

Feb. 21, 1961

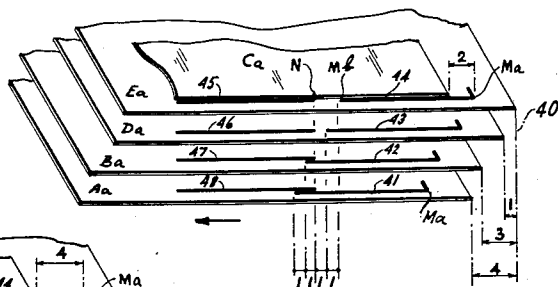
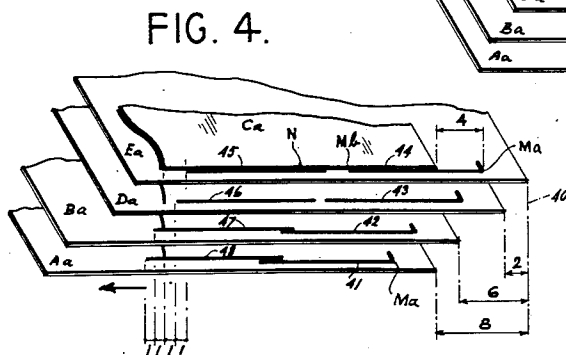
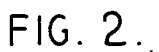
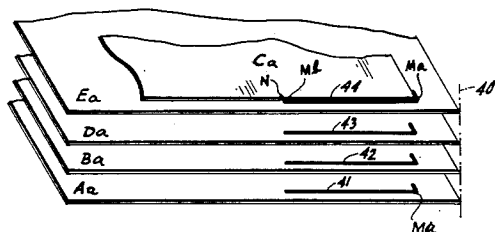
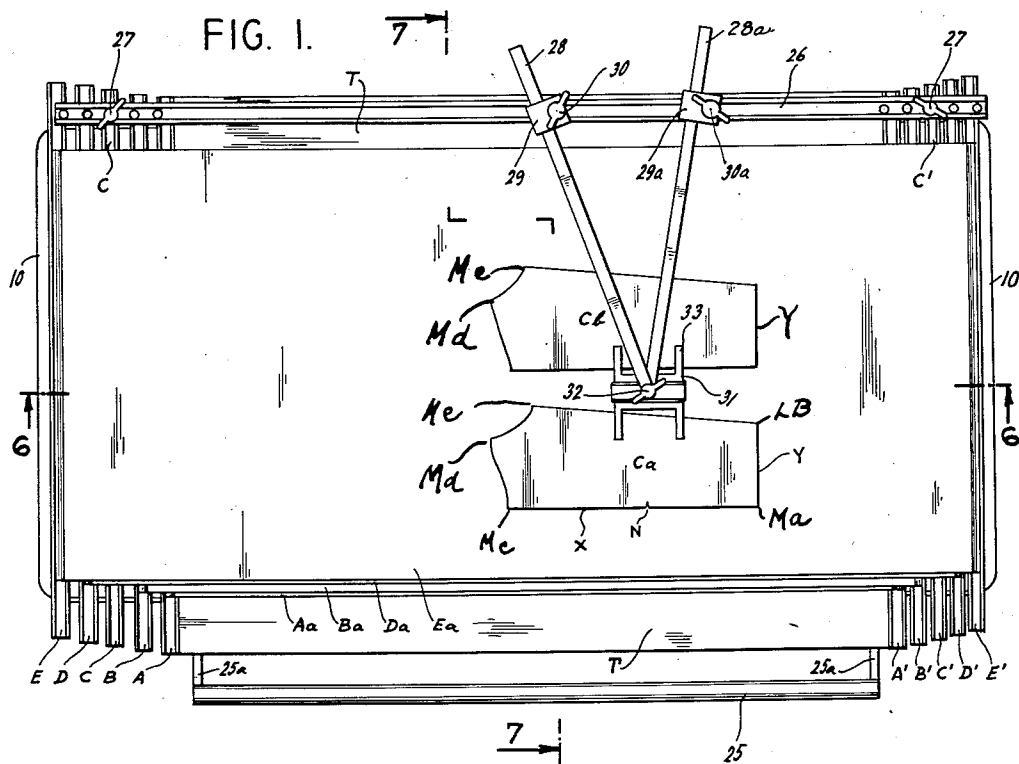
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2,972,188

MAKING GRADED PATTERNS FOR GARMENTS

Filed June 16, 1958

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

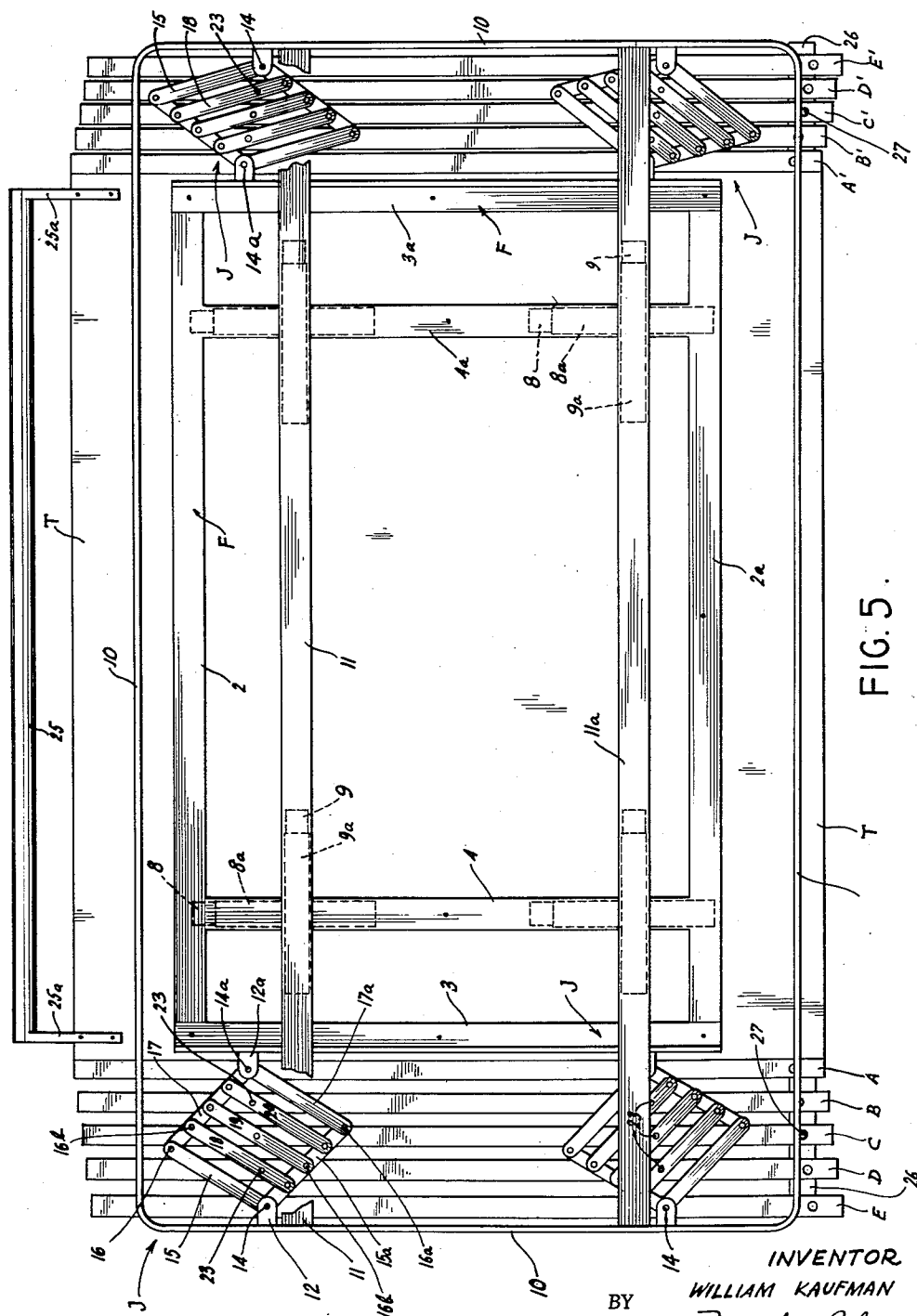


FIG. 5.

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3 Sheets-Sheet 3

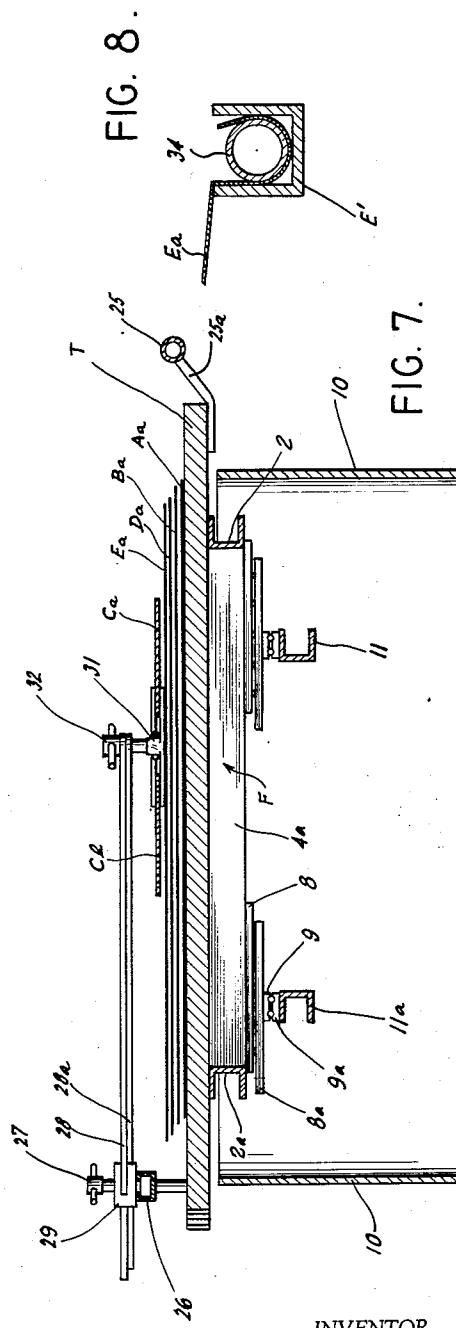
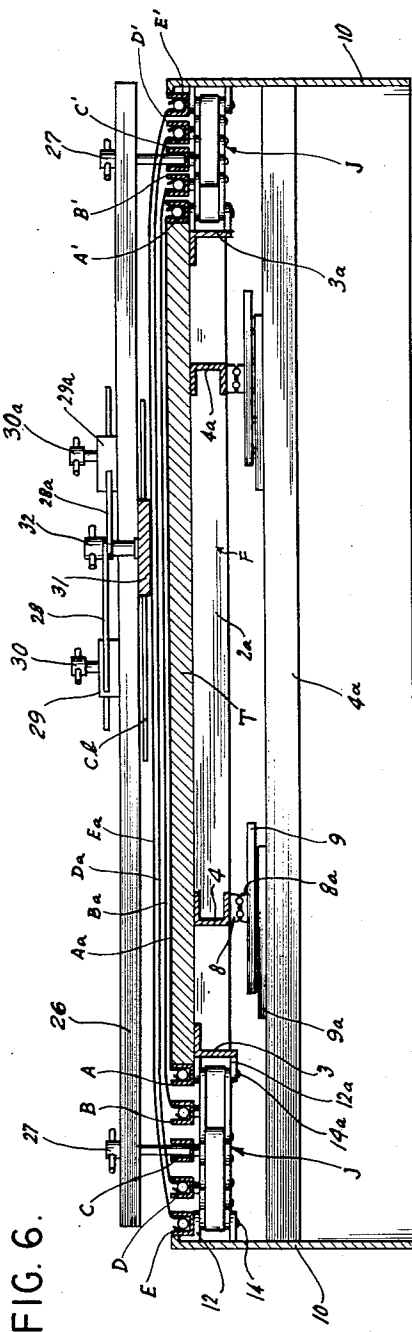


FIG. 8.

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2,972,188

MAKING GRADED PATTERNS FOR GARMENTS

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Filed June 16, 1958, Ser. No. 742,187

5 Claims. (Cl. 33—12)

My invention relates particularly to a new and improved apparatus for making one or more graded patterns from an original or master pattern.

In making men's and women's garments and articles of wearing apparel, it is well known to use master patterns for cutting out the various parts of the garment or other article.

Frequently the manufacturer of the garment or other article is supplied with a set of master patterns in only a single size.

Thus, in women's dresses, there is a well-known system of sizes which are arranged in a consecutive series which are designated by consecutive even numbers, such as 8, 10, 12, 14, 16, 18, 20.

As one example, the manufacturer may have only a single set of master patterns in size-16 of said system. It is frequently necessary to have a corresponding set of patterns in one or more of the other sizes of said series or system, and to make said corresponding patterns in one or more of said other sizes by using the size-16 master patterns. These corresponding patterns are designated as "graded" patterns in the trade.

Heretofore, and for many years, it has been necessary to make each graded pattern from a respective master pattern in a time-consuming and expensive operation.

This invention provides a quick, cheap, accurate and simple method and apparatus for making one or more graded patterns from a respective master pattern.

Without limitation to any specific example, the annexed drawings and the following description illustrate an embodiment in which a size-16 master pattern in said system is used to make four graded patterns in the same system, in the respective sizes 12, 14, 18, 20.

Fig. 1 is a top plan view of the improved apparatus, which provides one means for practicing the improved method.

Fig. 2 is a diagrammatic perspective view, which illustrates the beginning of a grading operation.

Fig. 3 is similar to Fig. 2, showing a first step in a grading operation.

Fig. 4 is similar to Fig. 3, showing a step subsequent to the step of Fig. 3.

Fig. 5 is a bottom plan view of Fig. 1.

Figure 6 is a longitudinal vertical section on the longitudinal line 6—6 of Fig. 1.

Fig. 7 is a transverse vertical section on the transverse line 7—7 of Fig. 1.

Fig. 8 is a detail sectional view.

The table T has a planar top face and a planar bottom face. In this example, said top and bottom faces are rectangular. Said top and bottom faces are maintained in respective horizontal planes. The table T is horizontally movable in all directions relative to a supporting wall 10. This wall 10 is a support which is kept stationary during the operation of the apparatus. Said wall 10 rests upon a suitable base. Said wall 10 has inner and outer vertical faces which are substantially of rectangular cross-section.

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At its longitudinal and vertical front face, the table T has a longitudinal and horizontal bar 25, which is fixed to the bottom face of table T by lateral rods 25a. This bar 25 is used by the operator, in order to shift table T in any selected horizontal direction relative to wall 10.

The bottom face of table T is fixed to a rigid frame F, so that table T is shifted relative to the support or wall 10 in unison with frame F.

The rigid frame F comprises respective front and rear longitudinal frame-bars or rails 2 and 2a; left and right transverse side-bars or side-rails 3 and 3a; and supplemental transverse bars or rails 4 and 4a. The longitudinal front and rear bars 2, 2a, and the transverse supplemental 4, 4a have channel shapes in cross-section, with planar and horizontal top and bottom flanges. The left side-bar 3 and the right side-bar 3a are angular in cross-section, with planar and horizontal top flanges and vertical and planar edge-flanges.

Parallel and longitudinal wall-bars or rails 11 and 11a, which are channel-shaped in cross-section, are fixed to the transverse side-portions of wall 10. These bars 11, 11a have top planar and horizontal flanges.

Four longitudinal plates 9a are fixed to the planar, horizontal and longitudinal top faces of longitudinal wall-bars 11 and 11a. As shown in Fig. 5, the opposed ends of each of said wall-bars 11 and 11a are fixed to the support 10. Two said plates 9a are fixed to each of the wall-bars 11 and 11a.

An upper longitudinal plate 9 is supported movably on each lower longitudinal plate 9a, so that each upper plate 9 is movable back-and-forth in a single longitudinal direction relative to its respective lower plate 9a. The movement of each upper plate 9 relative to wall 10 is limited to a back-and-forth longitudinal movement in the direction of rails 11 and 11a, by any suitable means.

Conveniently, the adjacent surfaces of the plates 9 and 9a of each pair are provided with anti-friction members such as anti-friction rollers or balls, and with races for these anti-friction members. These races and anti-friction members limit the movement of each plate 9 relative to wall 10, to the selected back-and-forth longitudinal movement in a direction parallel to wall-bars 11 and 11a.

A lower transverse plate 8a is fixed to each longitudinal plate 9, so that each transverse plate 8a moves longitudinally back-and-forth in unison with its plate 9 in a single longitudinal direction relative to wall 10, in a direction parallel to wall-bars 11 and 11a.

An upper transverse plate 8 is supported movably on each lower transverse plate 8a. Each upper transverse plate 8 is fixed to the bottom horizontal face of a respective transverse supplemental rail 4 or 4a of frame F. Each upper transverse plate 8 is transversely movable back-and-forth relative to its respective lower transverse plate 8a in a direction parallel to transverse rails 3, 3a. The movement of each transverse plate 8 relative to wall 10 can be limited to a transverse back-and-forth movement by any suitable means. The adjacent surfaces of the transverse plates 8 and 8a of each pair of said transverse plates 8—8a may be provided with anti-friction rollers or balls and races for said anti-friction members, in order to limit the movement of plates 8 relative to wall 10, to a transverse back-and-forth movement.

Hence, when handle 25 is moved relative to wall 10, longitudinally either to the left or right from any position of table T relative to wall 10, the frame F is longitudinally shifted relative to wall 10 in unison with table T.

In such longitudinal movement of table T, the lower longitudinal plates 9a of each longitudinal set 9—9a remain fixed relative to wall 10, the upper longitudinal plates 9 of each longitudinal set 9—9a move longitudinal-

ly relative to the wall-rails 11 and 11a and wall 10, and the lower transverse plates 8a and the upper transverse plates 8 of each transverse set 8—8a and the supplemental transverse frame-bars 4 and 4a and the other frame-bars 3, 3a, 2, 2a then move only longitudinally in unison with table T.

If the table T is moved transversely relative to wall 10 from any position of table T, frame F and table T are shifted transversely in unison with the upper transverse plates 8 of the transverse sets 8—8a, relative to the wall-rails 11 and 11a and relative to support 10, without longitudinally shifting plates 9 or 9a.

Any other horizontal movement of table T relative to wall 10 has a longitudinal component and a transverse component, so that table T has a free, universal horizontal movement relative to wall 10.

The transversely disposed left and right side-rails or bars 3 and 3a of frame F, are movably connected to the transversely disposed side-portions of wall 10, by means of four identical, horizontal joints J. There are two such left joints J at the respective left side-rail 3, and two such right joints J at the right side-rail 3a.

Two identical, rigid, longitudinal and horizontal lugs 12, which are transversely spaced from each other, are fixed to the left side-portion and also to the right side-portion of wall 10. These horizontal lugs 12 at each side of wall 10 are identical with horizontal, longitudinal lugs 12a. The lugs 12 and 12a are arranged in pairs. These lugs 12a are rigidly connected to the left and right side-rails 3 and 3a of frame F.

The lugs 12 and 12a of each pair are connected by a joint which is conveniently designated as a "lazy-tongs" joint.

Each joint J includes four horizontal, identical, flat, rigid outer joint-bars 15, 15a, 17, 17a. The bars 15 and 15a of each joint J have ends which overlap each other at a respective lug 12. These overlapping ends of bars 15 and 15a of each joint J are turnably connected to each other and to a respective lug 12, by means of a pivot pin 14, which has a vertical axis.

The outer joint-bars 17 and 17a of each joint J have ends which overlap each other at a respective lug 12a. These overlapping ends of bars 17 and 17a of each joint J are turnably connected to each other and to a respective lug 12a by means of a pivot pin 14a, which has a vertical axis. The adjacent ends of outer bars 15 and 17 of each joint J overlap each other. These adjacent ends of said bars 15 and 17 are turnably connected by a respective pivot pin 16, which has a vertical axis.

The adjacent ends of outer bars 15a and 17a of each joint J overlap each other. These adjacent ends of said bars 15 and 17a are turnably connected by a respective pivot pin 16a, which has a vertical axis.

In this embodiment, four graded patterns can be made simultaneously from a respective master pattern Ca or Cb, or four graded patterns are made simultaneously from each said master pattern Ca and Cb. Hence, each lazy-tongs joint J has three intermediate, flat, rigid, horizontal joint-bars 18, 19, 20. The number of intermediate joint-bars is one less than the number of graded patterns which are simultaneously formed from a respective master pattern.

Each of the intermediate joint-bars 18, 19, 20 is always maintained parallel to the parallel outer joint-bars 15 and 17a.

Between the vertical axes of the pivot-pins 14, 16, 14a, 16a, the outer joint-bars 15, 17, 17a, 15a of each joint J always have the shape of a parallelogram whose adjacent ends are pivoted to each other at the vertical axes of the pivot pins 14, 16, 14a, 16a at the corners of the parallelogram.

The ends of each intermediate joint-bar 18, 19, 20 overlap the opposed and parallel outer joint-bars 15a and 17. A respective pivot pin 16b, which has a vertical axis, turnably connects each respective end of each of

the intermediate joint-bars 18, 19, 20 to the opposed and parallel outer joint-bars 15a and 17. Hence each intermediate joint-bar 18, 19, 20 is always located at one side of a parallelogram. The other sides of said parallelograms are provided by one of the outer joint-bars 15 and 17a, and by parts of bars 17 and 15a.

In this embodiment, there are two groups of identical, horizontal, transverse holding-bars E, D, C, B, A, and A', B', C', D', E', which are arranged in respective left and right groups. Each said horizontal holding-bar has a channel-shape in cross-section, with its open face at its top, as illustrated in Fig. 8. These holding-bars are arranged in respective pairs A—A', B—B', C—C', D—D', E—E'. The number of holding bars in each group is one more than the number of graded patterns which are made simultaneously from a respective master pattern. These holding-bars are always maintained parallel to the side-portions of wall 10 and to rails 3 and 3a.

The extreme or first left holding-bar E is held fixed to the left transverse side-portion of wall 10, by means of the two left pivot pins 14 and the two left lugs 12. The extreme or first right holding bar E' is similarly fixed to the right transverse side-portion of wall 10 by the two right lugs 12 and the two right pivot pins 14'.

The vertical axes of the two left pivot pins 14 intersect the central and transversely disposed axis of left holding bar E. The vertical axes of the two right pivot pins 14' intersect the central and transversely disposed axis of the corresponding right holding bar E'.

The second left holding bar D is connected to the two intermediate bars 18 of the two left joints J, by means of two vertical pins 23, whose vertical axes intersect the central and transversely disposed axis of said holding bar D. The companion holding bar D' is similarly connected in the same manner to the two intermediate bars 18 of the two right joints J.

The third holding bars C and C' are similarly respectively connected to the two bars 19 of the two left joints J and to the two bars 19 of the two right joints J.

The fourth holding bars B and B' are similarly respectively connected to the two bars 20 of the left joints J and to the two bars 20 of the two right joints J.

The holding bars A and A' are respectively connected to the table T. This is done by the two left lugs 12a and the two left pins 14a, and by the two right lugs 12a and the two right pins 14a.

As above noted, these holding bars E, D, C, B, A, and E', D', C', B', A' are always maintained parallel to each other and parallel to the transversely disposed left and right side-portions of wall 10.

The respective vertical axes of the five pins 14, 23, 23, 23, 14a of each joint J are always maintained on a horizontal line which always intersects the vertical axes of pins 14 and 14a in the respective joint J.

The five vertical axes of the pins 16, 16b, 16b, 16b, 14a in each joint J are always on the same straight line, which is the median axis of outer bar 17 of the respective joint J.

The five vertical axes of the pins 14, 16b, 16b, 16b, 16a of each joint J are always on the same straight line, which is the median axis of outer bar 15a of the respective joint J.

As measured along the median axis of bar 17 of each joint J, there are four equal distances 16—16b, 16b—16b, 16b—16b, 16b—14a.

As measured along the median axis of bar 15a of each joint J, there are four equal distances 14—16b, 16b—16b, 16b—16b, 16b—16a.

For convenience, it is assumed that table T is in an original position in which the line—14—23—23—23—14a of each joint J is in the longitudinal direction, instead of being transversely inclined to the longitudinal direction. Such inclination is shown in Fig. 5. In said assumed original position of table T, the original longitudinal distance between the vertical axes of the respec-

tive pairs of pivot pins 14 and 14a at the left side of the apparatus is conveniently designated as "V." In such case, the longitudinal distance between the central transverse axes of first and second bars E and D is twenty-five percent (25%) of "V"; said longitudinal distance between the central transverse axes of first and third bars E and C is fifty percent (50%) of "V"; and said longitudinal distance between the central transverse axes of first and fourth bars E and B is seventy-five percent (75%) of "V." These ratios apply at the right side of the apparatus.

Hence, if table T is shifted relative to wall 10, longitudinally to the left from said assumed original position, through a distance which is designated as "VS," the respective longitudinal spacings between the respective central transverse axes of the bars E, D, C, B, A in the shifted position of table T, will be as follows:

Between E and A, V minus VS

Between E and B, $0.75V$ minus $0.75VS$, namely, $0.75(V \text{ minus } VS)$

Between E and C, $0.50V$ minus $0.50VS$, namely, $0.50(V \text{ minus } VS)$

Between E and D, $0.25V$ minus $0.25VS$, namely, $0.25(V \text{ minus } VS)$.

The spacings between right bar E' and each of the other right bars A', B', C', D' are correspondingly increased.

The four pairs of bars E—E', D—D', B—B', A—A' are conveniently designated as copy-holding bars, because they support four respective sheets or layers Ea, Da, Ba, Aa.

These four sheets or layers Ea, Da, Ba, Aa of this embodiment are made of the well-known "carbonless" copy paper, so that if a mark is made upon the top sheet Ea, corresponding marks are simultaneously made on the lower sheets Da, Ba, Aa, to provide a respective set of four superposed marks. This type of copy paper is a well-known article of commerce.

The transverse edge-portion of the bottom or table sheet Aa are releasably clamped by cylindrical clamping bars 34 to the transverse bars A and A', which are fixed to the transverse edges of table T, so that, sheet Aa is always moved in unison with table T. The bottom sheet Aa is thus clamped to be maintained under longitudinal tension. Hence the sheet Aa is maintained by said tension, pressed against the top face of table T.

One transverse edge of sheet Aa can be initially clamped to one of the transverse holding bars A or A', by means of one of the cylindrical clamping bars 34. The sheet Aa is then stretched longitudinally away from the holding bar A or A' to which it has been initially clamped by the respective bar 34, and the other bar 34 is applied to the unclamped end of sheet Aa while turning the cylindrical bar 34 around its axis, so that sheet Aa is clamped to both of its bars A, A' in longitudinally taut condition, but without substantially stretching said sheet Aa.

Each of the other copy sheets Ba, Da, Ea is similarly connected by a respective pair of clamping bars 34, to its respective pair of holding bars B—B', D—D', E—E', so that each copy sheet is maintained longitudinally taut without any substantial stretch, and the four copy sheets Ea, Da, Ba, Aa are urged downwardly in the zone above the top of table T, so that the four copy sheets abut each other in said zone. However, each of the three lower copy sheets or layers Aa, Ba, Da is freely slidable in all directions in said zone of contact relative to the next upper layer Ba, Da, Ea.

In this example, two size-16 master patterns Cb and Ca are used, and a set of graded patterns is made simultaneously from each said master pattern. These patterns Ca and Cb of this embodiment represent master patterns of the vertical front and rear facing parts of a dress at the respective front and back faces of the dress. Each

master pattern Ca and Cb has a relatively long straight edge "X" which has a notch N, and a relatively short straight edge "Y" which is perpendicular to edge "X." Each said master pattern Ca and Cb has a general contour which is shown in Fig. 1. Each master pattern includes important points Mc, Md, Me, LB, Ma.

These master patterns Ca and Cb are rigidly connected to a rear horizontal and longitudinal bar 26, which has a channel-shape in cross-section, with the open face of said channel at its top. This bar 26 is rigidly connected to the holding bars C and C', which act as pattern-holding bars. Hence patterns Ca and Cb move longitudinally and transversely in unison with pattern-holding bars C and C'. The longitudinal bar 26 is always perpendicular to bars C and C'. The long straight edge "X" of each master pattern Ca and Cb is preferably maintained in the longitudinal or substantially longitudinal position which is shown in Fig. 1.

These master patterns Ca and Cb are made of stiff paper or other flexible and resilient material. Said master patterns are held pressed against the top face of top marking sheet Ea. However, said master patterns Ca and Cb are easily slidable relative to the top face of the top marking sheet Ea.

The rear longitudinal bar 26 is releasably fixed to the rear end-parts of pattern-holding bars C and C', by means of conventional fastening members 27.

Identical blocks 29 and 29a are releasably and adjustably fixed to rear longitudinal bar 26. These blocks 29 and 29a are fixed to selected points of bar 26. Said blocks 29 and 29a have non-circular bores, in which identical bars 28 and 28a fit slidably. Said bars 28 and 28a have overlapping ends in the zone above table T. A clamp 31, which releasably clamps the master patterns Ca and Cb, is releasably fixed to said ends of bars 28 and 28a, by means of a conventional fastening member 32. For convenience, the table T may be designated as the supporting member. The clamp 31 is conveniently designated as the pattern support, which supports at least one master pattern. Said pattern support 31 is connected to the support or table T by movable connecting means which consist of bars 28, 28a, blocks 29, 29a and bar 26, and said connecting means permit the movement of the pattern support 31 relative to supporting member T, in two directions which are perpendicular to each other, so that the pattern-support 31 has a universal horizontal movement relative to supporting member T.

For convenience, it is assumed that table T and the master patterns Ca and Cb are originally in their respective positions shown in Fig. 1 and in Fig. 5, and that table T is shifted longitudinally relative to wall 10 to the left of its said original position of table T, and that the original longitudinal distance between the axes of pins 14 and 14a is "V," and that the length of said left longitudinal shift of table T is "VS."

In such case, the left shift of master patterns Ca and Cb relative to wall 10 is fifty percent of "VS," in this example. Since the top layer Ea is held fixed relative to wall 10, the left shift of master patterns Ca and Cb relative to top layer Ea is fifty percent of "VS" in this example. Since the shift of next layer Da relative to wall 10 is twenty-five percent of "VS," the left shift of master patterns Ca and Cb relative to layer Da is 25% of "VS" in this example and said master patterns Ca and Cb will be shifted to the left relative to said layer Da. Since the shift of next layer Ba is seventy-five percent of "VS" in this example, said layer Ba will be shifted to the left relative to said master patterns Ca and Cb, through a distance of twenty-five percent of "VS." Since the shift of the bottom or table layer Aa is one hundred percent of "VS" in this example, said layer Aa is shifted to the left relative to said master patterns Ca and Cb, through a distance of fifty percent of "VS."

As previously noted, the flat master pattern Ca has easy sliding contact with the top layer Ea. The method

of using the master pattern *Ca* is identical with the method of using the companion master pattern *Cb*.

In this illustrative example, the size system has a series of sizes which are designated by consecutive even numbers, such as size-12, size-14, size-16, size-18, size-20.

The difference in dimensions between the patterns of consecutive sizes will vary, depending upon the dimensions of the respective part of the garment, and depending upon the part of the garment.

For convenience, it is assumed that the master pattern is a rectangle, with its long face "X" in the longitudinal position. In such simple assumed case, the steps are as follows:

Step 1

The table T is initially stationary relative to fixed support 10. The original positions of the four corners of the rectangular master pattern relative to fixed support 10 are marked on the fixed top layer *Ea*. If desired, the original positions of the four edge-lines of the rectangular master pattern relative to fixed support 10 or any part of any edge-line can be marked on said fixed top layer *Ea*. Each marking on said fixed top layer *Ea* will be reproduced on the lower shiftable layers *Da*, *Ba*, *Aa*.

Step 2

The table T is shifted longitudinally to the left relative to support 10 into a shifted position relative to support 10, through a total distance of sixteen units. In this example, the length of a unit is one-sixteenth of an inch.

The result is to shift the rectangular master pattern eight units (0.50 inch) longitudinally to the left, relative to support 10. The apparent effect is to increase the length of "X" by eight units (0.50 inch) upon top layer *Ea*, thus increasing the true length of "X" which is in the rectangular size-16 master pattern, to the correct length in the size-20 pattern, if the increase in length of "X" is one-quarter of an inch (0.25 inch) from size-16 of the master pattern to the next-graded size-18, and is another one-quarter of an inch (0.25 inch) from size-18 to the next-graded size-20.

If table T is thus shifted longitudinally one inch to the left, the marking layer *Da* is shifted one-quarter inch (0.25 inch), or four units, longitudinally to the left relative to support 10, in this example.

Hence, when a marking corresponding to the shifted position of the front left corner of edge "X" is made upon top, fixed layer *Ea*, the corresponding marking on layer *Da* is four units or one-quarter of an inch to the left of the original marked position of said left corner on said layer *Ea*. This will correspond to an increase in length of four units (0.25 inch), of edge "X" on layer *Da*, corresponding to graded size-18.

If table T is thus shifted one inch or sixteen units longitudinally to the left relative to support 10, the layer *Ba* is longitudinally shifted twelve units (0.75 inch) to the left of its original position, relative to support 10. In such case, the new shifted position of the left corner of the master pattern relative to layer *Ba* is the difference between twelve units and eight units, namely, four units to the right of its original position. Hence, the marking of edge "X" on layer *Ba* will be four units shorter than in the size-16 master pattern, thus corresponding to the next-graded smaller size-14.

When table T is thus longitudinally shifted one inch or sixteen units to the left, the table layer *Aa* is also longitudinally shifted to the left through sixteen units relative to support 10. As a result, the new marking of the front left corner of the master pattern on the table layer *Aa* is eight units to the right of its original position on said table layer *Aa*, thus corresponding to an edge "X" which has been decreased in length by eight units (0.50 inch) in the graded size-12 pattern.

It is assumed in this example, that the length of edge "Y" is to be changed to the same extent as the change in

edge "X," in the four graded patterns in sizes 12, 14, 18, 20.

In such case, the table T is shifted transversely rearwardly from the shifted position which the table T occupies at the end of Step 2.

Step 3

The table T is shifted transversely rearwardly, relative to support 10, through a shift of one inch or sixteen units. The rear corners of the rectangular master pattern are marked on the top fixed layer *Ea*.

As a result, the transverse rearward shifts relative to support 10, will be as follows:

Part:	Transverse rearward shift relative to support 10
Master pattern.....	8 units or 0.50 inch.
Layer <i>Da</i>	4 units or 0.25 inch.
Layer <i>Ba</i>	12 units or 0.75 inch.
Layer <i>Aa</i>	16 units or one inch.
Layer <i>Ea</i>	Zero shift.

The rear corners of the rectangular master pattern are marked on the top fixed layer *Ea*, thus producing corresponding sets of new markings on the shiftable layers *Da*, *Ba*, *Aa*.

If lines corresponding to "Y" are drawn to these new markings on layers *Ea*, *Da*, *Ba*, *Aa*, the effect in the fixed layer *Ea* is to increase the width of the rectangle by eight units, because the transverse shift of the master pattern is one-half of the transverse shift of the table in this example; to increase the width of the rectangle on layer *Da* by four units; to decrease the width of the rectangle on layer *Ba* by four units; and to decrease the width of the rectangle on the table layer *Aa* by eight units.

Hence, in this case, but without limitation to any example, the five patterns of the sizes 12, 14, 16, 18, 20 are to different scales in which each longitudinal dimension differs from the corresponding longitudinal dimension in next lower and next higher sizes by a selected fixed value, and each transverse dimension differs from the corresponding transverse dimension in the next lower and next higher sizes by the same selected fixed value.

However, depending upon the desired example, this variation may be only in either the longitudinal or transverse dimension, or there may be different variations in said dimensions.

However, it is frequently desirable to shift table T longitudinally in a plurality of stages, and also to shift table T transversely in a plurality of stages.

Thus Fig. 1 shows a master pattern *Ca* which has a notch N in edge "X." It is common practice to provide each master pattern with one or more notches, which serve as guides in using the set of master patterns.

Also, Fig. 1 shows curved edges *Md*—*Mc* and *Me*—*Md*, and shows a straight transverse edge "Y," which is perpendicular to edge "X." This transverse edge "Y" has a corner LB.

It is common practice to provide such master patterns which have one or more curved edges. In the master pattern *Ca* shown in Fig. 1, the important points are the outline points *Me*, *Md*, *Mc*, LB, *Ma* and the point *Mb* which is at one base point of notch N.

In such case, the procedure is as follows:

Step 1

As shown in Fig. 2, the line 44 is marked on top, fixed layer *Ea*, while table T is held fixed relative to support 10. This line 44 is from right front corner point *Ma* up to the point *Mb*. The notch N is not marked during this step. If desired, only the corner point *Ma* and the notch point *Mb* are marked on top, fixed layer *Ea*. Also, the left corner point *Mc* may be marked on top, fixed layer *Ea*, producing corresponding superposed markings on layers *Da*, *Ba*, *Aa*.

The line 40 is a theoretical vertical line. In Fig. 2, this line 40 indicates that each marking on the top, fixed

layer *Ea* is the top marking of a respective superposed set of markings on layers *Da*, *Ba*, *Aa*.

Step 2

In this example, the value of a unit of shift is one-sixteenth of an inch. In this example, the table *T* is shifted longitudinally to the left of its original position in this step, through a distance of four units (0.25 inch). The original position of table *T* is shown by the position of table layer *Aa* in Fig. 2.

The shifted position of table *T* is indicated by the shifted position of table layer *Aa* in said Fig. 3. The position of line 40 is the same in Fig. 2 and Fig. 3, because the top layer *Ea* remains fixed.

As illustrated in Fig. 3, this left longitudinal shift of four units of table *T* results in shifting marking layer *Da* longitudinally to the left through a distance of one unit or one-sixteenth of an inch. The layer *Ba* is shifted longitudinally to the left through a distance of three units or three-sixteenths of an inch. Since layer *Aa* is fixed to table *T*, said layer *Aa* is shifted longitudinally to the left through a distance of four units or 0.25 inch.

The master pattern *Ca* is thus longitudinally shifted to the left in this example, through a distance of two units (0.125 inch).

After table *T* has been thus shifted, and while table *T* is held temporarily stationary, suitable markings are made on top layer *Ea*, while simultaneously forming corresponding sets of markings on the layers *Da*, *Ba*, *Aa*.

The notch *N* or point *Mb* may be thus marked on top layer *Ea*. The front corner points *Ma*, *Mc* or one of them, may be marked on top layer *Ea*. The superposed lines 45, 46, 47, 48 may be marked on the four layers *Ea*, *Da*, *Ba*, *Aa*. These lines 45, 46, 47, 48 may optionally be of the same length, which may optionally be equal to the length of the lines 44, 43, 42, 41 which are shown in Figs. 2, 3, 4.

The effect of this first shift on top layer *Ea* is to increase the original longitudinal spacing of point *Mb* from point *Ma* in Fig. 2, by two units in Fig. 3; to increase said original longitudinal spacing of point *Mb* from point *Ma* by one unit on layer *Da*; to decrease said original longitudinal spacing of point *Mb* from point *Ma* on layer *Ba* by one unit; and to decrease said original longitudinal spacing of point *Mb* from point *Ma* by two units on table layer *Aa*.

As above noted, said new, shifted position of point *Mc* may be marked on top layer *Ea*, thus producing three corresponding markings on layers *Da*, *Ba*, *Aa*.

Step 3

The table *T* is again shifted in a second shift longitudinally to the left, through another longitudinal shift of four units, from the position of Fig. 3 to the position of Fig. 4.

This results in a total left longitudinal shift of layer *Da* through a total distance of two units (0.125 inch); a total left longitudinal shift of layer *Ba* of six units; a total left longitudinal shift of table layer *Aa* of eight units; and a total left longitudinal shift of master pattern *Ca* of four units.

For convenience, it is assumed that Fig. 4 represents the final left longitudinal shift of layers *Da*, *Ba*, *Aa*.

The effect in Fig. 4 is to increase the original longitudinal spacing between corner point *Ma* and notch *N* by four units on fixed, top layer *Ea* and to increase the original length of edge "X" by four units on said top layer *Ea*; to increase said spacing and said length by two units on layer *Ba* by two units; and to decrease said spacing and said length on layer *Aa* by four units.

The points *Mc*, *Md*, *Me* and *LB* may be marked on top layer *Ea*, while table *T* is temporarily stationary in its fully shifted position of Fig. 4, thus producing corresponding sets of markings on the three lower layers *Da*, *Ba*, *Aa*.

Step 4

The respective decrease or increase in transverse dimension of the master pattern which is required for the respective graded patterns, depends on the garment and the respective master pattern.

As one convenient example, it is assumed that parallel lines are drawn in the plane of the master pattern *Ca* from the points *Md* and *Me* to the edge "X" and that said lines are transverse lines perpendicular to edge "X."

The length of said transverse line which is drawn from point *Md* is conveniently designated as "L" and the length of said transverse line which is drawn from point *Me* is conveniently designated as "LL."

In the next larger size-18 graded pattern in this size system, the length of the transverse line from point *Md* to edge "X" is "L" plus four units in this example; and the length of the transverse line from corner point *Me* to edge "X" is "LL" plus six units in this example. The length of a unit is one-sixteenth of an inch.

In the next large size-20 graded pattern, the length of the transverse line from point *D* to edge "X" is "L" plus eight units in this example, and the length of the transverse line from corner point *Me* to edge "X" is "LL" plus twelve units in this example.

Hence, in each size the length of the transverse line from point *Md* to edge "X" is four units greater than the corresponding line in the next lower size; and the length of the transverse line from corner point *Me* to edge "X" is six units greater than in the next lower size.

Thus, in the size-14 graded pattern, the length of the transverse line from point *Md* to edge "X" is "L" minus four units, and the length of the transverse line from point *Me* to edge "X" is "LL" minus six units.

Therefore in this example, there are two transverse shifts of the size 16 master pattern *Ca* through respective transverse distances of four units and two units, corresponding in this example to a first transverse shift of eight units of table *T* in this Step 4, and a second transverse shift of four units of table *T* in a succeeding Step 5.

After the first transverse shift of table *T* through eight units (0.50 inch) in this Step 4, the locations of points *Mc*, *Md*, *Me* are again marked on top, fixed layer *Ea* and the lower layers. Any other points may be optionally marked on the four marking layers.

Step 5

The table *T* is given a second transverse shift, which is four units in this step in this example, and the important points of master pattern *Ca* are again marked upon the top layer *Ea*, thus producing simultaneous sets of markings on the lower layers.

Hence, in this example, if the master pattern *Ca* is a simple rectangle of size-16, the next larger graded size-18 pattern has an increase in width of six units or three-eighths of an inch (0.375 inch) over said master pattern *Ca*, the next larger graded size-20 pattern has an increase in width of twelve units (0.75 inch) over master pattern *Ca*, the next-smaller graded size-14 pattern has a decrease in width of six units (0.375 inch) relative to master pattern *Ca*, and the next-smaller graded size-12 pattern has a decrease in width of twelve units (0.75 inch) relative to master pattern *Ca*.

Even if the graduated patterns have curved lines corresponding to *Me—Md* and *Md—Mc*, the absolute accuracy of these curved lines is not so important, because when these curved lines of the graduated patterns are followed by the shears or by a cutting knife in cutting the fabric, it is impossible to follow such curved cutting lines with absolute accuracy. These curved lines can be marked upon the four marking layers at the end of each stage, while the shifted table *T* is temporarily stationary.

By using the markings of the curved lines *Me—Md* and *Md—Mc* which are made or can be made at the end of one or more of the respective stages, the operator of

the machine can finally easily approximately mark the correct corresponding curved lines upon each graded pattern.

The table T and the frame 10 may be provided with suitable longitudinal and transverse scales, in order to indicate the correct lengths of the longitudinal and transverse shifts of the table T. The table T may be omitted, save at the points where it is connected to the movable joints, because the taut marking layer or marking layers may be made of heavy paper, which do not require the marking support of a table.

The invention includes the complete combination or combinations disclosed herein, and includes all the sub-combination or sub-combinations disclosed herein, and numerous changes, omissions from and additions to the specific disclosure herein.

It is within the scope of the invention to use one or more marking layers which are movable relative to the support. Thus, as one example, the invention includes the use of the fixed marking layer Ea, and the use of only a single marking layer which is movable relative to said fixed marking layer. The invention can also be used with only a single marking layer which is movable relative to support 10. The important factor is to move at least one marking layer and the master pattern relative to each other, through respective strokes of respective different lengths, in which these lengths have a selected ratio.

Fig. 1 shows that two master patterns may be connected to the bar 26, to be shifted in unison when the table T is shifted relative to support 10. Any desired number of master patterns may be fixed to the bar 26, depending upon the size of the apparatus, in order to increase the number of graded patterns which are simultaneously produced.

In some cases, depending upon the garment and upon the respective master pattern, the change in dimension of the graded pattern from the master pattern may be along only a single dimension, such as the longitudinal dimension "X." The invention is therefore not limited to a process or machine whereby the graded pattern is different from the master pattern in two dimensions which are perpendicular to each other.

For convenience, the wall 10 is designated as the main support member. This main support member may be of any type. The means for holding the master pattern are conveniently designated as the master-pattern-support means. The table and the master-pattern-support are shifted simultaneously and at different ratios relative to the support 10. The ratio of shift of the master pattern relative to the shift of the table may be less than one, as in this embodiment, or said ratio of shift may be greater than one.

The scope of the invention is stated in the annexed claims.

I claim:

1. A machine for marking a graded pattern upon a marking sheet with the use of a master pattern, comprising a support, marking-sheet-holding-means for holding a marking sheet in selected relation to said support, said marking-sheet-holding-means being movably connected to said support and being adapted and operative to hold a marking sheet movably relative to said support, master-pattern-holding means movably connected to said support, and actuating means adapted and operative to shift said marking-sheet-holding means and said master-pattern-holding means in unison relative to said support and in respective different ratios which have a fixed relative value, said master-pattern-holding means being located and operative to hold a master pattern in marking position relative to the marking sheet which is held in said marking-sheet-holding-means in order to conveniently mark the important points of said master pattern upon said marking-sheet.

2. A machine for marking a graded pattern upon a

marking sheet with the use of a master pattern, comprising a support, fixed holding means for holding a fixed marking sheet in fixed relation to said support, movable holding means which are movable relative to said support, said movable holding means being adapted and operative to hold a movable marking sheet movably relative to said support, master-pattern-holding means which are movable relative to said support, and actuating means adapted and operative to shift said movable holding means and said master-pattern-holding means in unison relative to said support and in respective different ratios which have a fixed relative value, said master-pattern-holding means being located and operative to hold a master pattern in close marking position to said fixed holding means in order to conveniently mark the important points of such master pattern upon the fixed marking sheet which is held by said fixed holding means, said movable holding means being operative to hold a movable marking sheet in close marking proximity to said fixed marking sheet during the operation of the machine.

3. A machine for marking a graded pattern from a master pattern, said machine having a longitudinal axis; said machine having a support which has left and right support sides which are spaced longitudinally from each other, a table movably connected to said support, said table being horizontally movable relative to said support, said table having left and right table-sides which are spaced longitudinally from each other, two left joints which connect the left support-side of the support and the left table-side to each other, two right joints which connect the right support-side of the support and the right table-side to each other, each said joint comprising four edge-links which are connected at their edges by four vertical pivot pins whose vertical axes are at the corners of a parallelogram, the pivot pins of each joint comprising two diametrically opposed mounting pins and two free pins which are located intermediate said mounting pins, one mounting pin of each said joint being fixed to a support-side, the other mounting pin of each joint being fixed to a table-side, means for holding a table marking sheet fixed to said table and in contact with the top of said table, each said joint comprising an additional link which is parallel to one of the edge-links of the respective joint, the additional link of each joint being pivotally connected at its ends to a pair of the opposed edge-links of the respective joint, the additional links at the left side of the table having a left and transversely-disposed pattern-holding bar connected thereto, the additional links at the right side of the table having a right and transversely-disposed pattern-holding bar connected thereto, said pattern-holding bars being located at equal longitudinal distances from said mounting-pins, and pattern-holding means connected to said pattern-holding bars and adapted to hold a master pattern in marking relation to said marking sheet.

4. A machine according to claim 3, having means for holding a marking sheet fixed to said support, and superposed relative to said table marking sheet.

5. A machine according to claim 3, in which each joint has a plurality of said additional links and each pair of additional links at each side of the table has a respective transversely disposed paper-holding bar at each side of the table, said paper-holding bars being arranged in pairs at each side of the table, the paper-holding-bars of each pair being equally longitudinally spaced from the respective right and left mounting pins, each pair of paper-holding bars having means for holding a marking sheet in a plane across the top of said table.

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