The apparatus serves to handle film made by a stationary blowhead and comprises flattening plates and squeeze rolls which are reversibly rotatable about the axis of the tubular film fed thereto. At least two direction-changing rolls for deflecting the web through about 180° and two turning rods for deflecting the web through about 180° with simultaneous change in direction are disposed in succession and in alternation between the flattening plates and take-off rolls, on the one hand, and a stationary pair of feed rolls, on the other hand, and are mounted on supports which are rotatable about the axis of rotation of the flattening plates and pivotally movable relative to each other. Said rolls and rods are arranged so that the axes of the direction-changing rolls and of the turning rods are tangential to circles centered on the axis of rotation of the flattening plates. The radius of the circle which is inscribed in the path of the pivotal movement of the axes of the turning rods is π/4 diameter of the turning rods. The direction-changing rolls are in every possible operating position radially outwardly of those portions of the turning rods which are wrapped by the web.
FLATTENING AND TAKE-OFF APPARATUS FOR BLOWN TUBULAR PLASTICS FILM

In the manufacture of films of thermoplastic materials it will be known that fluctuations in film thickness are unavoidable. When winding up such films having fluctuations in thickness, the thicker portions in each convolution build up to form annular beads which cause the film to become permanently deformed in this region. After such a film is unwound again, it cannot be laid perfectly flat and this will make it difficult to apply printing to the film or in processing the film to form, say, packaging bags or other products. In the manufacture of tubular films by the blowing process and flat films made by severing a tubular film longitudinally, the annular beads on the coils and the disadvantages associated therewith can be avoided if provision is made for relative rotation between the blowhead for the film and the flattening and withdrawal apparatus. Such rotation can be continuous or reciprocating with the direction of rotation being reversed after an angle of about 360°. Such rotation distributes the errors in thickness over the entire width of the coil much in the same way as a cable is wound on a drum and therefore the cylindrical coil of film will exhibit no annular beads.

To avoid the disadvantages associated with having to rotate the entire film extrusion press or its blowhead or the take-off and flattening apparatus together with the film winder, the prior U.S. Patent Application Ser. No. 74,285 filed Sept. 22, 1970, and the prior Canadian Patent Application Ser. No. 93,857 filed Sept. 23, 1970, disclose a flattening and take-off apparatus in which the flattening plates and squeeze rolls are reversibly rotatable about the axis of the tubular film fed thereto and in which a lateral direction-changing rod is provided downstream of the squeeze rolls and parallel thereto to be reversibly rotatable together therewith about the rotary axis of the flattening plates, followed by at least three further direction-changing rods which are independently rotatable about the rotary axis of the flattening plates and of which the first and third are located in the central region and the second is located laterally, and wherein the spacing of the lateral rods from the rotary axis is selected so that in every possible operative position the lateral rod is disposed radially outwardly of those portions of the centrally disposed rod about which the film is passed, stationary film-guiding apparatus being provided downstream of the last direction-changing rod. In that apparatus disclosed in said prior patent applications, the axes of the direction-changing rods which are disposed in the central regions and consist of turning rods are intersected by the axis of rotation of the flattening plates and the outer direction-changing rods consist of rotatably mounted rolls. In that arrangement, the pivotal movement results necessarily in a lateral wandering of the film to an extent which depends on the diameter of the turning rods. Means for laterally adjusting the film-guiding means or the winder may be provided to compensate the lateral wandering of the film during the pivotal movements. Such means for a lateral adjustment, however, add considerably to the structural expenditure.

For this reason it is an object of the present invention to improve a flattening and take-off apparatus of the type defined, which has been claimed in said two prior applications, that the film does not perform a lateral wandering during the pivotal movements so that separate rate means for a lateral adjustment are no longer required.

In a flattening and take-off apparatus for blown tubular plastics film made by a stationary blowhead, which apparatus comprises flattening plates and squeeze rolls which are reversibly rotatable about the axis of the tubular film fed thereto, that object is accomplished according to the invention in that at least two direction-changing rolls for deflecting the web through about 180° and two turning rods for deflecting the web through about 180° with simultaneous change in direction are disposed in succession and in alternation between the flattening plates and take-off rolls, on the one hand, and a stationary pair of feed rolls, on the other hand, and are mounted on supports which are rotatable about the axis of rotation of the flattening plates and pivotally movable relative to each other, said rolls and rods being arranged so that the axes of the direction-changing rolls and of the turning rods are tangential to circles centered on the axis of rotation of the flattening plates, the radius of the circle which is inscribed in the path of the pivotal movement of the axes of the turning rods being π/4 diameter of the turning rods and the direction-changing rolls being in every possible operating position radially outwardly of those portions of the turning rods which are wrapped by the web.

Because the distance from the centers of the turning rods to the axis of rotation of the flattening plates is π/4 diameter of the turning rods, the intersection of the center lines of the film web sections approaching and leaving the turning rod lies in the central pivotal axis. As a result, a lateral wandering of the film web during the outward pivotal movement of the system is avoided. Further in this arrangement, the flattening plates, the take-off rolls and the supports for the pivoted rolls of the reversible system can all be mounted on a central shaft to result in a particularly favourable space-saving construction and, with due regard to certain minimum dimensions, can be used for practically any desired film widths.

The maintenance of the above-defined spacing of the turning rods from the central axis can be dispensed with in favour of a larger spacing if the outer direction-changing rod which is located between the inner rods that are adjacent to the central axis is in the form of a turning rod. During rotation of this turning rod the film is then not supplied in a straight line but obliquely and, after deflection, withdrawn correspondingly obliquely. This construction permits the central supporting shaft carrying the flattening plates, squeeze rolls and the entire reversingly rotating take-off system to be given any desired large diameter without dependence on the diameter of the turning rod.

It is also possible for the axes of the direction-changing rolls which are in the form of turning rods and are disposed in the central region to be intersected by the rotary axis of the flattening plates. In order to avoid in such arrangement the need for lateral adjusting means, the direction-changing rod disposed between the two turning rods in the central region must also consist of a turning rod, which the film approaches obliquely and leaves obliquely.

If the direction-changing rolls and the turning rods are aligned with one another in the direction of the rotary axis of the flattening plates when the latter are in a central position of their reciprocating path, rotation through 180° from this central position is necessary in...
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both directions. To permit the changes in direction of the film necessitated by such rotation, two turning rods in the central region will be necessary and adequate, film deflection through 90° taking place at each turning rod in the limiting position.

The greater the number of storeys or levels, the less will be the maximum turning angle of the individual turning rods and thus their required lengths. This is because the required length of a turning rod increases as the angle through which the film is passed about the rod becomes more steep. The length of the part of the turning rod required for the maximum film width as well as the largest turning angle of the turning rod are cumulatively decisive for the required spacing of the direction-changing rolls from the central axis. If more turning rods are used in succession, then each rod may be shorter and disposed at a smaller maximum angle to the direction-changing rolls or turning rods that are upstream and downstream thereof and thus each rod can be disposed closer to the central axis and nevertheless fulfill the requirement that in every possible operative position it be located radially outwardly of those parts of the inner turning rods about which the film is passed.

The use of a larger number of inner and outer direction-changing rods thus permits the entire apparatus to be made more compact and for the space required radially of the central axis to be reduced. On the other hand, this increases the manufacturing costs and the space required in the axial direction.

It is particularly advantageous if the rotary movements of the supports of the direction-changing rods are positively intercoupled. This relieves stresses in the film and ensures accurate central running of the film over the direction-changing rods because otherwise the film would itself have to bring about the turning movements of the individual direction changing rods.

Such positive coupling or guiding can be effected by gearing or by a lever system. In the aforementioned constructions having a central shaft, the gearing may comprise either double gears which are loosely mounted on an auxiliary shaft parallel to the central shaft or single gears which are fixed to the auxiliary shaft, these double or single gears co-operating with corresponding gear segments which are concentric with the central shaft and fixed to the mounting for the flattening plates, to the supports for the direction-changing rods and to a stationary bearing sleeve. The auxiliary shaft may be held by a special holder to the support for that direction-changing rod which is the central rod in relation to the rods that are movable relatively to the squeeze rolls, the auxiliary shaft being held diametrically with respect to this central rod. This ensures that the auxiliary shaft will be located on the bisector of the deflection angle between the flattening plates and the take-off apparatus so that the direction-changing rods will not strike the auxiliary shaft.

If the positive guide is provided by a lever system, the latter may be in the form of spherically movable lazy tongs, points of intersection of the components of the lazy tongs co-operating respectively with the mounting for the flattening plates, squeeze rolls and first direction-changing rod as well as with the supports for the further direction-changing rods and with a stationary bearing sleeve. If the point of intersection of the central axes of the film lengths approaching and leaving the inner turning rods lie on the rotary axis of the flattening plates by maintaining dimensions stated above in the axis of rotation of the flattening plates, then the spacings of the points of intersection of the components of the lazy tongs will be equal. However, if these points of intersection are disposed behind the rotary axis and if an outer turning rod is also provided between the inner rods, as in the design defined above, then the required rotation of the inner turning rods relatively to the squeeze rolls or the stationary pair of feed rolls will be less than relatively to the outer turning rod. Accordingly, the spacings of the uppermost and lowermost points of intersection of the lazy tongs should, corresponding to the ratio of the angles of rotation, be selected to be smaller than the spacings of the points of intersection in the central region. The converse applies if the points of intersection of the central axes of the film lie in front of the rotary axis of the flattening plates, as in the design defined above. In this case the spacings of the uppermost and lowermost points of intersection of the lazy tongs should be selected to be larger than the spacings of the points of intersection in the central region, again corresponding to the ratio of the angles of rotation.

It is a feature of the invention that the so-called squeeze rolls can be two direction-changing rolls which are spaced from one another and over which the flattened film is passed in S formation. Such spaced rolls effect adequate squeezing without creating marked frictional forces which could prove a hindrance to the film right up to the stationary pair of feed rolls.

Preferably the second squeeze roll and the lowermost turning roll on the mounting for the flattening plates are in the form of cooling rolls. The film is passed over these two rolls through 180° in opposite senses and therefore both sides of the film will be cooled to the same extent.

The apparatus of the invention preferably has a vertically disposed central shaft. If the supports for the direction-changing rods are positively guided, the apparatus could also be employed with a horizontally mounted central shaft. During turning between the limiting positions of the turning rods, differences may, depending on the construction, occur in the length of the path between the squeeze rolls and the stationary feed rolls. However, these length differences are not of practical importance.

With the design described above, the length difference with a turning rod diameter of, say, 10 cm is as little as 13.2 cm but is distributed over a film length of 30,000 cm because this is the length of film passing through the apparatus during 10 minutes of continuous turning through 180° at a film speed of 3,000 cm per minute. The error is therefore as little as 0.044 percent of the film length. If even length differences of this order are to be excluded then one of the outer turning rods, preferably the central rod, can be held at a variable spacing from the central shaft, the spacing being variable in dependence on the turning angle by means of a cam so that the film length within the reciprocating rotary system will always remain the same.

Examples of the invention will now be described with reference to the accompanying diagrammatic drawings, in which:

FIG. 1 is a simplified side elevation of a preferred form of reciprocating rotary apparatus in the basic position (zero degree position);
FIGS. 2 to 4 are reduced simplified plan views of the FIG. 1 apparatus showing the rolls and turning rods respectively in the 0°, 90° and 180° position;

FIG. 5 is a side elevation corresponding to FIG. 1 but of a second embodiment of reciprocating rotary apparatus in the basic or zero degree position;

FIG. 6 is a detail of the FIG. 5 embodiment as viewed in the direction of the arrow VI in FIG. 5;

FIG. 7 is a sectional detail taken on the line VII—VII in FIG. 5;

FIG. 8 shows a different embodiment of a reversing apparatus according to the invention;

FIG. 9 shows of the embodiment of FIG. 8 a detail which corresponds to that of FIG. 6;

FIG. 10 is a diagrammatic view showing a further modification; and

FIG. 11 shows of the embodiment of FIG. 10 a detail which corresponds to that of FIG. 6.

An extruder (not shown) having a blowhead (not shown) forms a tubular film 1 which is flattened by flattening plates 2 that are fixed to an auxiliary frame 3. The auxiliary frame is carried by a cross-member 4 on a supporting shaft 5 which is rotatably mounted in the main frame 6 of the apparatus. The frame 6 includes columns 7 supported on a take-off platform 8 having an aperture 9 in line with the shaft 5. The flattening apparatus comprising the plates 2, auxiliary frame 3, cross-member 4 and shaft 5 is rotated by means of a gear motor 10 of which the direction of rotation is reversed after every 360° by any suitable means such as stationary electric end switches.

The flattened film is passed in S formation about two squeeze rolls 11 and 12 and a guide roll 13 which is carried by a holder 13' in the auxiliary frame 3 and which therefore participates in the reversed or reciprocating rotary motion of the auxiliary frame. It has been found that looping of the film in S formation about the rolls 11,12 achieves adequate squeezing of the film so that no air can escape from the tubular portion into the flattened portion of the film. Since there is thus no intense pressure as would be applied during flattening of the film with conventional squeeze rolls, it will be particularly advantageous if the two rolls 12, 13 are in the form of water-cooled rolls because the film passes about these rolls in opposite senses and through precisely 180° so that both sides of the film are cooled to the same extent. The supply and withdrawal conduits for the cooling water constitute the only flexible energy supply connections that are necessary for the apparatus of the invention and this helps to ensure efficient operation.

Downstream of the guide roll 13 and pivotably mounted to one side of the supporting shaft 5 there are a first turning rod 14 and its mounting 15 and bearing sleeve 16, a direction-changing roll 17 with its mounting 18 and bearing sleeve 19 and a second turning rod 20 with its mounting 21 and bearing sleeve 22. All these rods are tangential to imaginary circles concentric with the central axis of the supporting shaft 5. The required spacing or radius will be described later. Downstream of the turning rod 20 there is a stationary pair of feed rolls 23, 24 and a winder (not shown) for the film. The feed rolls can effect take-off of the film from the blowhead, in which case no other driven rolls need be provided in the entire apparatus. It is also possible to form the squeeze rolls 11, 12 as take-off rolls.

As diagrammatically indicated in FIGS. 2 to 4, the direction-changing effect for the film results from the fact that between the successive direction-changing rolls and turning rods 13, 14, 17, 20 and 23/24 an angle of twist is set up corresponding to one quarter of the angle of twist of the auxiliary frame 3 with flattening plates 2 relatively to the stationary frame 6. In the FIG. 1 embodiment the individual rotatable elements are positively intercoupled by gear segments 25, 26 at the respective ends of each bearing sleeve 16, 19 and 22 as well as on the cross-member 4 and on the bearing sleeve 27, these gear segments being engaged by four corresponding double gears 28 which freely run on a shaft 29. The shaft 29 is fixed by a holder 30 to the bearing sleeve 19 of the central direction-changing roll 17 so that the entire gear 28, 29, 30 effecting positive interconnection and guiding for the required relative rotations will always be disposed in the free space on the angular bisector behind the two turning rods 14, 20.

The spring 31 shown in FIG. 1 is intended to indicate that in order to counteract play in the gears 25, 26, 28 the shaft 29 is preferably spring-influenced so as to avoid dead spots in the gearing. The required ratios for the gears 25, 26, 28 are calculated from the known formulae for planetary gears.

In a modification, only one gear segment 25 is provided on each of the sleeves 16, 19, 22, 27 and the cross-member 4 to engage with a respective single gear 28 on a shaft 29 which will in this case be rotatable, the holder 30 and calculation of the gear ratio being the same as already described.

The desired positive coupling for the rotational movements can also be brought about by a lever system in the form of spherically movable lazy tongs, the central pivot points of the tongs lying in alignment above one another when in the basic (zero degree) position at the cross-members 4, the movable bearing sleeves 16, 19 and 22 and the stationary bearing sleeve 27. This construction is illustrated in FIGS. 5 and 6. The hinge holder 32 is mounted on the cross-member 4 to rotate therewith, the hinge holder 33 on the bearing sleeve 16, the hinge holder 34 on the bearing sleeve 19, the hinge holder 35 on the bearing sleeve 22 and the hinge holder 36 on the bearing sleeve 27, the attachment being on that side which is remote from the direction-changing rolls and turning rods 13, 14, 17 and 20 so that the film will not be impeded by the levers. The hinge holders 32 to 36 are connected to the lazy tongs which comprise strip levers 37 and 38 and associated connecting hinges 39. FIG. 6 is a simplified drawing showing the elongation of the lever system when the hinge holders 32 to 36 are laterally displaced, the spacing between each pair of hinge holders 32—33, 33—34, 34—35 and 35—36 being one quarter of the lateral displacement of the lowest hinge holder 32. This path also corresponds to a quarter of the rotary angle. By reason of the twist which the system undergoes during pivoting of the direction-changing rolls of the turning rods, the necessary spherical movability is in the simplest case achieved by making the levers 37 and 38 of relatively wide but thin spring steel strip so that they will follow the twist of the system without collapsing. In contrast with gearing, the lever system provides almost play-free positive coupling whereas the above-described first embodiment makes it necessary to take special precau-
tions to eliminate play. On the other hand, tilting and bending is inherently impossible with gearing.

The pivotal axis for the turning rods 14, 20 lies at the intersection of the central film axes because otherwise the film would wander sideways during turning of the system. This also makes the particularly advantageous and space-saving central mounting of the pivot rolls possible. By simple geometric calculations, it will be found that the central spacing A (FIG. 1) of the axis of a turning rod having an outer diameter D is equal to \( \pi/4 \) times D.

Further geometric calculation will show that the diameter \( d \) of the supporting shaft 5 can amount to about \( D/2 \). By fixing the diameter of the turning rods 14, 20 one can therefore also influence the stability of the shaft within substantially free limits so that the turning rod system of the invention may be designed for films of any desired large widths, with the mounting being central.

Since the turning rods move about the intersection of the central film axes whilst they are being rotated, rotation of the system will result in practically no alteration in the path covered by the film, this enabling the particularly advantageous and stationary mounting of the pair of take-off rolls at the discharge side of the apparatus and thus the fixed installation of the associated electric current and control conduits. The small differences in length between the straight and oblique looping about the turning rods are, as already mentioned, practically negligible.

Nevertheless, to eliminate this difference in the length of film which occurs when the apparatus of FIG. 1 is rotated and which amounts to:

\[ F = \sqrt{2 (D - D_1 \pi D)} = 1.32 \cdot D \]

the intermediate roll 17 of the system may be moved by a cam in such a way that the error \( F \) is accurately compensated. Since the roll 17 is encompassed by the film by \( 180^\circ \), the maximum stroke of the roll 17 must for this purpose amount to \( F/2 \).

The displacability of the roll 17 is achieved by joining the holder 18 to a longitudinally displaceable square extension 18' (FIG. 7) located in a corresponding socket of the bearing sleeve 19. The extension 18' constitutes a cam follower and rides on a cam 40 which is fixed to the supporting shaft 5. The extension 18' need not be resiliently urged into engagement with the cam because such urging is automatically effected by the film that is slung about the roll 17.

As shown in FIG. 7, in the basic or zero degree position the extension 18' is in a retracted position. At the maximum positions of +180° and -180°, the supporting shaft 5 and cam 40 have turned through +90° or -90°, respectively, relatively to the bearing sleeve 19, at which time the extension 18' is disposed as indicated in broken lines. By designing the cam 40 in increments, one can thus ensure that the length of film in the reversible system will always remain exactly constant.

In the simplest form, the turning rods are non-rotatable shafts provided with coverings having a low coefficient of friction. However, friction nevertheless occurs and the coverings must be frequently replaced. This disadvantage can be eliminated by providing rotary turning rods with rotary supporting elements which, by reason of the component of movement of the individual surface portions in the axial and peripheral directions, permit practically friction-free and wear-

free diversion of the film through any desired angles. The features of such turning rods are described in prior Patent applications.

As has been stated in the introductory part of the specification, the embodiments described hereinbefore afford the advantage that the intersection of the center lines of the film web portions and approaching and leaving the turning rod lies in the central pivotal axis so that a lateral wandering of the film web during the outward pivotal movement of the system is avoided. This is due to the fact that the distance from the centers of the turning rods to the axis of rotation of the flattening plates is \( \pi/4 \) diameter of the turning rod. The modifications which are diagrammatically shown in FIGS. 8 to 11 represent another possibility to avoid a lateral wandering of the film web during the reversing movement. To avoid such lateral wandering in the embodiment of FIG. 8, the relative turning angle between the direction-changing roll 48 (provided upstream of the reciprocating rotary system) and the turning rod 49 and between the pair of take-off rolls 50 (provided downstream of the reciprocating rotary system) and the turning rod 51 is selected to be smaller than between each of the turning rods 49, 51 and the direction-changing rod 52 that is located therebetween as viewed in the direction of film feed, the rod 52 in this case also being a turning rod. The film is thus supplied to the turning rod 52 at an acute angle and led off again at a corresponding acute angle. In the illustrated limiting position of the system, the resultant acute angle between the central film axis and the perpendicular on the turning rod 52 is indicated by \( \alpha \). The turning angle of the turning rod 49 or 51 relatively to the roll 48 or 50, respectively, is then smaller by \( \alpha/2 \) than in the case of equal relative turning angles between the turning rods 49, 51 and 52. The rotary angle between the turning rods 49, 51 and the turning rod 52 therebetween is correspondingly larger. The size of the angle \( \alpha \) depends on the diameters D and D₁ of the turning rods 49, 51, 52 and on the spacing L of the turning rod 52 from the rotary axis of the flattening plates and can be readily calculated when these parameters are known.

The unequal rotary angles in the individual pivotal planes can be readily achieved by appropriately designing the gearing for the positive coupling. If lazy tongs are used, the spacings of the points of intersection should be unequal but symmetrical with respect to the horizontal central plane. Such tongs are diagrammatically illustrated in FIG. 9. The spacing \( l₁ \) is larger than the spacing \( l₂ \), the ratio being given by \( l₂/l₁ = (45° + \alpha/2) / (45° - \alpha/2) \).

The use of additional outer turning rods in the FIGS. 1 to 7 embodiments using a central supporting shaft would also make it possible to dispense with the arrangement of the inner turning rods at a spacing of \( \pi D/4 \) from the rotary axis of the flattening plates. If, as shown in FIG. 10, the spacing A of the inner turning rods 53, 54 from the rotary axis is increased, for example in order to accommodate a larger central shaft 55 and so as to make the design independent of the diameter D of the turning rods, then the relative turning angle of the inner turning rods 53, 54 must be larger relatively to the upstream and downstream rolls 56, 57 than the FIGS. 1 to 7 embodiments and the film will again be led at an acute angle to and from the outer turning rod 58. The length ratio shown in FIG. 11 for the indi-
individual sections of the lazy tongs is in this case given by
\[ \frac{\alpha}{\beta} = \frac{(45^\circ - \alpha/2)}{(45^\circ + \alpha/2)}. \]

I claim:

1. A flattening and take-off apparatus for handling a blown tubing of plastics material made by a stationary blowhead comprising a reversibly rotatable central shaft, flattening plates and squeeze rollers mounted to said central shaft and adapted to be reversibly rotated through an angle up to 360° about the axis of said central shaft and of the fed tubing, a lateral direction changing rod for deflecting the fed tubing through an angle of about 180° mounted to said central shaft and positioned after the squeeze rollers and parallel to said squeeze rollers and adapted to be reversely rotated in unison with said squeeze rollers about the axis of rotation of said central shaft and said flattening plates, at least three additional rods for deflecting the fed tubing through an angle of about 180° positioned after said lateral direction changing rod, each of said additional rods being mounted to said central shaft to be rotatable relative to each other about the axis of rotation of said central shaft and flattening plates, the first and third of said additional deflecting rods being positioned in the region of said axis of rotation, the second of said additional rods being a direction changing rod and being laterally positioned, the lateral direction changing 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 rods which are positioned in the region of said axis of rotation, and stationary means for guiding the tubing positioned after the last of said direction changing rods in the direction of travel of said tubing.

2. Flattening and take-off apparatus according to claim 1, in which each of said first and third additional rods is spaced from the axis of rotation of said central shaft a distance equal to \( \pi/4 \) times their respective diameters.

3. Flattening and take-off apparatus according to claim 1 including means for intercoupling the rotational movement of said additional rods.

4. Flattening and take-off apparatus according to claim 3, in which said intercoupling means comprises a lever system.

5. Flattening and take-off apparatus according to claim 4, in which said lever system comprises lazy tongs in which the points of intersection of the components of said lazy tongs cooperate with the mounting for said flattening plates, the mountings for said additional rods, and a stationary bearing sleeve.

6. Flattening and take-off apparatus according to claim 1 in which said squeeze rollers comprise two direction-changing rollers, which are spaced apart and wrap the flattened fed tubing in an S-shaped path.

7. Flattening and take-off apparatus according to claim 10, in which the second of said squeeze rollers and said lateral direction changing roller consist of cooled rollers.

8. Flattening and take-off apparatus according to claim 1, in which said intercoupling means comprises a cam such that the length of the path said fed tubing follows remains constant.

9. Flattening and take-off apparatus according to claim 8, in which said lever system comprises lazy tongs in which the second of said additional rods is held at a variable distance from said central shaft by means of a cam such that the length of the path said fed tubing follows remains constant.

10. Flattening and take-off apparatus for handling a blown tubing of plastics material made by a stationary blowhead comprising flattening plates and squeeze rollers adapted to be reversely rotated through an angle up to 360° about the axis of the fed tubing, a lateral direction changing rod positioned downstream of the squeeze rollers and parallel to said squeeze rollers and adapted to be reversely rotated in unison with said squeeze rollers about the axis of rotation of said flattening plates, at least three additional direction changing rods positioned downstream of said lateral direction changing rod, each of said additional direction changing rods being mounted to be rotatable about the axis of rotation of said flattening plates, the first and third of said additional direction changing rods being laterally positioned, the lateral direction changing 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 direction changing rods which are positioned in the region of said axis of rotation, and stationary means for guiding the tubing positioned downstream of said direction changing rods in the direction of travel of said tubing.

11. Flattening and take-off apparatus according to claim 13, in which the first and third direction changing rods are spaced from the axis of rotation of the flattening plates by a distance which exceeds \( \pi/4 \) times their respective diameters.

12. Flattening and take-off apparatus according to claim 13, in which the rotation axis of the first and third changing rods are intersected by the axis of rotation of the flattening plates.

13. Flattening and take-off apparatus according to claim 13, in which the first and third direction changing rods are spaced from the axis of rotation of the flattening plates by a distance which is less than \( \pi/4 \) times their respective diameters.

14. Apparatus according to claim 14, including means for intercoupling the rotation of the direction changing rods so that the rotation of the first and third
direction changing rods relative to the rotation of the second direction changing rod is \(45° + \alpha /2\) to \(45° - \alpha /2\), where \(\alpha\) is the angle between the center line of the fed tubing and the perpendicular to the second direction changing rod.

18. Apparatus according to claim 16, including means for intercoupling the rotation of the direction changing rods so that the rotation of the first and third direction changing rods relative to the rotation of the second direction changing rod is \(45° - \alpha /2\) to \(45° + \alpha /2\), where \(\alpha\) is the angle between the center line of the fed tubing and the perpendicular to the second direction changing rod.