Aug. 31, 1937. S. ASTER 2,091,262

PATTERN GRADING

Filed April 9, 1935 4 Sheets-Sheet 1

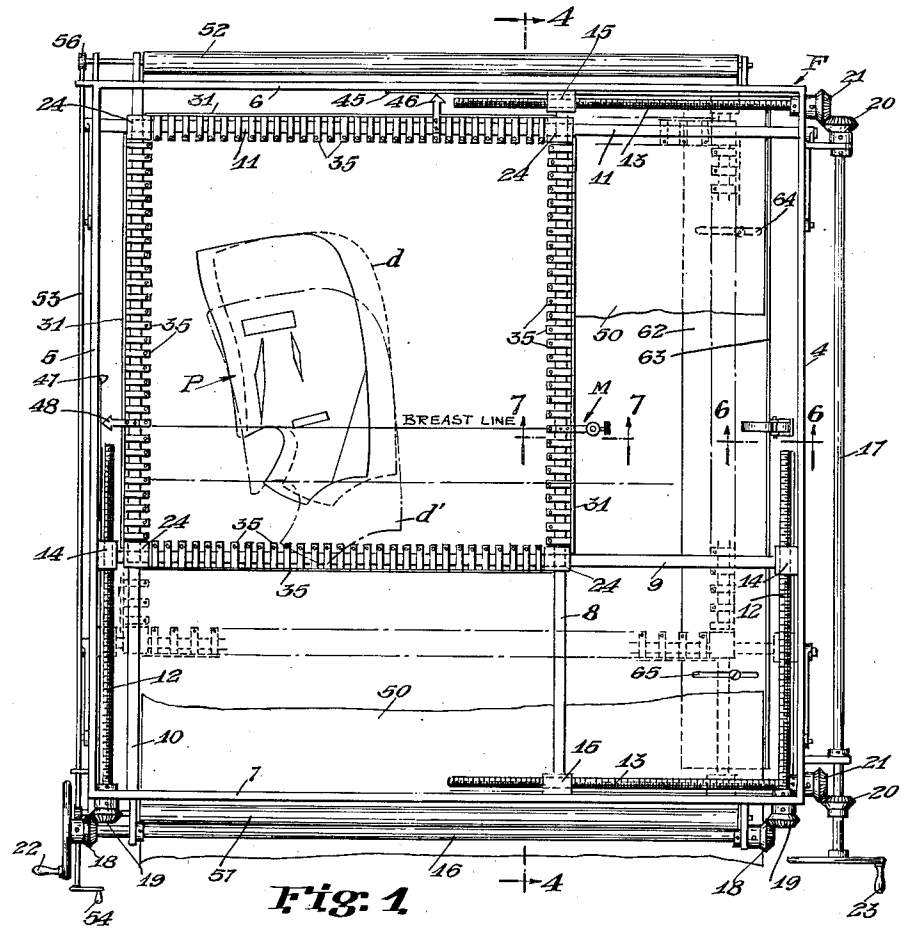

Fig: 1.

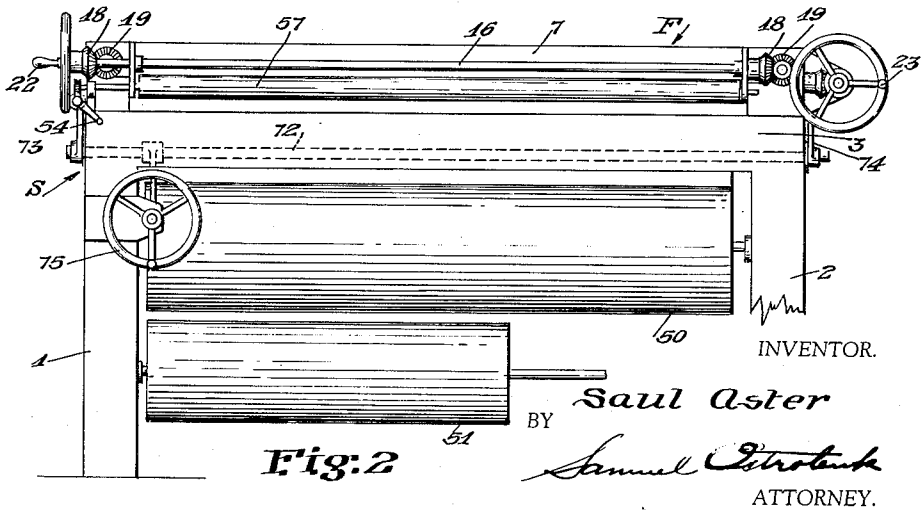

Fig: 2.

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PATTERN GRADING

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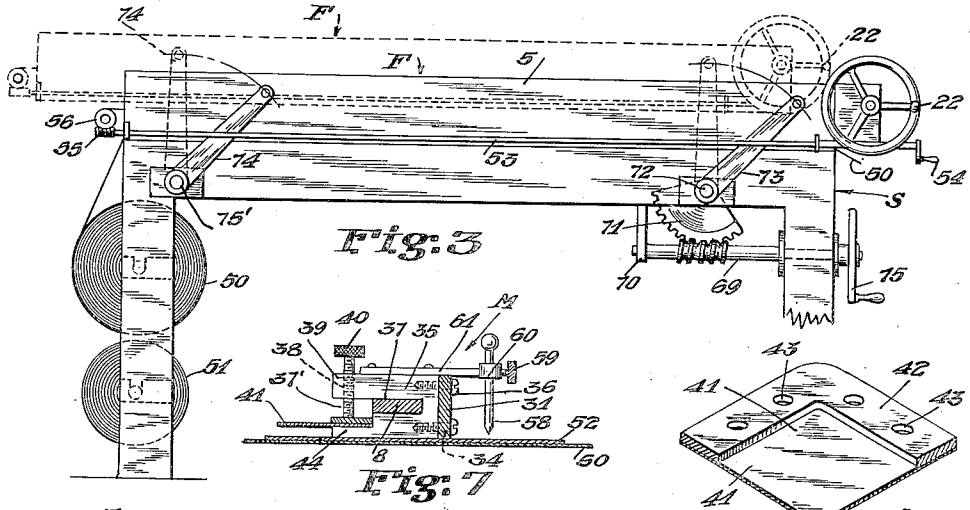

Fig: 3

Fig: 7

Fig: 8

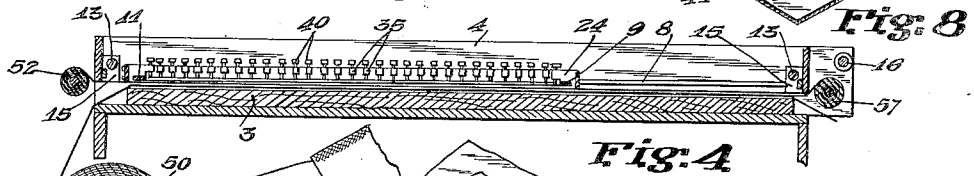

Fig: 4

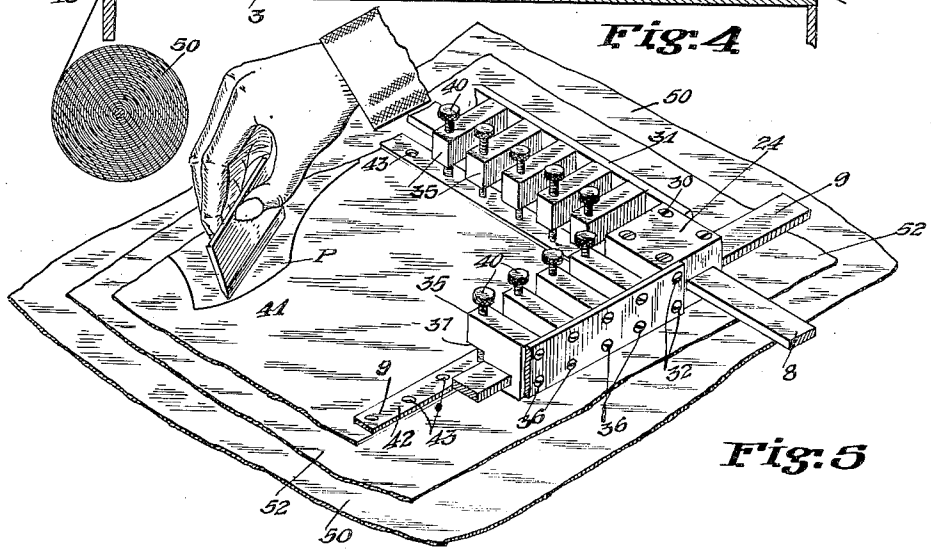

Fig: 5

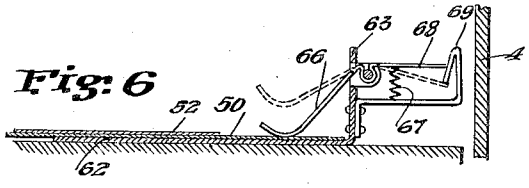

Fig: 6

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PATTERN GRADING

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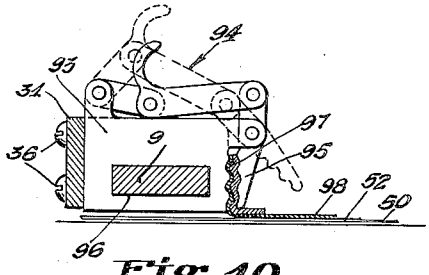

Fig. 10

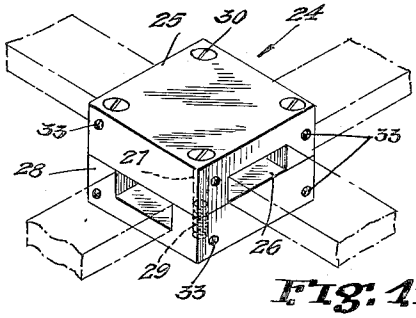

Fig. 11

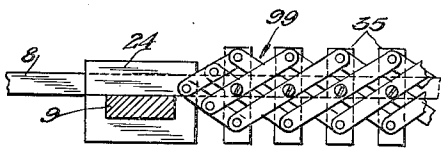

Fig. 12

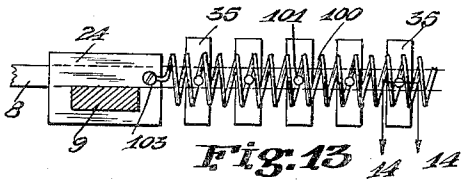

Fig. 13

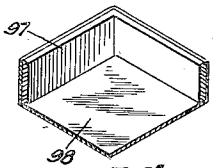

Fig. 15

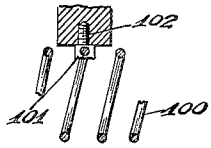

Fig. 14

Fig. 9

Fig. 16

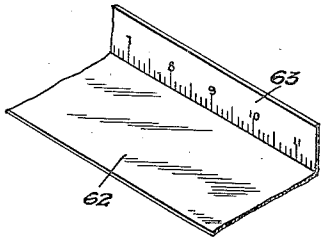

Fig. 17

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PATTERN GRADING

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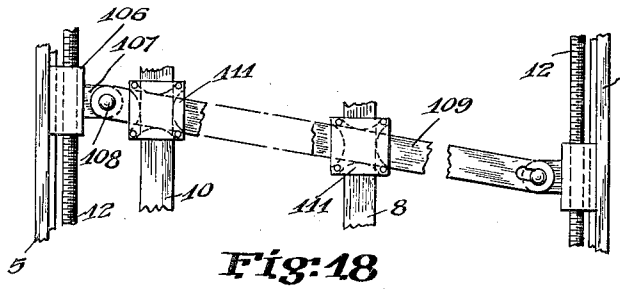

Fig:18

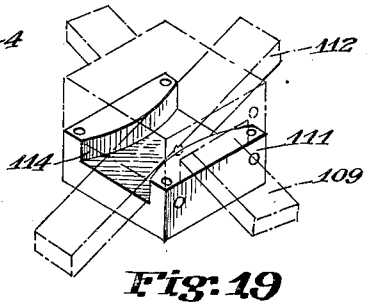

Fig:19

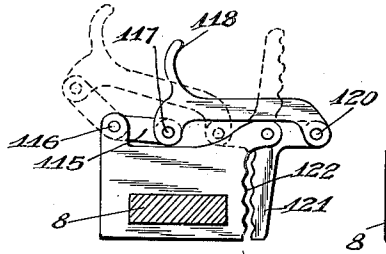

Fig:20

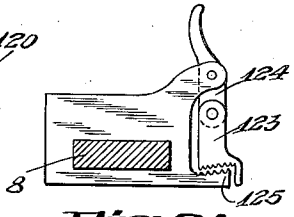

Fig:21

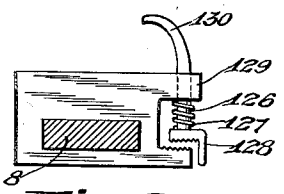

Fig:22

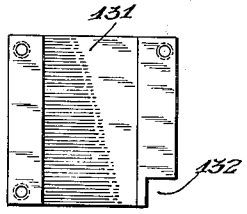

Fig:23

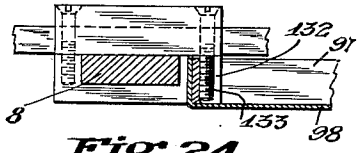

Fig:24

Fig:25

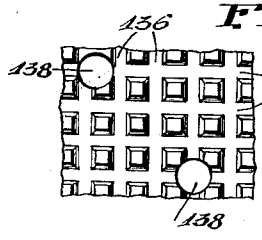

Fig:26

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Patented Aug. 31, 1937 2,091,262

UNITED STATES PATENT OFFICE

2,091,262

PATTERN GRADING

Saul Aster, New York, N. Y.

Application April 9, 1935, Serial No. 15,401

10 Claims. (Cl. 33—17)

My invention relates to novel methods of expanding members and more particularly relates to novel methods of obtaining patterns of different sizes from a master pattern.

The present practice in the garment industries for obtaining various patterns for different sizes of a particular design or style of a garment is to first construct what is known as the master pattern of that style.

As is well known, the designer employed to produce the design is a highly skilled individual who directs himself to the problem of producing the master pattern. The master pattern is usually designed to fit the ideal figure, that is, the one who has an average, and as far as possible perfect and proportioned figure; usually about 36 inches in circumference around the chest and 5' 8" for men and 5' 4" for women. This figure is called an ideal model.

Having produced the master pattern, it is now necessary to produce therefrom the corresponding patterns for that particular design or style of all the other sizes. This is called grading. It is very important that the graded patterns from the master pattern have the same graceful lines and effects as the master pattern itself.

It happens, however, that the variation from any one size to another is not uniform in all directions; nor in fact is it uniform in the same direction at all parts. Thus, for example, in going from a 36 to a 38, the length or up and down increase in dimension may be of one order and the width or sideway increase is of quite a different order.

Thus it is obvious that a simple device such as a pantograph ordinarily used for reproducing enlargements of a configuration may not here be used in view of the disproportionate changes. For example, if a size 36" is to be enlarged in width to 44" and all other parts are allowed to enlarge proportionately to the width, a pattern of an enormous height results. That, of course, would not do, because when a pattern is graded, it must be remembered that the wearer of the garment, whether 36" chest or 44", is still of height 5' 8", in measuring the ideal figure for men. Patterns for shorter people, say 5' 4" are designed shorter, while their range in sizes runs about in the same manner as for the 5' 8" but their heights must be kept within their own range. The same thing applies when patterns for tall persons are graded.

From the above it does not follow that when a pattern is graded it is enlarged or reduced in the width only. Far from it, and to illustrate this, I bring this following example:

If a pattern size 36" is to be enlarged to size 40", assuming that the height of the two persons these patterns are being made for are the same, namely 5' 8", they will both measure from the neck bone to the waist line 17". So it follows that while increasing the width from the master pattern to the size of 40", the 40" pattern will also have to be increased starting at the chest line (from the circumference line just below the arm pits) to the neck. The amount of the increase in that direction is from ⅛" to ⅙" (as some graders vary here). For every size enlarged, the part from the chest line up is increased, but still the distance from the neck bone to the waist line must remain the same, 17"; and the distance from the chest line to waist line will have to be shortened by as much as it was lengthened from chest line to neck bone. Some graders do not go to the trouble of shortening the distance from the chest line to waist line when enlarging, and as a result they get their garments long waisted.

There are at least two known ways for grading patterns. One is the chart system, which is mainly employed in grading men's clothing. The other is the so-called "shoving system" which is mainly employed in grading ladies' wear and the like. The former method is regarded as superior and more correct than the second, as will be explained hereinafter.

In the chart system, as well as the shoving system, each member of the several parts of the pattern has to be graded separately, while with my method all members of the pattern are graded simultaneously.

When grading in accordance with the chart system, grading as it is being done at present, the grader traces the master pattern on paper and extends lines beyond the borders of the said tracing at different points from some central point of the tracing, marking off as many fractions of an inch as the largest desired pattern will require. The lines of sizes in between the master pattern and the largest pattern that needs to be produced are divided with a proportional divider into as many parts on the above mentioned lines, numbering each division with its proper size. Alongside of it the master pattern is used to connect the marked off points of the largest size on that same paper, and accordingly on the same paper is obtained a chart of the master pattern and the largest pattern and the divisions between them for the other sizes needed.

The grader then puts this chart on pattern paper and with a scriber he makes small holes through the chart and the pattern paper on points near where the sizes are numbered, on all edges of the pattern. Then using the master pattern as a guide he connects all the little holes with a pencil, and cuts it into a pattern, stamping the proper size on it.

From the above, it will be clear that at the very best, the accuracy is dependent upon the number

of points from which the new measurements are made and intermediate these points error inevitably must occur. Thus, if a relatively fewer number of points are employed, error is obviously greater.

This haphazard matter of design work not only is unsatisfactory because of its inaccuracies, but also is extremely costly even for the approximate degree of accuracy that is obtained.

When the pattern is a simple one involving straight horizontal and vertical lines, as for example an ordinary rectangle, there is no difficulty and, in fact, it would be a relatively simple matter to obtain new sizes from the master by a few simple measurements as described above.

When, however, curves are involved as is in fact the case with most garments, curves in fact of very complex order, it becomes practically impossible to measure the horizontal and vertical component at every point of the changing slope of the curve in order to obtain the change in measurements both as to length and as to width at that point. Accordingly the grader, who attempts to reproduce different sizes from the master, is compelled to fall back upon a considerable amount of guesswork and trial and error drawing and inevitably falls into a certain amount of at least human error in the reproduced designs for the different sizes.

Moreover in many trades, especially in the ladies' wear, where styles are changing very fast and there are many styles at one time, the grader cannot afford to "lose time" to make such a comprehensive grade as above mentioned. Accordingly they grade their patterns by the shoving system by putting the master pattern directly on the pattern paper, marking one side, and marking off from the pattern to a point for the next size. He shoves the pattern on the paper connecting the different points until he has marked the new size. He cuts out this new pattern and uses it in the same way as he used the master pattern before—to produce the next size pattern, and so on.

The result is that one part will not fit with an associated part because one may have been increased more than the other. Any one garment is made up from about 5 to 20 or more different pieces, each one having its own pattern of its corresponding size; when the pattern as to that size is in error as to any one piece the adjoining piece to which it is to be secured will not properly fit the first piece and, in fact, if the adjoining piece itself is made from an erroneous pattern and grading, this error may become cumulative and quite serious.

This is particularly true in the case of ladies' wear, such as overcoats and other garments that do not increase by a chart system, but merely by cutting out from the 36 size to the 38 and then cutting out the 38, outlining the same on paper and increasing the different measurements, then cutting out the size and cutting out the 40 and so on. It is not possible to increase the 36 directly to a 44; rather it is necessary to go gradually from one size to the next.

In accordance with my invention, I contemplate an automatic method for obtaining the desired or necessary changes in each direction simultaneously, automatically selecting the proper horizontal and vertical or transverse and longitudinal dimensional changes for any complicated type of pattern curvature. Moreover in accordance with my invention, the change in any one direction may be accomplished from any section on the pattern independent of and without affecting other portions. Thus in accordance with my invention, it is possible to increase the length from the breast line upwardly while at the same time decreasing the distance from the breast line downwardly and all of this is accomplished automatically without any charting or plotting, the changes being obtained along every point of the perimeter of the pattern.

Line curvatures or contours are very important when the designer creates a garment; in order to preserve the line contour, this device will increase or decrease dimensions without any modification of the lines, while in grading a pattern by hand, especially when there are curved or sloping lines, the grader is very apt to err in some part and while the garment may fit, the lines of grace that the designer intended to give the 36 size will be lost when it is formed in different sizes.

Moreover, while at present the designer has to make different patterns for the different heights in order that the grader can grade them into the different sizes, with my device it is possible to obtain also simultaneously different heights while grading as to sizes, from any pattern.

Accordingly, objects of my invention are to provide novel methods of producing related figures from a master figure; for producing patterns of different sizes from a master pattern; to produce methods for automatically controlling the width or circumferential dimension of a garment pattern outline to any desired amount and independently of and without affecting the longitudinal dimension; to automatically control the length of a garment to any desired amount independently of and without affecting the width; to automatically control the dimensions from the breast line upwardly of the pattern independently of and without affecting the dimensions below the breast line, and conversely to control the length from the breast line downwardly without correspondingly affecting the dimensions from the breast line upwardly; to affect all of these changes independently of each other and in a point by point operation, all automatically and simultaneously.

There are other objects of my invention which together with the foregoing will appear in the following description in connection with the drawings in which:

Fig. 1 is a top plan view of the device.

Fig. 2 is a partly broken away front elevation of the device.

Fig. 3 is a side elevation of the device, showing in dotted lines when the device is raised from the lower frame.

Fig. 4 is a sectional view on line 4—4 in Fig. 1.

Fig. 5 is a fragmentary perspective view of the lower right hand corner of the device.

Fig. 6 is a sectional view on line 6—6 in Fig. 1.

Fig. 7 is a sectional view on line 7—7 in Fig. 1.

Fig. 8 is a fragmentary perspective view of the mat, showing the reinforced clamping edge.

Fig. 9 is a transverse section through the device in perspective, showing the adjustable clamping employed in the device.

Fig. 10 is a cross-section through one of the rectangular guide bars showing a preferred modified arrangement for clamping the mat.

Fig. 11 is the corner slide showing in perspective.

Fig. 12 is a rear view of a series of clamps with one corner slide, showing a modified form of securing clamps on the sliding guides.

Fig. 13 is another modified form similar to Fig. 12.

Fig. 14 is a sectional view on line 14—14 in Fig. 13.

Fig. 15 is a fragmentary view showing a modified form of Fig. 8.

Fig. 16 is a perspective of a modified form of bracket adjustment support for bar 31 of Fig. 9.

Fig. 17 is a perspective of a guide for the pattern paper and a scale for replacing the marking of the breast line at M, Fig. 1.

Fig. 18 is a detail of a modified construction permitting angular adjustment of the cross bars 8 and 9 of Fig. 1.

Fig. 19 is a perspective of a modified form of a sliding unit.

Figs. 20 to 22 and 24 are cross sections of modified forms of clamping devices.

Fig. 23 is a plan view of the corner block.

Fig. 25 is a fragmentary cross section of a modified form of the device which is adapted for obtaining printed reproductions of the several gauges of patterns.

Fig. 26 is a modified fragmentary plan view of the top of the table.

Referring to Figs. 1 and 2, the main structure S consisting of legs 1 and 2 and cross bar 3 supports a frame F of convenient size which preferably is of rectangular shape consisting of sides 4 and 5 and opposing sides 6 and 7, forming a rectangular frame, in which a mat to be described hereinafter with all the other means to operate same is mounted.

As shown in Fig. 1 and more clearly illustrated in Figs. 5 and 9, bars of rectangular section 8 and 9 are mounted on two pairs of screws 13 and 12, through the internally threaded portions 14 and 15, which are secured at both ends of these rectangular bars 8 and 9 and form integral parts with same. It will be noted as illustrated in Figs. 1 and 4, that the internally threaded portions 14 located at each end of bar 9 are slidably mounted on guides secured to sides 4 and 5 of the frame F. Similarly internally threaded portions 15 are located at each end of bar 8 and are slidably mounted in guides secured to sides 6 and 7 of the frame F.

The above two pairs of screws are mounted in suitable bearings on the frame F. Screws 12 are operative from the shafts 16 and screws 13 are operative from shaft 17.

Bevel gears 18, mounted on shaft 16 are meshed with corresponding bevel gears 19, which are mounted on the screws 12, and bevel gears 20, mounted on the shaft 17, mesh with corresponding bevel gears 21 mounted on the screws 13.

A handle 22 secured on the end of the shaft 16 at its left end will permit manual operation of the shaft 16 thus revolving the screws 12 through the meshing of the bevel gears 18 and 19. This will cause the bar 9 through its threaded portion 14 either to advance forward as shown in dotted lines or to retard in the opposite direction according to which direction the screws 12 are manually rotated.

The same operation is performed on bar 8 through the screws 13 by turning handle 23 which is mounted on shaft 17. As in the above bevel gears 20 mesh with bevel gears 21 mounted on screws 13 to drive these either clockwise or counterclockwise, thus moving bar 8 to the right or left.

As shown in Fig. 1, bars 10 and 11, similar in shape and form to those of bars 8 and 9, are mounted on frame F, bar 10 being mounted parallel to bar 8 and secured rigidly to sides of frames 6 and 7, and bar 11 being rigidly mounted on sides 4 and 5 of frame F parallel to bar 9. Hence bars 8 and 9, as shown in dotted lines in Fig. 1, are permitted to travel in a parallel relation to their respective bars 10 and 11, when their respective screws 13 and 12 are actuated.

For convenience and simplification of construction, I mount bars 8 and 10 above bars 9 and 11 allowing said bars 8 and 10 to slide on said bars 9 and 11, but it will be understood that I may reverse this relation if desired.

At the four intersections of bars 8, 9, 10 and 11, these bars are interengaged through a sliding unit 24 as shown in Fig. 11 consisting of an upper half like block 25, with a transverse slot 26 milled on one side, to permit one of the bars 8, 9, 10 or 11 to slide freely in said slot. The upper half block 25 is provided with four drilled or otherwise machined openings 27 for assembly purposes with the lower half similar block 28, which has four tapped openings 29 registering with openings 27 in block 25. The two halves 25 and 28 are secured together thereby by means of four screws 30. A transverse slot in this lower half member 28 intersects the slot 26 in the upper half member 25 for slidably receiving another of the bars 8, 9, 10 and 11. As shown in Fig. 1, a unit 24 is located at each corner where the bars 8 and 9, 10 and 9, 11 and 8, and 11 and 10 intersect. For the purpose of making this slide unit 24 interchangeable, tapped holes 33 are provided on each face of the unit so that the slide can be readily used at any corner of the device. Mounted on the slide units 24' are elastic strip members 31, Figs. 5 and 7, secured by means of screws 32 for which tapped holes 33 are provided as in the slide unit 24. The strip 31, preferably of rubber, is provided with a series of openings 34 in a double row formation, making the openings of the upper row in line with the openings in the lower row.

Mounted on the rubber strip 31 are a series of clamps 35 secured as by means of screws 36, each clamp having tapped holes in its rear or mounting side. As will be explained hereinafter, the rubber strip 31 permits any desired spacing of clamps 35. Each clamp 35 is milled out at the center to form a rectangular slot 37 for slidably receiving one of the guide bars 8, 9, 10 or 11 and which is free to slide therein. As shown, in Figure 7, the open end 37' of the slot 37 is of a much wider dimension than the slot itself. A tapped hole 38 from the upper projection 39 of the clamp receives a thumb screw 40 which extends transversely across the open end 37' to clamp a rubber mat or membrane 41 which will be described in the following.

The elastic member such as rubber or the like forming mat 41 is illustrated in Fig. 1 and more clearly in Fig. 5. The edges of mat 41 are preferably reinforced, with a heavier rubber strip 42 secured to the mat 41 by any well known means, such as glue, cement, vulcanization, or the like. This strip 42 extends on all four sides of the mat, and is perforated with a single row of holes 43, which are in line with the thumb screws 40 of the clamps 35.

Thus when the thumb screws 40 are permitted to enter the perforations 43 in the reinforcing strips 42, they will clamp the mat 41 against the lower member 44 (Fig. 7) of the clamp 35, holding the mat 41 secured in position for operation.

The operation of the apparatus thus far de-

scribed will now be clear. The outline of the master pattern from which other patterns are to be formed is first placed with its breast line to correspond to a line that has been previously made on the rubber mat at M, all parts of the master pattern running one way, and is then traced on the mat 41. The mat 41 has been placed in position as shown in Fig. 5, with the reinforced edges 42 resting on the series of lower members 44 of clamps 35.

With the mat 41 taut and the master pattern design traced thereon, the apparatus is now in condition for obtaining all the other patterns.

To this end, it is merely necessary now to first operate hand wheel 23 the proper direction to drive worm screws 13 through bevel gears 20 and 21 for moving bar 8 to the right. As bar 8 moves to the right, it will stretch the rubber mat 41 secured through clamps 35 and will carry sliding units 24 slidably along bars 9 and 11 to the right.

As the rubber mat stretches, all points on the mat will be stretched, the clamps 35 merely becoming spaced from each other by the stretching action of their common carrier strip 31. This permits all points on the pattern to be stretched in a horizontal direction a corresponding amount. It will be obvious that the horizontal displacement of every point of the pattern irrespective of the complexity of curvatures of the pattern will be stretched and that the width of the pattern can thus be homogeneously increased in any desired amount, as for example to the dotted portion *d* shown.

These new pattern shapes may then be traced on paper through carbons placed between the rubber mat and a paper blank as will be described in the following.

Similarly for changing the length of the pattern, the hand wheel 22 is rotated in a direction for driving worm screws 12 through bevel gears 18 and 19 to move bar 9 downwardly. In this case, slide bars 24 sliding over rods 8 and 10 will stretch the rubber mat lengthwise. As before, every point on the pattern will be moved and the overall lengthwise dimension homogeneously increased as illustrated in the second dotted line *d'* (Fig. 1).

A convenient scale 45 at one side of the device with a corresponding pointing arm 46 has been provided for laterally indicating positions and a similar scale 47 with a corresponding pointing arm 48 will indicate the longitudinally increased position.

Referring to Figs. 2 and 3, rolls of paper 50 and 51 of different widths are mounted on the rear uprights of the main frame S, paper is conducted under the mat 41 and the top of table 3. A roll of carbon sheet 52 is also mounted above the paper and introduced between the paper 50 and the mat 41. A shaft 53 that extends the length from in front of the device is provided with an operating handle 54 at one end and ending at the rear of the device operates the carbon sheet, unrolling it through a pair of worms 55 and worm gears 56 and rolling it up on a corresponding roller 57 at the front of the machine, thus holding the carbon sheet in a straight and even tension, although it will be understood that any other means for accomplishing this may be employed.

In practice, in grading different sizes and dimensions certain dimensions are taken from the breast line L as illustrated on the outlined figure on the mat. When the new dimensions are taken from the master, it is often necessary to increase the dimensions in one direction say downwardly from the breast line while either increasing the dimensions in the opposite direction (downwardly) or even decreasing the dimension. In accordance with my invention, a marker M as illustrated in Fig. 7 is provided and located in line with the above mentioned breast line as shown in Fig. 1. The stud 58 is securely held by a thumb screw 59 against the hub 60 of the bracket 61, which is mounted on one of the clamps 35.

When it is desired to increase the length of the lower portion of the pattern only, that is, from the breast line down, the mat is extended bringing the breast line to dimensions desired. A mark is made by the marker M on the paper. Then after the entire lower part of the figure P has been transferred on to the paper by a tracing wheel or the like as shown in Fig. 5, the extended mat 41 is brought back to its original position or to any other dimension that may be desired. The paper may be brought back until the mark made previously coincides with the breast line L and the mat 41 and the pattern in the rest of the upper portion of the figure P is traced.

In order to guide the paper in a straight line and have it in a rigid position while the pattern is being traced off, and also to hold the pattern paper in fixed position while raising the entire device by means of the arms (73 and 74 of Figure 3) from the top of the table in order to make the necessary stretching or other adjustments, a guide 62 (Fig. 6) having an upright leg 63 is secured with tier screws to the main table. The screws are entered through horizontal slots 64 and 65 located at each end of the guide 62. These slots allow the lateral adjustment for different widths of paper at the center approximately of the guide 62. A clamp 66 is pivoted at the upright leg 63 of the guide 62 and is actuated by a compression spring 67 on its extended arm 68 of the clamp 66. Normally a catch 69 secured to the upright leg 63 holds the extended arm 68 in the dotted position shown. When 69 is sprung back, the arm 68 of the clamp 66 is released, and then the action of spring 67 engages and clamps the paper in position as shown.

Referring to Fig. 3, it will be noted that provision has been made to raise the entire grading device from its table, thus releasing the paper from the pressure of the device acted upon it, and allowing the operator to remove the paper on which the figure has been transferred.

To accomplish this, a worm 69 mounted on brackets 70 engages with a sector gear 71 which is mounted on shaft 72, with a pair of arms 73 on each side of the main frame at the front. At the rear of the frame another pair of arms 74 are mounted on a shaft 75'. At their upper ends, arms 73 and 74 are pivotally connected to the sides 4 and 5 of the frame F.

Thus in turning the worm 69 through the wheel 75, the sector 71 with arms 73 will rotate in the direction indicated by arrows, raising the frame F with its mat and entire mechanism to the position indicated in dotted lines. The carbon rolls being attached to frame F will rise with it. Thereafter arm 73 may be operated so that the mat 41 is brought against the top of the table and locked against rising.

In Fig. 9, a modified form of holding the breast line of the mat in any position desired is shown.

On the sides 4 and 5 of the frame F dove-tail slides 76 are mounted, with thumb screws 77 for locking the slides when necessary.

A stud 78 projects upwardly therefrom adapted to receive bracket 79 which can also be clamped securely in any position desired on the stud 78, by tightening thumb screw 80. Bracket 79 carries a square rod 81, which is thus supported on the sides 4 and 5 of the frame F.

As can be noted the square bar 81 carries sliding members 82 and 83, which can be secured in position when desired by clamping thumb screws 84 and 85. Adjustable blades 86 and 87 are respectively mounted at the lower extensions 88 and 89 projecting downwardly from above-mentioned sliding members 82 and 83. The blades 86 and 87 are provided with an uneven and serrated and rough-like edge 90 at its bottom, to provide a firm grasping on the rubber mat 41 when applied for the purpose here described.

The elongated slot 91 shown at the front blade 86 is to provide for an adjustment when it is desired to increase or decrease the width of the clamping unit. Screw 92 locks the two blades after adjustment has been made.

Before operating the gears the thumb screws on the clamps that are in line with blades 86 and 87 must be secured to bars 8 and 10 to prevent the rubber mat from tearing or distorting the outlines previously made.

When using the device of Fig. 9 to hold the breast line straight on the mat, the arrangements of the units of the lazy-tongs in Fig. 12 cannot be used.

In measuring from the breast line, one direction may be held from moving while the other portion is stretched by lowering brackets 79 on stud 78, thus carrying rod 81 down until the edges 86 and 87 firmly engage the rubber mat along the breast line. Thereafter the rubber mat is stretched as described above.

In this manner, the marking of the paper for locating the breast line and the inconvenience of moving the paper for that purpose has been overcome by this arrangement of clamping the mat 41.

In Figure 10 I have shown a preferred modified form of the mat clamping device. The rectangular body 93 of a convenient width is approximately of the same general dimensions as the clamp 35 previously described, but in place of the screw a toggle unit 94 for clamping of the mat and releasing same is used. A jaw like form with corrugations on the locking link 95 and corresponding indentations on the clamp body 93 is used to secure a positive grip on the mat. A rectangular slot 96 in the body of the clamp is machined out to permit the entry of guide bars as previously described.

It will be understood that the locations of these rectangular slots are lower in the clamps mounted on bars 9 and 11 and are slightly higher in those clamps which are mounted on bars 8 and 10, in order to bring the entire unit of the mat clamps in an even line on top and bottom of said clamp.

The rubber mat used in combination with clamp 93 of Fig. 10 is illustrated fragmentarily in Fig. 15. A reinforcing edge 97 is molded of the same piece or otherwise attached to the body 98, of the mat, and as shown in Fig. 10 the clamping is made on the reinforced edge.

Another form of joining all the clamps on the guide bars 8, 9, 10 and 11, and carrying them in a relative sliding unison while stretching the rubber mat can be obtained as I have illustrated in Figs. 12, 13, and 14.

In Fig. 12, a unit of lazy-tongs 99 is secured to the center of the clamps 35, or to the modified clamp 93, and at each end it is pivotally connected to the sliding units 24. The operation of same is self-evident.

In Fig. 13, I have shown a coiled spring 100 which is clearly shown to take the place of rubber strip 31 as in my first embodiment described above or the second modified form of the lazy-tongs in Fig. 12.

Each clamp 35 is secured to the coil spring 100 at its proper location by a screw 101 having a threaded portion 102, which is screwed in a tapped hole of the clamp 35, and having a sound hole in its head to permit entrance of the coil spring 100. The admittance of the said coiled spring could be easily attained by turning the spring in the direction required and passing said spring from one clamp into the other clamp, thus anchoring both ends of the coil spring to the sliding units 24 as shown at 103.

In Fig. 18, I have shown a modified construction of the cross bars 8 and 9 of Fig. 1 in which, instead of maintaining these bars parallel with their corresponding bars 10 and 11, these bars may be turned at any angle with their corresponding bars so as to enable stretching of varying degrees at different positions along the mat.

As illustrated the internally threaded member 106 has extending therefrom a lug 107 carrying a pin 108. The cross bar 109 equivalent to rod 9 is pivotally mounted at one end on pin 108 and at the other end on an equivalent pin. The sliding unit 111 through which bars 109 and 112 pass differs from the sliding unit shown in Fig. 1, merely by the curved edges 114 as shown in Fig. 19 which enable rotation of the bars 109 and 112 to any desired angle with respect to each other.

In Fig. 20, I have shown a modified form of clamp in which link 115 of a toggle is pivoted as at 116 to the body of the clamp. The other end of the link 115 is pivoted at 117 which also pivotally carries handle 118. Handle 118 is pivoted at its opposite end to pin 120 which carries the serrated tooth member 121. The serrations of member 121 are in operative relation with the serrations 122 on the main member. In the position shown, these teeth engage and grip the reenforced edge of the rubber mat. For releasing the rubber mat it is merely necessary to operate handle 118 to the dotted position. The toggle operation will throw the member 121 in its upright vertical position shown permitting the edge of the rubber mat (Fig. 15) to be placed freely in its position.

In Fig. 21, I have shown a modified construction in which a simple toggle joint 123 and 124 is provided. Here the lower serrations 125 on the main member are shown cammed upwardly so as to prevent the link 123 of the toggle from accidentally slipping loose. If desired no reinforcements on the edge of the rubber mat are necessary when using the clamps of Figures 21 and 22.

In Fig. 22, the toggle construction is replaced by a spring operated arm 126 which is normally forced downwardly by the compression spring 127 between the jaw 128 and projection 129. To release the rubber mat gripped between the teeth at jaw 127, the handle 130 is operated to raise member 126 against the action of the spring 127.

In Fig. 23, I have shown the bottom view of

corner slide bar showing the central aperture 131 for receiving one of the cross bars. This construction is employed in connection with the rubber mat whose edges are turned up. For receiving the turned up edge, a corner 132 of the corner slide member is cut away to permit the turned up edge of the mat to be inserted as shown in Fig. 24. A screw 133 is then screwed down as shown, clamping the mat in place.

As already explained, after the new gauge of the pattern is obtained, this pattern is traced with a tracing wheel as illustrated in Fig. 1 and the design appears through the carbon paper on the record sheet below it. It will be obvious that other methods for reproducing the new pattern design may be employed.

One such method is shown in Fig. 25 in which light sensitized paper is used. When the new pattern is obtained in the manner described above, a beam of light is impinged on the mat and the new line is photographically printed on the light sensitive paper.

In Fig. 25, a suction method is applied to eliminate the air confined between paper and rubber mat 41. For this purpose perforated paper 134 is used. The top 135 of the main stand is grooved in both directions as illustrated at 136 and 137 in Figs. 25 and 26 and has holes 138 drilled through the top to permit the exhaust of the air. The pan member 139 mounted at the end of a pipe connection 140 which is extended from a suction pump (not shown) is tightly secured to the bottom of the frame top.

In Fig. 16, a finer adjustment is provided for tightening or raising the entire mechanism of the breast line holder as illustrated in Fig. 9. A special yoke 141 slides on the threaded portion 142, holding within its jaws 143 and 144 a knurled nut 145 that, when turned, will raise or lower the clamping means. This arrangement is used, of course, on both sides of the device.

Although I have shown my invention as specifically applied to grading pattern designs, it will be obvious that my invention may be employed for stretching members where desired and maintaining the members continually in taut condition.

Moreover, although for purposes of illustration, I have shown specific apparatus therefor, it will be obvious that this apparatus and especially the specific parts thereof may undergo changes without departing from the spirit of the invention and I accordingly do not wish to be limited thereby, except as set forth in the appended claims.

I claim:

1. The method of grading patterns from a master pattern which comprises recording the master pattern on an elastic mat, independently changing the distance between all corresponding points along one direction on the recorded pattern by a predetermined ratio, by correspondingly changing the distance between the opposite sides of the elastic mat extending transverse of the direction, and independently changing the distance between all corresponding points on the recorded pattern along a second direction, transverse to the first direction, by a second predetermined ratio by correspondingly changing the distance between the sides of the elastic mat extending transverse of the second direction, and recording the resultant pattern.

2. The method of grading patterns from a master pattern which comprises recording the master pattern on a stretched elastic mat, independently changing the distance between all corresponding points along one direction on the recorded pattern simultaneously by a predetermined ratio by correspondingly changing the distance between the opposite sides of the elastic mat extending transversely of the direction, and independently changing the distance between all corresponding points simultaneously on the recorded pattern along a second direction transverse to the first direction, by a second predetermined ratio by correspondingly changing the distance between the sides of the elastic mat extending transverse of the second direction, and recording the resultant pattern.

3. The method of grading patterns from a master pattern which comprises recording the master pattern on an elastic mat, independently changing the distance between all corresponding points along one direction on the recorded pattern simultaneously by a predetermined ratio, by correspondingly changing the distance between the opposite sides of the elastic mat extending transverse of the direction while maintaining constant the distance between all corresponding points on the pattern along a direction transverse to the first direction, and independently changing the distance between all corresponding points simultaneously on the recorded pattern along the transverse direction by a second predetermined ratio by correspondingly changing the distance between the sides of the elastic mat extending transverse of the second direction, and tracing the resultant pattern on a sheet supported beneath the elastic mat.

4. The method of grading patterns from a master pattern which comprises recording the master pattern on a stretched elastic plane surface, independently changing the distance between all corresponding points along the length of the recorded pattern, simultaneously by the ratio of the required pattern length into the recorded pattern length by correspondingly changing the distance between the opposite sides of the elastic plane surface extending perpendicular to the length, and independently changing the distance between all corresponding points simultaneously on the recorded pattern along the width of the recorded pattern by the ratio of the required pattern width into the recorded pattern width by correspondingly changing the distance between the sides of the elastic plane surface extending perpendicular to the width, and recording the resultant pattern.

5. The method of grading patterns from a master pattern which comprises recording the master pattern on a stretched rectangular elastic plane surface, independently changing the distance between all corresponding points along the length of the recorded pattern by the ratio of the required pattern length into the recorded pattern length by correspondingly changing the distance between the opposite sides of the elastic plane surface extending perpendicular to the length while maintaining constant the distance between all corresponding points along the width of the pattern, and independently changing the distance between all corresponding points on the recorded pattern along the width of the recorded pattern by the ratio of the required pattern width into the recorded pattern width by correspondingly changing the distance between the sides of the elastic plane surface extending perpendicular to the width, and photographically recording the resultant pattern.

6. The method of grading patterns from a

master pattern which comprises stretching a rectangular elastic mat in a plane, recording the master pattern on the elastic mat with a reference line of the pattern arranged parallel to one side of the elastic mat, changing the distance between the sides of the mat perpendicular to the reference line by the ration of the required pattern width into the recorded pattern width for changing the distance between all corresponding points of the pattern along the direction parallel to the reference line a proportional amount, independently changing the distances between the sides of the mat parallel to the reference line corresponding to the length of the required pattern perpendicular to the reference line with respect to the similar length of the recorded pattern, whereby a resultant pattern is constructed on the mat having predetermined dimensional changes with respect to the master pattern and having contour lines geometrically corresponding with the master pattern contour, and recording the resultant pattern.

7. The method of grading patterns from a master pattern which comprises stretching an elastic mat in a plane by uniformly gripping the mat along the sides thereof, recording the master pattern on the elastic mat with the reference line of the pattern arranged parallel to one side of the elastic mat, changing the distance between the sides of the mat perpendicular to the reference line by the ratio of the required pattern width parallel to the reference line into the similar recorded pattern width for changing the distance between all corresponding points of the pattern along the direction parallel to the reference line a proportional amount while maintaining constant the distance between all corresponding points of the pattern in a direction perpendicular to the reference line, independently changing the distances between the sides of the mat parallel to the reference line corresponding to the length of the required pattern perpendicular to the reference line with respect to the similar length of the recorded pattern while maintaining constant the distance between all corresponding points of the pattern along its width whereby a resultant pattern is constructed on the mat having predetermined dimensional changes with respect to the master pattern and having contour lines geometrically corresponding with the master pattern contour and tracing the resultant pattern.

8. The method of grading patterns from a master pattern which comprises stretching an elastic mat in a plane by uniformly gripping the mat along the sides thereof, recording the master pattern on the elastic mat with the reference line of the pattern arranged parallel to one side of the elastic mat, changing the distance between the sides of the mat perpendicular to the reference line by the ratio of the required pattern width parallel to the reference line into the similar recorded pattern width for changing the distance between all corresponding points of the pattern along the direction parallel to the reference line a proportional amount, clamping the elastic mat along the reference line of the pattern to prevent movement of the reference line, independently changing the distances between the sides of the mat parallel to the reference line and the reference line by predetermined amounts corresponding to the length of the required pattern perpendicular to the reference line with respect to the similar length of the recorded pattern, whereby a resultant pattern is constructed on the mat having predetermined dimensional changes with respect to the master pattern and having contour lines geometrically corresponding with the master pattern contour, and recording the resultant pattern on a sheet supported beneath the elastic mat.

9. The method of grading patterns from a master pattern which comprises stretching an elastic mat in a plane by uniformly gripping the mat along the sides thereof, recording the master pattern on the elastic mat with the breast line of the pattern arranged parallel to one side of the elastic mat, changing the distance between the sides of the mat perpendicular to the breast line by the ratio of the required pattern width into the recorded pattern width for changing the distance between all corresponding points of the pattern along the direction parallel to the breast line a proportional amount while maintaining constant the distance between all corresponding points of the pattern in a direction perpendicular to the breast line, clamping the elastic mat along the breast line of the pattern to prevent movement of the breast line, independently changing the distances between the sides of the mat parallel to the breast line and the breast line by predetermined amounts corresponding to the length of the required pattern with respect to the length of the recorded pattern while maintaining constant the distance between all corresponding points of the pattern along its width whereby a resultant pattern is constructed on the mat having predetermined dimensional changes with respect to the master pattern and having contour lines corresponding geometrically with the master pattern contour, and tracing the resultant pattern on a sheet supported beneath the elastic mat.

10. The method of grading patterns from a master pattern which comprises stretching a rectangular elastic mat in a plane by uniformly gripping the mat along the sides thereof, recording the master pattern on the elastic mat with the breast line of the pattern arranged parallel to one side of the elastic mat, changing the distance between the sides of the mat perpendicular to the breast line by the ratio of the required pattern width into the recorded pattern width for changing the distance between all corresponding points of the pattern along the direction parallel to the breast line a proportional amount while maintaining constant the distance between all corresponding points of the pattern in a direction perpendicular to the breast line, clamping the elastic mat along the breast line of the pattern to prevent movement of the breast line, independently changing the distances between the sides of the mat parallel to the breast line and the breast line by predetermined amounts corresponding to the length of the required pattern with respect to the length of the recorded pattern while maintaining constant the distance between all corresponding points of the pattern along its width whereby a resultant pattern is constructed on the mat having predetermined dimensional changes with respect to the master pattern and having contour lines corresponding geometrically with the master pattern contour, and photographically recording the resultant pattern through the elastic mat.

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