# United States Patent

**Chung et al.**

[15] **3,656,177**

[45] **Apr. 11, 1972**


[54] **METHOD AND APPARATUS FOR FORMULATING FABRIC PATTERNS**


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[73] Assignee: **Proctor & Schwartz, Inc.,** Philadelphia, Pa.



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[21] Appl. No.: **20,853**

[52] **U.S. Cl.** ..........**444/1,** 28/4, 28/72.2

[51] **Int. Cl.** ..........**G06f 15/06,** G06f 15/20

[58] **Field of Search** ..........28/4, 72.2; 235/150; 340/172.5

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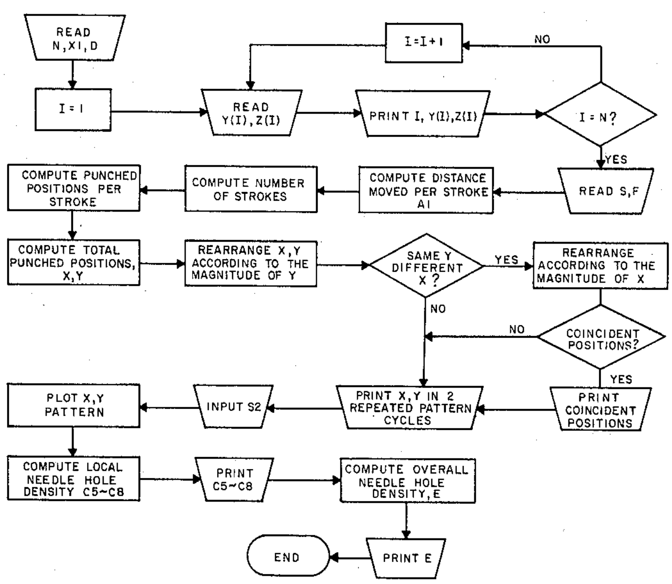
[57] **ABSTRACT**

The application of computer technology to the needle punching of fabric wherein the input data of needle density, needle positions, strokes per minute, and fabric feed rate give rise to the plotting of a pattern of needle punches which can be reviewed for desirability. Coextensive webs of fabric of the same color or of different colors may then be fed into a needle punching machine under input data found desirable with needle penetration of the webs forcing the fibers into the desired pattern including an evenly punched pattern for single color fabric or for surface finishing and a special, designed pattern for multi-color fabric.


**10 Claims, 2 Drawing Figures**



PATENTED APR 11 1972 3,656,177

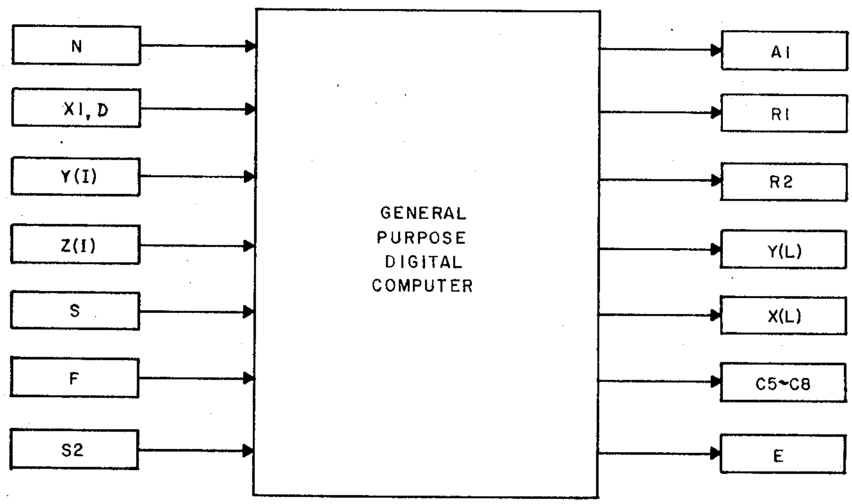



FIG. I

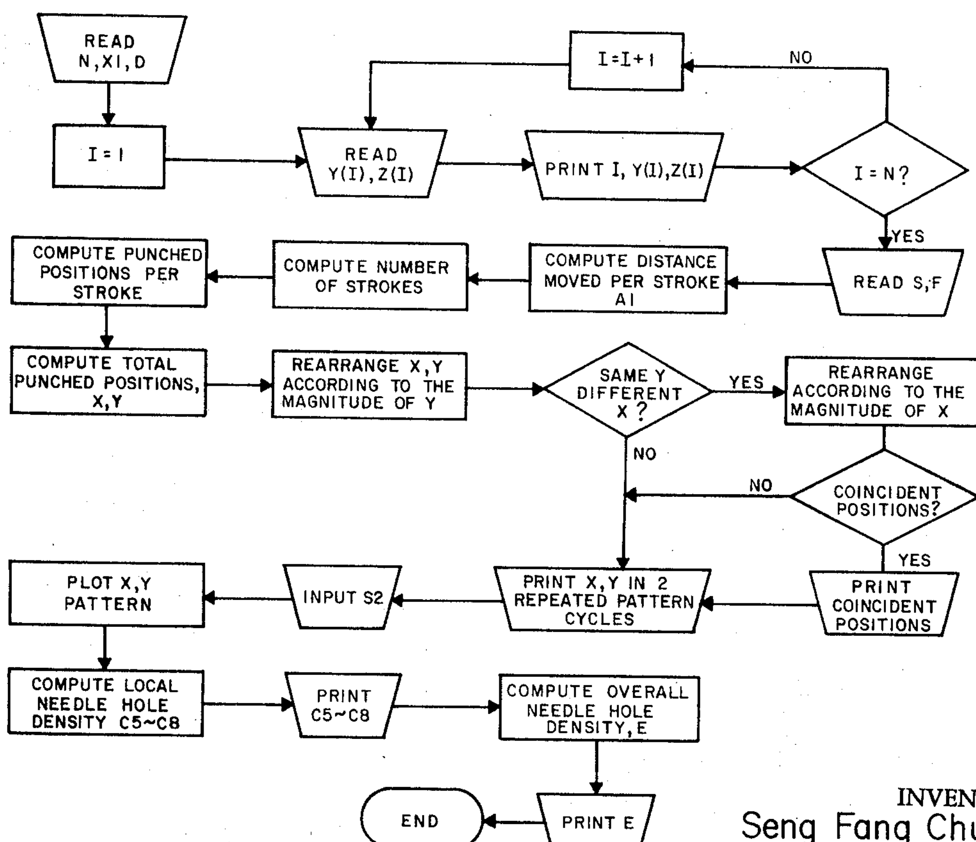



FIG. 2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# METHOD AND APPARATUS FOR FORMULATING FABRIC PATTERNS

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the application of computer technology to fabric pattern forming and, more particularly, to fabric pattern forming by subsequent use of a needle loom.

2. Description of the Prior Art

The prior art in the field of fabric pattern forming has been limited by the concept of conventional needle boards of 64, 77, 109 and 122 needle density. Preblending of fibers before needle punching, surface printing of the fabric after needle punching such as die cutting and silk screening, and feeding single or coextensive webs of the same or different colors into a needle loom have been the accepted pattern forming techniques. The preblending of fibers has permitted complete fiber penetration throughout the thickness of the fabric after needle punching but has failed to provide desired choice of fabric patterns. Surface printing of fabric after needle punching has permitted the obtaining of desired fabric patterns but has failed to provide fiber penetration of the fabric thickness. Thus, in the latter instance, with insufficient penetration of color into the fabric, wear of the fabric eventually destroyed the pattern and exposed undesirably colored, underlying fibers. The feeding of single or coextensive webs of the same or different colors into a needle loom has permitted pattern formulation of limited scope since trial and error runs have been quite expensive on actual product and the number of input variables has been limited by the use of convention boards and the difficulties in redesigning boards without simplified procedures.

The application of computer technology to the needle punching field of fabric pattern formulation is unknown and, as disclosed hereinafter, solves the inherent problems of the prior art as set forth above.

## SUMMARY OF THE INVENTION

This invention is directed toward the use of a digital computer with input data of board needle density, needle positions in X and Y coordinates, strokes of the needle punching machine per minute (or, as otherwise stated in industry, revolutions per minute), and feed rate of the fabric into the needle loom. To obtain a desired fabric pattern the computer is programmed to print out a plot of holes punched under a set of input data, and the plot is read as a simulation of the pattern which would be formed if the fabric were run through the needle loom. The input data in whole or in part may be varied on a trial and error basis until a plot simulating the desired pattern is viewed. Fabric with the desired pattern formation may be obtained from the infeed of a plurality of webs coextensive with each other as desired and of varied color under a conventional needle punching process but utilizing the input data giving rise to a simulation of the desired pattern.

It is therefore an object of the present invention to open the field of fabric pattern forming to a large choice of patterns.

This and other objects, features and advantages of the present invention will become more apparent when reading the following description and claims.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a block diagram of a general purpose digital computer with its inputs and outputs in accordance with the present invention; and

FIG. 2 is a flow diagram of the method proposed to be carried out on the computer.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

The use of a "general purpose digital computer" (as shown and described in U.S. Pat. No. 3,400,371, granted Sept. 3, 1968 to Amdahl et al. for Data Processing system, which patent is incorporated herein by reference) programmed as hereinafter described gives rise to apparatus hereinafter referred to as a "special purpose digital computer". Also, as used herein the phrase "needle punching machine" is interchangeable with the phrase "needle loom" with conventional needle punching as the primary function.

Conventional needle boards which are fastened to the eccentric arm of a needle punching machine have needle densities in the order of magnitude of 64, 77, 109 and 122 needles per inch. The measure of such density is the number of needles along the width of the board for each inch of length of the board, the width being that dimension of the board along the Y axis and the direction of fabric movement. Conventional boards of any of these needle densities have readily determinable X and Y coordinates for each needle position appearing on the board. Thus, with known needle density, needle positions, the number of strokes per minute (or rpm) of the eccentric arm of the needle loom and the feed rate in feet per minute of the fabric as it is to be fed through the needle loom, not only may the punched hole density of the resultant fabric be determined but also the advancing increment in the fabric moving direction for each subsequent needle punch may be determined. Thus, changes in any of the needle density, needle positions, strokes per minute and/or feed rate gives rise to a different fabric pattern formulation because of the resultant variance in either or both of the X and Y coordinate advancing increments. Although the X and/or Y coordinate increments are intended to remain constant for any plot printout, the scope of this invention includes a possible determinate variance within a single plot printout. Thus, if the needles were positioned in slots in the needle board, possibly of a circular configuration, the needles could be programmed for movements within the slot in reaction to stroke numbers to give rise to an X and/or Y coordinate increment variance within a single plot printout. Also, needle presence may be governed by programmed control to change needle density, and of course, feed rate and strokes per minute may also be modified within a single plot printout to give rise to an X and/or Y coordinate increment variance. The disclosure hereinafter, however, is directed toward fabric pattern formulation with conventional needle boards (constant needle density and positions) and constant feed rate and strokes per minute for a single plot printout in order to facilitate an understanding of the convepts involved.

With out special purpose digital computer, we initially feed in and print out the input data, as shown in FIG. 1, and more fully explained hereinafter, of needle density (needles/inch), needle X,Y coordinate positions, intended strokes per minute and intended fabric feed rate (feet/minute). The computer then as seen in FIG. 2 calculates (1) the distance of fabric moved per stroke according to

intended fabric feed rate/intended strokes per minute;

2) the resultant overall needle hole density in holes per square inch according to

$$\frac{\text{needle density}}{\text{(1) above} \times 12}\text{; and}$$

(3) how many strokes are required before obtaining (2) above according to

$$\frac{\text{width of needle board in inches}}{\text{(1) above} \times 12}$$

The latter calculation is required in order for the computer to begin recording the requisite data for a punched hole plot because the initial few strokes do not punch out the intended hole density. The computer then calculates and prints out the X and Y coordinates of the punched hole positions of each stroke based on the original X and Y coordinate data and the advancing increments thereto as determined by the fabric distance moved per stroke and examines whether there are coincident punched hole positions or not. In a normal needle punching operation, the feed orientation is such that only the Y coordinate will have an increment. Coincidence of holes is undesirable because of the resultant improper fiber concentrations and, therefore, is best eliminated where a clear pattern is desired. The examination of coincident positions is accomplished by determining whether any Y coordinates of hole positions are the same and if so whether the X coordinates of those positions are the same; of course, if both X and Y coordinates of punched hole positions are the same, then the holes are coincident. A printout of the number of coincident holes and their X and Y coordinates follows.

In order to obtain an enlarged approximate (because of the typewriter terminal printout spacing) plot of the punched hole positions for viewing of the simulated pattern, the computer (because the printout by the computer is keyed to the Y coordinate positioning of the punched hole positions) must rearrange the punched hole positions in the order of magnitude of the Y coordinates. For those holes having the same Y coordinates, rearrangement is according to the order of magnitude of the X coordinates. With the punched hole positions arranged in magnitude of Y coordinates, the computer may print out the rearrangement of punched hole positions and plot the punched hole positions on the enlarged scale (approximately 10 times actual scale). Thus, one may view the plot printout of punched hole positions to determine improper pattern formulation such as bunched hole positions et cetera in addition to the printout by the computer of the coincident punched hole positions which cannot be seen in the plot printout. Also, since the resultant impact force in operation of a needle loom is directly proportional to the needle density, it is preferable to have a plot printout to assist in determining unnecessary needles for a desired pattern to thereby reduce the needle density. Of course, needles may be removed merely to improve an undesirable printout.

Local needle density may be obtained by having the computer count the number of punched holes per designated area.

As is readily apparent, a change in any of the input data will change the pattern of hole positions on the plot printout. For example, an increase in the feed rate keeping each of the other input data constant gives rise to a lesser hole density whereas an increase in strokes per minute keeping the other input data constant increases the hole density.

If the plot printout of punched hole positions proves undesirable, the previously mentioned steps may be repeated with a change in at least one of the input data, as, for example, a change in the feed rate and/or strokes per minute to obtain the desired pattern formulation. Once the desired pattern formulation is obtained through trial and error, the input data resulting in such desired formulation is utilized on a needle loom.

By way of example, and referring to FIGS. 1 and 2, the following computer program is offered:

Language of the Program: BASIC

| Input Variable: Symbol | Variable | Unit |
|---|---|---|
| N | Total no. of needles in 1 column (Y axis) | |
| X1 | Distance between the needles in X axis on board | in. |
| D | needle density | needles/in. |
| Y(I) | needle position in Y axis of the Ith needle | in. |
| Z(I) | needle position in X axis of the Ith needle | in. |
| S | strokes/min. or RPM | strokes/min. |
| F | material feed rate | ft./min. |
| S2 | number of pattern cycles to be plotted | |

| Output Variable: Symbol | Variable | Unit |
|---|---|---|
| A1 | distance moved | in./stroke |
| R1 | least number of strokes for material passing through the board. | |
| R2 | No. of coincided positions | |
| Y | punched hole position in Y axis | |
| X | punched hole position in X axis | in. |
| C5 to C8 | local hole densities | holes/in.[2] |
| E | overall needle hole density | holes/in.[2] |

```
100 PRINT "SIMULATION OF NEEDLE PUNCHING
  MACHINE FOR A GIVEN NEEDLE BOARD"
110 DIM X(200), Y(200),P(65,95),Z(65)
115 READ N,X1,D
120 PRINT
125 PRINT "NEEDLE DENSITY="D"NEEDLES/IN."
130 PRINT "NEEDLE POSITIONS:"
140 PRINT USING 145
145: NO.          Y(IN.)          X(IN.)
160 FOR I=1 TO N
170 READ Y(I),Z(I)
180 PRINT USING 190, I,Y(I),Z(I)
190: ###        ##.###        .###
200 NEXT I
210 READ S,F
215 W=Y(N)
220 A1=F*12/S
230 R1=INT(W/A1+.99)+1
240 L1=W+2*A1
250 M=INT(L1/A1+.99)+1
260 T2=(M-1)*A1
270 PRINT
272 IF O1=2 THEN 340
280 PRINT "GIVEN: STROKES/MIN. ="S, "FEED
  RATE, FT/MIN. ="F
290 PRINT "       LENGTH IN Y DIRECTION ="W"
  IN."
300 PRINT "       DISTANCE BETWEEN HOLES IN X
  DIRECTION ="X1"IN."
310 PRINT "DISTANCE MOVED, IN./STROKE ="A1
320 PRINT "LEAST NUMBER OF STROKES FOR
  MATERIAL PASSING
THROUGH "
330 PRINT W"IN. LONG OF PUNCH BOARD ="R1
340 PRINT
341 FOR I=1 TO N
342 IF Z .5-X1 THEN 346
343 V9=V9+1
344 Z(N+V9)=Z(I)+X1
345 Y(N+V9)=Y(I)
346 NEXT I
347 N=N+V9
350 FOR K=1 TO M
360 FOR I=1 TO N
370 IF K=1 THEN 400
380 P(I,K)=P(I,K-1)-A1
390 GOTO 410
400 P(I,K)=Y(I)+(M-1)*A1
410 IF P(I,K)>L1 THEN 470
420 IF P(I,K)<W THEN 470
430 L=L+1
440 G=G+1
450 Y(L)=P(I,K)
460 X(L)=Z(I)
470 NEXT I
480 NEXT K
485 I1=INT(1/X1)
490 X5=1-I1*X1
500 FOR L=1 TO G-1
510 FOR J=L+1 TO G
520 IF Y(L)-Y(J)>.0003 THEN 650
530 IF ABS(Y(L)-Y(J))<=.0003 THEN 610
540 T1=Y(L)
550 T2=X(L)
560 Y(L)=Y(J)
570 X(L)=X(J)
```

```
580 Y(J)=T1
590 X(J)=T2
600 GOTO 650
610 IF X(L)+.0003>=X(J) THEN 650
620 T3=X(L)
630 X(L)=X(J)
640 X(J)=T3
650 NEXT J
660 NEXT L
670 L=1
680 L=L+1-R5
690 R5=0
700 IF ABS(Y(L)-Y(L-1))>.0003 THEN 930
710 IF X(L)<>X(L-1) THEN 930
720 IF R0=1 THEN 760
730 PRINT "COINCIDED POSITIONS:"
740 PRINT "(PRINT OUT THE PORTION OF Y="L1"IN.
  TO"W"IN.)"
750 PRINT " Y(IN.)", "X(IN.)"
760 PRINT USING 770 , Y(L),X(L)
770: ##.###        .###
780 L=L+1
790 IF ABS (Y(L)-Y(L-1))>.003 THEN 850
800 IF X(L)<>X(L-1) THEN 850
810 R5=R5+1
820 PRINT USING 830 , Y(L),X(L)
830: ##.###        .###
840 GOTO 780
850 L=L-1
860 FOR J=L-R5 TO G-1-R5
870 X(J)=X(J+1+R5)
880 Y(J)=Y(J+1+R5)
890 R0=1
900 NEXT J
910 R2=R2+1
920 G=G-1-R5
930 IF L<G THEN 680
940 PRINT "PUNCHED HOLE PATTERN REPEATS AT
  EACH "A1"IN.
IN Y DIRECTION "
950 PRINT "AND "X1"IN. IN X DIRECTION"
960 PRINT "NO. OF COINCIDED POSITIONS IN "A1"
  IN. LONG"X1"IN.
WIDE="R2/2.
970 PRINT
980 PRINT "PUNCHED POSITIONS:"
990 PRINT "(PRINT OUT THE PORTION OF Y="W+
  A1*2'in. TO"W"IN.)"
1000 PRINT "Y(IN.)", "X(IN.)"
1010 FOR L=1 TO G
1020 IF Y(L)>W+2*A1 THEN 1050
1030 PRINT USING 1040, Y(L),X(L)
1040: ##.###        .###
1050 IF X(L)<=X5 THEN 1080
1060 R3=R3+I1
1070 GOTO 1090
1080 R3=R3+I1
1090 NEXT L
1095 PRINT
1096 S2=0
1100 PRINT"DO YOU WANT 1 OR 2 CYCLES";
1110 INPUT S2
1150 FOR Q=1 TO 5
1160 PRINT
1170 NEXT Q
1180 PRINT USING 1510
1190 PRINT USING 1490
1200 DIM F(100)
1210 F9=1
1220 F6=.01666
1230 F8=0
1240 K=0
1250 F7=Y(1)
1260 FOR Q=1 TO 200
1290 IF Y(Q)>=F7 THEN 1430
1300 PRINT F7,
1310 FOR I=1 TO F9
1320 IF F(I)=0 THEN 1360
1330 PRINT '+    ;
1340 F(I)=0
1350 GOTO 1370
1360 PRINT '    ;
1370 NEXT I
1380 PRINT
1400 F9=1
1410 F7=F7-F6
1415 IF F7<Y(1)-S2*A1 THEN 1480
1420 IF Y(Q)<F7 THEN 1300
1430 F8=X(Q) *100+1.5
1440 F(F8)=1
1450 IF F9>F8 THEN 1470
1460 F9=F8
1470 NEXT Q
1480 PRINT USING 1490
1490: ↑ .... ↑ .... ↑ .... ↑ .... ↑ .... ↑ .... ↑ .... ↑ .... ↑ .... ↑ .... ↑
1500 PRINT USING 1510
1510:              0     5     10     15     20     25
  30     35     40     45     50
1520 PRINT
1530 PRINT USING 1540
1540:          Y(IN)                     X(IN X .01)
1550 FOR Q=1 TO 5
1560 PRINT
1570 NEXT Q
1610 PRINT
1620 R4=R3/(2*A1)
1630 W1=W+A1/4
1640 W2=W+A1/2
1650 W3=W+3*A1/4
1660 W4=W+A1
1670 FOR L=1 TO G
1680 IF Y(L)>W4 THEN 1930
1690 IF Y(L)+.003>=W3 THEN 1740
1700 IF Y(L)+.003>=W2 THEN 1790
1710 IF Y(L)+.003>=W1 THEN 1840
1720 IF Y(L)+.003>=W THEN 1890
1740 C1=C1+1
1750 GOTO 1930
1790 D1=D1+1
1800 GOTO 1930
1840 C2=C2+1
1870 GOTO 1930
1890 C3=C3+1
1900 GOTO 1930
1930 NEXT L
1940 C5=(C1*2)/(W4-W3)
1950 C6=(D1*2)/(W3-W2)
1960 C7=(C2*2)/(W2-W1)
1970 C8=(C3*2)/(W1-W)
1990 PRINT
2020 PRINT
2030 IF R4<50 THEN 2090
2040 PRINT "DENSITY:"W3"TO"W4IN.="C5"
  HOLES/SQ.IN."
2050 PRINT "DENSITY:"W2TO"W3"IN. ="C6"-
  HOLES/SQ.IN."
206 PRINT "DENSITY:"W1"TO"W2"IN. ="C738
  HOLES/SQ.IN."
2070 PRINT "DENSITY:"W"TO"W1"IN. ="C8"
  HOLES/SQ.IN."
2080 GOTO 2120
2090 PRINT "DENSITY:"W2"TO"W4"IN. ="(C5+
  C6)/2"HOLES/SQ.IN."
2100 PRINT "DENSITY:"W"TO"W2"IN. ="(C7+
  C8)/2"HOLES/SQ.IN."
2120 E=D/A1
2130 PRINT "NEEDLE HOLE DENSITY:"E"HOLES/SQ.
  IN."
2140 PRINT "END"
2150 PRINT
```

9999 END

The above program presupposes constant input data during any one operation of a needle loom. The possibility does exist, as state previously, that in order to obtain a desired pattern formulation the needle loom itself may be automatically controlled for variable feed input data such as feed rate or strokes per minute during a single operation.

One desired input data is obtained, the fabric pattern may be formed in numerous ways. One of the principle ways of obtaining a pattern under desired input data is to utilize a pair of webs (or more) each of a different color and coextensive with each other as desired. According to the principles of needle punching, the area of needle penetration gives rise to a blending of the fibers of the webs from the top of one web to the bottom of the other. Thus, if a plurality of webs of different color are utilized, penetration of a needle will give rise to the fibers of one web of one color penetrating through and blending with the fibers of the different colored web. The melds or blends of differently colored fibers in the areas of needle penetration will contrast with the surrounding non-blended areas to thus give rise to the desired pattern.

As previously stated, surface treating of the fibers of a fabric for pattern forming purposes is unacceptable because of the wear result on The pattern. Another principle way of utilizing computer technology in fabric pattern forming is to first surface treat the fabric and then needle punch under desired input data to blend the surface treated and non-surface treated fibers in the needle penetration area through the thickness of the web. In essence, by surface treating a single web, the web thickness provides two differently colored layers similar to two coextensive webs of different color. Also, embossed areas with patterns may be accomplished on fabrics such as carpeting (for lettering or numbering et cetera) by merely placing the desired embossment configuration as a second web coextensive with the primary web at the desired place of embossment.

Thus, a general purpose digital computer has been disclosed as a special purpose digital computer under a defined program to accomplish fabric pattern formulation, the input data of formulation being transferable to a needle loom for actual pattern forming.

Since the preferred embodiment may be modified in numerous ways within the scope of the present invention, as, e.g., by varying needle lengths or removing needles in accordance with a plot printout of the computer to obtain varying depths of penetration of blends of fibers of the fabric being fed into the needle loom or by formulating patterns for concurrent use under double needling principles from above and below the webs et cetera, the preferred embodiment should be viewed as illustrative and not in a limiting sense.

What we claim is:

1. A general purpose digital computer, which is capable of storing input data including needle density, needle coordinate positions, intended needle loom strokes per minute and intended needle loom fabric feed rate, having stored in its memory a set of program instructions for formulating fabric patterns to be formed on a needle loom, the program comprising instructions for calculating the distance of fabric moved per stroke and the coordinates of the punched hole positions of intended, successive strokes of the needle loom, in instructions for storing the coordinates of said punched hole positions, instructions for rearranging the said stored coordinates in the order of magnitude of at least one of said coordinates thereof, and instructions for initiating commands to print out a plot of the punched hole positions according to the said stored coordinates.

2. The apparatus set forth in claim 1 wherein the program further comprises instructions for comparing said stored coordinates to determine coincident punched hole positions.

3. The apparatus set forth in claim 2 wherein the program further comprises instructions for printing out the coordinates of said coincident punched hole positions.

4. The apparatus set forth in claim 1 wherein the program further comprises instructions for rearranging identical ones of said at least one coordinate according to the order of magnitude of another of said coordinates.

5. The apparatus set forth in claim 1 wherein the program further comprises instructions for calculating the number of strokes of the needle loom required before obtaining the intended overall needle hole density and instructions for controlling said storing of the punched hole position coordinates to preclude said storing until said number of strokes has occurred.

6. A method of formulation of fabric pattern designs to be formed by a needle loom employing a general purpose digital computer, comprising the steps of storing in said computer input data including needle density, needle coordinate positions, intended strokes per minute of the needle loom and intended fabric feed rate of the needle loom operating said computer under instructions for, calculating the distance of fabric moved per stroke, instructions for calculating and storing the coordinates of the punched hole positions of intended successive strokes of the needle loom, instructions for rearranging the coordinates of said punched hole positions in accordance with the order of magnitude of at least one of said coordinates thereof, and instructions for printing out a plot of said coordinates.

7. The method set forth in claim 6 further comprising the step of operating the computer under instructions for rearranging identical ones of said at least one coordinate in accordance with the order of magnitude of another of said coordinates.

8. The method set forth in claim 6 further comprising the step of operating the computer under instructions for comparing the stored coordinates of said punched hole positions.

9. The method set forth in claim 8 further comprising the step of operating the computer under instructions for printing out the coordinates of those punched hole positions which are coincident.

10. The method set forth in claim 6 further comprising the steps of operating the computer under instructions for calculating the number of strokes of the needle loom required before obtaining the intended overall needle hole density and instructions for controlling the storing of said punched hole position coordinates to preclude said storing of punched hole position coordinates until said number of needle loom strokes has occurred.

* * * * *

## UNITED STATES PATENT OFFICE
# CERTIFICATE OF CORRECTION

Patent No. 3,656,177 Dated April 11, 1972

Inventor(s) Seng Fang Chung, William L. Kuechler, George J. Steinbronn

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 33: "reaction" should be ...relation... .

Column 2, line 46: "out" should be ...our... .

Column 4, line 46: "342 IF Z.5-X1 THEN 346" should be...
342 IF Z(I)>.51-X1 THEN 346... .

Column 6, lines 20 through 23 should read as follows:

1490: ↑.... ↑.... ↑.... ↑.... ↑.... ↑.... ↑....↑...

.↑.... ↑....↑

1500 PRINT USING 1510

1510: 0 5 10 15 20 25 30 35

40 45 50

Column 6, line 62: "206" should be ... 2060 ... .

Column 6, line 62: "C738" should be ... C7 ... .

Column 7, line 4: "state" should be ...stated... .

Column 7, line 8: "One" should be ...Once... .

Column 8, line 2: "in" should be deleted.



(continued.....)

FORM PO-1050 (10-69)
USCOMM-DC 60376-P69
☆ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334

UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

Patent No. 3,656,177 Dated April 11, 1972

Inventor(s) Seng Fang Chung, William L. Kuechler, George J. Steinbronn

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

(continued...)

Column 8, line 31: a comma should be inserted after "loom".

Column 8, line 32: the comma after "for" should be deleted.

Column 8, line 34: a comma should be inserted after "intended"

Signed and sealed this 12th day of September 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents



FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
☆ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334