

[54] **METHOD OF AND APPARATUS FOR FOLDING, SEWING AND CONVEYING SHEET MATERIALS**

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[58] Field of Search... 112/2, 121.11, 121.12, 121.15, 112/121.29, 10; 270/37

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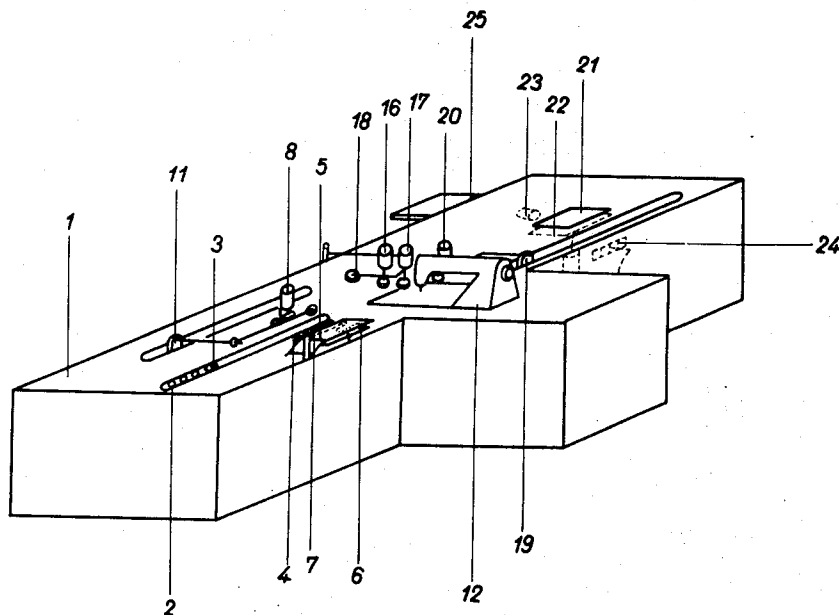
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[57] **ABSTRACT**

A method of and apparatus for folding and conveying sheet materials. A work support is provided having a work surface. Sheet material blanks are engaged by engaging means and advanced along the work surface while being maintained in a predetermined orientation with respect to a folding device to which they are transported. The folding device folds the sheet materials in a predetermined manner and the folded blank is then advanced again along the work surface to a processing station where it is engaged and moved with respect to a processing device according to a predetermined program while being acted upon by the processing device. Subsequently the thus-produced processed article is engaged and removed from the processing device to be stacked and counted.

6 Claims, 14 Drawing Figures



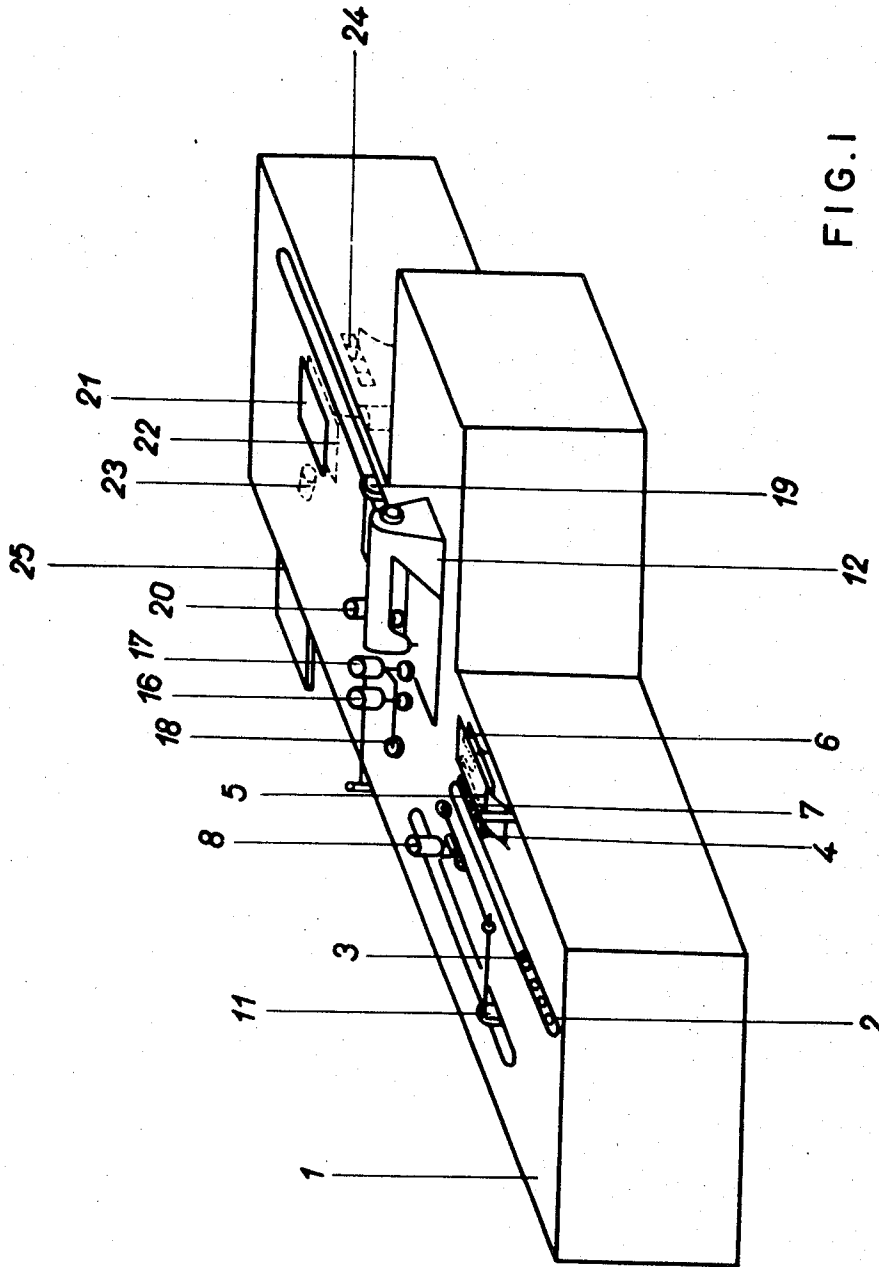
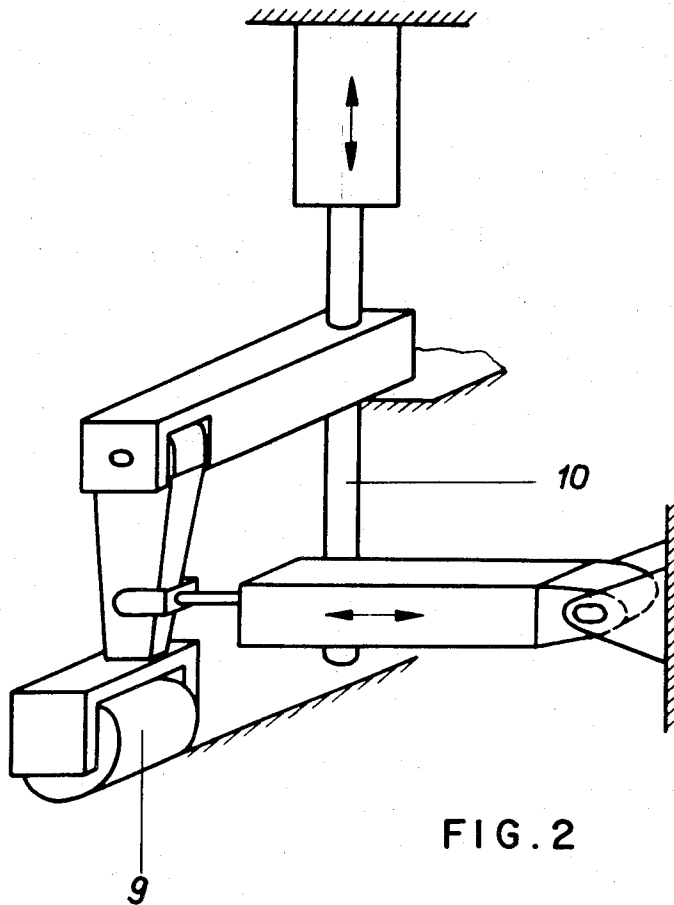


FIG. 1

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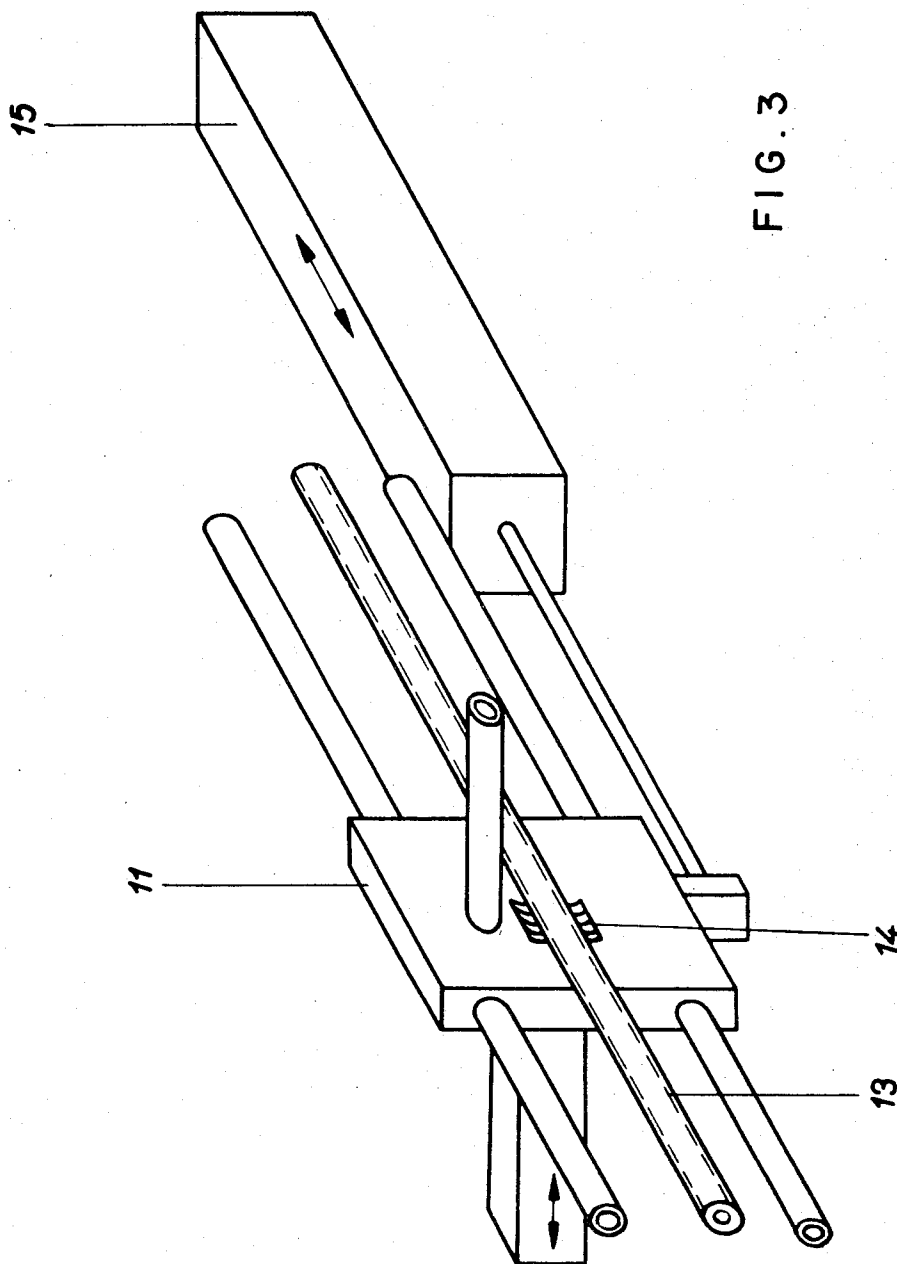


FIG. 3

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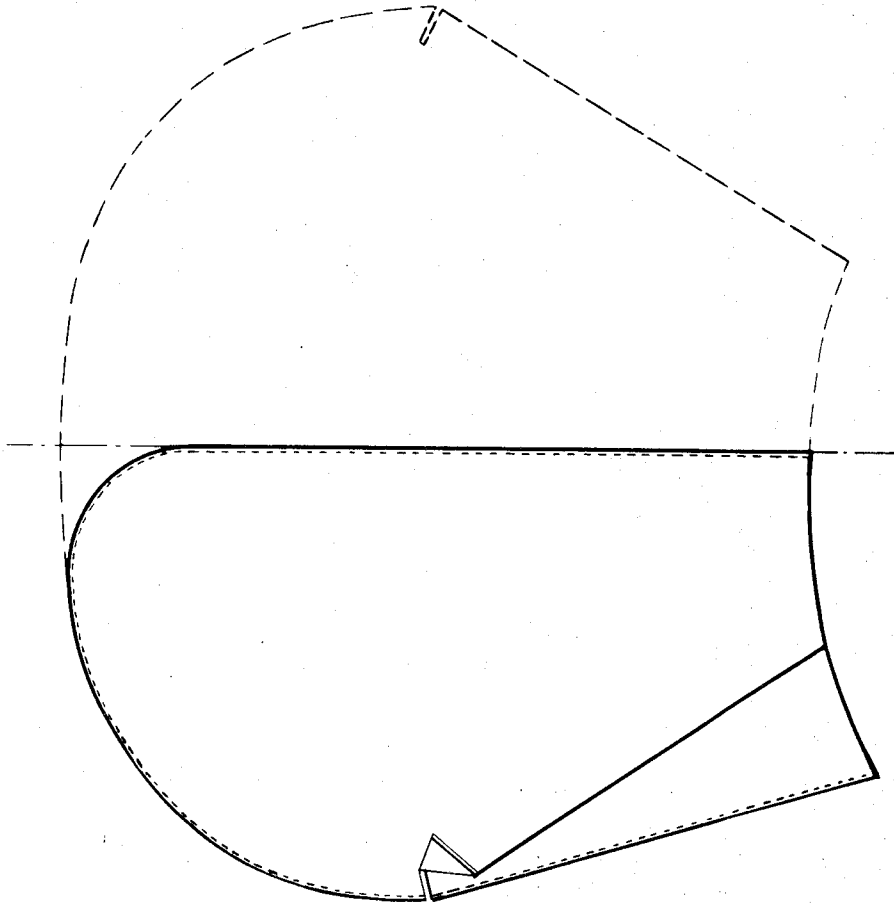
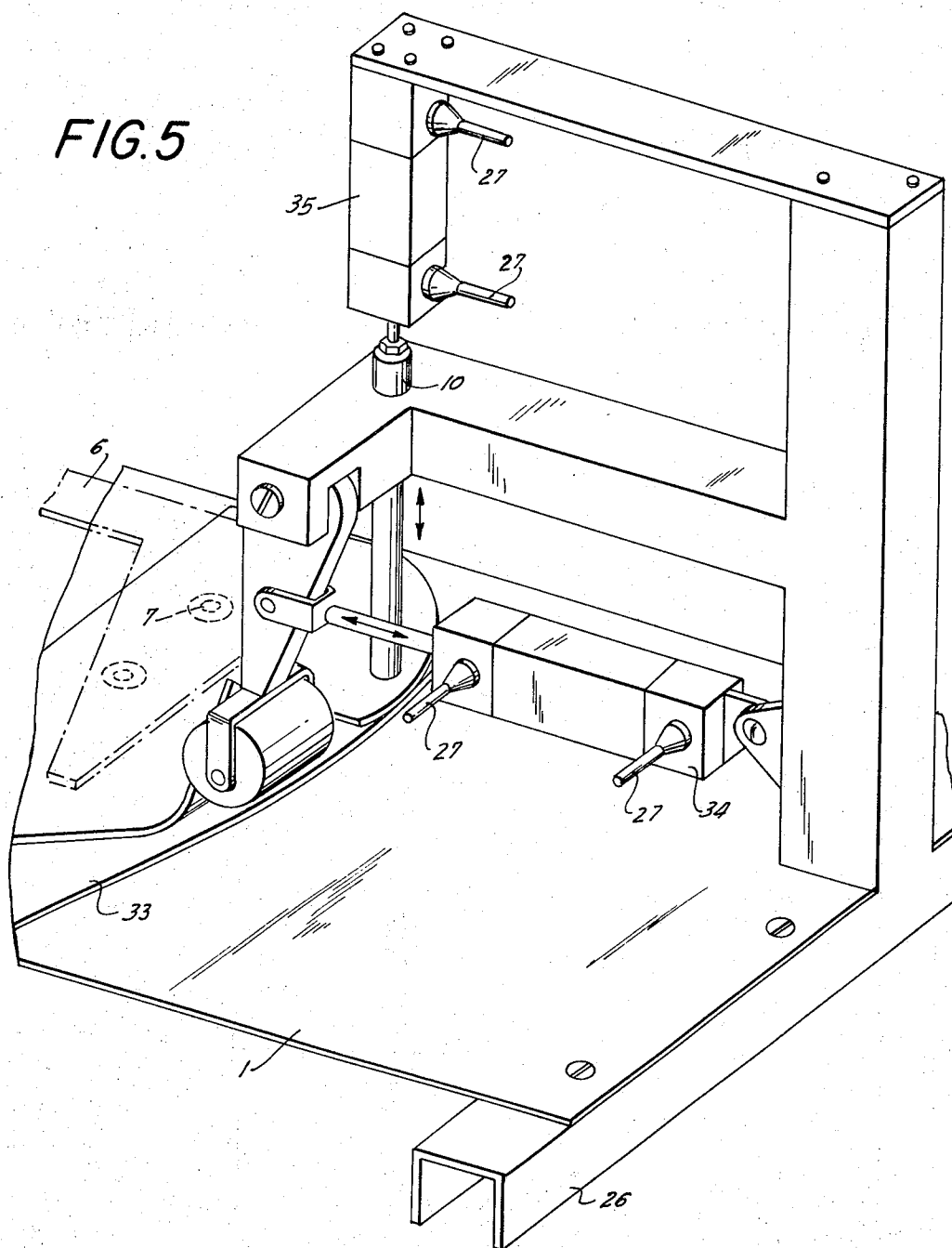


FIG. 4

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FIG. 5



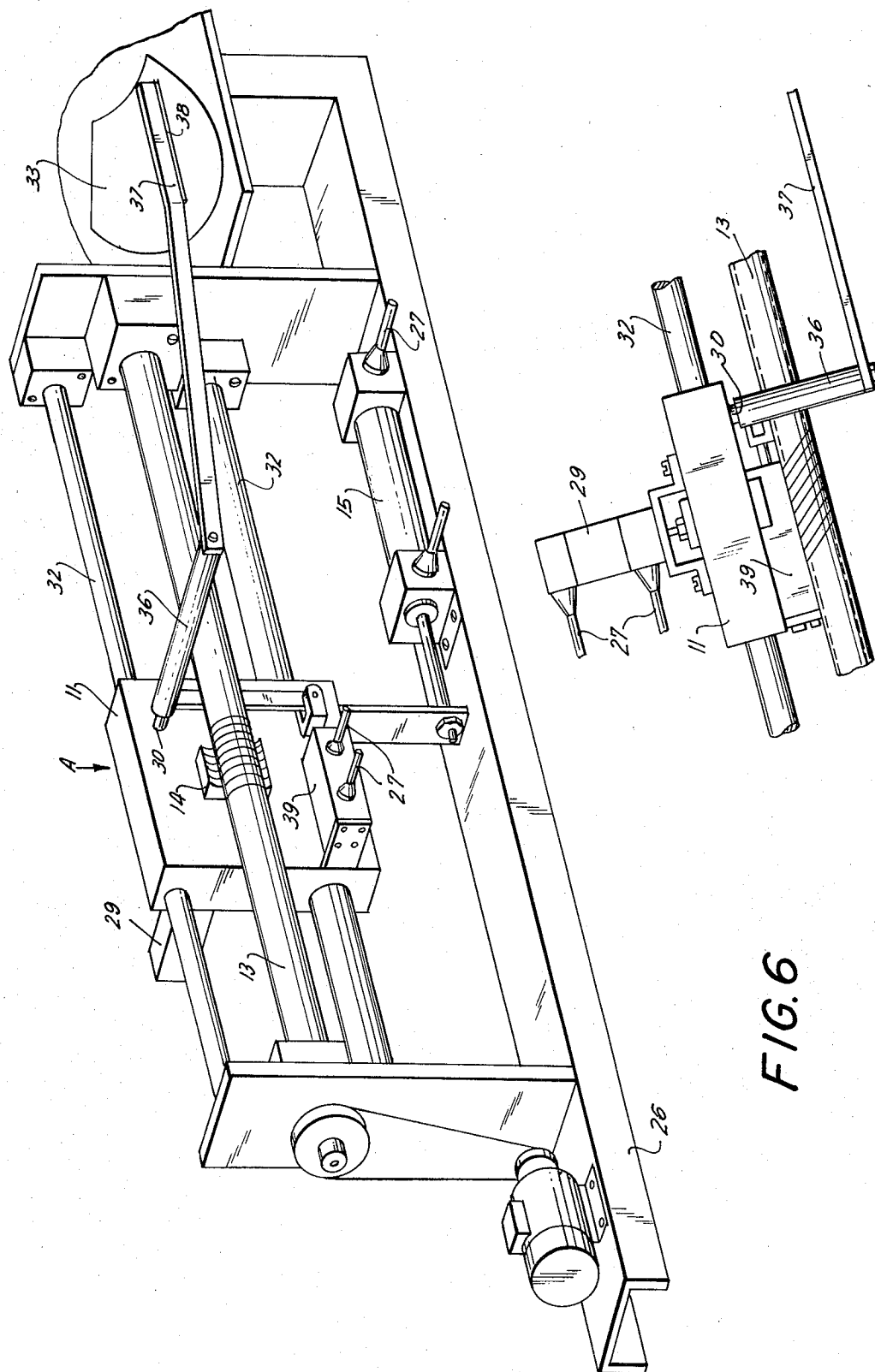


FIG. 6

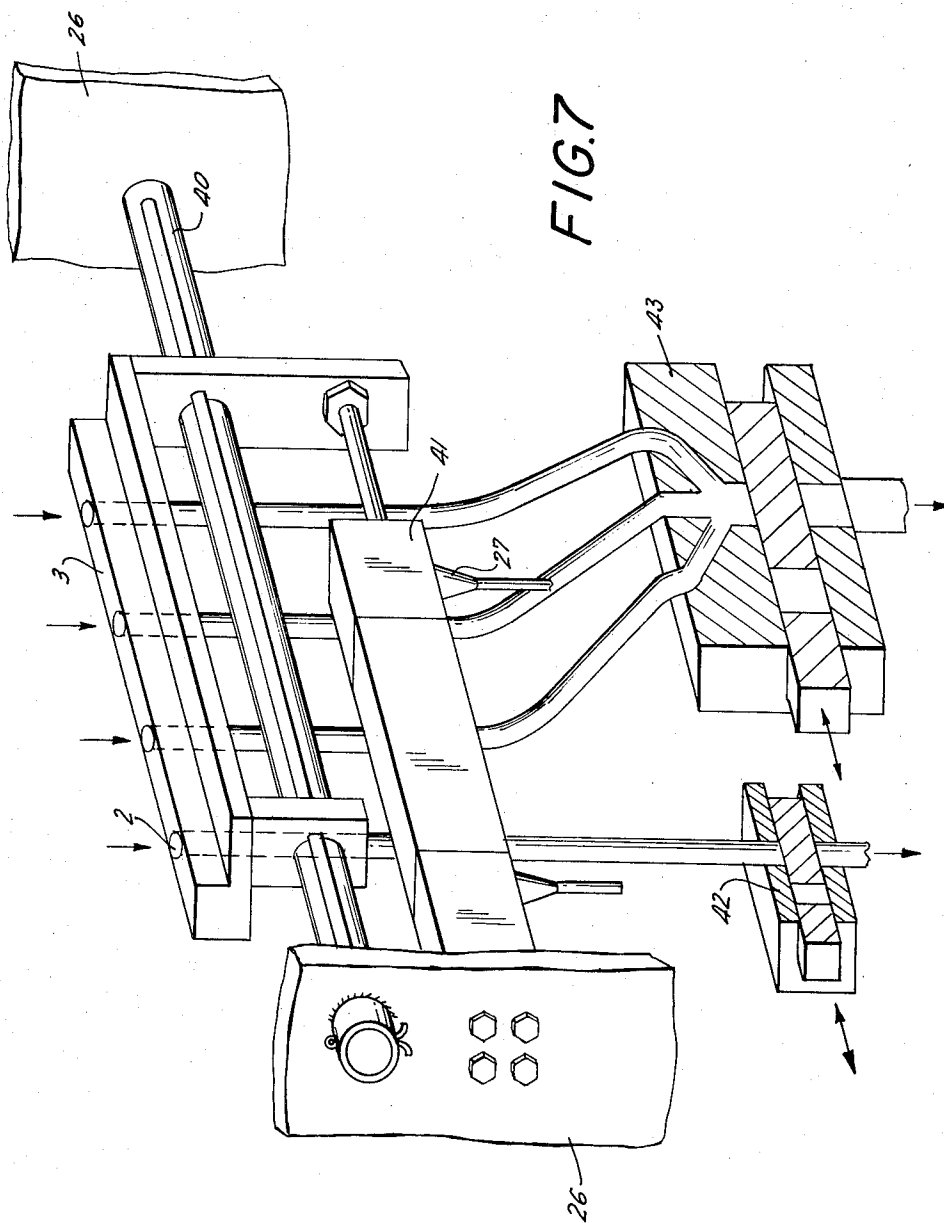


FIG. 8

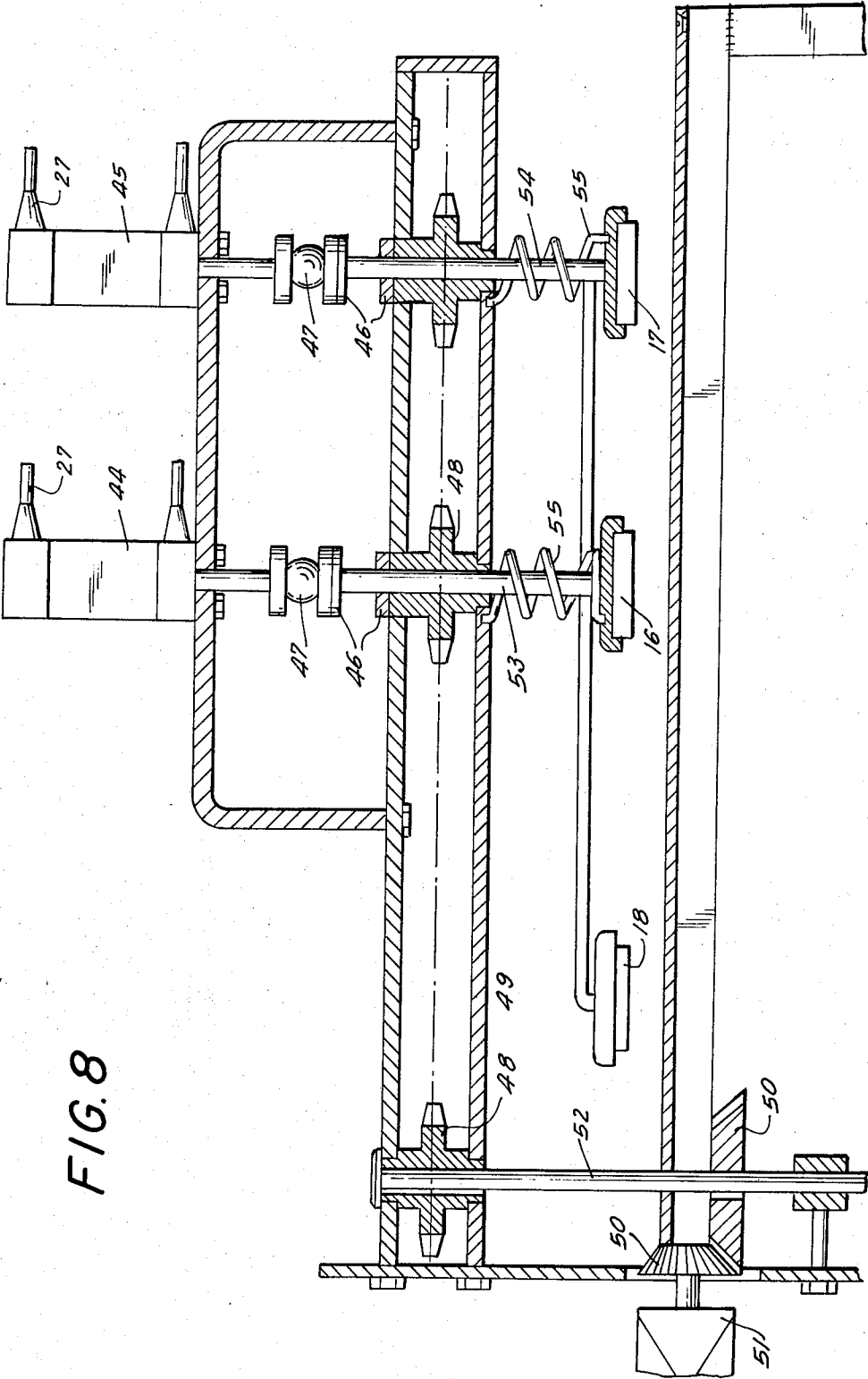


FIG. 9

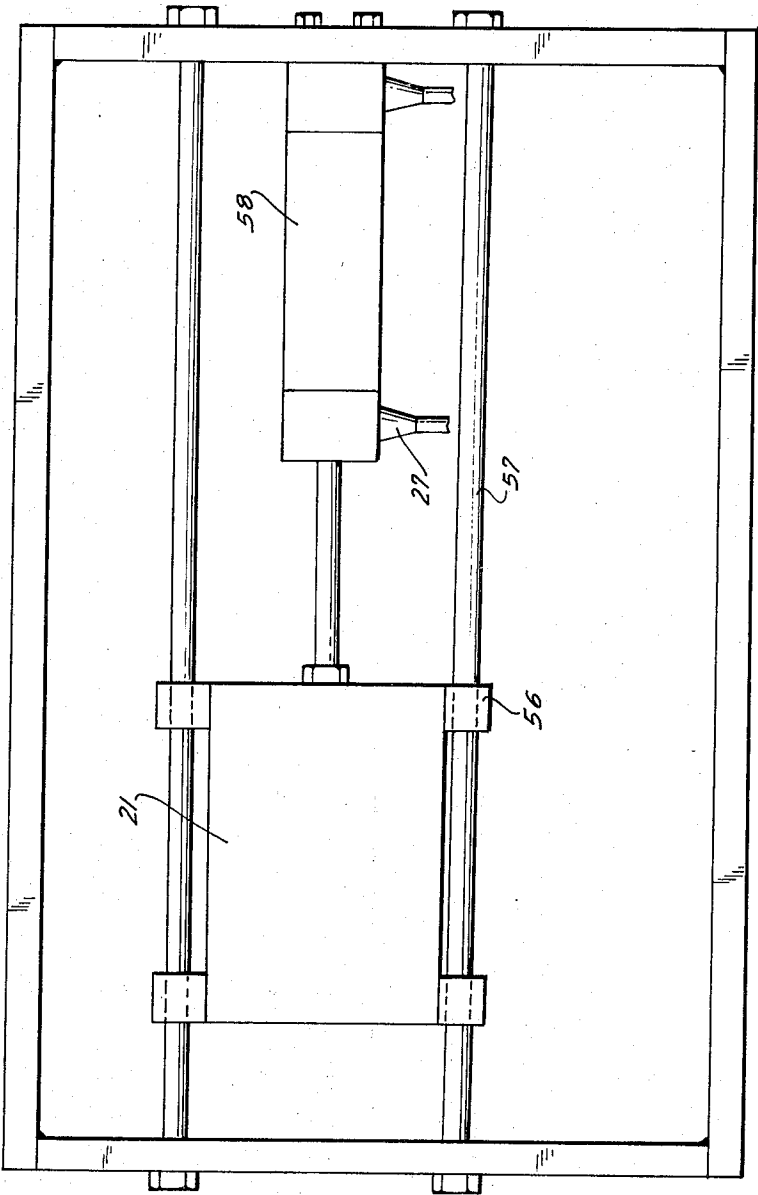
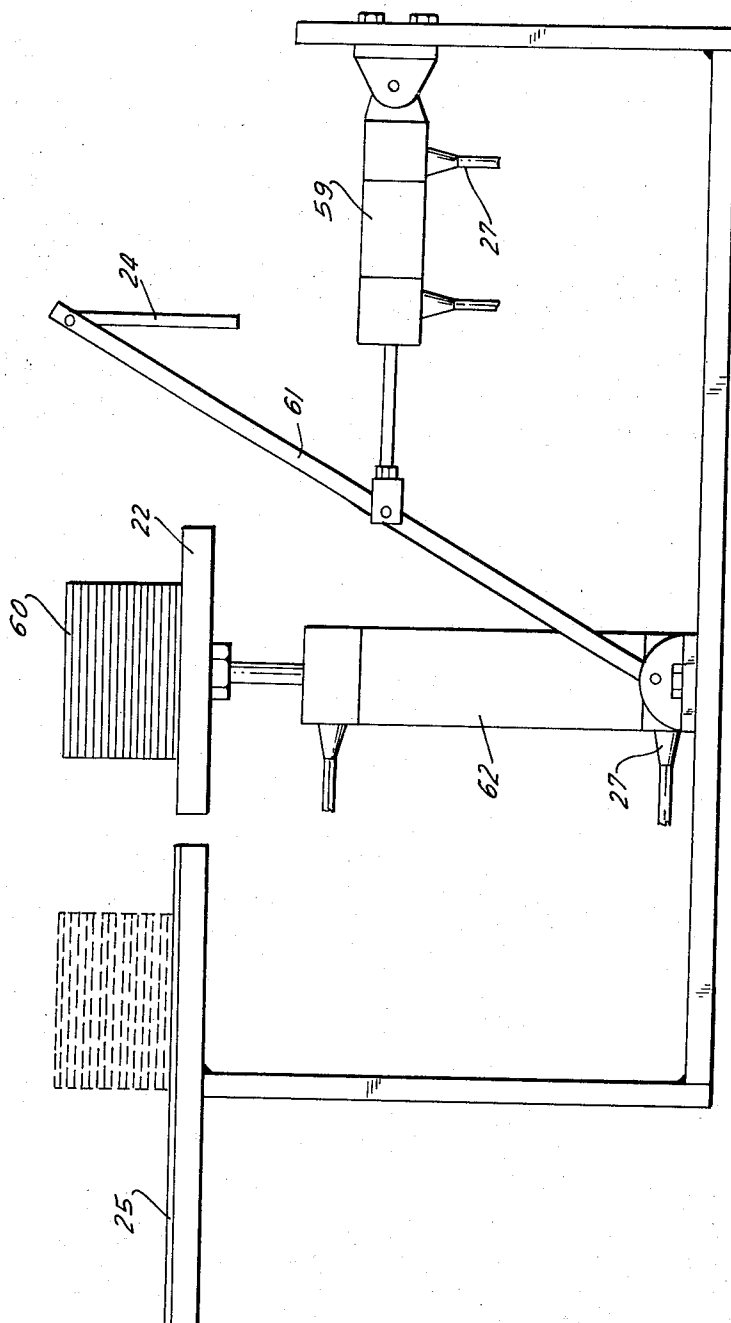


FIG. 10



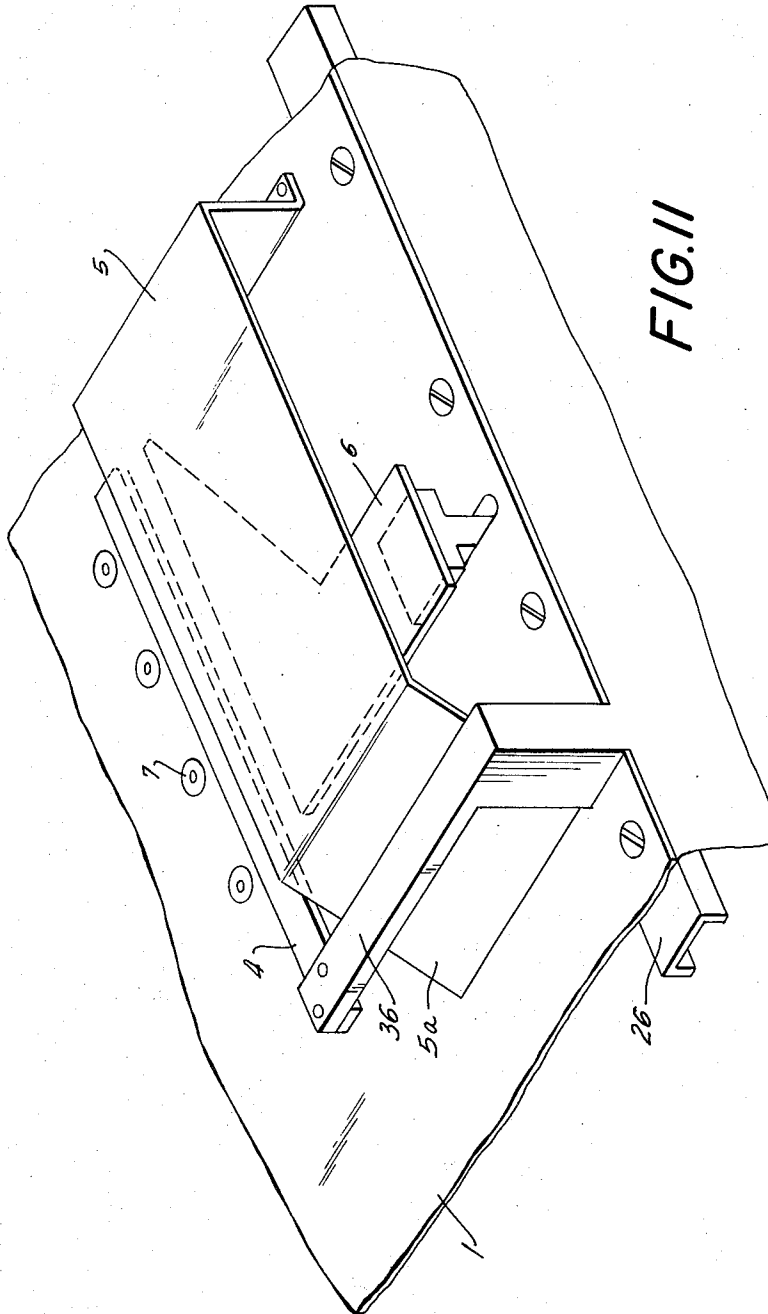


FIG. II

FIG. 12a

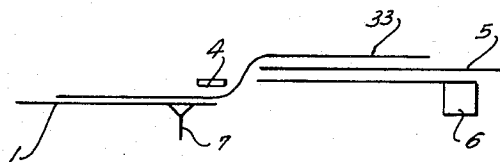


FIG. 12b

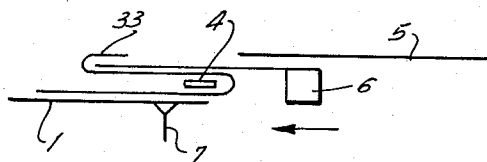
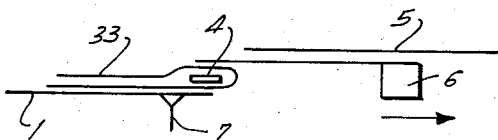


FIG. 12c



METHOD OF AND APPARATUS FOR FOLDING, SEWING AND CONVEYING SHEET MATERIALS

BACKGROUND OF THE INVENTION

The present invention is concerned with sheet materials, and more particularly with a method of folding and conveying sheet materials. The invention is also concerned with an apparatus for carrying out the method.

There are applications where sheet materials of flexible textiles or other suitable sheet materials, must undergo folding and subsequent processing. This is true, for instance, of the manufacture of trouser pockets, or pockets in general, and the invention is particularly concerned with this aspect and will be explained hereafter with reference thereto. In the manufacture of trouser pockets, it is known to clamp the workpiece, that is the sheet material blank, in a so-called cassette, leaving only the edges which are to be sewn or otherwise processed, projecting from the cassette. Thus, the cassette serves as a guide for the blank while the same is advanced to the various processing stations, and also serves to stiffen the blank.

Of course, it will be appreciated that use of such a cassette requires a continuous shifting of the cassette from its starting position—where the cassette receives the blank—to the one or more processing stations, and thereupon back to the starting position after the processed blank has been removed. This requires equipment for carrying out this shuttling motion and evidently it also requires time for the cassette to traverse the distances involved. Beyond this the use of the cassette necessitates the insertion therein of the sheet material blank in already folded condition, and the removal of the processed blank from the cassette, both of which operations require manual labor or suitable equipment.

It is clear that improvements are desirable in this field.

SUMMARY OF THE INVENTION

It is, accordingly, an object of the present invention to provide such improvements and to avoid the aforementioned disadvantages.

A concomitant object of the invention is to provide an improved method of processing i.e. folding and conveying sheet material blanks of the type under discussion, which method will result in an increase of the production speed while reducing the producing costs involved.

A further object of the invention is to provide such a method which is suitable for automation.

Yet an additional object of the invention is to provide an apparatus capable of carrying out the novel method.

In pursuance of the above objects, and others which will become apparent hereafter, one feature of our invention resides in the provision of a method according to which we deposit sheet material blanks on a work surface and engage and advance the blanks along the work surface to a folding device while maintaining the blanks on a work surface in predetermined orientation relative to the folding device. On reaching the folding device, each blank is engaged and folded and thereupon the thus-folded blank is again advanced along the work surface to a processing station where it is acted

upon by a processing device. As this takes place, and it should be understood that the processing device may for instance be a sewing machine, the folded blank is moved on the work surface relative to the processing device in accordance with a predetermined program, that is it is made to perform straight and/or curved movements in accordance with the seam to be sewn. As this takes place, the blank is converted into a processed article which is subsequently removed from the processing station along the work surface to be stacked and counted downstream thereof by a suitable means provided for this purpose.

Our method may be carried out by depositing the sheet material blanks on a work table where they are engaged by a holding device having holding elements which advantageously may be separately operable. The holding elements are arranged in parallelism or at an angle to the folding line along which the blank is to be folded. The blank is held in predetermined orientation by the holding device and advanced to the folding device or folding station which comprises a folding needle and a removable folding slide which latter is preferably constructed as a part of the work table. The folding device may also be constituted by a rigid or movable folding needle and a rigid or movable folding element having a surface located in a plane above the level of the work table surface and connected therewith via a rigid or movable member having an inclined surface extending upwardly from the work table surface to the surface of the folding member. A separately movable folding slide may be provided in known manner and holding elements are arranged alongside of or underneath the folding needle in the work table. It is advantageous to so construct this arrangement that the movable folding needle is arranged so that it clamps the blank to be folded to the work table surface during the folding process.

The folding station is further provided with a corner folder which is vertically movable and consists of a heated or unheated roller mounted so as to be horizontally movable about an axis, and a hold-down device with the roller preceding the hold-down device as the corner folder moves towards the work table surface.

Further holding and transporting elements engage the folded blank downstream of the folding station and carry out straight-line transporting of the folded blank on the work table surface. The transporting elements are driven by a threaded spindle which may be placed into a motion-transmitting engagement with a suitable gear associated with the transporting and holding elements.

Suitable cams serve to effect linear and/or curved movements of the folded blank at the processing station.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a diagrammatic perspective view of an apparatus according to the present invention;

FIG. 2 is a diagrammatic perspective detail view of a planar folding device for use in the apparatus shown in FIG. 1; and

FIG. 3 is a diagrammatic detail view showing the drive for transporting elements of the apparatus shown in FIG. 1; and

FIG. 4 is a diagrammatic view of a blank to be converted;

FIG. 5 is a view analogous to FIG. 2, but illustrating the apparatus in more detail;

FIG. 6 is a perspective detail view of the apparatus of FIG. 1;

FIG. 7 is a partially sectioned perspective view of another detail of the apparatus in FIG. 1;

FIG. 8 is a sectional elevation of a further detail of the FIG. 1 apparatus;

FIG. 9 is a view illustrating still another detail of the apparatus in FIG. 1;

FIG. 10 shows a further detail of the apparatus in FIG. 10, in a side-elevation view;

FIG. 11 is a fragmentary perspective view, illustrating another detail of the apparatus in FIG. 1; and

FIGS. 12a, 12b and 12c illustrate in three diagrammatic views the operation of the device utilized in the apparatus of FIG. 1 for folding of the blank.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Before entering into a detailed discussion of the drawing, we wish to emphasize that certain components and elements illustrated in the drawing are already very well known in the art and have therefore been shown only diagrammatically with the understanding that their specific construction is not considered a part of the present invention.

Discussing now the drawing in detail, it will be seen that we provide a work table 1 having a substantially horizontal work surface. A transporting device 3 is movable in direction from the left-hand towards the right-hand side of FIG. 1 and is provided with pneumatic holding elements 2 or engaging instrumentalities of known construction. In the preferred embodiment of our invention, the holding elements 2 are individually controllable, or some at least are individually controllable; specifically, the holding element 2 which is closest to the left-hand side and thus faces the direction from which sheet material blanks are being fed, is operated earlier than the remaining holding elements so as to make it possible to align the unfolded sheet material blank properly once it is cut. The transporting element 3 serves to advance the unfolded sheet material blank towards the processing station provided with a processing device 12, here to be shown as a sewing machine. The drive means for the element 3 is not illustrated because it is well known.

FIG. 4 shows an exemplary sheet material blank for making a pocket. The broken lines illustrate the blank in unfolded condition and the solid lines shows the configuration of the blank in folded condition, as will be discussed hereafter.

The element 3 advances the unfolded sheet material blank towards the right-hand side of FIG. 1, that is towards the sewing machine 12, until the blank reaches the position in which the folding line, along which it is to be folded to make a folded blank which is to be converted into a pocket, is located parallel to and along-

side of the rigid folding needle 4 and that part of the blank which is to be folded is supported on the rigid folding member 5 which is joined with the work surface of the work table 1 via the illustrated inclined member 5a so that the part to be folded may slide up over this inclined member and come to rest on the member 5. A so-called folding slide 6 is located below the member 5 and mounted for horizontal movement in direction transversely to the advancement of the element 3 and thereby of the blank of sheet material. The slide 6 is provided with a recess on that side which faces the sewing machine so as to push the blank over the folding needle 4. Suction nozzles 7 are provided which are arranged alongside the folding needle 4 in the work table 1 and they serve to engage the blank during the folding process so as to prevent a change in the position of the blank during the folding process. Simultaneously with operation of the suction nozzles 7 to engage the blank, the device 3 with its pneumatic holding elements 2 releases the blank and returns to its starting position at the left-hand side of the drawing of FIG. 1.

The folding device further includes a corner folder 8 consisting of a roller 9 and a hold-down device 10. While the slide 6 folds the blank over the folding needle 4, the corner folder 8 is lowered in direction towards the work table 1 with the roller 9 preceding the hold-down device 10 during such movement and coming to rest on the unfolded portion of the blank in such a way that during folding the notched portion of the part of the blank which is to be folded and which is not included in the sewing process to follow, moves against the roller 9 and forms an angle of approximately 90° with reference to the plane of the work surface of the work table 1. The part of the blank which is to be operated on is located on the work surface of the work table 1 and is clamped thereagain by the hold-down device 10 which rests on it. As soon as the device 10 has assumed its holding position, the roller 9 is swivelled so that that part of the blank which is already at an angle of 90° is further deflected to assume an angle of approximately 180° so as to stay out of the way of the sewing machine 12 when the blank is advanced thereto. The corner folder 8 is lifted off the blank and the now-folded blank is engaged by transport element 11 which is also movable in direction towards the sewing machine 12. The element 11 is lowered onto the folded blank in the region of the recess which is provided in the slide 6; it and transports the blank in synchronism with the operating speed of the sewing machine 12 towards and past the latter.

Synchronization of the transporting speed of the element 11 with the operation of the sewing machine 12 is achieved by a screw spindle 13 which is actuated by the drive of the sewing machine 12, and a meshing threaded member 14 which may be moved into motion-transmitting engagement with the screw spindle 13 and which is drivenly associated with the element 11. The main motive power is derived from a separate drive 15 which serves by itself to effect return of the transport element 11 after the member 14 has been moved out of motion-transmission engagement with the screw spindle 13 and after the element 11 has been lifted off the blank. In other words, advancement of the element 11 is effected via the separate drive 15 whereas synchronization with the sewing machine 12 is effected

by virtue of the fact that the screw spindle 13 is actuated by the drive of the sewing machine 12. Thus, both drives can be either simultaneously or alternately made to act upon the element 11.

In the sewing of a pocket, it is not only necessary that the blank be converted into a pocket be not only moved in a straight line with reference to the sewing machine, but also in one or more curved lines. After completion of the straight line or rectilinear sewing process and during transition to curved movement, cam guide element 16, which is movable about its longitudinal axis synchronously with the sewing speed and is arranged vertically within working range of the sewing machine 12, serves to guide the blank at such time at which the transport element 11 is lifted off the blank and returns to its starting position. By altering the radius of the curved seam being sewn on the blank, the cam guide element 16 is replaced by a similar element 17 with which an auxiliary cam guide element 18 is rigidly connected and which basically is similar to the cam guide element 16. After completion of the curvilinear movement of the blank, the cam guide element 17 is lifted off the blank and at the same time the transport element 19, similar to the element 11 and moving in direction away from the sewing machine 12 towards the right-hand side of FIG. 1, engages the blank and serves to guide the latter during the final rectilinear movement for the final rectilinear seam portion.

When the sewing process is completed, the threads are cut by a known cutting device 20 and the element 19 advances the thus-processed article, which is now a pocket, to a stacking plate 21, which is arranged in a cutout 1a of the work table 1 in such a manner that it is horizontally movable transverse to the direction of advancement of processed article. The transport element 19 presses the processed article, that is the completed pocket, against the stacking plate 21 and, when the same is laterally drawn away, the completed article falls down onto a stacking table 22 which is arranged below the stacking plate 21. The transport element 19 returns to its starting position adjacent the sewing machine 12 as the article falls onto the stacking table 22, and during this descent of the article the latter activates a suitable signalling device, here a photoelectric cell 23 which serves to count, in connection with a suitable counter of well known construction, the number of stacked articles on the stacking table 22. After the stack on the stacking table 22 has reached a predetermined number, it is pushed off the stacking table 22 onto a support 25 by an ejector device 24.

Where utilized in FIGS. 5-11, reference numeral 24 identifies an ejector and reference numeral 25 a support table. A frame is identified with reference numeral 26. The connections for pneumatic hoses are designated with numeral 27. A motor has reference numeral 28.

Element 29 is a cylinder provided as the illustrated spindle nut. An arm is designated with numeral 30 and an inclined surface with reference numeral 31, whereas a guide rod has reference numeral 32.

The blank is identified in FIGS. 12a-12c with reference numeral 33.

Numerals 34 and 35 designate pneumatic cylinders 36 a turnable arm cooperating with cylinder 39, and 37 a guide element. An elastic surface has reference nu-

meral 38. A further guide rod is designated with numeral 40, a pneumatic cylinder with numeral 41 and two valves for suction air have numerals 42 and 43.

Further pneumatic cylinders 44 and 45 cooperate with elements 16 and 17, respectively. A friction coupling is designated with numeral 46. A pressure-exerting ball has numeral 47, whereas numerals 48 and 49 designate a chain sprocket and a chain, respectively.

In FIG. 8 a level gear transmission is designated with numeral 50, a motor acting upon it with numeral 51, and a shaft mounting a gear of the transmission has reference numeral 52. Reciprocable members 53 and 54 are also shown in FIG. 8, being urged to one (upper) end position by the expansion and torque-exerting springs 55.

A slide bearing 56 in FIG. 9 mounts a guide rod 57, adjacent which is located pneumatic cylinder 58 for element 21. Another pneumatic cylinder (see FIG. 10) cooperates with element 24. In the latter figure, a stack of converted (sewed) pockets 60 is also shown in two positions, in solid and in broken lines, respectively. A pivoted lever 61 cooperates with element 22 —on which the stack 60 is located— and cylinder 62 serves for raising and lowering the element 22, lever 61 being connected with cylinder 62 for displacing the same to effect shifting of the stack 60 from full-line to broken-line position.

The operation of the folding device is shown in FIGS. 12a, 12b and 12c in three successive steps; it is believed to be self-explanatory from these figures. Direction of movement of element 6 is indicated in FIGS. 12a-12c by the illustrated arrows.

We wish it to be understood that such of the elements shown herein which have not been illustrated in detail and not described specifically, including the pneumatic holding elements 2, the ejector device 24, and others, are well known to those skilled in the art and that their construction forms no part of the present invention. They have been set forth for the sake of completeness but are not believed to require detailed discussion.

Resort to our novel method and apparatus according to the present invention permits automating the manufacture of pockets and like articles, thereby increasing manufacturing speed with a concomitant decrease in manufacturing costs.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of applications differing from the types described above.

While the invention has been illustrated and described as embodied in an apparatus for processing sheet material, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

What is claimed is:

1. Apparatus for producing a textile product from textile material, comprising in combination, a work support having a work surface; first means for advancing a textile material blank along said work surface in a substantially rectilinear path while maintaining said blank at a predetermined orientation; second means ar-

ranged to receive said blank from said first means and operative for folding the blank transversely of said path, said second means comprising a stationary elongated folding element on said work surface and extending longitudinally of said path, a pair of surfaces located in said path laterally adjacent said folding element and including a first surface upwardly inclined from said work surface in direction of movement of said blank and an adjoining downstream second substantially horizontal surface located at a level above said work surface and said folding element, and a slide member movable between said second surface and said folding element transversely of said path for folding said blank transversely of the latter; third means for engaging and advancing the folded blank along said work surface in said path to a sewing station; fourth means, comprising a sewing machine at said sewing station for sewing said blank so as to convert it into a textile product; fifth means, including cam means, for engaging and turning the folded blank during sewing with reference to said sewing machine along a predetermined curved path so that the sewing machine sews a correspondingly curved seam; and sixth means for engaging the completed textile product and removing it from said sewing station along said work surface.

2. Apparatus as defined in claim 1; further comprising stacking means arranged to receive at least partly

finished textile products from said sixth means and including

a stacking plate movable below said work surface into and out of registry with a cut-out provided in said work surface, said sixth means being operative for pressing said textile product into contact with said stacking plate while the same is in registry with said cut-out.

3. Apparatus as defined in claim 1, said second means being operative for folding said blank along a predetermined folding line, and said first means being arranged with a predetermined spacing and orientation relative to said folding line.

4. Apparatus as defined in claim 1, said second means comprising suction means operative for holding said blank in predetermined position while the blank undergoes folding.

5. Apparatus as defined in claim 1, said second means comprising clamping means operative for clamping said blank against said work surface and holding it in position while the blank undergoes folding.

6. Apparatus as defined in claim 1; further comprising drive means for said first and third means operatively associated therewith and including driven screw-spindle means and cooperating engaging means movable into and out of motion-transmitting engagement therewith.

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