United States Patent [19]

Kratzert

[11] **3,716,322**

[45] **Feb. 13, 1973**

[54] **APPARATUS FOR FLATTENING AND TAKING AWAY BLOWN TUBING OF PLASTICS MATERIAL**

[75] Inventor: **Friedrich Kratzert,** Rosenheim-Schlossberg, Germany

[73] Assignee: **Windmoller & Holscher,** Lengerich of Westphalia, Germany

[22] Filed: **Sept. 22, 1970**

[21] Appl. No.: **74,285**

[30] **Foreign Application Priority Data**

Sept. 27, 1969 Germany.....P 19 48 935.1

[52] **U.S. Cl.**.....**425/392,** 425/327

[51] **Int. Cl.**.....**B29c 17/00**

[58] **Field of Search** ...18/145; 264/95; 425/324, 325, 425/392, 327

[56] **References Cited**

UNITED STATES PATENTS

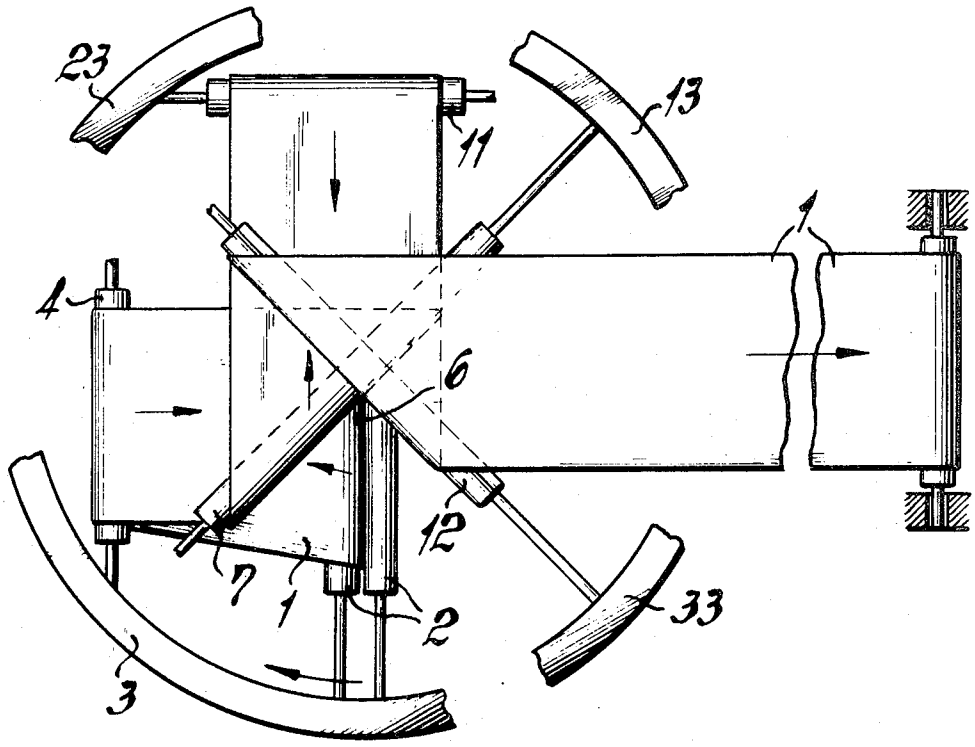
3,492,693	2/1970	Clarke et al.	425/327
3,576,935	4/1971	Dyer et al.	425/327 X

Primary Examiner—Robert D. Baldwin
Assistant Examiner—Michael O. Sutton
Attorney—Fleit, Gipple & Jacobson

[57] **ABSTRACT**

The process serves to distribute any variations in thickness in the peripheral direction of the tubing, in conjunction with a process in which the tubing is blown and is either wound up or processed further in stationary devices. The plane in which the tubing is flattened is pivotally moved about the axis of the tubing reversingly in steps of at least approximately 360°. The flattened tubing is deflected about a deflecting member, which is reversingly moved in unison with the flattening plane and is laterally offset from the axis of rotation of the flattening plane and disposed in a plane that is at right angles to the flattening plane. The tubing is then moved about additional deflecting members, which are disposed in planes that are parallel to the plane which contains the first deflecting member and are also pivotally moved reversingly about the axis of rotation of the flattening plane. The angles through which the deflecting members are moved decrease as the distance from the flattening station increases. Successive deflecting members are alternatingly disclosed at least close to and more remote from the axis of rotation of the flattening plane. The tubing which has moved about the last deflecting member is moved in a constant direction in another plane, which is at right angles to the axis of rotation of the flattening plane.

8 Claims, 10 Drawing Figures



PATENTED FEB 1 3 1973

3,716,322

SHEET 1 OF 4

FIG. 1

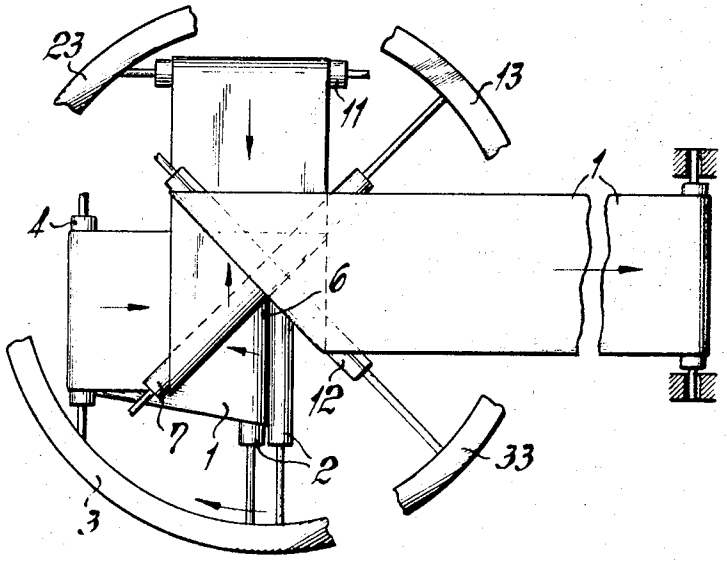
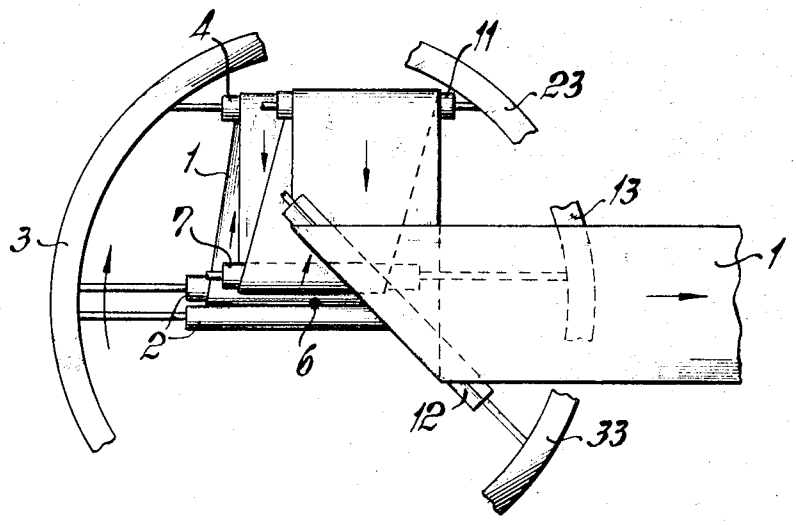


FIG. 2



INVENTOR
Friedrich KRATZERT
BY
Fleit, Gipple & Jacobson
his ATTORNEYS

FIG. 3

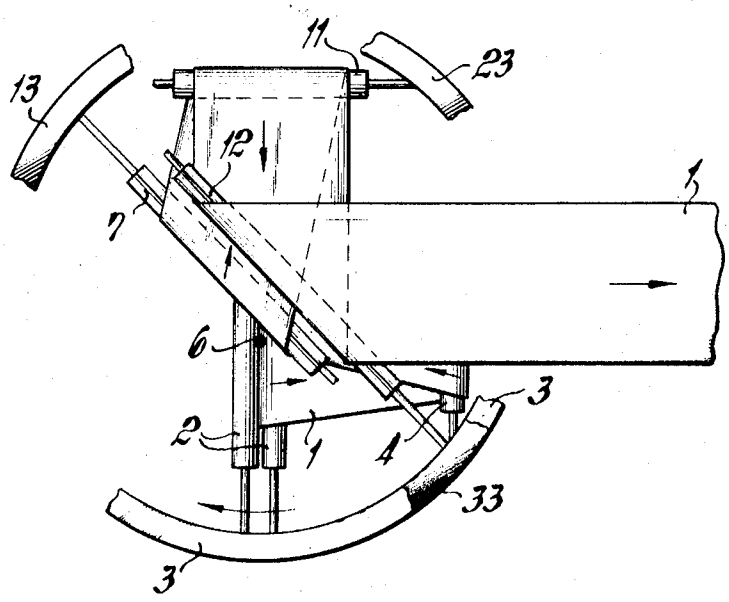
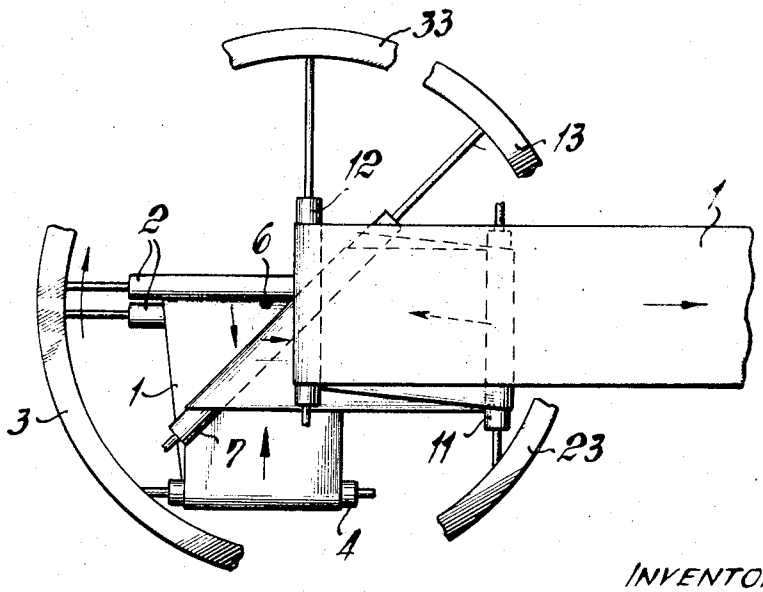


FIG. 4



INVENTOR
Friedrich KRATZERT
BY
Fleit, Gipple & Jacobson
his ATTORNEYS

FIG. 5

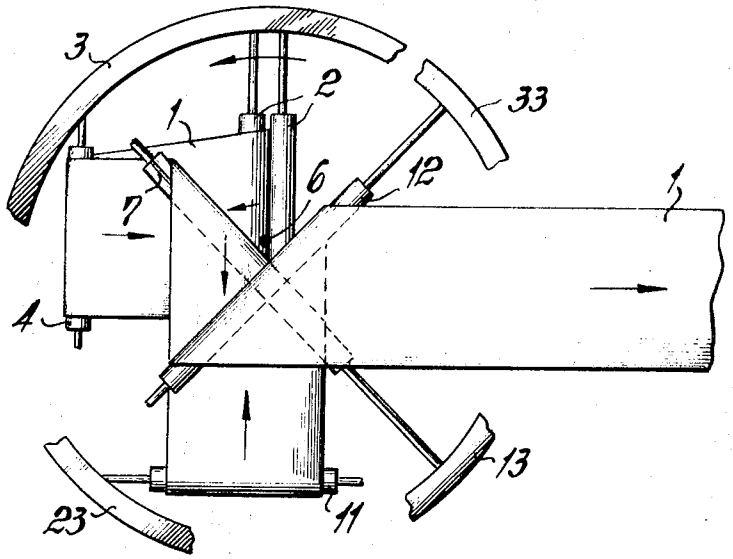
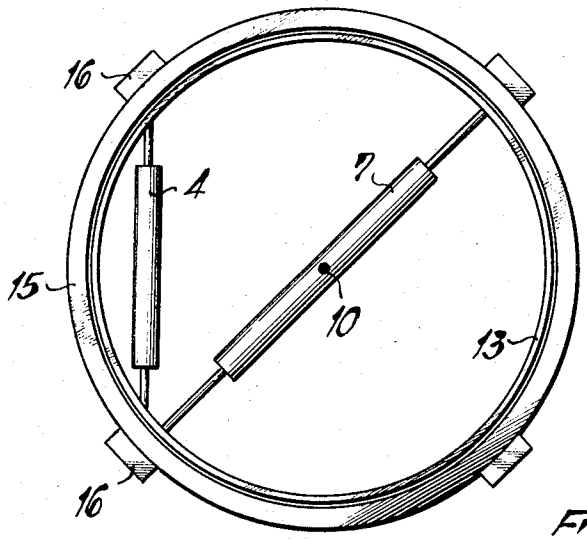


FIG. 6



INVENTOR
Friedrich KRATZERT
BY
Fleit, Gipple & Jacobson
his ATTORNEYS

FIG. 7

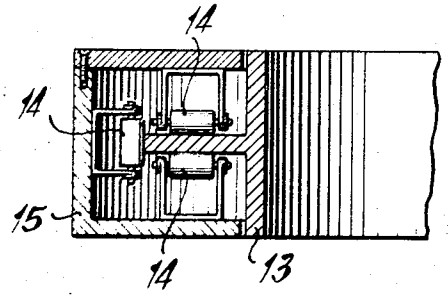


FIG. 8

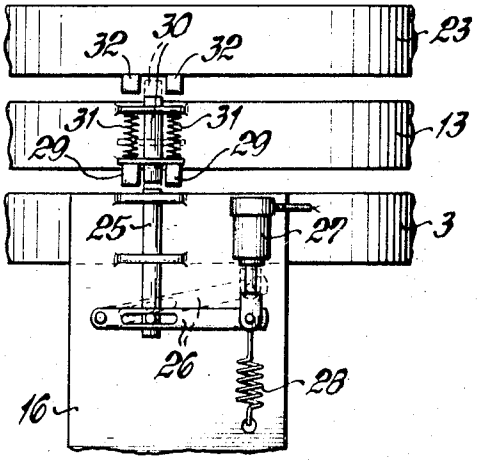


FIG. 10

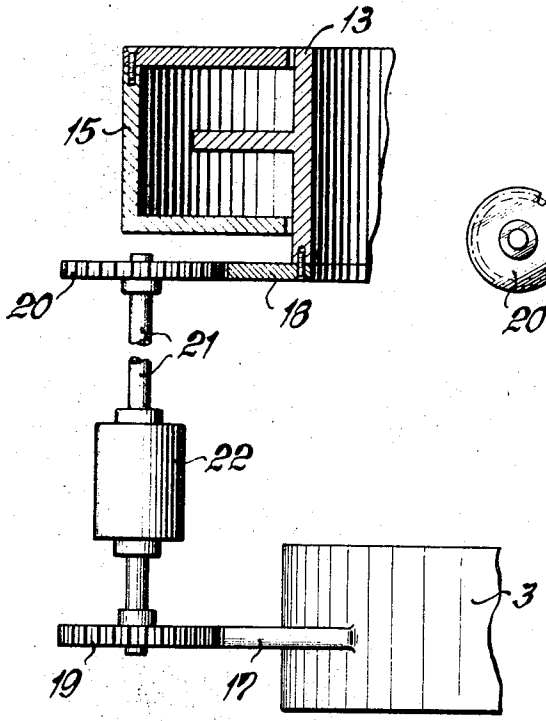
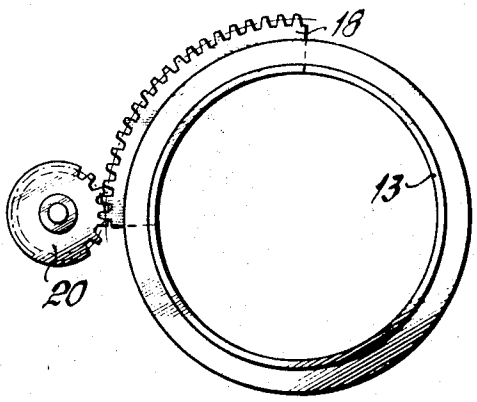


FIG. 9



INVENTOR
Friedrich KRATZERT
BY
Fleit, Gipple & Jacobson
his ATTORNEYS

APPARATUS FOR FLATTENING AND TAKING AWAY BLOWN TUBING OF PLASTICS MATERIAL

It is known that thickness variations are inevitable in the manufacture of sheeting of synthetic thermoplastics. When such sheeting varying in thickness is wound up, the extra thicknesses of the sheeting accumulate so that the roll is formed with annular beads, which result in a permanent deformation of the sheeting in that area. When such sheeting is unwound, it is no longer perfectly planar so that the printing on the sheeting and its processing to packages or the like are rendered difficult.

In the blow-forming of tubing and the manufacture of flat sheeting by a longitudinal cutting of a blown tubing, the annular beads on the rolls and the resulting disadvantages may be avoided by a relative rotary motion between the tubing blow head and the flattening and take-away device. This rotation may consist of a continuous rotation or a rotation which is reversed after steps of about 360°. As a result of this rotation, the thickness variations of the sheeting are distributed throughout the width of the roll, just as a rope which is wound on a drum, so that cylindrical rolls result which have no annular beads.

In order to avoid the disadvantages which are due to the known rotary arrangement of the entire screw extruder or its tubing flow head or of the take-away and flattening device together with the means for winding up the sheeting, the French Pat. specification No. 1,553,853 discloses a process in which the blown tubing is made and is wound up or processed further in stationary apparatus and only the flattening plates and the squeeze rollers are reversingly revolved in steps of 360°. In this process, the flattened tubing is moved about a deflecting member which is inclined to the longitudinal direction of the sheeting and which is reversingly moved in unison with the flattening device. The tubing is then moved in an on-edge orientation to guiding and deflecting rollers provided at the periphery of the device for revolving the flattening and take-away device. The tubing is thereafter moved to a stationary deflecting member, which is also inclined to the longitudinal direction of the tubing, and from there is moved vertically downwardly to the means for winding up the tubing. During the reversing angular movement, the tubing in an on-edge orientation is so deflected by the circular series of deflecting rollers provided at the periphery of the revolving means that the tubing, which is taken away continuously, does not contact the deflecting members carried by the revolving wheel.

That known proposal has considerable important disadvantages. It results in a considerable increase in overall height because the tubing moved in an on-edge orientation requires an additional height above the squeeze rollers, which height corresponds to the width of the tubing, in addition to the space requirement for the revolving means and the like. Because sheeting in a width of as much as 3 meters is now required, the additional height required in the known process is very considerable. Besides, the use of the known process particularly with wide and heavy tubing often involves a slipping of the tubing as it moves in an on-edge orientation or a sagging of the tubing, particularly because the tubing must be moved in an on-edge orientation with a span of about three times the width of the tubing. This requirement cannot be fulfilled if the tubing if very wide. Another disadvantage of the known process resides in that the access to the flattening, squeezing and deflecting device is difficult because that device is virtually enveloped as a result of its reversing motion. The deflection by the deflecting rollers provided at the periphery of the revolving means results in continual, considerable changes in the length of the tubing between the blow head and the means for winding the tubing or the succeeding processing machine. Particularly where the arrangement is directly succeeded by a processing machine, e.g., a printing machine, these changes are a great disadvantage because complicated measures are required to compensate the changing speed of the tubing.

Another disadvantage of the known proposal resides in that one of the deflecting members which are inclined to the longitudinal direction of the tubing belongs to the reversing system whereas the other of said deflecting members belongs to the stationary system so that variations may result from a swaying of parts of the superstructure and from inaccurate motion so that different relative positions are assumed by the deflecting rods. Such different relative positions may result in considerable disturbances in operation. Another advantage of the known arrangement resides in that the assembly requiring a high precision can be carried out only on the site because the stationary and reversing deflecting systems must be separately delivered.

It is an object of the invention to provide a process and apparatus which are free of the numerous disadvantages of the known system and enable more particularly the design of the required apparatus having a small overall height and a movement of the flattened tubing from the reversing by moved squeeze rollers to a stationary feeding device, ensure an easy accessibility, a highly accurate motion and a simple assembly, and avoid or minimize changes in the length of the tubing between the blow head and the winding-up or processing apparatus.

The process according to the invention which is proposed to solve that object is characterized in that the flattened tubing is deflected about a deflecting member, which is reversingly moved in unison with the flattening plane and is laterally offset from the axis of rotation of the flattening plane and disposed in a plane that is at right angles to the flattening plane, the tubing is then moved about additional deflecting members, which are disposed in planes that are parallel to the plane which contains the first deflecting member and are also pivotally moved reversingly about the axis of rotation of the flattening plane, the angles through which the deflecting members are moved decrease as the distance from the flattening station increases, successive deflecting members are alternatingly disposed at least close to and more remote from the axis of rotation of the flattening plane, and the tubing which has moved about the last deflecting member is moved in a constant direction in another plane, which is at right angles to the axis of rotation of the flattening plane. As a result of the process of the invention, the tubing which is moving inwardly and outwardly between the outer and inner deflecting members is moved with an inclination at least to the inner deflecting members so that it moves away from said inner deflecting members with a corresponding inclination when it has been

deflected. As a result, all angular positions of the reversingly moved flattening plane can be compensated as the tubing is deflected several times before it reaches the stationary feeding device.

When the process according to the invention is to be carried out by a flattening and take-away apparatus for handling blown tubing of plastics material made by a stationary tubing blow head, in which apparatus the flattening plates and squeeze rollers are adapted to be pivotally moved reversingly in steps of at least approximately 360° about the axis of the fed tubing, the apparatus is designed so that the squeeze rollers are succeeded by a lateral deflecting rod, which is parallel to the squeeze rollers and is reversingly moved in unison with them about the axis of rotation of the flattening plates, said deflecting rod is succeeded by at least three additional deflecting rods, each of which is mounted to be individually rotatable about the axis of rotation of the flattening plates, the first and third of said additional deflecting rods are disposed in the central region, the second of said additional deflecting rods is laterally disposed, the distance from the lateral deflecting rods to the axis of rotation is selected so that they are in any possible operating position radially outwardly of the wrapped portions of the deflecting rod which is disposed in the central region, and the last deflecting rod is succeeded in the direction of travel of the tubing by stationary means for guiding the tubing.

The invention enables a very small overall height and a compact design of the reversing system. When the minimum number of four deflecting rods are used, the additional height required over the squeeze rollers corresponds only to four times the rod diameter. Because the tubing is moved with a horizontal orientation in the reversing station associated with a conventional tubing blow head blowing in a vertical direction, there will be no slip and no sagging so that the apparatus according to the invention can easily handle even very wide tubing. The apparatus according to the invention is easily accessible and the length of the tubing between the squeeze rollers and the feeding device remains substantially constant at all times so that undesired influences due to varying speeds of the tubing, particularly if the apparatus is directly succeeded by a processing machine, need not be feared. It will also be desirable that all deflecting rods belong to one and the same system so that relative changes between the position of the movable system and the succeeding parts of the overall plant cannot adversely affect the exact mode of operation of the apparatus. The assembly is simplified because the entire device which serves to compensate the reversing motion of the flattening plates and squeeze rollers can be assembled by the manufacturer and it is sufficient on the site to install said device into the overall plant between the tubing blow head and the means for winding up the tubing or the succeeding processing machine.

According to the invention, at least those deflecting rods which are disposed in the central region, near the axis of rotation of the flattening plane, have a surface structure which facilitates a movement of the deflected tubing with components of motion in the peripheral and axial directions (turning rods). A turning rod may consist most simply of a non-rotatable rod having a low-friction surface of plastics material. It may alternatively be provided on its surface with air outlet orifices, through which air can be blown between the tubing and the surface of the turning rod. In another embodiment, a multiplicity of movable balls are received in the surface of the turning rods. Numerous other embodiments of turning rods may be conceived.

A preferred embodiment of an apparatus according to the invention is characterized by a pair of squeeze rollers, which are carried by a revolving rim, which is pivotally movable reversingly through steps of 360°, a deflecting roller, which is mounted in the revolving rim and disposed laterally of and extends parallel to the squeeze rollers, and three deflecting rods, which are mounted in revolving rims which are coaxial with the first revolving rim and pivotally movable independently of the first revolving rims, the first and third of said deflecting rods being centrally disposed and the second deflecting rod being laterally disposed, and by means for guiding the tubing, which means succeed the third deflecting rod. At least the central deflecting rods consist suitably of turning rods.

Further details of the invention will become apparent from the subsequent specification with reference to the drawing, in which an embodiment of the invention is shown diagrammatically and by way of example. In the drawing

FIGS. **1** to **5** are diagrammatic perspective top plan views showing the means provided according to the invention for guiding the tubing in different phases of an angular step of the reversing device.

FIG. **6** is a top plan view showing a central deflecting rod with its revolving rim and the lower lateral deflecting rod in the position shown in FIG. **1**.

FIG. **7** is a sectional view showing one of the revolving rims which carry the deflecting rods.

FIG. **8** is a diagrammatic view showing a device for interlocking the revolving rims and

FIGS. **9** and **10** show means for a controlled drive of a revolving rim as shown in FIG. **7** in dependence on the angular movement of the pair of squeeze rollers.

A blown tubing **1** is delivered in the usual manner to a pair of motor-driven squeeze rollers **2**, which are firmly mounted on a revolving rim **3**, which is reversingly moved through steps of 360°. A deflecting roller **4** is fixed to the revolving rim **3** and disposed laterally of the squeeze rollers **2** and extends parallel to the latter. The deflecting roller is pivotally moved in unison with the pair of squeeze rollers **2** about the axis of rotation **6**. The lateral distance of the deflecting roller **4** from the nip between the two squeeze rollers **2** or their axis of rotation **6** must exceed one-half of the width of the tubing **1** because it will be impossible otherwise to move the tubing about the succeeding turning rod **7**.

That turning rod **7** is pivotally mounted above the squeeze rollers **2** and has an axis of rotation **10** which is disposed approximately vertically above the axis of rotation **6** of the squeeze rollers **2**. The turning rod **7** serves to deflect the tubing through such angles that the changes caused in the direction of the tubing fed via the deflecting roller **4** by the pivotal movement of the pair of squeeze rollers **2** are compensated during an angular movement through 180°. For this purpose, the turning rod **7** must be capable of changing the position of its longitudinal axis relative to the longitudinal axis of the

deflecting roll 4 through an angle of 45° from the parallel position toward both sides.

This object may be accomplished by various arrangements. The simplest arrangement is a mounting in a revolving rim such as is shown by way of example in a sectional view in FIG. 7. A rotatable inner rim 13 made from a T-section carries the turning rod 7 and is mounted in a stationary outer rim 15, which is provided with anti-friction rollers 14, and secured to stationary vertical columns 16. The pivotal movement of the turning rod 7 relative to the roller 4 may easily be limited to 45° on both sides by the provision of corresponding stops.

Having left the turning rod 7, the tubing moves about the deflecting rod 11, which may consist of a rotatably mounted roller and in a similar revolving rim disposed above the turning rod 7 is mounted so that the longitudinal axis of the rod 11 is a chord of the circle defined by the rotating rim 23. The requirements concerning the distance from the deflecting roller 11 from the center of its revolving rim 23, which is also disposed vertically above the axis of rotation 6 of the squeeze rollers 2, are the same as for the deflecting rollers 4. Both rollers are suitably spaced equal distances apart from the axes of their pivotal movement.

From the deflecting roller 11, the tubing is moved about the turning rod 12, which is disposed above the deflecting roll 11 and is also mounted in a revolving rim 33. The requirements stated in connection with the turning rod 7 are analogously applicable to the turning rod 12. The turning rod 12 serves to compensate the changes in the direction of the tubing coming from the deflecting roller 11 relative to the succeeding winding device or the succeeding stationary guiding rollers. For this purpose, the position of the longitudinal axis of the turning rod 12 relative to the axis of rotation of the deflecting roller 11 may be changed from the parallel position to both sides up to an angle of 45°.

At the beginning of an angular step of the revolving rim 3 and of the pair of squeeze rollers 2, the various rollers are in the position shown in FIG. 1. From that position, the pair of squeeze rollers 2 begin to revolve in unison with the deflecting roller 4 in the direction of the arrow about the axis of rotation 6. Whereas the deflecting roller 11 and the deflecting rod 12 remain initially in their original position, the turning rod 7 follows the angular movement at one-half of the angular velocity thereof to compensate the change in the direction of the tubing arriving from the deflecting roller 4 relative to the deflecting roller 11. When the pair of squeeze rollers 2 have moved through an angle of 90°, the turning rod 7 has moved through an angle of 45°. After that movement, the rollers are in the position shown in FIG. 2.

If the revolving rim 13 which carries the turning rod 7 is freely rotatable and the tubing is of sufficient strength, the pivotal movement of the turning rod 7 is enforced by the tubing itself. Only when the resistance opposing the rotation is so high that it would stretch the tubing must the revolving rim 13 be provided with drive means so that the turning rod 7 is positively moved to positions which correspond to the position of the deflecting roller 4 at any time.

This object may be accomplished in a simple manner, e.g., by a geared transmission for transmitting the angular movement of the pair of squeeze rollers 2 to the revolving rim 13 with a reduction ratio of 1:2. For this purpose, a rack 17 is secured to the revolving rim 3 and extends around one-half of its circumference. A rack 18 having the same diameter and the same number of teeth is provided on the revolving rim 13 but extends only around one-fourth of the circumference of the rim 13. Gears 19 and 20 having the same size mesh with the racks 17 and 18, respectively and are connected by a vertical shaft 21 and a reducing gear 22 having a reduction ratio of 1:2, as is shown in FIGS. 9 and 10. In this arrangement any angular movement of the revolving rim 3 with the squeeze rollers 2 results in an angular movement of the revolving rim 13 and the turning rod through one-half the angular movement of the revolving rim 3 but only in a range which corresponds to an angular movement of the turning rod 7 through 2 × 45° relative to the deflecting roller 2 because the rack 18 extends only around one-fourth of the periphery of the revolving rim 13.

After a further angular movement of the squeeze roller 2 and the deflecting roller 4 through 90°, these rollers are in the position shown in FIG. 3. The resulting change in the direction of the tubing which moves about the roller 4 is compensated by a corresponding inward pivotal movement of the turning rod 7, the longitudinal axis of which finally includes again an angle of 45° with the longitudinal axis of the deflecting roller 4 (FIG. 3).

Whereas the deflecting roller 11 and the turning rod 12 have thus far remained in their initial position, they are now used to compensate the change in the direction of the tubing during the remaining angular movement of the squeeze rollers 2 through 180°. For this purpose, the rollers 4 and 11 and the turning rod 7 are so interlocked when the position shown in FIG. 3 has been reached that they can no longer change their relative position and can only move as a unit. Such interlock can be accomplished in a simple manner with known means. An embodiment of such device is diagrammatically shown in FIG. 8. A rod 25 is movably mounted on a frame part of the revolving rim 3 and can be moved upwardly or downwardly by means of a lever 26, a magnet 27, and a spring 28 and under control of an electric contact. When the position shown in FIG. 3 is reached, the rod 25 moves upwardly into a gap between the guide members 29, which are secured to the revolving rim 13 for the turning rod 7. By that movement, the rod 25 pushes upwardly the rod 30, which is normally held in a lower position by the spring 31 and which snaps between cams 32 provided on the revolving rim 23 for the deflecting roller 11.

When the deflecting rollers 4 and 11 and the turning rod 7 and the means which carry these deflecting members have thus been interlocked, the latter members revolve in unison to the position shown in FIG. 4 and after a complete revolution of the revolving rim 3 and the pair of take-away rolls 2 reach the position shown in FIG. 5, in which the angular movement is reversed and all motions are performed in the reverse order and direction.

From the position shown in FIG. 3 to the position shown in FIG. 5, the turning rod 12 has performed the same functions as previously the turning rod 7. For this purpose, the turning rod 12 is similarly mounted in a

revolving rim 33 and may be provided with suitable drive means, if desired. Such drive means must be offset from that for the turning rod 7 through 180°. This has the advantage that the rack 17 which is provided on the revolving rim 3 and required to drive the turning rod 7 begins the revolution of the revolving rim 13 which carries the turning rod 12 exactly when the drive for the revolving rim 33 carrying the turning rod 7 has been terminated.

The sequence of movements of the deflecting members may be different from the one described hereinbefore, although the latter appears to be highly desirable. Any other combinations of partial movements which serve to accomplish the object of the process may be selected and are included in the invention.

I claim:

1. A flattening and take-away apparatus for handling a blown tubing of plastics material made by a stationary blow head comprising flattening elements and squeeze rollers adapted to be pivotally moved reversingly in steps of at least approximately 360° about the axis of the fed tubing, a lateral deflecting rod positioned after the squeeze rollers and parallel to said squeeze rollers and adapted to be reversingly moved in unison with said rollers about the axis of rotation of said flattening elements, at least three additional deflecting rods positioned after said lateral deflecting rod, each of said additional deflecting rods being mounted to be individually rotatable about the axis of rotation of said flattening elements, the first and third of said additional deflecting rods being positioned in the region of said axis of rotation, the second of said additional deflecting rod being laterally positioned, the lateral deflecting rods being arranged at such a distance from said axis of rotation that they are, in all possible operating positions, positioned radially outwardly of the wrapped portions of said deflecting rod which is positioned in the region of said axis of rotation, and stationary means for guiding the tubing positioned after the last of said deflecting rods in the direction of travel of said tubing.

2. Apparatus according to claim 1, in which said squeeze rollers are arranged in pair and are carried by a revolving rim which is adapted to be pivotally moved reversingly through steps of 360°, and in which said lateral deflecting rod following said squeeze rollers is also mounted in the revolving rim, and in which said additional deflecting rods are mounted in revolving rims which are coaxial with said first revolving rim and pivotally movable independently of the said first revolving rim, said first and third of said additional deflecting rods being centrally positioned and said second addition deflecting rod being laterally positioned and in which said stationary means for guiding said tubing is positioned after said third deflecting rod.

3. Apparatus according to claim 2, in which at least said central deflecting rods consist of turning rods.

4. Apparatus according to claim 2, in which said deflecting rods are mounted in superimposed revolving rim assemblies comprising a movable inner rim and a stationary outer rim and anti-friction rollers secured in stationary columns.

5. Apparatus according to claim 2, including means for interlocking said revolving rims for the first and second deflecting rods with said revolving rim for said squeeze rollers.

6. Apparatus according to claim 5, in which said revolving rim for said squeeze rollers carries a rod which is vertically movable by a magnet against a spring force, and including guide members and a rod provided with a return spring carried by the inner rim of said revolving rim assembly for said first deflecting rod, and further including coupling cams carried by said inner rim of said revolving rim assembly for said second deflecting rod.

7. Apparatus according to claim 5, in which said first and third deflecting rods are adapted to move at one-half of the speed of said squeeze rollers.

8. Apparatus according to claim 7, including a rack mounted on said revolving rim for said squeeze rollers and which has a length corresponding to one-half of the periphery of a circle, and including racks which are carried by the rotatable rims of said revolving rim assemblies for said first and third deflecting rods and which have a length corresponding to one-fourth of the periphery of a circle, and including gears of equal size connected by a reducing gear and in mesh with said racks.

* * * * *