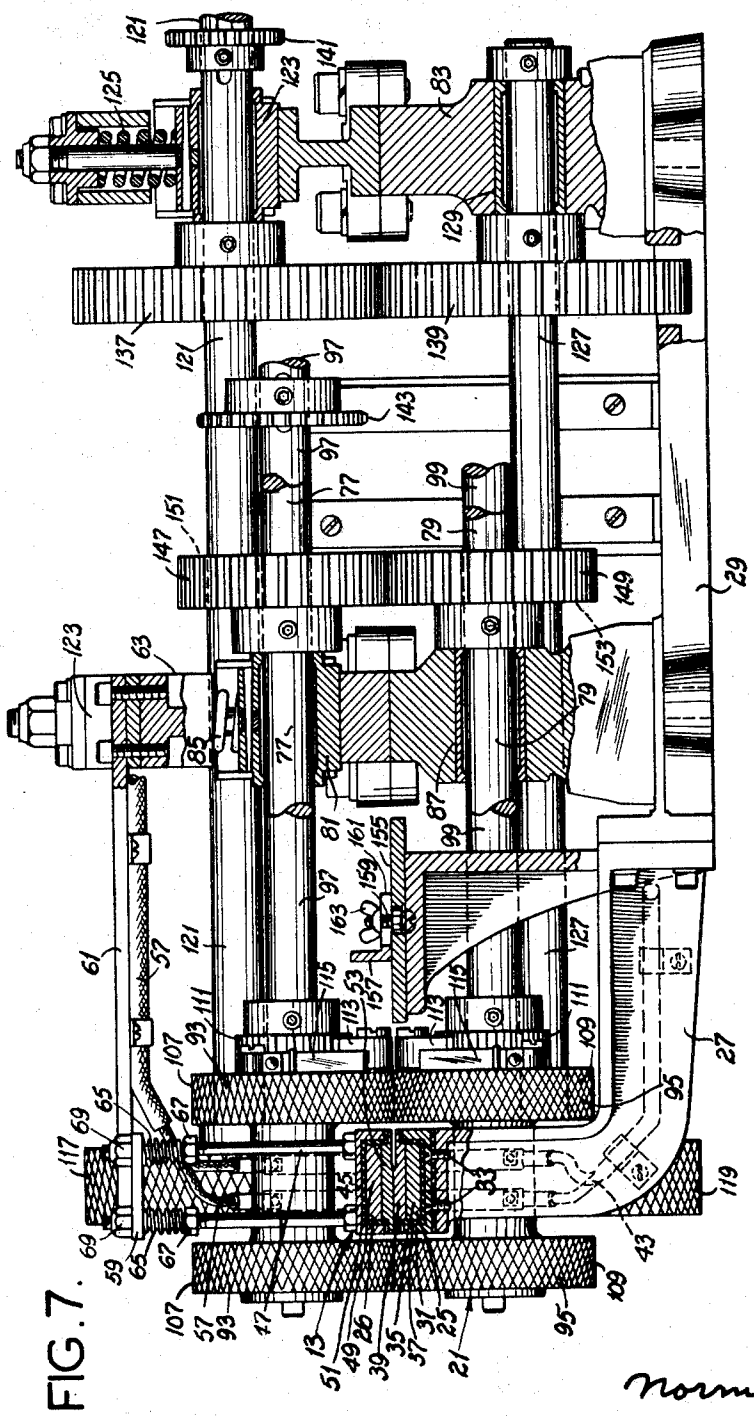


FIG. 7.

Norman E. Weeks,
Inventor.
Haynes and Koenig,
Attorneys.

Patented Nov. 22, 1949 2,489,210

UNITED STATES PATENT OFFICE

2,489,210

APPARATUS FOR ADHESIVELY UNITING SHEET MATERIALS

Norman E. Weeks, Indianapolis, Ind., assignor to Bemis Bro. Bag Company, St. Louis, Mo., a corporation of Missouri

Application December 7, 1946, Serial No. 714,756

10 Claims. (Cl. 154—1.6)

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This invention relates to apparatus for adhesively uniting sheet materials, and more particularly to apparatus for adhesively securing valve sleeves to bag valves.

Among the several objects of the invention may be noted the provision of an improved apparatus for adhesively uniting sheet materials, particularly valve sleeves in bag valves, by means of thermoplastic adhesive; the provision of apparatus of this class adapted to accomplish accurate and effective securement of valve sleeves to bags in minimum time so as to achieve a high production rate of valved bags per operator; and the provision of apparatus for this purpose which requires no special skill on the part of the operator and which may be reliably and safely employed. Other objects will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the elements and combination of elements, features of construction and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

Fig. 1 is an exploded view illustrating a bag and valve sleeve in the process of assembly;

Fig. 2 is a perspective illustrating the assembled bag and valve sleeve;

Fig. 3 is a semi-diagrammatic plan view of the apparatus of this invention also illustrating the step of uniting the sleeve and bag;

Fig. 4 is a view of a completed valve bag;

Fig. 5 is an enlarged detail plan view of the apparatus, certain parts being broken away;

Fig. 6 is a section taken on line 6—6 of Fig. 5;

Fig. 7 is a section taken on line 7—7 of Fig. 5; and,

Fig. 8 is a side elevation as viewed from the right of Fig. 5.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Referring now particularly to Figs. 1–3, Fig. 1 illustrates a textile fabric bag 1 and a valve sleeve 3 which are to be adhesively joined with the apparatus of this invention to form a valve bag. At this stage of the process in the manufacture of the valve bag, the mouth 5 of the bag is open. The sleeve 3 comprises a rectangular paper sheet, the short sides of which are caused to extend longitudinally with respect to the bag. The sleeve is creased on its longitudinal center

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line 7 and has a slit 9 extending inward from its outer edge upon the center line. The sleeve is also prepared with a transverse stripe of thermoplastic adhesive 11 by means of which it is to be adhesively secured to the bag.

To form a valve bag, the sleeve 3 is folded upon the crease with adhesive 11 on the outside of the folded sleeve. It is then inserted into the mouth of the bag, being fitted in a corner thereof as illustrated in Fig. 2, with the stripe of adhesive engaging the inside wall of the bag adjacent its mouth and with the slitted portion of the sleeve extending outward. This bag and sleeve assembly, hereinafter referred to as the "work," is then fed through a heated presser unit 13 (Fig. 3) in a direction parallel to the edge of the bag mouth at such a relatively low rate of speed as to permit the adhesive to soften and secure the sleeve to the bag under pressure. It will be noted from Fig. 3 that the aforesaid corner of the bag is introduced first into the presser unit. It will also be noted that once this corner of the bag has been fed through the presser unit there remains a substantial portion of the work, designated X in Figs. 2 and 3, in which there is no adhesive to be acted upon. Consequently, there is no necessity for feeding this portion of the work through the presser unit at the same relatively low rate of speed as said corner. In order to clear the bag rapidly from the presser unit once its corner issues therefrom, so that the operator may soon feed another bag and sleeve assembly thereto, the apparatus of this invention further includes means for pulling the bag through the unit at considerably higher speed than the aforesaid rate so as quickly to eject the completed product. Thus, that limited portion of the bag and sleeve assembly wherein adhesive is to be softened is fed through the presser unit slowly enough to permit the adhesive to soften, and the remainder of the bag is pulled rapidly out of the presser unit.

The resultant product, which corresponds to Fig. 2 except that the sleeve 3 is now affixed in the corner of the bag at its mouth, is subsequently formed into a valve bag illustrated in Fig. 4 by tucking in the sleeve-lined corner to form a sleeve-lined valve flap. A seam 15 is finally stitched across the mouth of the bag to close it. This forms a valved bag having a valve inlet 17, of which the sleeve liner forms an inward extension, the bag being adapted to be filled with comminuted or pulverulent material by inserting a filling spout through the valve inlet. When the bag is filled, the pressure of the filling

closes the valve and thereby prevents leakage of the filling from the bag, as will be readily understood from the art.

Generally, as stated, the apparatus of this invention embodies means for feeding the work through the presser unit 13 at the rate of speed such as to permit the adhesive to soften. This means comprises two sets 19 and 21 of continuously driven draw rolls which are driven at such a speed as to advance the work at the aforesaid rate. Work issuing from the presser unit is subsequently gripped and pulled through the presser unit and ejected therefrom by a set 23 of continuously driven pulling rolls, which are adapted to impart the aforesaid higher speed of travel to the work. As will be made clear, suitable means are provided in the drives for the draw rolls to permit them to rotate faster than their drives during the work pulling operation.

The presser unit 13 comprises a lower fixed heated presser head 25 and an upper heated presser head 26 which is spring-biased into engagement with the lower head. The lower head is fixed upon the end of a supporting arm 27 which extends outward and upward from the base plate 29 of the apparatus. It comprises a channel bar 31 which is secured by screws 33 to the end of arm 27 with the channel opening upward. Disposed within the channel is an electrical resistance strip heating element 35. A layer 37 of suitable heat insulating material, such as asbestos, is disposed between the heating element and the channel. A steel plate 39 is secured by screws 41 (Fig. 6) to the channel over the heating element. This plate has a smooth upper surface which forms the lower pressure-receiving surface of the presser unit 13. Current is supplied to the heating element 35 by conductors 43.

The upper presser head 26 is similar to the lower head and comprises a channel bar 45 fixed upon the lower end of rods 47 with the channel opening downward. Disposed within the channel is an electrical resistance strip heating element 49, a layer 51 of heat insulating material being disposed between the heating element and the channel. A steel plate 53 is secured by screws 55 to the channel over heating element 49. This plate has a smooth lower surface which forms the pressure-applying surface of the presser unit 13. Current is supplied to heating element 49 by flexible conductors 57.

The upper ends of rods 47 are slidable in apertures in a plate 59 carried by a supporting arm 61 extending outward from a pedestal 63 on base plate 29. The rods are biased downward by compression springs 65 reacting between the under surface of the plate 59 and nuts 67 threaded on the rods to bias the upper presser head into engagement with the lower presser head. The bias is adjustable by means of nuts 69 threaded on the ends of rods 47 extending through plate 59.

From the above it will be clear that work may be fed between the heated pressure plates 39 and 53, as illustrated in Fig. 3, to soften the thermoplastic adhesive stripe 11 on the valve sleeve and to press the bag and valve sleeve firmly together to effect adhesive affixing thereof. The upper plate 53 rises against the bias of springs 65 in accordance with the thickness of the work. The work is fed through the presser unit from right to left as viewed in Fig. 6, it will be noted that plates 39 and 53 diverge at their right hand ends to form an inlet throat 71.

The work is fed between the presser heads by

the aforesaid sets 19 and 21 of draw rolls. The set 19 comprises upper and lower spool-shaped rolls 73 and 75 mounted upon upper and lower draw roll shafts 77 and 79, respectively. The upper shaft 77 is journalled in vertically sliding bearings 81 in the aforesaid pedestal 63 and in another pedestal 83 mounted on base plate 29 and axially spaced from pedestal 63. Bearings 81 are guided for vertical sliding movement in suitable guideways in the pedestals and are biased downward by compression springs 85. Lower shaft 78 is journalled in fixed bearings 87 in the pedestal. The arrangement is such that the axially spaced knurled flange portions 89 of the upper draw roll 73 are biased into engagement with the axially spaced knurled flange portions 91 of the lower draw roll 75, and the upper draw roll may rise as work is fed through the apparatus in accordance with the thickness of the work. The nip of draw rolls 73 and 75 is adjacent the forward end of inlet throat 71 of the presser unit and the pass plane of these rolls is substantially coincidental with the mating plane of the pressure surfaces of plates 39 and 53 (Fig 6).

The set 21 of draw rolls is similar to set 19, comprising upper and lower spool-shaped rolls 93 and 95 mounted upon upper and lower draw roll shafts 97 and 99, respectively. Upper shaft 97 is journalled in vertically sliding bearings 101, corresponding to bearings 81, in pedestals 63 and 83. These bearings are biased downward by springs 103 corresponding to the springs 85. Lower shaft 99 is journalled in fixed bearings 105 in the pedestals. Thus, the knurled flange portions 107 of the upper draw roll 93 are biased downward into engagement with the knurled flange portions 109 of the lower draw roll 95, and the upper draw roll may rise as work is fed through the apparatus in accordance with the thickness of the work. The nip of draw rolls 93 and 95 is some distance rearward of the exit end of the presser unit and the pass plane thereof is substantially coincidental with the plane of the pressure surfaces of plates 39 and 53. It will be noted that the presser unit is disposed within the recesses of the draw rolls between their flange portions.

Each of the aforesaid draw rolls 73, 75, 93 and 95 is adapted to be driven by its respective shaft through an overrunning clutch in order to permit each draw roll to be rotated faster than its shaft when required. As illustrated particularly in Fig. 6, each of the draw rolls is rotatably mounted upon the end of its shaft. A ratchet 111 is fixed upon each draw roll shaft adjacent the draw roll thereon. Pivotally mounted upon the inside flange portion of each draw roll is a pawl 113 biased into engagement with the respective ratchet by a spring 115 carried by said flange portion. The arrangement of the ratchet and pawl mechanism is such that when the draw rolls are rotated in the forward direction at a speed faster than the speed of their respective shafts, the draw rolls may overrun their shafts, the pawls ratcheting over the ratchet teeth during such overrunning action.

The set of pulling rolls comprises an upper knurled roll 117 and a lower knurled roll 119. Upper roll 117 is fixed upon the end of a shaft 121 journalled for rotation in vertically slidable bearings 123 in pedestals 63 and 83. These bearings are guided for vertical sliding movement in suitable guideways in the pedestals and are biased downward by compression springs 125. The lower pulling roll 119 is fixed on the end of a shaft 127 which is journalled in fixed bearings 129 in the

pedestals. The arrangement is such that the upper pulling roll 117 is biased into engagement with the lower pulling roll 119. It will be noted that the upper pulling roll may rise as work is fed through the apparatus in accordance with the thickness of the work. The pulling rolls 117 and 119 are located in such position that the work issuing from between the pressure plates 39 and 53 of the presser unit is picked up in the nip of these rolls and fed outward (to the left as viewed in Fig. 6). Pulling rolls 117 and 119 are of greater diameter than the draw rolls 73, 75, 93 and 95 and their peripheral speed is greater than that of the draw rolls to pull the work through the apparatus at a higher rate of speed than the rate at which the work is fed forward by the draw rolls.

Suitable driving means is provided for driving the draw roll and the pulling roll shafts. As illustrated in Fig. 3, a motor 131 is coupled through a speed reducer 133 and a belt drive 135 to drive the upper pulling roll shaft 121. The upper pulling roll shaft is coupled to drive the lower pulling roll shaft 127 at the same speed by means of intermeshing gears 137 and 139 fixed on the upper and lower shafts 121 and 127, respectively. The upper pulling roll shaft 121 is coupled to drive the upper draw roll shaft 77 by a speed-reducing chain and sprocket drive 141. The upper draw roll shaft 77 is coupled to drive the upper draw roll shaft 97 at the same speed by means of a chain and sprocket drive 143. The upper draw roll shaft 77 is coupled to drive the lower draw roll shaft 79 at the same speed by means of gears 147 and 149, and the upper draw roll shaft 97 is coupled to drive the lower draw roll shaft 99 at the same speed by gears 151 and 153.

The apparatus also includes means for guiding the work into the presser unit and into the nip of the set 19 of drawing rolls. This means comprises a table 155 supported upon the base plate 29 of the apparatus with its upper surface substantially coplanar with the mating plane of the pressure plates 39 and 53 and the pass plane of the draw and pulling rolls. A guide bar 157 is transversely adjustably mounted upon the table. Screws 159 extend upward from the table through slots in slotted fingers 161 on the bar, and the bar is clamped in adjusted position by wing nuts 163 threaded on the screws.

The operation of the apparatus is as follows:

The guide bar 157 is initially adjusted relative to the longitudinal center line of the presser unit 13 so that the distance from the face of the bar to this center line is equal to the distance Y from the outer edge of the valve sleeve 3 to the center line of the stripe 11 of adhesive thereon. Current is supplied to heaters 35 and 49 to heat the pressure plates to a temperature sufficient to soften the adhesive consistent with the rate of speed at which the work is fed therebetween. The motor 131 is energized to drive the draw rolls 73, 75, 93 and 95 and pulling rolls 117 and 119 continuously.

The operator inserts the bag and valve sleeve assemblies illustrated in Fig. 2 successively into the inlet throat 71 of the presser unit in the manner shown in Fig. 3, employing the guide bar 157 as a guide for the outer edge of the valve sleeve. The work is inserted into the throat 71 and between pressure plates 39 and 53 a sufficient distance to introduce it into the nip of the draw rolls 73 and 75, whereupon these draw rolls (and subsequently the draw rolls 93 and 95) function to feed the work forward between the plates at a

speed equal to the nominal peripheral speed of the draw rolls. With the outer edge of the valve sleeve in engagement with guide bar 157, registration of the stripe 11 of adhesive between the pressure plates is assured. As the work is fed between the pressure plates, the adhesive is softened by heat and the plates press the walls of the bag and the valve sleeve firmly together to effect adhesive affixing thereof.

As the forward edge of the work leaves the presser unit, it is caught in the nip of pulling rolls 117 and 119 and the work is pulled through the presser unit at substantially higher speed and delivered from the apparatus to a station where the subsequent operation of tucking in the corner of the bag is performed. During pulling of the work by pulling rolls 117 and 119, draw rolls 73, 75, 93 and 95 are driven by the work in the forward direction at a greater speed than that nominally imparted thereto by their respective drive shafts. During this phase of the operation, the draw rolls overrun their shafts, this being permitted by the pawl-and-ratchet overrunning clutches.

The feature of pulling the work through the presser unit by means of the high-speed pulling rolls is of considerable importance inasmuch as it reduces to a minimum the time required to feed the work through the apparatus. Note that once the corner of the bag having the valve sleeve therein has been fed through the presser unit, there remains the considerable length X of the work to be fed although no heating and pressing operation needs to be performed thereon. Pulling rolls 117 and 119 function to pull this length of the work rapidly through the apparatus after the corner has passed through the pressure plates 39 and 53, and thus the work is delivered away from the apparatus as rapidly as possible and its output is greatly increased, particularly on wide bags. It will also be noted that it is important to feed that portion of the work including the stripe 11 of adhesive between the pressure plates at a rate of speed consistent with the temperature of the plates to enable sufficient softening of the adhesive to effect adhesion of the valve sleeve and bag. The relatively low speed drive of the draw rolls to accomplish this is effected by the speed-reducing drive 141 for the draw rolls.

Thus, the operator may rapidly feed one bag and valve sleeve assembly after the other through the apparatus, inasmuch as each assembly is fed through the apparatus in minimum time. The valve sleeves are effectively secured to the bags in the course of their passage between the pressure plates 39 and 53 due to the heating and softening of the thermoplastic adhesive 11 by the presser unit and the application of pressure to the work. It will be noted that the work is gripped between the knurled flange portions 89 and 91 of draw rolls 73 and 75 and between the knurled flange portions 107 and 109 of draw rolls 93 and 95 in its passage through the apparatus. This permits the portion of the work between the flange portions of the draw rolls to pass between the pressure plates 39 and 53, and be drawn evenly therethrough.

It will be understood that the heaters 35 and 49 are preferably under the control of a suitable thermostatic control device responsive to plate temperature so as to maintain plates 39 and 53 substantially at the temperature required to soften the adhesive for the rate of speed at which the work is fed between the plates. It will be apparent that the plates 39 and 53 must be main-

tained at higher temperatures for higher speeds of the draw rolls in order to soften the adhesive in the course of the passage of the work between the plates.

While the apparatus of this invention has been particularly described herein with reference to its use for securing valve sleeves to bags, it will be understood that it is readily adaptable for use for securing other sheet materials by means of thermoplastic adhesive over a limited portion of the area thereof.

Cross reference under Rule 43 is made to applicant's divisional application entitled Method of adhesively uniting sheet materials, Serial No. 53,717, filed October 9, 1948.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. In apparatus of the class described, a pair of cooperating spool-shaped draw rolls having axially spaced flange portions adapted to grip and feed work, a pair of relatively movable heated pressure plates biased into pressure engagement, said plates being disposed between said flange portions with the plane of engagement of the plates substantially coincidental with the pass plane of said rolls.

2. In apparatus of the class described, a pair of cooperating spool-shaped draw rolls having axially spaced flange portions adapted to grip and feed work, a pair of relatively movable heated pressure plates biased into pressure engagement, said plates being disposed between said flange portions with the plane of engagement of the plates substantially coincidental with the pass plane of said rolls, said draw rolls being relatively transversely movable and being biased into pressure engagement.

3. In apparatus of the class described, a pair of cooperating spool-shaped draw rolls having axially spaced flange portions adapted to grip and feed work, a pair of relatively movable heated pressure plates biased into pressure engagement, said plates being disposed between said flange portions with the plane of engagement of the plates substantially coincidental with the pass plane of said rolls, means for driving said draw rolls at a predetermined speed, overrunning clutch mechanism in said drive means permitting said rolls to run faster than the drive means, a drive, and a work puller adapted to grip and feed forward work issuing from said pressure plates at a speed higher than said predetermined speed.

4. In apparatus of the class described, a pair of cooperating spool-shaped draw rolls having axially spaced flange portions adapted to grip and feed work, a pair of relatively movable heated pressure plates biased into pressure engagement, said plates being disposed between said flange portions with the plane of engagement of the plates substantially coincidental with the pass plane of said rolls, means for driving said draw rolls at a predetermined speed, overrunning clutch mechanism in said drive means permitting said rolls to run faster than the drive means, and a work puller adapted to grip and feed forward work issuing from said pressure plates at a speed higher than said predetermined speed, said work puller comprising pulling rolls adapted to pull work through said pressure plates at said higher speed.

5. Apparatus for adhesively securing valve sleeves in bags comprising at least one set of cooperating spool-shaped draw rolls having axially spaced flange portions adapted to grip and feed a bag and sleeve assembled with thermoplastic adhesive therebetween, a pair of relatively movable pressure plates biased into pressure engagement, said plates being disposed between said flange portions with the plane of engagement of the plates substantially coincidental with the pass plane of said rolls, heaters for heating said plates to a temperature sufficient to soften said adhesive in the course of its passage between said plates, means for driving said draw rolls at a predetermined speed, overrunning clutch mechanism in said drive means permitting said rolls to run faster than the drive means, and pulling rolls adapted to grip a bag and sleeve assembly issuing from said pressure plates to pull said assembly through said plates at a speed higher than said predetermined speed.

6. In apparatus of the class described, a heated presser unit for applying heat and pressure to an assembly of sheet materials having a thermoplastic adhesive therebetween over a limited portion thereof, a first sheet-feeding device positioned to feed said portion of the assembly through the presser unit, means for driving said device at such a rate of speed as to permit the adhesive to soften and unite said materials over said portion under heat and pressure, overrunning clutch mechanism included in said drive means permitting said device to run faster than the drive means, and a second sheet-feeding device located to engage said portion after it issues from the presser unit and driven at a substantially higher rate of speed than the first sheet-feeding device to pull the remainder of the assembly through the presser unit at the higher rate of speed and thereby rapidly to clear the presser unit so that it may receive another assembly.

7. In apparatus as set forth in claim 6, the presser unit comprising a pair of relatively movable heated pressure plates biased into pressure engagement.

8. In apparatus of the class described, a heated presser unit for applying heat and pressure to an assembly of sheet materials having a thermoplastic adhesive therebetween over a limited portion thereof, a first set of feed rolls positioned to feed said portion of the assembly through the presser unit, means for driving said rolls at such a rate of speed as to permit the adhesive to soften and unite said materials over said portion under heat and pressure, overrunning clutch mechanism included in said drive means permitting said rolls to run faster than the drive means, and a second set of feed rolls located to engage said portion after it issues from the presser unit and driven at a substantially higher rate of speed than the first set of rolls to pull the remainder of the assembly through the presser unit at the higher rate of speed and thereby rapidly to clear the presser unit so that it may reecive another assembly.

9. In apparatus of the class described, a heated presser unit for applying heat and pressure to an assembly of sheet materials having a thermoplastic adhesive therebetween over a limited portion thereof, a set of draw rolls comprising a pair of relatively movable rolls biased into pressure

engagement positioned to feed said portion of the assembly through the presser unit, means for driving said device at such a rate of speed as to permit the adhesive to soften and unite said materials over said portion under heat and pressure, overruning clutch mechanism included in said drive means permitting said draw rolls to run faster than the drive means, and a set of pulling rolls comprising a pair of relatively movable rolls biased into pressure engagement and located to grip said portion after it issues from the presser unit and driven at a substantially higher rate of speed than the draw rolls to pull the remainder of the assembly through the presser unit at a higher rate of speed and thereby rapidly to clear the presser unit so that it may receive another assembly.

10. In apparatus of the class described a heated presser unit comprising a pair of relatively movable heated pressure plates biased into pressure engagement for applying heat and pressure to an assembly of sheet materials having a thermoplastic adhesive therebetween over a limited portion thereof, a first set of draw rolls positioned to feed said portion of the assembly through the presser unit, means for driving said rolls at such a rate of speed as to permit the adhesive to soften and unite said materials over said portion under heat and pressure, overrunning clutch mechanism included in said drive means permitting said rolls to run faster than the drive means, and a set of pulling rolls located to grip said portion after it issues from the presser unit and driven at a substantially higher rate of speed than the draw rolls to pull the remainder of the assembly through the presser unit at the higher rate of speed and thereby rapidly to clear the presser unit so that it may receive another assembly.

NORMAN E. WEEKS.

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