This invention relates to mandrels, or former shoes, of machines for making bags or tubing from flat sheet stock, and more particularly to forming mechanism for use with thermoplastic sheet stock.

Machines for making bags or tubing from rolls of web-like flat sheet stock or material have a mandrel or former shoe about which the travelling sheet material is folded or wrapped. The lateral edges of the sheet material are overlapped on the mandrel and, if the material is nonheat-sealable, are glued together or, if the material is heat-sealable, such as polyethylene, are heat sealed together to form a permanent tube having a longitudinal seam. Difficulties are had, however, with materials such as polyethylene in forming or shaping the sheet material into a tube by conventional mandrels or former shoes. Among its other characteristics, polyethylene is quite stretchable and also has a somewhat tacky surface which develops considerable frictional drag when moved against another surface.

Tubing or bag making machines of the type undergo consideration usually have a pair of draw rolls for pulling the material through the machine. The forming mechanism usually is located in advance of such rolls and receives material to be tubed from a large roll of such material. Because of its stretchable characteristic, polyethylene sheet material elongates considerably in a longitudinal direction when it is pulled through the forming mechanism by the draw rolls. This longitudinal stretching of the material causes a lateral contraction of the same, so that the material tends to grip the former shoe or mandrel very tightly. On flat plate-like former shoes in particular, polyethylene stock is under considerable lateral tension at the side or lateral edges of the former shoe. Because of its aforementioned high frictional drag characteristics, this lateral tension of polyethylene stock greatly increases its frictional drag with the edges of a flat mandrel or former shoe. In some instances, this frictional drag may become so excessive that the draw rolls are unable to pull the material over the former shoe. In other instances, the frictional drag results in excessive wrinkling of the stock and imperfect folding or wrapping of the same about the mandrel, so that wrinkles and imperfections appear in the overlapped longitudinal edges of the material. Consequently, the subsequent heat sealing operation results in defects in the seal constituting the longitudinal seam in the tube.

For the above reasons, polyethylene stock which is intended for the production of bags usually is made by an extruding process to produce seamless tubular stock which eliminates the necessity of tubing operation and its attendant difficulties. Seamless tubular stock is far more expensive, however, than flat stock.

Accordingly, it is an object of this invention to provide a former shoe for tubing polyethylene sheet stock which will eliminate wrinkles in the shaped tube and permit the formation of a substantially perfect longitudinal seal of the overlapped edges of the stock.

It is another object of this invention to provide an improved former shoe for tubing polyethylene sheet stock with side gussets, which former shoe eliminates wrinkles in the tube by the minimization of frictional drag between the travelling stock and the shoe.

Other objects, advantages and novel features of this invention will become apparent from the following description and accompanying drawings, in which:

Figure 1 is a plan view of a manually inclined folding fingers 36 having cross lower ends or tip portions 38 beneath
which the edge portions of the travelling sheet material pass in order to urge the edge portions downwardly, in overlapping condition, on top of the former shoe 14.

Beyond the fingers 36, there is provided another bracket 40, which may be appropriately supported on the table 20 in the central fashion as the shorter bracket 19. Adjustably supported on the bracket 40 are a pair of wheels 42 which ride on top of the former shoe 15 over the sheet material in order to maintain the edge portions thereof in their overlapped condition until they are secured together by appropriate mechanism (not shown). In some instances, it is desirable for these wheels 42 to be angled somewhat with relation to the direction of movement of the sheet material 12, in order to draw the same more snugly about the lateral edges of the former shoe 14.

After passing from the former shoe 14, the overlapped edges of the shaped tube 16, if the latter is of thermoplastic material, are usually heat sealed in a conventional manner by known apparatus to form a permanent tube. If the sheet material is of paper, or the like, which cannot be heat sealed, the overlapped edges of the stock usually have paste or glue applied thereto to secure them together to form a permanent tube.

The apparatus thus far described is conventional and forms no part of this invention. Accordingly, a more detailed description thereof is believed unnecessary here.

As previously stated, when polyethylene or similar stretchable sheet material is formed into a tube by apparatus of the type described above, the longitudinal stretching of the material by the longitudinal tension imparted thereto by the draw rolls causes lateral contraction of the stock with the result that it is pulled extremely tightly against the side edges of a former shoe. Consequently, frictional drag of the material with the side edges of a former shoe becomes so excessive that the aforementioned difficulties arise and result in the formation of imperfections in the formed tube. In order to eliminate these objections to conventional former shoes, the former shoe 14 embodying this invention is provided with mechanical means for substantially completely eliminating frictional drag between the travelling sheet material 12 and the side or lateral edges of the former shoe, with the result that no difficulties whatever, such as wrinkling, etc., are had in the tubing of polyethylene and similar stretchable material on the former shoe 14. Consequently, the completed tube 16 is free of imperfections in its longitudinal seal or seam 30.

In order to accomplish the above object, the former shoe 14 comprises a pair of superimposed vertically-spaced substantially-rectangular plates 44. At each of the four corners of the shoe, there is mounted between the plates 44 a peripherally-grooved pulley wheel 46 which projects slightly outwardly of the side or lateral edges 48 of the shoe (Figures 1 and 3). Conveniently, these pulleys 46 may be journaled on pins 50 fastened to the plates 44, and the pulleys preferably are provided with hubs 52 on both sides thereof for spacing the wheels from the plates. Mounted on each pair of pulley wheels 46 at each side of the shoe 14 is an endless belt 54 having one flight 56 thereof projecting slightly beyond the corresponding lateral edge 48 of the shoe. In actual practice, it has been found that a coil spring serves admirably for this purpose.

It will be seen that travelling sheet material 12 is folded about the flights 56 of the belts 54 without being pulled tightly or snugly against fixed lateral edges of the plates 44. Accordingly, the belts 54 move with the travelling sheet material 12 to thereby greatly reduce and minimize any drag between the travelling sheet material and the fixed lateral edges 49 of the former shoe. Since the sheet material 12 is not pressed tightly against the upper and lower surfaces of the former shoe 14, very little frictional drag occurs at these surfaces. Hence, for all intents and purposes the anti-friction endless belts 54 substantially eliminate all frictional drag of the material 12 with the fixed parts of the shoe 14, with the result that the tubing of travelling sheet stock on the shoe 14 is accomplished with ease and with no wrinkling of the stock. Further, since the tension or force required to move the sheet stock 12 over the shoe 14 is thus greatly reduced, lateral contraction of the stock occasioned by longitudinal stretching of the same is also reduced, to thereby result in a further reduction of frictional drag of the material with the shoe 14. Consequently, the possibility of tearing of the stock by longitudinal tension therein is substantially completely eliminated.

In instances where the material-engaging flight 56 of each belt 54 tends to sag or be pulled inwardly by lateral contraction of the stock 12, additional pulley wheels 46 may be mounted between the plates 44 to avoid this difficulty and prevent tight frictional engagement of the stock with the side edges of the plates 44.

Referring now to Figures 6 to 8, there is shown therein a former shoe 58 embodying the invention for tubing sheet material and providing the tube 60 with inwardly-directed side folds or gussets 62 (Figure 9). Since the folding mechanism shown in Figure 6, other than the shoe 58, may be identical with the corresponding folding mechanism shown in Figures 1 and 2, no detailed description thereof will be repeated here. The former shoe 58 in this instance is formed in three sections, a central section 64 and two extending sections 66 and 68 which is supported in overhanging relation to the table 20 by the bracket arm 24, comprises two vertically-spaced superimposed generally-rectangular plates 68 secured together in any conventional manner, as by the longitudinal central rib 70, best shown in Figure 8. The central section 64 thus forms a shoe 72 along its longitudinal edges between the upper and lower plates 68, such space essentially constituting longitudinal edge grooves. It is within these spaces or grooves 72 that travelling sheet material is forced or pressed inwardly to form side gussets 62 when the sheet material is wrapped or folded around the central section 64 of the former shoe 58.

Each side section 66 of the former shoe 58 is identical, so a description of one will suffice for both. A longitudinally-extending bar 74 is secured for lateral adjustment relative to the central section 64 of the shoe to vary the depth of the gussets, as by means of bolts 76 extending through transversely-spaced plates 78 and holes bored in the table 20. Mounted on the bar 74 for rotation about vertical axes, as by means of upstanding journal pins 80, are a plurality of longitudinally-spaced peripherally-grooved pulley wheels 82 adapted to extend into the longitudinal edge spaces 72 between the upper and lower plates 68 of the central shoe section 64. Three such pulley wheels 82 are shown in the drawings spaced at substantially equal intervals along the length of the bar 74. Mounted for travel on these wheels is an endless belt 84, again preferably in the form of a coil spring.

It will be seen that the sheet material 12 is pressed inwardly into the longitudinal edge grooves 72 of the central former shoe section 64 only by contact with the inner flights 86 of the endless belts 84 and, therefore, since the belts move with the material, substantially no friction whatever is developed between the belts and the material. It will be noted that the leading pulley wheels, i.e., those at the entering end of the former shoe 12, are of smaller diameter than the remaining pulley wheels, so that the material is progressively urged into the longitudinal edge grooves 72 of the central section 64 to more smoothly form the side gussets 62. It will be realized, of course, that this progressive formation of the gussets may be accomplished through the use of leading pulley wheels of substantially the same diameter as the remaining wheels but having their axes of rotation spaced further laterally outwardly of the side edges of the center section of the former shoe. Further, it will be evident that additional
5 pulley wheels may be used, if necessary, to maintain the flights of the belts against the sheet material.

It is evident that where the travelling sheet material is folded about the side edges of the upper and lower plates of the center section, some frictional drag possibly may occur. It has been found in actual practice, however, that the greatest frictional drag of sheet material against a conventional gusseting former shoe occurs where the gusseting plates press or force the traveling material into the longitudinal edge grooves of the center section of the shoe. Hence, elimination or reduction of frictional drag at these points, has been found to be sufficient to permit the formation of gusseted tubes without undesirable wrinkling and the other disadvantages heretofore described.

It will thus be seen that the objects of this invention have been fully and effectively accomplished. It will be realized, however, that the specific embodiments disclosed herein for the purpose of illustrating the principles of this invention are susceptible of change without departing from such principles. For example, the invention obviously is applicable to former shoes of other cross-sectional configurations, such as round, etc. Hence, this invention includes all modifications encompassed by the spirit and scope of the following claims.

We claim:

1. In a former shoe for placing a longitudinal fold in traveling, stretchable sheet material, e.g., polyethylene, and having an edge extending generally in the direction of travel of the material and over which edge the sheet material is folded, the combination of rollers spaced along the direction of travel of the material, an endless belt mounted on said rollers and having a relatively narrow portion engageable with the material, said belt having a flight defining said edge and over which flight the material is adapted to be folded at substantially an acute included angle, said flight being movable with the material to thereby reduce drag between the material and the former shoe at said edge.

2. The structure defined in claim 1 in which the belt comprises a coil spring.

3. A flat former shoe around which traveling, stretchable sheet material, e.g., polyethylene, is adapted to be folded to form tubular stock, comprising: an elongated, plate-like member; means defining a groove in a longitudinal edge of said member; an endless belt having a relatively narrow portion engageable with the material; and rollers mounting said belt and journaled on said member at longitudinally spaced locations thereof, said belt having a flight disposed somewhat outwardly of said groove and extending generally parallel thereto for engagement and movement with sheet material folded over said edge to reduce the drag between the sheet material and said shoe at said edge.

4. A flat former shoe around which traveling, stretchable sheet material, e.g., polyethylene, is adapted to be folded to form tubular stock having side gussets comprising: an elongated, plate-like member; means defining a groove in a longitudinal edge of said member; an endless belt having a relatively narrow portion engageable with the material; and rollers mounting said belt and journaled at locations spaced along the direction of travel of the material, said belt having a flight extending within said groove and generally parallel thereto for engagement and movement with sheet material folded over said edge to press the material into said groove to form a side gusset.

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