Dec. 18, 1956 W. H. ANGEVINE, JR 2,774,525

PLEATING APPARATUS

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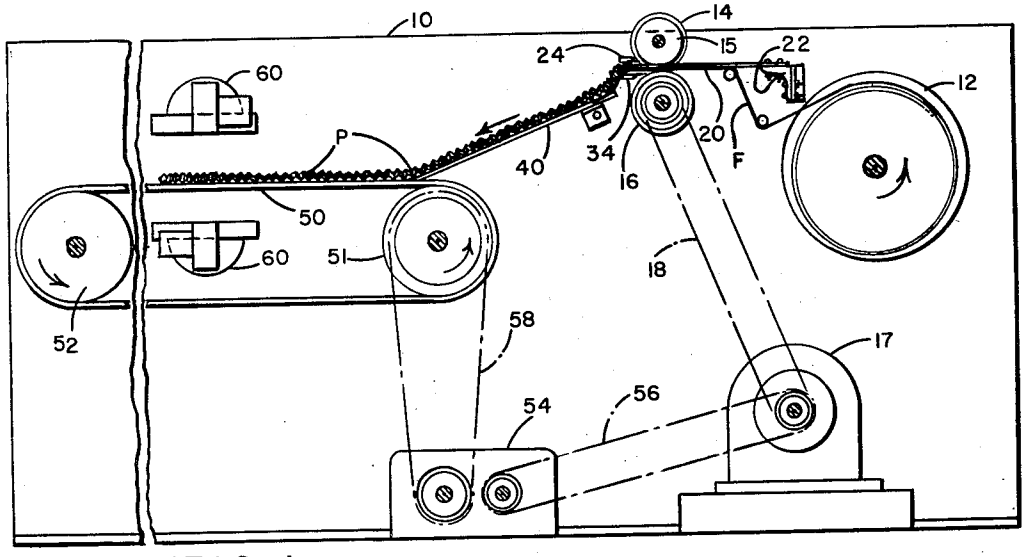


FIG. 1

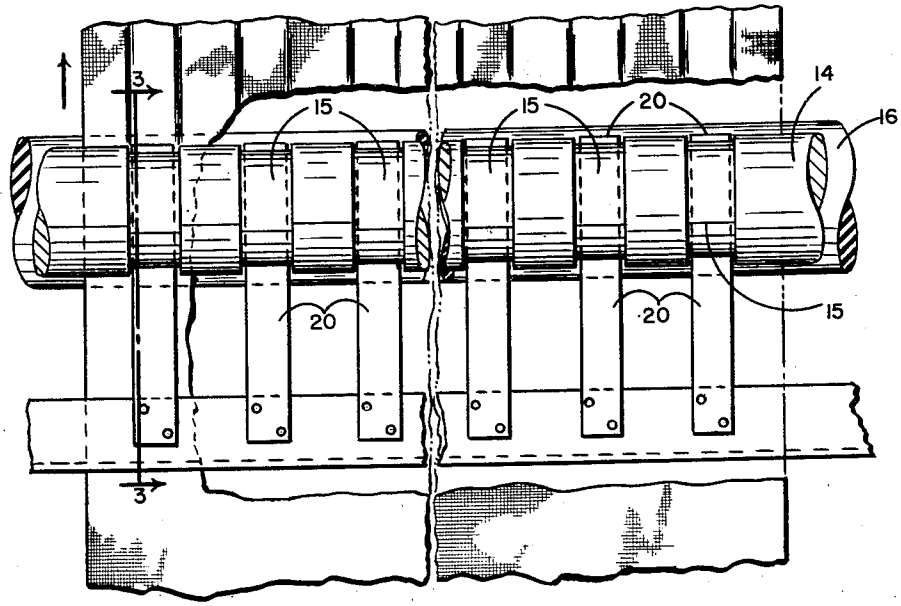


FIG. 2

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FIG. 3

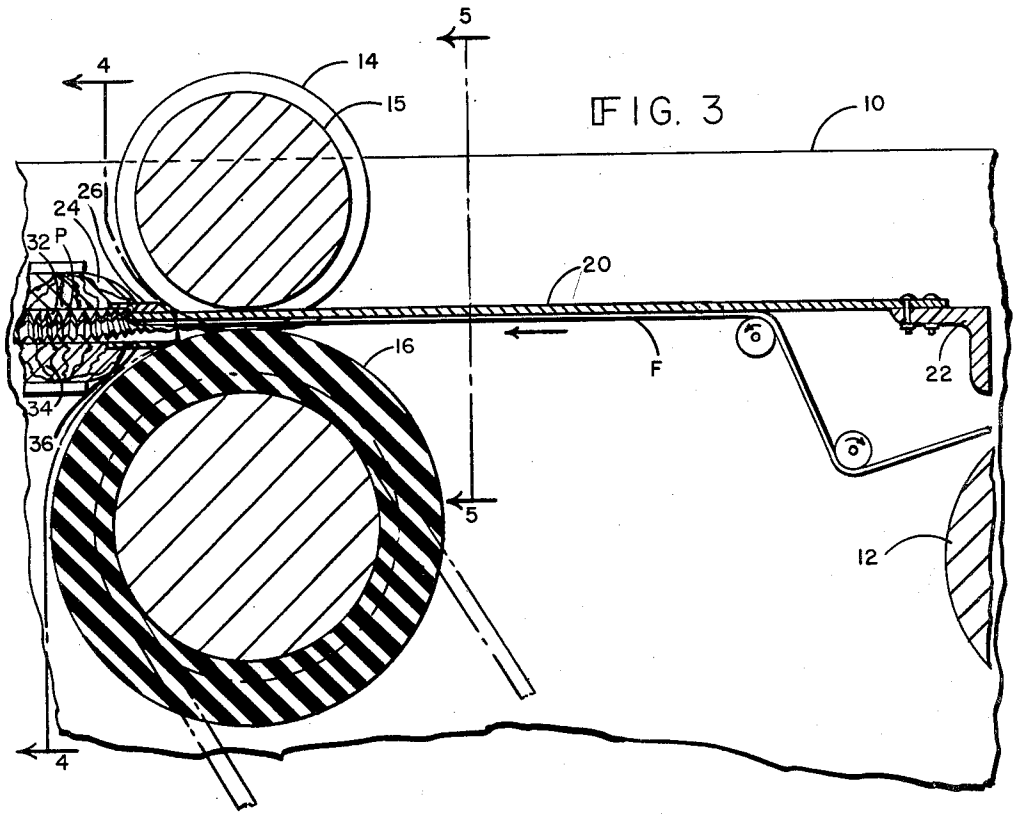
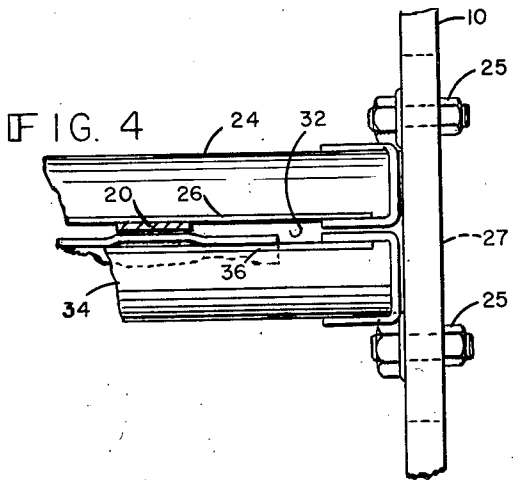


FIG. 4

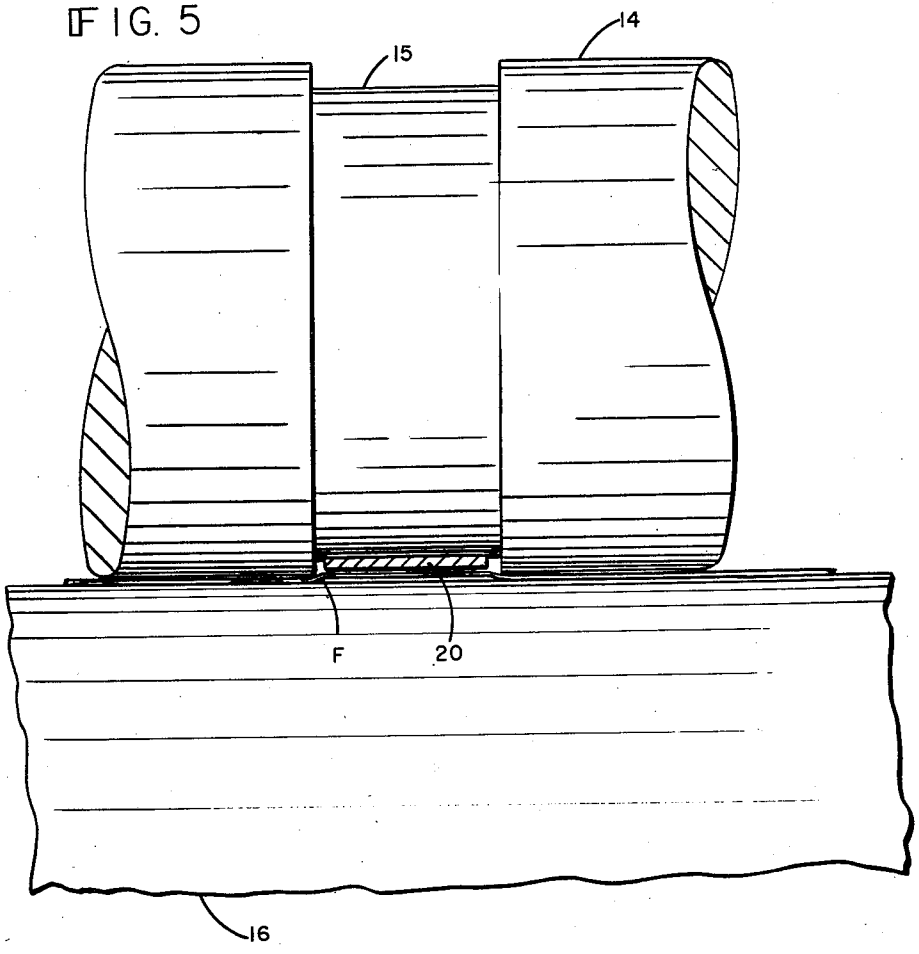


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FIG. 5



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2,774,525

PLEATING APPARATUS

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Application July 1, 1955, Serial No. 519,386

5 Claims. (Cl. 223—32)

This invention relates to pleating apparatus and methods of pleating sheet material such as fabric and the like, and more particularly, to novel apparatus and methods for continuously pleating at high speed an extended web of textile fabric, either natural or synthetic or mixed, to provide attractive, irregular pleats having their folds extending generally transversely of the long dimension of the fabric web.

Heretofore, the pleating of textile fabrics has provided regular pleats since the pleating operation was generally carried out on the known pleating machinery which operated on a step by step principle individually to form each fold of a pleat by means of reciprocating folding blades. Thus, such machines not only were incapable of pleating textile fabric to provide anything but uniform pleats, but they operated at an extremely slow production rate of at the most but two or three yards a minute.

Furthermore, as a practical matter, many of the most economical techniques for permanently setting fabric in pleated form could not be employed with such machines, since they were relatively mechanically complicated and, hence, not well adapted to withstand the effects of solutions of resinous fabric-setting materials, such as are commonly employed, for example, with cotton fabrics. As a result, such machines were limited to the heat setting of thermoplastic fiber-containing fabrics, for example, nylon fabrics — all of which resulted in costly production.

Accordingly, it is an object of the present invention to provide a novel apparatus and method for continuously and rapidly pleating an extended web of textile fabric or other sheet material in a direction transversely thereof, for example, at speeds as high as 50 yards a minute or even higher to provide a novel irregular pleated effect.

It is a feature of the invention that resinous or other setting solutions, including aqueous solutions, may freely be used during the practice thereof, so that, for example, cotton fabric impregnated with a resinous material adapted to be set or hardened as by heating or otherwise may be pleated and the pleats then made permanent to handling and washing by hardening such resinous material. Thus, the invention has made possible the economical mechanical production of permanently irregularly pleated cotton fabrics.

As a further feature of the invention, the pleats themselves are produced in the sheet material in a somewhat random configuration with variations both along the length of the pleats and from pleat to pleat which provides a novel and highly attractive effect.

Still further features of the invention will appear from the following description of a preferred embodiment thereof, together with the accompanying drawings, in which:

Fig. 1 is a diagrammatic side view of novel apparatus of the invention which may be employed in carrying out the method of the invention;

Fig. 2 is an enlarged plan view of the apparatus of Fig. 1;

Fig. 3 is an enlarged side cross-sectional view of a portion of the apparatus of Fig. 1 taken on the line 3—3 of Fig. 2;

Fig. 4 is a partial and elevational view of the portion of the apparatus of Fig. 3 taken on the line 4—4 thereof; and

Fig. 5 is a greatly enlarged elevational view of the portion of the apparatus of Fig. 3 taken on the line 5—5 thereof.

Referring to the drawings, a machine frame **10** is provided, which frame supports by means of suitable bearings (not shown) a mill roll **12** made up of an extended web of textile fabric F to be pleated. Following said mill roll, a pair of cooperating rolls, in pressure contact with one another, are mounted on said frame for feeding the fabric F therebetween, said rolls including a metallic upper roll **14** having a plurality of spaced peripheral grooves **15** therein, and a lower roll **16**, having a rubber covering of about 65 durometer hardness reading to provide a plurality of laterally spaced pressure nips with open portions therebetween. The rolls **14** and **16** are mounted on frame **10** by means of suitable bearings (not shown) and have mounted thereon suitable gears running in contact with one another for positively turning said rolls at substantially the same peripheral speeds, the lower roll **16** being positively driven by a motor **17** through a suitable chain or belt drive **18**.

A plurality of metallic spring strip members **20** are positioned in the grooves **15** on roll **14**, each of said members being mounted at its rear end on a laterally extending support **22** so that its free end extends in the direction of travel of the web of fabric F through a groove **15** substantially beyond the nip of rolls **14** and **16**. The spring strip members **20** are preferably biased to press lightly toward the floor of grooves **15** and are sufficiently narrower to allow the roll to run without binding. This creates a space where there is no driving nip, the action of the top roll **16** being blocked by the strip members **20**. Preferably, the spring strip members are of substantial length for the desirable strength and flexibility.

Immediately following the pressure nip rolls **14** and **16**, in the direction of travel of their contacting surfaces and the direction of travel of the web of fabric F fed therebetween, is mounted on frame **10** on generally parallel, opposed, spaced relation, a pair of restraining blade members, an upper restraining blade member **24** and a lower restraining blade member **34**, such members preferably being so formed, or of a material, or both, providing a friction resistance or surface, for example, wood. The restraining blade members **24** and **34**—which are preferably provided with forward blade elements **26** and **36**, respectively, of metal which extend laterally of the machine along rolls **14** and **16**, the transverse ends of said blade members being adjustably mounted on frame **10** for movement toward and away from one another by means of bolts **25** in a vertical slot **27** on said frame. The forward portions of said blade members are arranged on either side of the nip of rolls **14** and **16**, closely adjacent to said rolls and preferably the leading edges of blade elements **26** and **36** thereon are in contact with said rolls with the lower surface of upper blade element **26** overlying the upper surface of spring strip members **20**. The height of the strip members **20** is thus governed by the upper restraining member **24**. The blade members preferably also extend for a substantial distance rearwardly of said nip in the direction of movement of said web to provide a longitudinally extended passageway **32** of substantial thickness in a direction perpen-

dicular to the web (whether pleated or unpleated) with the free ends of members **20** extending into said passageway. The passageway **32** has an open forward end for receiving the web as it is fed from the nip of the rolls and a normally open exit provided with a removable closure member (not shown). Such passageway cooperates with rolls **14** and **16** continuously and at high speed to form pleats in the web F and provide a pleated web P—all as hereinafter more fully explained.

Adjacent the normally open exit of the passageway **32** formed by the opposed spaced surfaces of blade members **24** and **34** is provided a delivery means presenting a downwardly inclined plane upper surface **40** (preferably of sheet metal) which acts as a means for conveying the pleated web P onto a foraminous conveyor belt **50** extending between its supporting rollers **51** and **52** respectively, for conveying said pleated web P without substantial longitudinal tension thereon, which might tend to pull out the pleats under some circumstances. The conveyor belt **50** is driven through its one roller **51** by means of motor **17**, a variable speed drive **54** being provided for adjusting the speed of movement of conveyor **50**. Said variable speed drive **54** is driven by said motor by a suitable belt or chain drive **56** and conveyor belt roller **51** in turn is driven from variable speed drive **54** by a suitable belt or chain **58**.

Preferably, heating means which may comprise electrical heaters **60**, or the like, are mounted on either side of the upper flight of conveyor belt **50** to heat and/or dry the pleated web P as, for example, to harden a resin solution therein to provide pleats permanent to washing.

In operation, rolls **14** and **16** are rotated at a peripheral speed of, say, 50 yards a minute positively to feed web F therebetween to draw said web from mill roll **12** and pass it into the open front end of passageway **32**, the web being passed under spring strip members **20** so that laterally spaced portions thereof will be confined between said members and lower roll **16**, with the intermediate portions nipped between the surfaces of rolls **14** and **16** (Fig. 5). Initially to form the pleats, as to start a new mill roll, the open exit of the longitudinally extended passageway between restraining members **24** and **34** is closed by the removable closure member so that the web will be positively confined against longitudinal movement by contact of the end thereof with said member. As rolls **14** and **16** continue positively to feed the web **10** into the passageway **32** between restraining members **24** and **34**, adjacent, successive pleats with lateral irregularities due to the effect of members **20** will be formed in said web as it is folded in a direction transversely thereof, that is essentially parallel to the filling yarns thereof, since it will be confined in a direction generally perpendicular to its surface (whether pleated or unpleated) by the spaced opposed surfaces of restraining members **24** and **34**, said surfaces cooperating with the web therein to fold the oncoming web from rolls **14** and **16**.

When the passageway has been substantially filled with web F in closely compressed folds or pleats, the closure member is removed and pleated web P will then move forwardly—due to the continuous infeed into the passageway **32**—outwardly beyond the open exit of the passageway onto the conveyor **40** and onto the upper surface of the moving conveyor belt **50**, the speed of said underlying belt being adjusted by means of variable drive **54** to continuously remove the closely compressed irregularly pleated web P from the exit of the passageway **32** without substantial longitudinal tension thereon, so that the web will be retained frictionally in closely compressed pleated form in a substantial longitudinal portion of passageway **32**, and in a somewhat expanded pleated form on conveyor belt **50**.

The passageway **32** formed by restraining members **24** and **34** not only confines the web in a direction perpendicular to its surface, but the opposed, friction surfaces of said members restrain the advance of the closely compressed pleated web by frictional contact with the transversely extending folded edge surfaces of the folds or pleats. Thus, as the unpleated web F is fed from the pressure nip between rolls **14** and **16** into the open end of passageway **32**, adjacent, successive pleats will be continuously formed as the web is folded due to the presence of the already closely compressed pleated web P within passageway **32** cooperating with the oncoming unpleated web. The dimensions of the formed pleats may be to some extent controlled by adjusting the spacing between the opposed surfaces of restraining members **24** and **34**, as well as by the frictional characteristics of their surfaces. The formation of the pleats can further be governed by the angle between the fingers **20** and the lower restraining member **34**.

According to this invention, permanently pleated material may readily be provided by treating an unpleated web F, for example, cotton fabric, with a resinous material adapted to be hardened. Such materials are well known in the art, typical examples being aqueous urea-formaldehyde resin solutions, melamine resin solutions, and the like. With such materials, the pleats are formed in the treated web before hardening thereof and the pleated web P is then at least partially hardened as, for example, by means of heaters **60** adjacent the upper flight of conveyor belt **50**, to set the resin, so that the pleated web may be handled. Subsequent heating may of course be used further to harden the resin.

Thermoplastic-containing textile materials may also readily be treated by means of the apparatus of the invention to provide permanently pleated materials as, for example, by preheating said fabrics by passing them over a heated plate provided in advance of pressure rolls **14** and **16** to soften the fabric sufficiently so that the folds of the pleats will be permanent upon cooling.

Thus it will be seen that a novel apparatus has been provided for continuously pleating sheet materials such as fabric and the like, at extraordinarily high speeds to provide an attractive irregularly pleated sheet material. Various modifications of the invention may be made within the spirit thereof and the scope of the appended claims.

I claim:

1. A pleating machine for continuously pleating an extended web of sheet material in a direction transversely thereof comprising a frame, a pair of cylindrical driven rolls mounted on said frame and having a pressure nip for feeding a web of sheet material therethrough, at least one of the said rolls having a plurality of laterally spaced peripheral grooves therein, a plurality of flat spring strip members extending through said grooves between said rolls, the flat side of said members being generally parallel to the floors of said grooves, and web restraining means providing a longitudinally extended passageway of substantial thickness extending from adjacent the nip of said roll means for receiving and folding said web as it is fed from said roll means and confining said web in a direction generally perpendicular thereto continuously to provide adjacent, successive, irregular pleats therein.

2. A pleating machine as claimed in claim 1 in which said restraining means includes a pair of opposed generally parallel spaced surfaces extending from closely adjacent said roll means and providing said longitudinally extended passageway.

3. A pleating machine for continuously pleating an extended web of textile material in a direction transversely thereof comprising a frame, a pair of positively driven cylindrical rolls rotatably mounted on said frame, one of said rolls having a plurality of laterally spaced peripheral grooves therein, and the other of said rolls being of resilient material to provide a plurality of laterally spaced pressure nips between said rolls with open portions therebetween, a plurality of flat spring strip members mounted on said frame on one side of said rolls with their free ends extending in the direction of movement of said web through said grooves between said rolls, the flat side of said members being generally

parallel to and urged toward the floors of said grooves and spaced from the side walls thereof, and a pair of opposed generally parallel spaced frictional restraining surfaces mounted on said frame on the other side of said rolls extending in the direction of movement of said web from the surfaces of said rolls on either side of said nip to provide a longitudinally extended passageway of substantial thickness for receiving and folding said web as it is fed from the nip of said rolls, confining it in a direction generally perpendicular thereto, and restraining the longitudinal movement thereof continuously to provide adjacent, successive, irregular pleats therein.

4. A pleating machine as claimed in claim 3 wherein the free ends of said members extend into said passageway.

5. A pleating machine as claimed in claim 3 further including underlying conveyor means for receiving the pleated web from the open end of said passageway, and heating means adjacent said conveyor for heating said web in untensioned condition.

References Cited in the file of this patent

UNITED STATES PATENTS

1,524,316	Schoepfer et al.	Jan. 27, 1925
2,141,235	Angeletti	Dec. 27, 1938
2,410,189	Straubel et al.	Oct. 29, 1946
2,668,573	Larsson	Feb. 9, 1954

FOREIGN PATENTS

494,735	Canada	July 21, 1953