Aug. 29, 1967 J. G. S. BILLINGSLEY ETAL 3,338,770

APPARATUS FOR HEAT-SEALING FILMS

Filed Oct. 18, 1963 3 Sheets-Sheet 1

FIG. 1

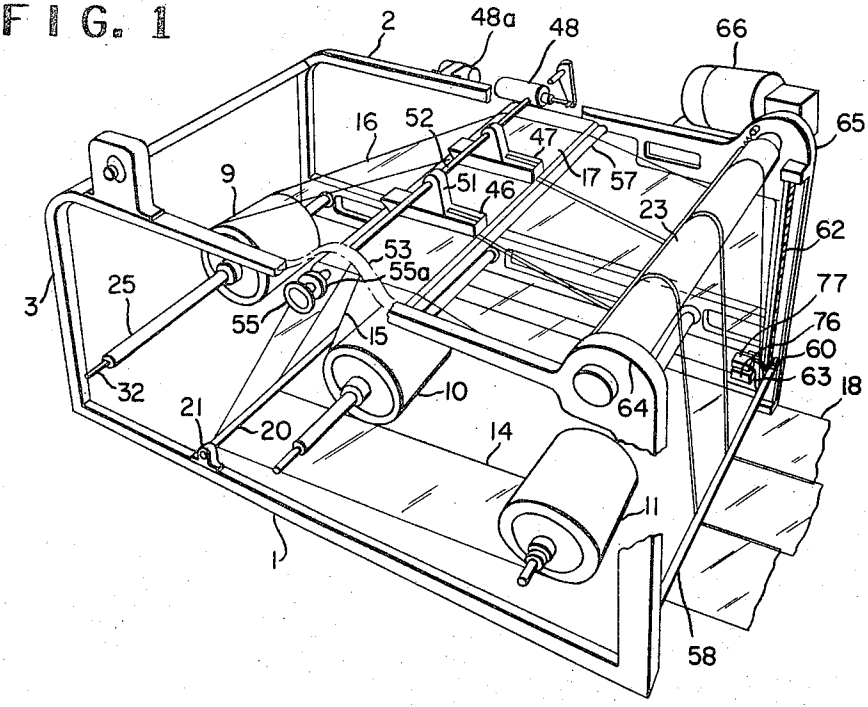
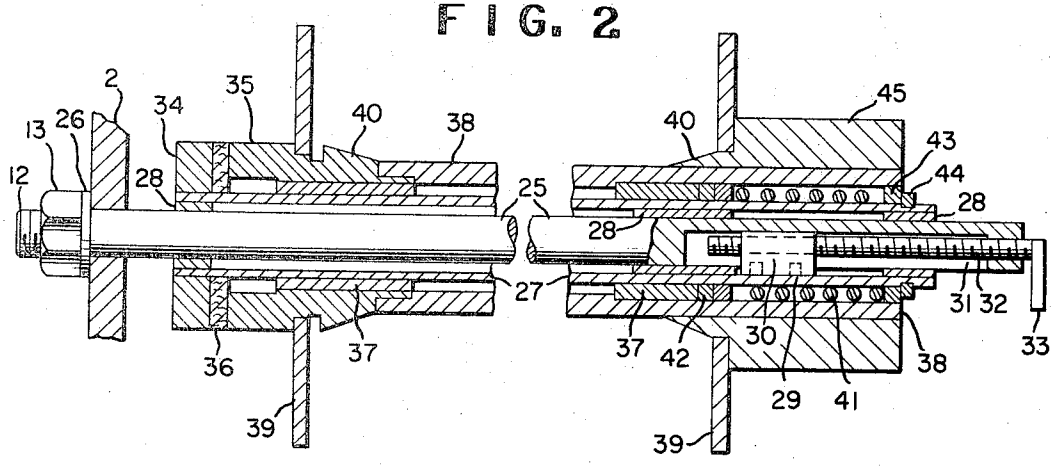


FIG. 2



INVENTORS
JOHN G. S. BILLINGSLEY
JOSEPH J. D'ANGELO
ALBERT LUBISCO
FRANK G. MAROS
PAUL G. STEPHAN

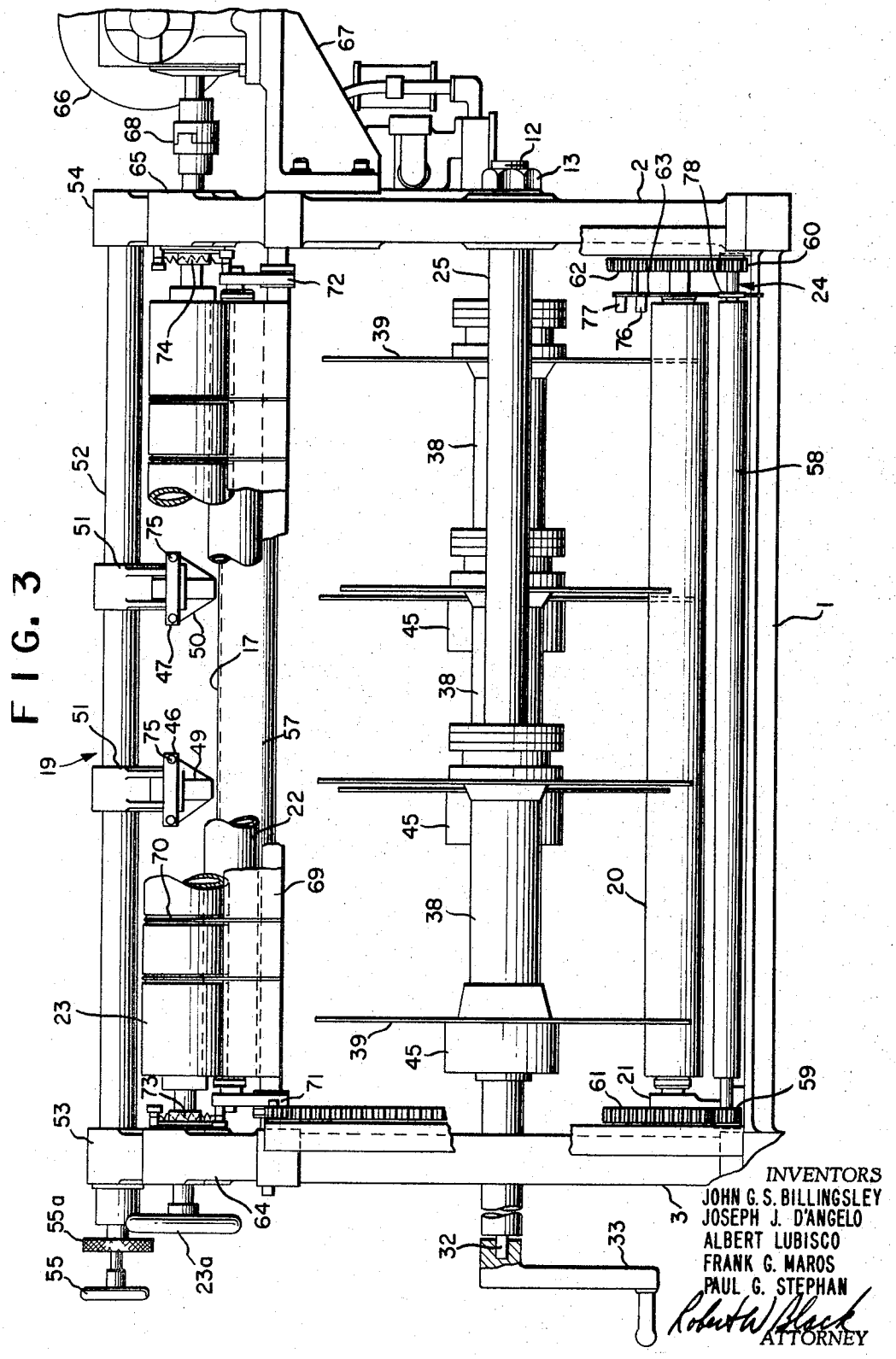
BY Robert W Black
ATTORNEY

Aug. 29, 1967 J. G. S. BILLINGSLEY ETAL 3,338,770

APPARATUS FOR HEAT-SEALING FILMS

Filed Oct. 18, 1963 3 Sheets-Sheet 2

FIG. 3



INVENTORS
JOHN G. S. BILLINGSLEY
JOSEPH J. D'ANGELO
ALBERT LUBISCO
FRANK G. MAROS
PAUL G. STEPHAN
Robert W. Black
ATTORNEY

Aug. 29, 1967 J. G. S. BILLINGSLEY ETAL 3,338,770

APPARATUS FOR HEAT-SEALING FILMS

Filed Oct. 18, 1963 3 Sheets-Sheet 3

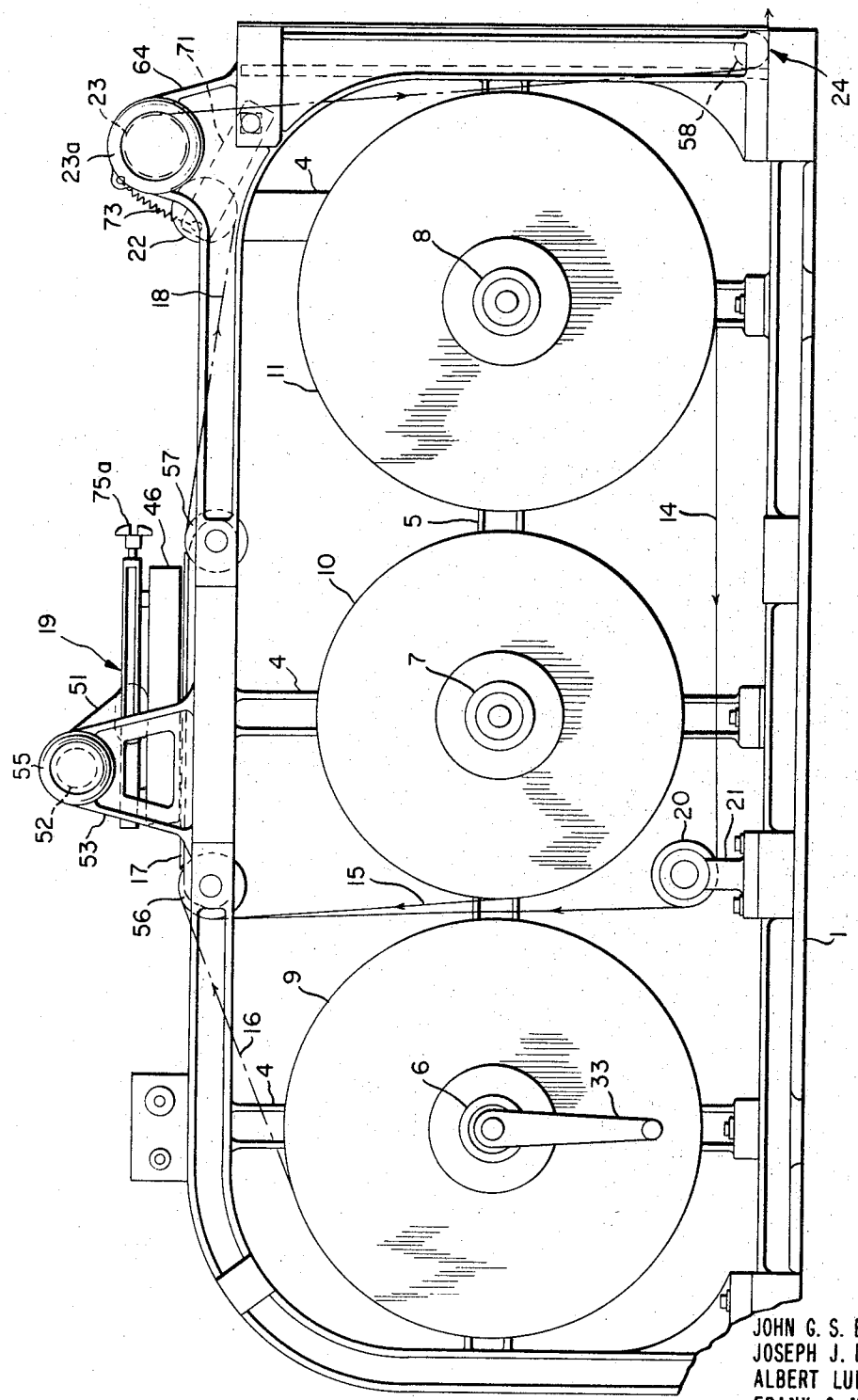


FIG. 4

INVENTORS
JOHN G. S. BILLINGSLEY
JOSEPH J. D'ANGELO
ALBERT LUBISCO
FRANK G. MAROS
PAUL G. STEPHAN

BY Robert W Black

ATTORNEY

United States Patent Office 3,338,770 Patented Aug. 29, 1967

3,338,770

APPARATUS FOR HEAT-SEALING FILMS

John George Selby Billingsley, Newark, Del., Joseph John D'Angelo, Wyckoff, N.J., Albert Lubisco, Merrick, N.Y., Frank George Maros, Park Ridge, N.J., and Paul Glenn Stephan, Landenberg, Pa., assignors to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware

Filed Oct. 18, 1963, Ser. No. 317,214
8 Claims. (Cl. 156—359)

This invention relates to film-combining apparatus and more particularly to automatically controlled film-combining and feeding apparatus.

Articles such as loaves of bread are often completely wrapped in a transparent film under which is placed a band of printed wax paper or film approximately ⅓ the width of the loaf and centrally located on the loaf. The printing on the band gives the type of bread, basic ingredients, baker's name, etc. This band proves to be very annoying since it impedes the removal of the slices of bread from within the package, which generally frustrates the consumer.

This problem is sometimes partially solved by heating the waxed label strip and adhering it to the transparent film before the bread is wrapped. This anchors the loose inner band but, from the standpoint of cost, it is desirable to eliminate the band completely. Obviously, this can be accomplished by printing the center portion of a wide web of film which is to be wrapped about the loaf of bread; however, this increases the cost of printing the film, since film printers charge on the basis of the width of the entire web of film printed, not upon the amount of printing alone. Accordingly, it becomes evident that the most economical solution to this problem lies in printing a web of film just wide enough for the printing, and then combining the printed web with a clear web on each side of it.

It is, therefore, an object of this invention to provide an automatically controlled, film-combining and feeding apparatus.

It is a further object of this invention to provide an apparatus for combining three continuous webs of film into a single continuous web and for feeding the combined continuous web directly to a wrapping machine.

It is a still further object of this invention to provide a film-combining and feeding apparatus which can be used in conjunction with and automatically controlled by the requirements of conventional bread-wrapping machines.

These and other important objects and advantages of the invention will become apparent as the same is more fully understood from the following description, which, taken in connection with the accompanying drawings, discloses preferred embodiments of the invention wherein:

FIGURE 1 is a simplified perspective view of the film-combining apparatus showing the positions of the film rolls, the heat-sealing assembly and the finished combined film discharge;

FIGURE 2 is a sectional view of the mandrel assembly;

FIGURE 3 is a cutaway end view of the film-combining apparatus and

FIGURE 4 is a side view of the film-combining apparatus.

Referring to the drawings, the film-combining apparatus of this invention comprises a base frame **1**, an open front frame **3**, a rear frame **2** having three substantially vertical ribs **4** intersecting a horizontal rib **5** which extends the length of rear frame **2**. Unwind mandrels **6**, **7** and **8** adapted to hold film rolls **9**, **10** and **11** are fixedly mounted at the intersections of ribs **4** and **5** by extending the threaded end **12** of mandrels **6**, **7** and **8** through the

intersections and fixing them in place by means of nut **13**. The opposite ends of **6**, **7** and **8** extend unattached through the opening in front frame **3**.

The three individual film webs **14**, **15** and **16** are drawn over table **17** with their edges in an overlapping manner and heat sealed into a single, continuous, combined web **18** by the heat-sealing assembly **19**. Outside web **14** passes around guide roll **20**, mounted on bracket **21**, affixed to the bottom frame **1**, and then over roll **56** onto table **17**. Center and back webs **15** and **16** go directly over roll **56** onto table **17**. Table **17** is covered with a tetrafluoroethylene resin-coated glass fabric to prevent sticking of the films. The combined web is then drawn into the nip between pressure roll **22** and drive roll **23**, both mounted between front frame **3** and rear frame **2** at the top exit end of the apparatus, and is then pulled under dancer roll **58** by the wrapping machine (not shown). The combining apparatus is positioned in line with the wrapping unit so that the combined web of film can be fed directly into the wrapping unit.

The details of mandrels **6**, **7** and **8** on which the film rolls are mounted are shown in FIGURE 2. The mandrel assembly shown in FIGURE 2 makes possible the rapid loading of rolls of film. The assembly consists of a cantilever-supported solid shaft **25** having a threaded end **12** which is bolted to rear frame **2** by means of nut **13** with an inserted washer **26**.

A hollow tubular shaft **27** is positioned around solid shaft **25**. Bronze bearings **28** are positioned between solid shaft **25** and hollow shaft **27** at each end, which allows hollow shaft **27** to be horizontally adjusted. The fit between the solid shaft and the tubular shaft is such that the tubular shaft does not rotate freely. Two set screws **29** connect a threaded nut **30** to tubular shaft **27**. Threaded nut **30** slides freely in groove **31** of solid shaft **25**. Threaded screw **32** inserted into the end of solid shaft **25** fits into threaded nut **30** and allows horizontal adjustment of the rotating portion of the mandrel on the solid shaft by turning crank **33**. Graduations are marked on the top of the crank end of the solid shaft and are uncovered as tubular shaft **27** is moved inwardly to indicate the position of the roll of film.

At the opposite end of the mandrel assembly, brake disk **34** is attached to the outer end of tubular shaft **27**, and between brake disc **34** and hub **35** a felt brake disc **36** is positioned to provide a braking surface between brake disc **34** and hub **35**. Hub **35** is force fitted into hollow outer tube **38**. Bronze bearings **37** allow hub **35** and outer tube **38** to rotate freely about tubular shaft **27**. A cheek plate **39** is fastened to hub **35** to help position the roll of film on the mandrel. Tapered lands **40** provide centering and gripping of the cardboard core of the film roll.

At the adjustment end of the assembly, hollow outer tube **38** is supported from inner hollow shaft **27** by bronze bearing **37**. Bronze bearing **37** is separated from braking spring **41** by two washers **42**. The braking spring is positioned between hollow outer shaft **38** and hollow inner shaft **27** and is kept in position by washer **43** and a snap ring **44**. The braking spring provides pressure through outer shaft **38** to hub **35**, thereby compressing felt brake disc **36** to provide braking action between stationary shaft **27** and rotating shaft **38**. This is necessary to reduce the forward spin of the mandrel once the unit has stopped, thereby eliminating film backlash. Removable hub **45** is positioned over hollow outer shaft **38** and is held in place by a thumb screw (not shown). Another cheek plate **39** is fitted onto hub **45**.

The heat-sealing assembly **19** comprises heat-sealing units **46** and **47** mounted in parallel on rotatable bar **52** over the overlapping edges of films **14**, **15** and **16** as they pass over table **17**. Rotatable bar **52** is actuated by

air cylinder 48 which is positioned by solenoid valve 48*a* which is, in turn, actuated by stop-start switch 76 located adjacent to and triggered by the dancer roll so that heat-sealing units 46 and 47 are raised and lowered to provide contact with the films passing across sealing table 17.

Heat-sealing units 46 and 47 are of the conventional type and are constructed of a conductive metal bar 49 with receptacles for a standard 220 volts heater cartridge (not shown) and a conventional temperature control device (not shown). The bottom of each unit, which contacts the film, is covered with a tetrafluoroethylene resin-coated glass fabric 50 to prevent sticking of the films. Rollers 75 attached to each side of the unit allow the fabric to be shifted when worn by turning knob 75*a*.

Each heat-sealing unit is pivotally suspended from an arm 51 which is mounted on rotatable bar 52. Rotatable bar 52 extends between front frame 3 and rear frame 2, mounted in brackets 53 and 54 extending above the front and rear frames. Hand wheel 55 adjusts the distance between the heat-sealing units 46 and 47 and hand wheel 55*a* moves the heat-sealing units 46 and 47, as a unit, to provide sideways adjustment from the center of the combining unit.

Rolls 56 and 57, positioned at each end of sealing table 17 and mounted on front frame 3 and rear frame 2, provide roll surfaces to assist the three webs of film on to and the combined web off of the heat-sealing table 17.

Drive roll 23 is grooved, rubber-covered roll extending between the front and rear frames at one end of the apparatus on brackets 64 and 65 extending above the front and rear frames. An electric motor 66 mounted on motor bracket 67 on rear frame 2 drives roll 23 through a right angle-gear reducer arrangement and is connected to drive roll 23 by coupling 68. A comb tray 69 with fingers 70 extending into the grooves of the rubber-covered drive roll prevents the web of film from wrapping around the roll. Comb tray 69 is mounted between the front and rear frames directly under the outer tangential edge of drive roll 23. Hand wheel 23*a* permits manual rotation of drive roll 23 when threading up the apparatus.

Pressure roll 22 is positioned on the opposite side of drive roll 23 from the comb tray 69 and is supported at each end by swing arms 71 and 72 mounted on the front and rear frames. Springs 73 and 74 are connected to pins extending from brackets 64 and 65 and from the pins connecting swing arms 71 and 72 to each end of pressure roll 22.

Dancer roll assembly 24 comprises the dancer or slack roll 58 having an internal shaft with gears 59 and 60 attached at each end which move vertically in racks 61 and 62 attached to the front and rear frames. Lever arm 63, of stop-start switch 76 and trim-speed switch 77, is attached to rear frame 2 and is positioned under dancer roll 58. Dancer roll 58 is mounted on its shaft through ball bearings and is therefore free to rotate as it is driven by the moving combined web 18. Since the counter-balanced lever arm 63 of stop-start switch 76 and trim-speed switch 77 will gradually cut into the surface of the rotating dancer roll 58 each time the dancer roll contacts the lever arm, a ball bearing 78 is located at the end of the dancer roll so that it provides a rolling, rather than a sliding relation with the lever arm.

In operation, the three individual rolls of film are mounted on separate mandrels so that they can be removed and replaced quickly with relative ease. The rolls are adjusted on the mandrels so that when the film is threaded through the unit, the center web overlaps the two outer webs. While the machine is especially suitable for using films of regenerated cellulose having heat-sealable coatings, any compatible heat-sealable films can be used.

The three webs of film are drawn over the stationary heat-sealing table and under the heat-sealing units to seal the three films into one continuous web. The resulting

single, continuous web is pulled between the pressure roll and the grooved rubber-covered drive roll providing a positive forward movement for the combined web. After leaving the drive roll, the combined web passes under a dancer roll at the output side of the apparatus to the wrapping machine. This roll compensates for the variable rate of film pull by the wrapping machine in that it actuates a switch which stops and starts the drive motor and also operates the solenoid valve which controls the heat-sealing units. This roll also actuates a switch which varies the speed of the drive motor.

Positioning of the combining apparatus in relation to the wrapping machine is very important since it is obvious that if the film is not fed in a straight line into the wrapping machine, but at a slight angle, the film will wrinkle and crease and impede the operation of the wrapping unit. It is also imperative that the combining apparatus be placed on the same center line as the wrapping unit.

The engagement and disengagement of the sealing units is controlled by and responsive to the combination of the dancer roll, the stop-start switch, the solenoid valve and the air cylinder. The dancer roll keeps the web of film under constant tension and moves in a vertical plane. When the combining apparatus produces excess film to the extent that the dancer roll drops to its lowest position, the roll opens a switch which breaks the electrical circuit to the solenoid valve. This valve then shifts the air pressure to the opposite end of the air cylinder and the air pressure pushes the piston which is attached to the arm of the rotatable sealer bar, lifting the sealer units off of the film, thereby preventing burn-through of the films. When film is again required by the wrapping unit, the movement of the film raises the dancer roll, thereby closing the switch which actuates the solenoid valve in the reverse direction and the sealers are again brought into contact with the film.

The dancer roll is important to the functioning of the apparatus in several aspects. Most wrapping machines do not pull film at a constant rate as the product is wrapped but pull film in a jerky and erratic motion; therefore, some compensation must be taken into account to overcome this variable. The dancer roll is a compensating mechanism which takes care of differences in the rate of the wrapping machine requirements and that which is produced in the combining operation. As the film is pulled by the wrapping unit, the dancer roll will rise with the film and when slack film is present, the dancer roll will drop downward. The term dancer roll is descriptive of its rising and falling motion as the machine is operated.

As can readily be seen, without this compensating mechanism the constant speed drive roll of the combining unit either produces excess film for the wrapping unit, which sooner or later causes a shutdown or, if driven too slowly, feeds insufficient film which causes the film to be pulled through the combining unit, possibly tearing the web. However, it has been found that the compensation provided by the dancer roll can be insufficient and excess film can still tend to be produced by the combining apparatus. Therefore, when the dancer roll reaches its lowest point in its vertical travel, it actuates a switch which stops the electric motor of the drive roll. This is the same switch which actuates the solenoid valve previously described.

To have further control over the motor drive mechanism in order to keep as continuous a film feed as possible, rather than stopping and starting the combining apparatus frequently, a separate "trim speed" switch is also installed on the lever arm below the dancer roll. This switch operates a resistance in the motor control circuit to reduce the operating speed of the drive roll approximately 15–20%. The average film speed obtained then depends upon the amount of dancer roll travel within the respective speeds mentioned above. The average film demand from the wrapping machine is therefore compensated for automatically by this feature.

A three position toggle switch is located on the opera-

tor's side of the combining unit to control the solenoid operation. When the switch is placed in the automatic position, the current travels through the stop-start switch which is actuated by the dancer roll and then to the solenoid valve. Under operating conditions, the stop-start switch is closed until actuated by the dancer roll which breaks the circuit which takes place when excess film is produced. In the manual position, the stop-start switch is by-passed and there is a direct flow of current to the motor and to the solenoid valve, thereby eliminating the automatic control provided by the dancer roll. The manual switch is generally used only in the initial film threading procedure so that the webs of film can be sealed together before feeding into the wrapping unit. The center position of the toggle switch allows no current to pass in either direction and deactivates the drive motor and the solenoid valve.

An advantage of this apparatus is that it can combine three individual webs of film for wrapping purposes. This allows for the fabrication of a variety of wraps in an economically feasible manner with reduced film printing costs. The combining unit is controlled by the wrapping machine and puts out only enough film to be used by the wrapping unit. The loading and unloading of rolls of film and the adjusting or positioning of these rolls easily and quickly is possible by the unique design of the mandrel assembly. The accomplishment of preventing burn-through of the film by the automatic removal of the heat sealer from the film when the unit has stopped is another important advantage of the apparatus.

What is claimed is:

1. Apparatus comprising in cooperative association a frame, means for supplying a plurality of heat-sealable film structures secured to said frame, means attached to said frame for supporting said film structures in a substantially flat and horizontal plane with the edge portions of adjacent film structures in overlapped relation, heat-sealing means attached to said frame adapted to contact said overlapped edge portions of said film structures for applying heat and pressure thereto and uniting said overlapped edge portions to provide a unitary and continuous web of film, drive means rotatably secured to said frame adapted to engage said unitary and continuous web of film thereby to draw said film from and through said heat-sealing means, and control means cooperatively associated with said heat-sealing means and said drive means in combination with a rotatable member disposed in said frame adapted to engage said unitary and continuous web of film whereby said rotatable member responsive to the movement of said web of film thereover actuates said control means for rendering operative said heat-sealing means and said drive means.

2. The film-combining apparatus of claim 1 wherein means for supplying a multiplicity of heat-sealable film structures comprises internally adjustable, cantilever-supported mandrels having integral brakes and being adapted so as to permit lateral positioning of heat sealable film thereon.

3. The film-combining apparatus of claim 1 wherein the means for heat-sealing the overlapped film edges comprises a rotatable bar positioned relative to said films; heated bars mounted from said rotatable bar adapted to contact the overlapped film edges and calibrated adjusting means for said heated bars for adjusting said bars in relation to each other and as a unit in relation to the center line of the apparatus, said heated bars being actuated into and out of contact with the films by an air cylinder controlled through a solenoid valve assembly which is actuated by said control means.

4. The film-combining apparatus of claim 1 wherein said drive means comprises a roll adapted to be driven by a motor and a pressure roll adjacent to and contacting said motor-driven roll, for engaging said unitary and continuous web of film therebetween.

5. The film-combining apparatus of claim 1 wherein said control means comprises an electric switch in cooperative association with a dancer roll under which said unitary and continuous web of film passes causing said dancer roll to rise and fall in a vertical path according to the movement of said web; a bearing positioned at one end of said dancer roll; a lever arm positioned near the lower extremity of the vertical travel of said dancer roll and extending under said bearing for actuating said switch thereby to control the speed of said drive means, including a second switch actuated by said lever arm for starting and stopping said drive means and actuating said heat-sealing means.

6. A film-combining apparatus comprising a frame, three internally adjustable mandrels cantilever-supported at one end by said frame, said mandrels having integral braking and calibrated lateral adjustment means and each adapted to support rolls of heat-seal films mounted thereon, a stationary table mounted on said frame over which said film structures pass with edge portions of adjacent film structures in overlapped relation, a rotatable bar positioned over said table having at least one heat-sealing unit adjustably mounted thereon and adapted to engage said overlapped edges to heat-seal said film structures into a unitary and continuous web including calibrated adjusting means on said rotatable bar for adjusting said heat-sealing units in relation to each other and as a unit in relation to the center-line of the apparatus, a solenoid valve assembly in cooperative association with an air cylinder operatively connected to and adapted to actuate said rotatable bar thereby moving said heat-sealing units into engagement with the overlapped edge portions of said film structures, a drive roll adapted to be driven by a motor in cooperative association with a pressure roll pivotably mounted on said frame adjacent thereto and between said drive roll and said stationary table for engaging said unitary and continuous film structure therebetween for drawing said films from said mandrels over said table and under said heat-sealing units, gear racks vertically mounted on each side of said frame under said drive roll in cooperative association with a dancer roll having an internal shaft and gears fixedly mounted on each end of said shaft whereby said dancer roll moves vertically within said gear racks in response to the movement of said unitary and continuous film structure thereover, a bearing positioned at one end of said dancer roll cooperatively disposed thereon for actuating a lever arm positioned near the lower extremity of the vertical travel of said dancer roll adapted to actuate a switch for controlling the speed of said motor and a second switch for starting and stopping said motor and for actuating said solenoid valve assembly.

7. The apparatus of claim 6 wherein the stationary table and heat-sealing bars are covered with a tetrafluoroethylene resin-coated glass fabric.

8. The apparatus of claim 6 wherein the drive roll is a grooved, rubber-covered roll and wherein metallic fingers extend into the grooves to prevent the web of film from wrapping around said drive roll.

References Cited

UNITED STATES PATENTS

2,712,343	7/1955	Stanton	156—583
2,805,700	9/1957	Klashing et al.	156—515
2,814,328	11/1957	Jess	156—554
2,918,106	12/1959	Fener	156—516
3,030,244	4/1962	Waite	156—554 XR
3,247,045	4/1966	Bursak	156—367

EARL M. BERGERT, *Primary Examiner.*

M. L. KATZ, *Assistant Examiner.*