

[54] **PATTERN GRADING APPARATUS**

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[58] Field of Search 33/17 A, 12, 26 A

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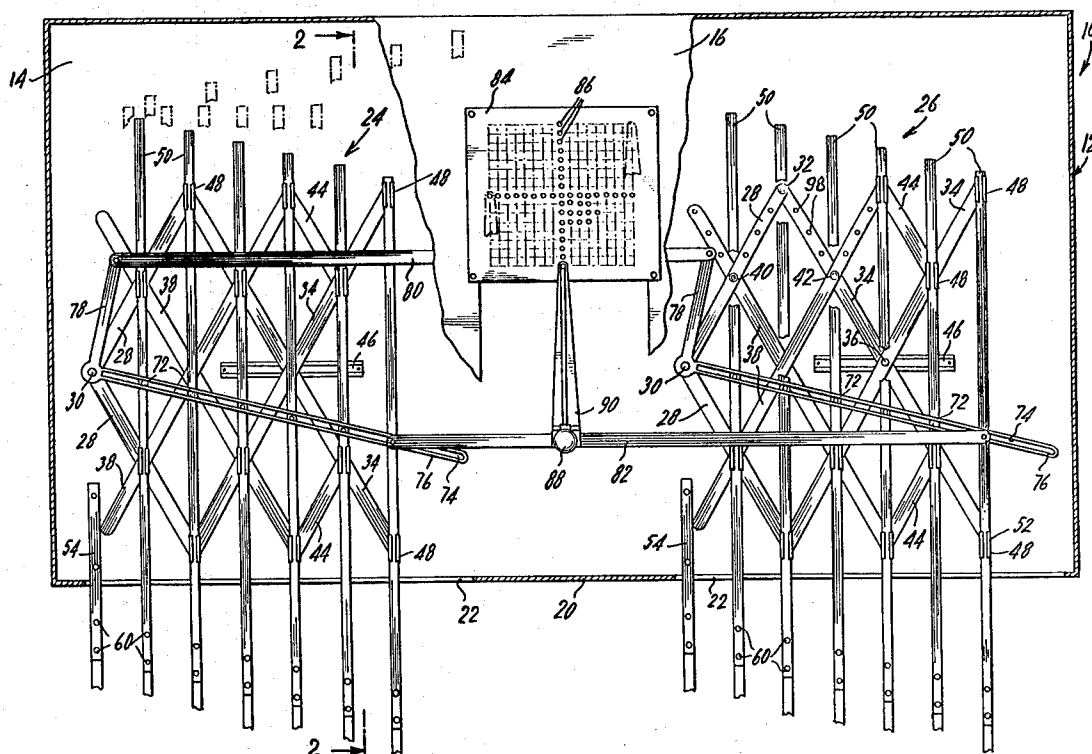
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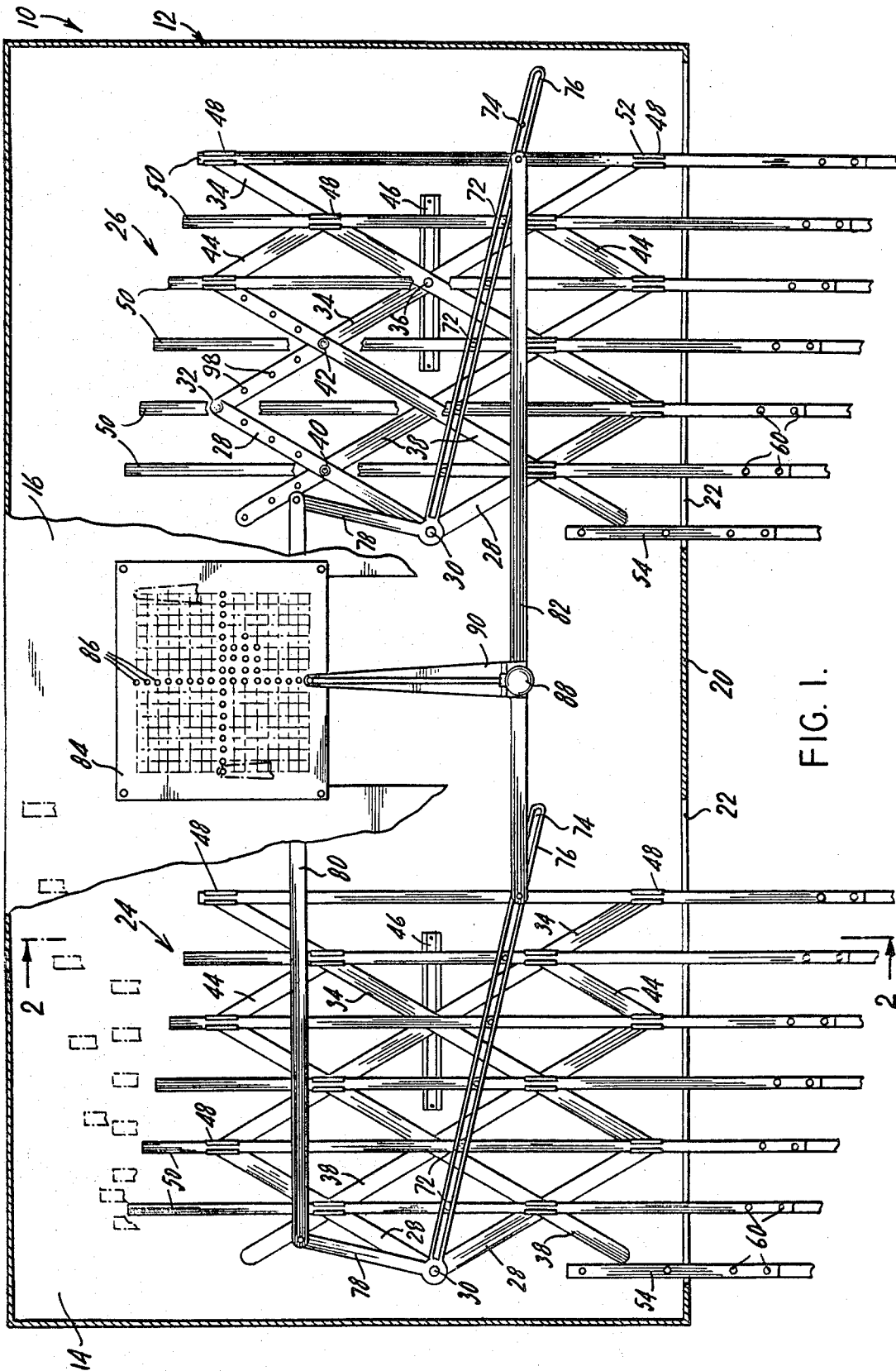
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[57] **ABSTRACT**

A pattern grading machine includes a pair of lazy-tong linkages each mounting a row of spaced, parallel pattern-supporting bars for longitudinal sliding movement. A slotted positioning bar interconnects the pattern-supporting bars in each row and a manually movable control bar interconnects the positioning bars and the lazy-tong linkages for selective lateral spacing of said pattern-supporting bars through actuation of said lazy-tong linkages and relative longitudinal movement of said pattern-supporting bars in a predetermined ratio through movement of said positioning bars.

8 Claims, 5 Drawing Figures





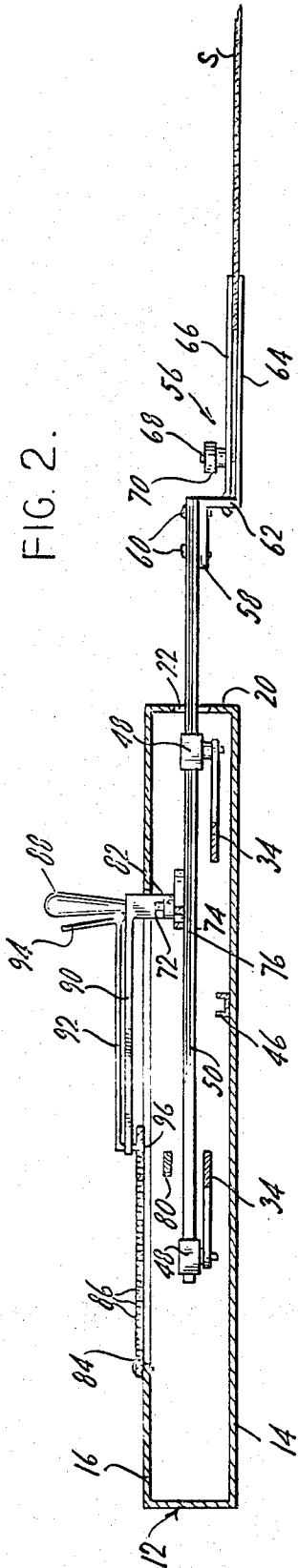


FIG. 5.

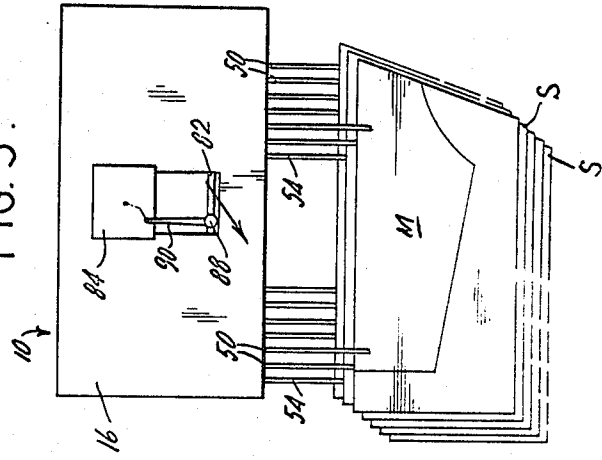


FIG. 4.

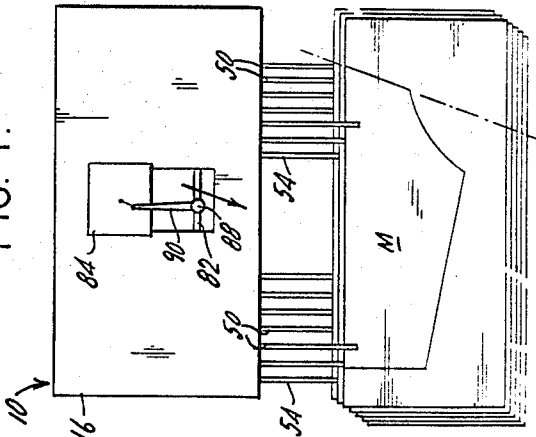
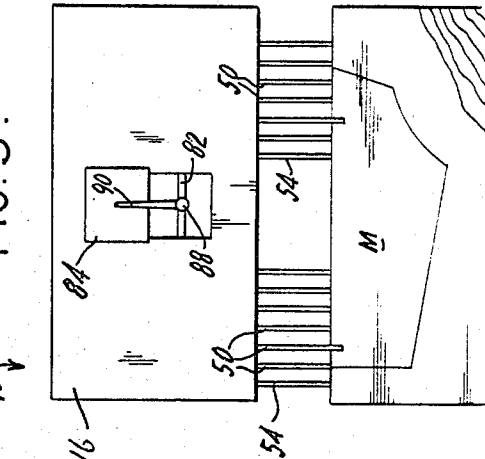


FIG. 3.



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PATTERN GRADING APPARATUS

In the commercial mass production of garments and articles of wearing apparel, a plurality of pre-formed panels are sewn together to form the individual garments. The panels are generally multiple cut from a stack of superimposed layers of the fabric forming the garment, the topmost layer having traced thereon from corresponding patterns, outlines of the respective panels, the patterns having been arranged on the stack in the most compact manner to effect the maximum efficiency of fabric employment. The patterns for the garment panels vary in shape depending upon the size as well as the style of the respective garment. It has been the practice to cut the master patterns to correspond to the panels forming the original garment, and to lay out and cut the patterns for garments of sizes differing from the sample garment by employing the master pattern as a guide, the other patterns varying in their longitudinal and girth or transverse dimensions from the master pattern in predetermined ratios in accordance with the relationship of the pattern sizes and the positions of the various points along the edges of the patterns. The manufacture of the various production of graded patterns from the master pattern has heretofore been a time consuming procedure, requiring highly skilled labor and hence being expensive and significantly contributing to the cost of the garment. Many types of equipment have been proposed for facilitating and expediting the production of graded patterns from master patterns but these have done little to remedy the deficiencies of the earlier practices. The equipment heretofore available was complicated, and required a high degree of skill in its use, frequently resulting in the production of improperly shaped graded patterns and otherwise leaving much to be desired.

It is, therefore, a principal object of the present invention to provide an improved apparatus for producing patterns for the manufacture of garments and articles of wearing apparel.

Another object of the present invention is to provide an improved apparatus for producing sets of size related garment patterns.

Still another object of the present invention is to provide an improved pattern grading apparatus.

A further object of the present invention is to provide an improved pattern grading apparatus capable of positioning a master pattern with a plurality of superimposed duplicating sheets in any desired spacial relationship by the use of a single control member.

Still a further object of the present invention is to provide an improved pattern grading apparatus including a programming member by which the required spacial relationships of the master pattern and duplicating sheets are indicated and facilitated.

Another object of the present invention is to provide an apparatus of the above nature characterized by its ruggedness, simplicity, adaptability, versatility and ease of use.

The above and other objects of the present invention will become apparent from a reading of the following description taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a top plan fragmentary view of a pattern grading apparatus embodying the present invention;

FIG. 2 is a sectional view taken along line 2—2 in FIG. 1;

FIG. 3 is a top plan view of the apparatus shown in use and illustrated in its centrally adjusted position; and FIGS. 4 and 5 are views similar to FIG. 3 and illustrating the apparatus in differently adjusted positions.

In a sense, the present invention contemplates the provisions of a pattern grading apparatus comprising a plurality of longitudinally spaced, transversely extending parallel bars, a sheet engaging element mounted on each of said bars, means for restricting the relative longitudinal movement of said bars to a substantially constant predetermined ratio, means for restricting the relative transverse movement of said bars to a substantially constant ratio, and a common control member for effecting the transverse and longitudinal movement of said bars.

According to a preferred form of the present pattern grading apparatus there is provided a base member on which is mounted a pair of laterally spaced longitudinally aligned lazy-tong linkages, the lazy-tong linkages being anchored to the base member by longitudinally aligned pivot pins, each connecting a corresponding pair of the lazy-tong links. Medially disposed longitudinal guides are located on the base member and followers carried by the lazy-tongs remote from the anchoring pivoting pins slidably engage the longitudinal guides to restrict the lazy-tong linkages to longitudinal movements attendant to the contraction and expansion thereof. A plurality of regularly longitudinally-spaced pairs of transversely aligned guide elements are mounted on the lazy-tong linkages and engage correspondingly spaced transverse bars restricting them to transverse movement relative to the respective guides, each of the bars carrying a sheet engaging member and a follower element. A positioning bar is swingably connected to each of the anchoring pivots and is provided with a longitudinal slot slidably engaging the slide bar follower elements, the positioning bars are connected by a cross bar which maintains them mutually parallel while permitting their pivotal movement. A control bar interconnects a pair of corresponding slide bars carried by the opposite lazy-tong linkages and is movable therewith to effect similar concurrent adjustment of the lazy-tong linkages and slide bar sets. A relatively stationary programming board is provided having transversely and longitudinally spaced apertures and the control bar carries a pin element which is movable into selective engagement with the programming board apertures.

Referring now to the drawings which illustrate a preferred embodiment of the present invention, the reference numeral 10 generally designates the improved pattern grading apparatus which comprises a housing 12 including a rectangular base defining wall 14, a top wall 16 having a medially located rectangular opening 18 formed therein, and a front wall 20 having a pair of longitudinally spaced aligned longitudinal slots 22 formed therein. Located in the housing 12 and mounted on the base 14 are a pair of longitudinal or laterally spaced, longitudinally aligned similar lazy-tong linkages 24 and 26 respectively which are illustrated as being of the compound type, it being understood that simple lazy-tong linkages may be employed as well.

Each of the lazy-tong linkages 24 and 26 includes a first pair of symmetrical relatively short links 28 which

are pivoted at their inner ends to a corresponding vertical pin 30 which is affixed to the base 14 thereby effecting the anchoring of the lazy-tong linkages thereto. Pivotally connected to the outer ends of the links 28 by pins 32 are a pair of relatively long links 34 which are approximately twice the length of the link 28. The long links 34 intersect and are pivotally connected at their mid-points by a pin 36 which is in longitudinal alignment with the pivot pin 30 and terminate at points in longitudinal alignment with the outer ends of the short links 28. A pair of long links 38, slightly shorter than the links 34 intersect each other at about their mid-points and intersect and are pivotally connected to the links 28 by pins 40 substantially midway between the pins 30 and 32 and intersect and are pivotally connected to the links 34 by pins 42 substantially midway between the pins 32 and 36. The outer ends of the links 38 are in longitudinal alignment with the inner ends of the links 34 and are connected by short links 44 to the links 34 at points about midway between the pins 36 and the outer ends of the links 34.

Underlying each of the lazy-tong linkages 24 and 26 and affixed to the base 14 is a longitudinally extending channel shaped track member 46 which is medially located relative to the lazy-tong linkages. The tracks 46 are slidably engaged by respective follower defining pins 36 to restrict the lazy tong linkages to a longitudinal movement which is attendant to the contraction and expansion of the lazy-tong linkages. It should be noted that the ratios of the longitudinal spacings between predetermined points on each of the lazy-tong linkages remains substantially constant and independent of the degree of expansion or contraction of the lazy-tong linkage.

A plurality of longitudinally equally spaced pairs of transversely aligned channel-shaped guide members 48 are mounted on the lazy-tong linkages 24 and 26, the pairs being located at the pivot pins 40, 32, 42 and 36, and at the intersections of the links 34 and 44 and at the outer ends of the links 34. An elongated bar 50 slidably engages each pair of transversely spaced guide members 48 and is retained therein by overlying lips 52 integrally formed with the respective guide members 48. The bars 50 project transversely forwardly of the housing 12 through the slots 22 and are parallel to each other and the spacing between successive slide bars 50 are equal. A stationary bar 54, parallel to the slide bars 50, is affixed at its trailing end to the base 14 and is in transverse alignment with each of the anchoring pins 30.

A sheet clamp 56 is mounted on the forward free end of each of the bars 50 and 54 and comprises an L-shaped bracket including a horizontal leg 58 underlying and separably attached to the free end of a respective bar 50 and 54 by means of screws 60 and a vertical leg 62 depending from the forward edge of the leg 58. A horizontal first clamp arm 64 is integrally formed with and projects forwardly of the bottom edge of the bracket leg 62, and a second clamp arm 66 overlies and extends along the clamp arm 64 and is suitably hinged at its trailing end to the bracket leg 62. A screw 68 is affixed to and projects upwardly from the clamp arm 64 and registers with an opening in the clamp arm 66 and a finger manipulatable nut 70 engages the screw 68 and permits the relative tightening and releasing of the cooperating clamp arms 64 and 66.

Projecting upwardly from each of the slide bars 50 is a follower defining pin 72 which slidably engages an elongated track defining slot 74 formed in the positioning bar 76 hinged at an end thereof to each of the anchor pins 30. Each of the positioning bars 76 is provided at its pivotal point with a rearwardly directed horizontal arm 78 which is perpendicular to the bar 76 and the free ends thereof are interconnected by a cross link 80. It should be noted that the positioning bars 76 are swingable about the respective pivots 30 and are maintained in mutual parallelism by the arms 78 and cross link 80. Moreover, with the swinging of the positioning bars 76, and bars 50 are transversely moved along their lengths, the difference in movement between successive bars being equal, whereby the ratio of their movements is substantially constant and the transverse movement of corresponding bars of the opposite sets thereof carried by the lazy-tong linkages 24 and 26 are the same.

A longitudinal control bar 82 is connected between a pair of corresponding slide bars 50 carried by the lazy-tongs 24 and 26 and is longitudinally and transversely movable. The transverse movement of the control bar 82 adjusts the transverse positions of the control bar interconnected slide bars 50, and hence the transverse positions of all the slide bars 50 by means of the concurrently swung positioning bars 76 in the manner described above. The longitudinal movement of the control bar 82 effects the longitudinal adjustment of the positions of the slide bars 50 by the corresponding contraction or expansion of the lazy-tong linkages 24 and 26.

In order to facilitate the proper positioning of the slide bars 50 in relation to the master pattern of which graded patterns are to be produced, there is provided a programming board or plate 84 mounted on the upper face of the housing top wall 16 along the rear edge of the opening 18. The plate 84 has a plurality of longitudinally and transversely spaced positioning sockets or apertures 86 formed therein.

An upwardly directed handle member 88 is mounted on the control bar 82 between its ends and is provided with a rearwardly directed arm 90 of a length slightly greater than the depth of the board 84 and disposed shortly above the level of the board 84. A bell crank is pivoted at its knuckle to the trailing upper face of the arm 90 for swinging about a longitudinal axis and includes a horizontal arm extending medially along the length of the arm 90 and an upwardly rearwardly inclined arm 94 disposed along the rear face of the handle 88. The arm 92 terminates at its free end in a depending peg or pin 96 which slidably register with a vertical bore formed in the end of the arm 90 and is adapted to releasably engage selected of the programming sockets 86.

In employing the pattern grading apparatus described above in producing a group of graded patterns from a master pattern M, the master pattern M is placed into clamping engagement with a pair of corresponding sheet clamp members 56 which are then tightened by means of the nuts 70. The master pattern M is locked in the clamp members 56 so that its longitudinal axis which may be delineated by the clamped edge thereof is parallel to the longitudinal axis of the apparatus 10 and the master pattern M is engaged by the pair of clamp members which correspond in size to

the master pattern M. Thus, in the example illustrated in FIGS. 3 to 5 of the drawing, the stationary bars 54 correspond to a size 20 and the succeeding slide bars of each set correspond to sizes 18, 16, 14, 12, 10 and 8 respectively. The master pattern M, being shown as a size 16, is engaged by a pair of slide bars 50 second from the fixed bars 54, which as aforesaid, correspond to size 16. A duplicating blank sheet S which may be of a conventional stiff paper is engaged by each corresponding pair of clamp members 56 and stacked in sliding superimposed relationship underlying the master pattern M.

The master pattern M contains a series of points which defines the shape thereof, such as the opposite ends of a straight edge which delineates the respective edge, a plurality of points along a curved edge which delineates such curved edge, a pair of suitably located points for delineating a slit, etc. For each of such points on the master pattern M, a corresponding point is required on each of the sheets S which is related to the master pattern defining points in accordance with the position thereof on the master pattern and the size of the graded pattern. The programming sockets 86 are suitably identified to be related to the master pattern defining points and the operator merely adjusts the handle 88 to bring the pin 96 into engagement with successive sockets 86 corresponding to respective master pattern defining points and with each such engagement, the operator punches, by means of an awl or the like, a hole through the respective master pattern defining point and the underlying sheets S. When holes have been punched in the above manner corresponding to all of the master pattern defining points, the sheets S are separated from the slide bars 50 and the graded patterns cut therefrom as delineated and defined by the holes punched therein. Since the sheets S and master pattern M are positioned for the punching of each hole in a relationship corresponding to that of the respective points in correspondingly graded patterns, the hole defined patterns are graded replicas of the master pattern. By reason of the correct relative positioning of the sheets S and the master pattern M being effected by the movement of a single control member, and a programming board being provided to correlate the movement of the control member with the positions of the points being punched, a minimum of skill is required to accurately and properly operate the present apparatus at maximum efficiency.

In accordance with an alternative and preferred rapid and simple procedure for cutting the graded patterns along projected lines corresponding to the lines delineating the master pattern M, the relative positions of the sheets S and master pattern M are successively adjusted by bringing the pin 96 into registry with successive sockets 86 whereby the sheets 15 and master pattern M are related so that the delineating edges of the master pattern M overlie and are oriented with the projected corresponding delineating edges of the graded patterns on the sheets S underlying the master pattern M. With each adjustment of the apparatus as aforesaid, the superimposed sheets S are cut along a line of the master pattern M corresponding to the adjustment of the apparatus. The aforesaid step repeated until the full outline of the master pattern M has been cut in its apparatus projected forms on the underlying sheets S to produce the corresponding graded patterns.

While the drawings show the grading apparatus as having six slide bars 50 associated with each of the two lazy tong linkages, it is to be understood that this number is shown merely for convenience of illustration. In an actual preferred commercial embodiment, the apparatus is supplied with 24 slide bars 50 in addition to the stationary bar 54 for each lazy tong. In FIG. 1, the upper portions of links 28, 34 and 38 of the right hand lazy tong assembly are shown provided with holes 98 for the mounting of guide members 48 which would receive the additional slide bars. This means that 25 pattern sheets could be supported on the apparatus, but in actual grading practice, 25 sheets will not be used at one time. The provision of this number of slide bars, however, permits the apparatus to be used for all standard grading sizes, for example, 1-inch grading, 1 1/2-inch grading and 2-inch grading, by mounting the pattern sheets upon selected slide bars, as will be presently explained. If the apparatus is to be used for only one size grading, the superfluous slide bars may be easily slid out of the lazy tong linkage and removed from the apparatus. The arrangement illustrated in FIG. 1 shows every fourth slide bar mounted on the lazy tong linkage, such arrangement being used when only 2-inch grading is required, as will be presently explained.

In the aforementioned preferred commercial embodiment, the apertures 86 in the programming plate 84 are spaced from each other by a distance of three-eighths inch. Since there are eight apertures on either side of both center lines of apertures which represent the null or starting position of the pattern sheets wherein the latter are all in aligned relationship, it will be apparent that the pin 96 can be moved in any direction from the center line by one aperture or distance of three-eighths inch, and a maximum of eight apertures or a distance of 3 inches.

The most common grading in commercial use is 2-inch grading. This means that in the course of the grading operation, the patterns are staggered with relation to each other by distances from one-sixteenth to one-half inch, but in different directions. By way of example, in conventional 2-inch grading, the patterns are staggered up one-eighth inch and one-sixteenth inch and a first cut is made. The patterns are then staggered out one-fourth inch and a second cut made, etc.

If the apparatus is to be used to cut patterns tin 2 inch grading, the master pattern and the pattern sheets are mounted on the first (stationary) bar 54, and upon the fifth, ninth, 13, 19, 25 and 29 slide bars 50 of each set. Thus, six pattern sheets in addition to the master pattern are used and are mounted on every fourth bar. The sheets are initially in registry, as shown in FIG. 3 and the pin 96 is located in the center or null aperture of the programming plate 84. If the operator now moves the pin one aperture to the right, for example, or a distance of three-eighths inch, the last movable slide bar 50 away from the stationary bar 54 by a distance of three-eighths inch, and the lazy tong linkage will cause the other bars to move proportionately decreasing distances away from the stationary bar 54, with the result that the 24 slide bars will be moved away from each other by a distance of one sixty-fourth inch. However, since the pattern sheets are supported by every fourth bar, the pattern sheets will be staggered relative to one another by a distance of one-sixteenth inch. If the pin is moved to the right by eight apertures, or 3

inches, the six pattern sheets will be staggered by a distance of one-half inch. Thus, the programming board apertures permit grading of the pattern sheets in any direction between the limits of one-half inch and one-sixteenth inch because of the manner in which the sheets are mounted for a 2-inch grading operation.

The operator can, therefore, follow the usual grading procedure as explained above, by moving the pin 96 in the appropriate direction and by the correct amount of apertures, and multiple grading will be automatically accomplished with each pattern being precisely staggered by the correct distance. It will also be observed that if the grading step calls for the pattern to be staggered up one-fourth inch and in one-sixteenth inch, this can be accomplished by a single movement of the pin angularly across the panel to the proper aperture, as indicated in FIG. 4.

In addition to two inch grading, many garment manufacturing plants require other size gradings such as 1-inch gradings, 1 ½-inch gradings, and even ½-inch gradings for children's clothing. Up to the present time, no grading machine has been capable of permitting gradings in different sizes without factory modifications of its internal mechanism. The instant apparatus not only permits gradings in any desired sizes but also permits different size gradings for different pattern sheets in the same operation.

For example, if it is desired to achieve 1-inch grading, the patterns are mounted on every other bar instead of on every fourth bar. Movement of the pin 96 by eight apertures or a total of 3 inches will now cause an overlap between each of the pattern sheets by one-fourth inch. Movement of the pin by a single aperture will cause pattern sheet staggering of one thirty-second inch. Similarly, to accomplish 1 ½-inch grading, the pattern sheets are mounted on every third bar of the 25 bars.

An important advantage of the apparatus of the present invention is its availability to grading operators who are skilled only in 2-inch grading. If called upon to perform 1-inch grading, for example, they ordinarily would not know the proper measurements for staggering the pattern sheets. With the instant apparatus, however, they need only be instructed to mount the patterns upon the proper slide bars. Once the pattern sheets are properly mounted, they operate the programming pin in exactly the same manner as for 2-inch grading and the apparatus automatically compensates and produces perfect 1-inch grading.

Another feature of the apparatus is its ability to produce combinations of gradings in one operation. For example, it is often required in women's clothing that 1-inch grading be used between sizes 8 and 10, 1 ½-inch grading between sizes 10 and 12, and 2-inch grading between sizes 12 and 16. This combination of gradings can be accomplished simultaneously in one operation of the apparatus, by merely mounting the pattern sheets on appropriate slide bars of the available 25 bars.

While there has been described and illustrated a preferred embodiment of the present invention, it is apparent that numerous alterations, omissions and additions may be made without departing from the spirit and scope thereof.

What is claimed is:

1. A pattern grading apparatus comprising a base member having a longitudinal guide, a lazy-tong linkage including a link pivot anchored to said base member and a transversely medially located follower engaging said guide to limit movement of said lazy-tong linkage to expansion and contraction in a first direction toward and away from said link pivot, a plurality of spaced sheet support bars mounted at spaced intervals on said lazy-tong linkage and individually slidable relative thereto in a second direction perpendicular to said first direction, a sheet gripping element mounted on each of said sheet support bars, a positioning member pivoted to said lazy-tong linkage at said anchored link pivot and provided with an elongated track, follower members mounted on each of said bars and slidably engaging said track for simultaneous sliding movement of said sheet support bars on said lazy-tong linkage in a predetermined ratio in response to pivoting movement of said positioning member, and a single control member connected to one of said sheet support bars and being manually movable in said first direction to vary the spacing between said sheet support bars, and in said second direction to pivot said positioning bar.

2. A pattern grading apparatus according to claim 1 in which said base member has a second longitudinal guide, a second lazy-tong linkage spaced from and aligned with said first lazy-tong linkage, said second lazy-tong linkage including a corresponding link pivot anchored to said base member and a transversely medially located follower engaging said second guide to limit movement of said second lazy-tong linkage to expansion and contraction in said first direction, a second plurality of spaced sheet support bars mounted on said second lazy-tong linkage for individual sliding movement relative thereto in said second direction and each mounting a sheet gripping element, a second positioning member pivoted to the anchored link pivot of said second lazy-tong linkage and provided with an elongated track, follower members mounted on said second plurality of sheet support bars and slidably engaging the track of said second positioning member, a cross link operatively pivotally connected between said positioning members to maintain said tracks mutually parallel, said control member extending between a pair of corresponding bars of said first and second plurality of sheet support bars.

3. The pattern grading apparatus of claim 2 including a relatively stationary programming member provided with a plurality of spaced indicia and a follower element carried by and movable with said control member and movable into selective registry with said indicia to correspondingly position said bars.

4. The pattern grading apparatus of claim 3 wherein said programming member comprises a plate having longitudinally and transversely spaced apertures formed therein and said follower element comprises a pin insertable into said apertures.

5. The pattern grading apparatus of claim 3 wherein guide members are mounted on corresponding transversely aligned points on said lazy-tong linkages, said bars slidably engaging respective transversely aligned pairs of said guide members.

6. The pattern grading apparatus of claim 3 including a pair of longitudinally spaced bars affixed to said base member in transverse alignment with said lazy-tong anchoring pivots and mounting sheet support elements.

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7. The pattern grading apparatus of claim 2 in which each of the bars of the first plurality of sheet support bars is paired with a corresponding bar of the second plurality of bars, the bars of each of said pairs being adapted to move to the same extent in said first and second directions, each of said pair of bars supporting a single sheet, one of which sheets is a master pattern, said bars moving said sheets relative to each other and to said master pattern to selected staggered grading positions in response to manual movement of said control member.

8. The pattern grading apparatus of claim 7 which also includes a stationary programming member comprising a plate affixed to said base member, said plate having longitudinally and transversely spaced apertures forward therein, and a follower element carried by and movable with said control member and including a pin selectively insertable into said apertures, said apertures being spaced from each other by distances corresponding to selected staggered grading positions of said sheets and master pattern.

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