No. 864,312. PATENTED AUG. 27, 1907.

C. H. LANDENBERGER.

WARP PRINTING MACHINE.

APPLICATION FILED MAR. 1, 1906.

3 SHEETS—SHEET 1.

Fig. 1.

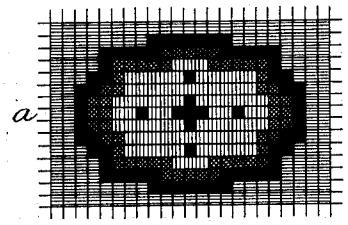
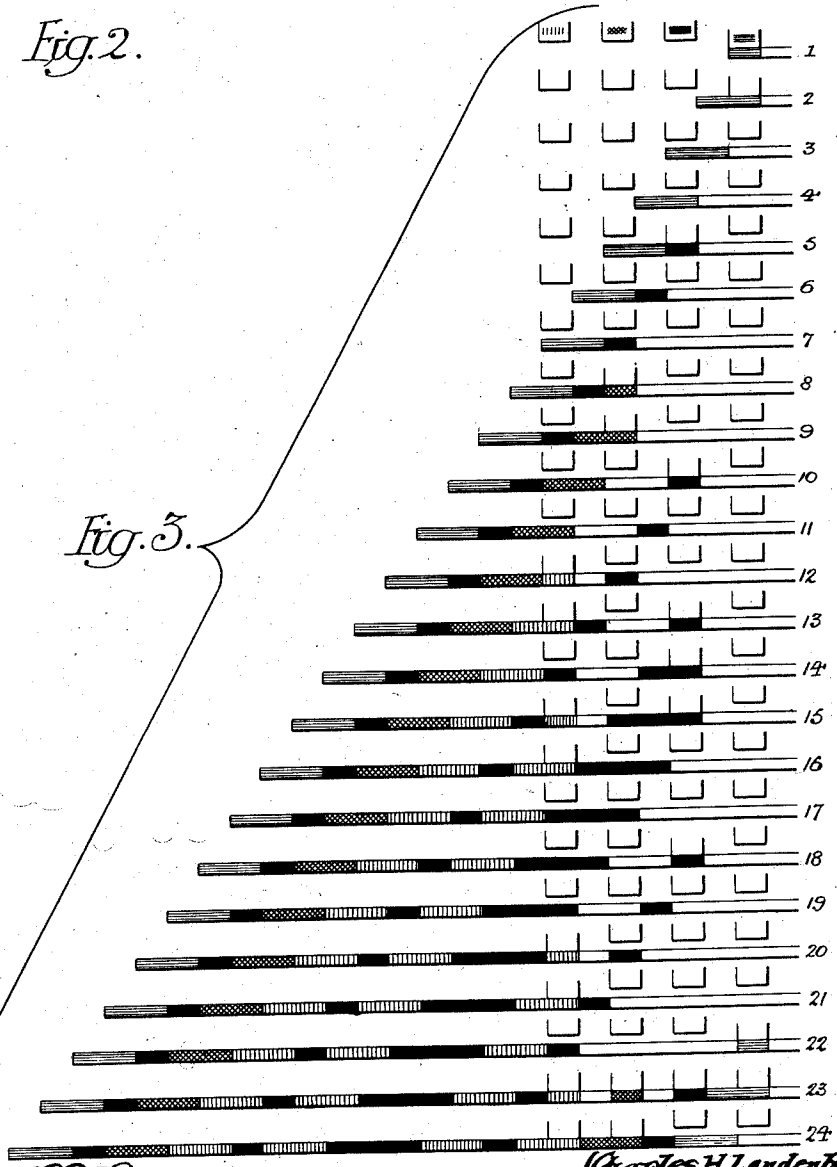




Fig. 2.

Fig. 3.



Witnesses:-
Hamilton D. Turner
Titus N. Sons.

Inventor { Charles H. Landenberger
by his Attorneys
Howson & Howson

No. 864,312. PATENTED AUG. 27, 1907.

C. H. LANDENBERGER.

WARP PRINTING MACHINE.

APPLICATION FILED MAR. 1, 1906.

3 SHEETS—SHEET 2.

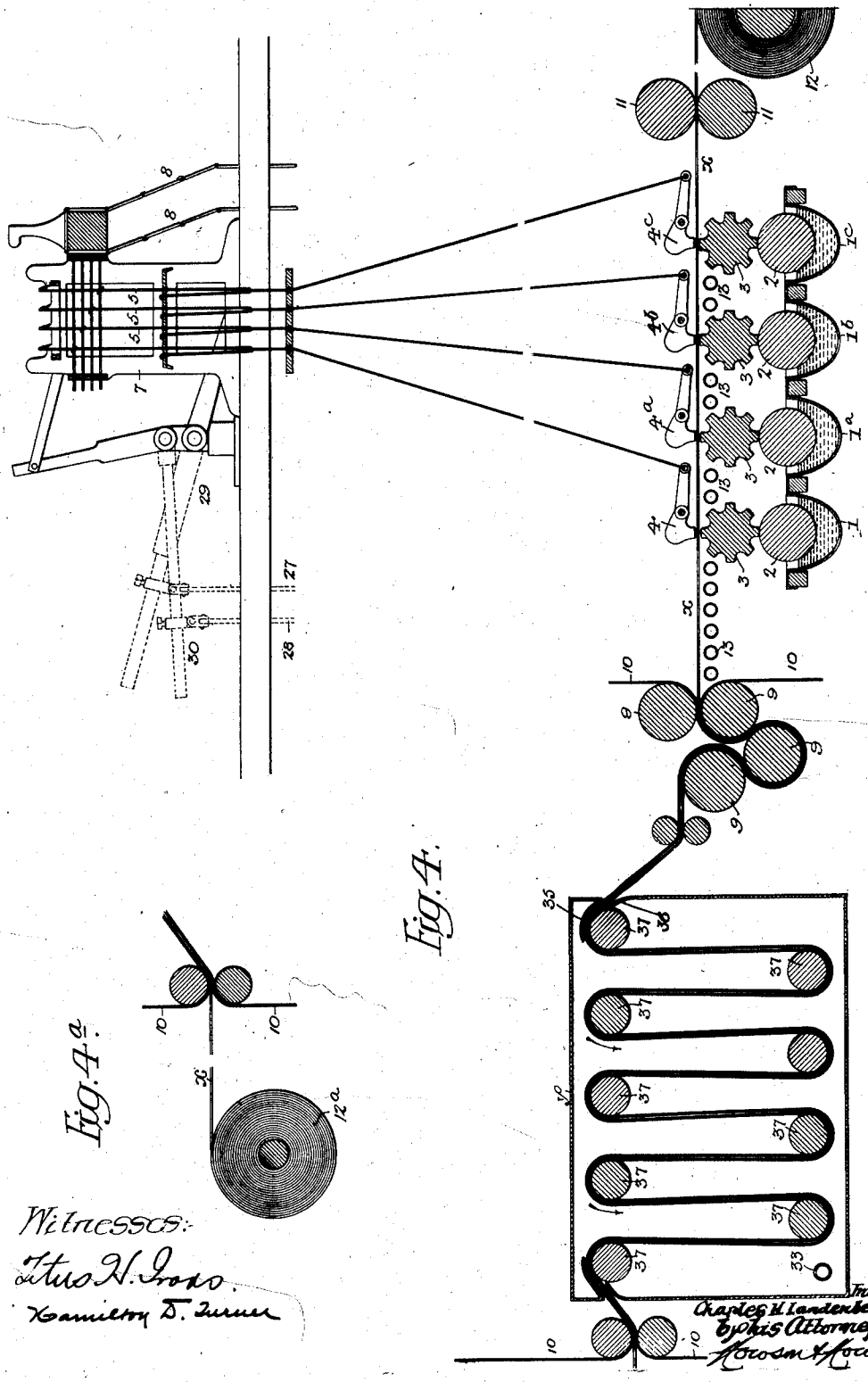


Fig. 4.

Fig. 4a.

Witnesses:
Otto N. Frost
Kameron D. Turner

Inventor
Charles H. Landenberger
by his Attorneys
Howson & Howson

No. 864,312. PATENTED AUG. 27, 1907.

C. H. LANDENBERGER.

WARP PRINTING MACHINE.

APPLICATION FILED MAR. 1, 1906.

3 SHEETS—SHEET 3.

Fig. 6.

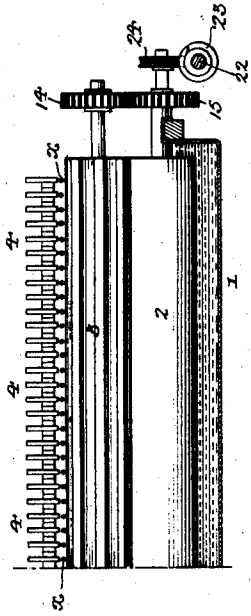


Fig. 7.

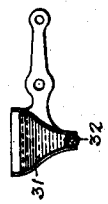
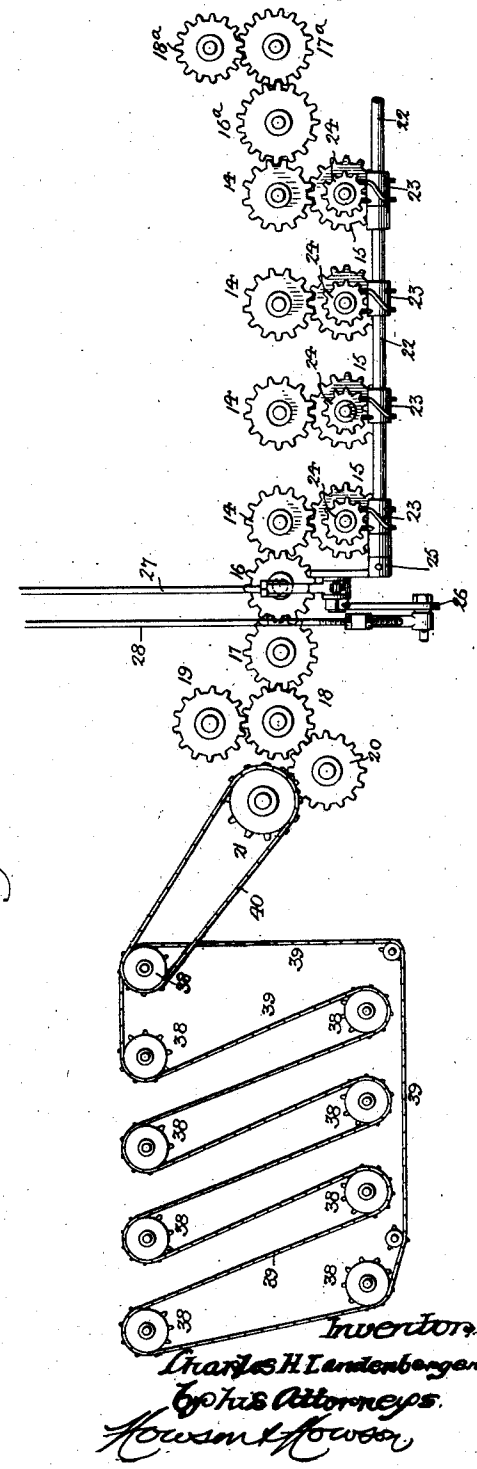


Fig. 5.



Witnesses:

Titus H. Sous.

Hamilton D. Turner

Inventor.

Charles H. Landenberger.

by his Attorneys.

Howson & Howson

UNITED STATES PATENT OFFICE.

CHARLES H. LANDENBERGER, OF PHILADELPHIA, PENNSYLVANIA.

WARP-PRINTING MACHINE.

No. 864,312. Specification of Letters Patent. Patented Aug. 27, 1907.

Application filed March 1, 1906. Serial No. 303,651.

To all whom it may concern:

Be it known that I, CHARLES H. LANDENBERGER, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Warp-Printing Machines, of which the following is a specification.

My invention relates especially to the printing of warp threads which are intended for the production of carpets, rugs or other fabrics of that class in which the pattern is printed upon the warp threads before the weaving of the fabric, although, in its broadest embodiment, my invention is also available for the printing of a pattern upon a woven or other fabric already produced.

My invention contemplates the use of a plurality of warp thread units, each comprising one or more warp threads, and a corresponding plurality of sets of color impression devices constituting what I term "frames", one for each color, each frame extending transversely across the warp units, and each comprising a series of independently acting impression devices. The impression devices which correspond with each warp unit are disposed in sequence, one behind another in the direction of the length of the warp threads. In connection with such warp thread units and impression devices are employed means for moving one of said elements, relatively to the other, in the direction of the length of the warp threads, such movement being effected preferably by a succession of intermittent impulses, each equal to the extent of one impression and each between successive impressions. Means, operated, and, by preference, directly operated, by a jacquard machine or equivalent pattern device are used for causing successive color impressions, one for each forward feeding impulse of the machine and these intermittent forward feeding impulses are, by preference, imparted to the warp thread units, the impression devices being relatively stationary.

The invention also comprises means for preventing the blurring or mixture of colors by contact of adjacent warp thread units with one another, or the fouling of the draft mechanism by coloring material derived from said warp thread units.

The invention also comprises means for effecting the setting of the colors upon the warp thread units by the application thereto of heat or the action thereupon of steam or other fluid, and the prevention, in great measure, of the uneven shrinkage and stretching of the warp thread units during such treatment, the purpose of this portion of the invention being to render it possible to wind the warp thread units, immediately upon their emergence from the treating chamber, directly upon the warp roller of the loom in which they are to be woven.

The invention also comprises certain detailed constructions and combinations of parts fully set forth and claimed hereinafter, the general purpose of the invention being to provide a machine whereby the quick and accurate printing of a warp or warps for a fabric of any desired pattern may be effected automatically and with a minimum of expense.

In the accompanying drawings, Figure 1, is a view of a section of design paper containing a certain element of a pattern for a fabric in whose construction are intended to be used warp threads such as those printed upon the machine forming the subject of my invention; Fig. 2, shows a certain length of one of said warp threads illustrating the parti-colored character of the same; Fig. 3, represents, in diagrammatic form, the succession of printing operations necessary for the production of said parti-colored length of warp thread; Figs. 4 and 4^a, are vertical sectional views of sufficient of a warp printing machine to illustrate my invention; Fig. 5, is a side elevation of gearing for driving the various elements of the machine; Fig. 6, is a transverse section of part of the machine, and Fig. 7, is a longitudinal sectional view illustrating a modification of one feature of the invention.

In Fig. 4 of the drawing, 1, 1^a, 1^b and 1^c, represent a series of color boxes, of which as many may be employed as the colors in the pattern may require. Mounted in each box, so as to be partially submerged in the coloring matter therein, is a color distributing roller 2, and above the latter, and in peripheral contact therewith, is a printing roller 3, the peripheral portion of the latter roller being, by preference, recessed for the purpose of dividing said periphery into a series of parallel sections or bars, each of a width determined by the extent of the narrowest strip of color to be imparted to any of the warp threads.

The color boxes, with their accompanying color distributing and printing rollers, are intended to be of a length equal to the width of the set or group of warp thread units which are to be printed, these warp thread units being disposed side by side above the printing rollers 3, and at such a distance apart as will prevent contact of one unit with another. Each color box, and each color distributing and printing roller, may constitute a single unitary structure, or it may be composed of any desired number of sections.

Each warp thread unit may comprise one or more warp threads, and each group of units may contain the entire number of threads necessary to constitute one or more complete warps for the production of a rug or other piece of fabric, or the group may consist only of one-half, one-third, or other fractional portion of an entire warp or set of warps. If each warp thread unit comprises two or more warp threads, the group of such units will represent a corresponding number of warps or fractions of warps.

Above the warp threads are arranged a series of impression levers 4, 4^a, 4^b and 4^c, one series for each of the printing rollers 3*f* each series or transverse row of impression levers constituting what I term a "frame" and containing as many levers as there are warp thread units in the group which is to be acted upon. A set of levers, comprising one for each color box, is disposed above each warp thread unit, the levers of the set being disposed in sequence one behind another in the direction of the length of the warp threads.

One arm of each impression lever terminates in an impression face directly above its corresponding warp thread unit, such lever being in lateral dimensions at least as wide as said unit, and in longitudinal dimensions at least as long as the width of the impression bar or rib of the printing roller 3, in connection with which it operates, hence, when either impression lever is operated to depress this face, it will depress the corresponding portion of the warp thread unit beneath it and bring the same into contact with the coloring material upon the uppermost impression bar or rib of the printing roller, thereby transferring said coloring material to the warp thread unit, the contact being continued for any length of time that may be necessary to insure the thorough absorption of the coloring matter by all of the fibers of said unit. The other arm of each of the impression levers is connected by a cord, wire or equivalent connection, to one of the lifting members 5 of a jacquard machine 7, or other equivalent pattern controlling device, hereinafter, for convenience, referred to simply as a jacquard machine. The cards 8 and lifter controlling needles or other pattern determining elements of said jacquard machine are designed to permit independent control of each impression lever.

The warp thread units *x* pass through the machine in a direction transverse to the axes of the printing rollers 3, and preferably by a succession of intermittent movements, each equal in extent to the length of the strip of coloring material applied to the unit at each operation of the machine, each movement being effected between successive operations of the impression devices, and being imparted to the warp threads by any suitable form of draft mechanism. Such draft mechanism comprises, in the present instance, a series of positively actuated draft rolls 9, and, in order to prevent contact of the freshly printed or colored warp threads with the surfaces of these draft rolls and consequent fouling of the latter, I interpose, between the warp threads and the rolls, upper and lower offset-webs 10 of textile or other relatively absorbent material, these offset-webs passing, with the warp threads, between and around the draft rolls, and through a steaming box *y* and being afterwards withdrawn from contact with the warp threads and directed to frictionally driven rolls to be subsequently washed and re-used.

In connection with the draft rolls 9, I prefer to use correspondingly driven let-off rolls 11, which receive the warp threads from a drum 12, on which they have been previously wound, thereby a certain length of each uncolored warp thread will be delivered to the printing devices, simultaneously with the taking up of a corresponding length of colored warp thread by the draft rolls. These colored warp threads as delivered by the draft mechanism are wound directly upon the warp beam or roller 12^a of the loom, without the necessity of any preliminary adjusting or registering operation.

It may, in many cases, be desirable to effect a drying or partial drying of the warp threads before they reach the draft mechanism, and for this purpose steam pipes 13 may be disposed between successive printing rollers and between the printing rollers and the draft rolls, as shown, or such heating devices may be located between the last printing roller and the draft rolls only.

The shafts of the color distributing rollers 2 and printing rollers 3 are geared together by means of spur wheels 14 and 15, as shown in Fig. 5, in order to insure the positive, uniform and coincident movement of said rollers, and like motion is transmitted to the various draft rolls 9 from the shaft of the last printing roller of the series through the medium of spur wheels 16, 17, 18, 19, 20 and 21, and to the let-off rolls 11 from the shaft of the first printing roller through the medium of spur wheels 16^a, 17^a and 18^a.

Movements of partial rotation are imparted to each of the color rollers and let-off and draft rolls of the machine, and the same are locked between their successive movements, the means employed in the present instance for effecting such operation being a longitudinal driving shaft 22 provided with a series of worms 23, each provided with a thread which engages a worm wheel 24 upon the shaft of one of the color distributing rollers, this thread being of such a character that it will, at one point in the rotation of the worm, impart forward movement to the worm wheel, but will arrest such movement and lock the worm wheel rigidly in position during the remaining portion of such rotation. By this means each of the color distributing and printing rollers and each of the draft rolls and let-off rolls may be operated at such time as the impression levers are free from contact with the warp thread units, all of said rollers being held and locked in stationary position during the time that the impression levers are forcing the warp thread units into contact with the printing rollers, it being understood, of course, that the normal position of each impression lever is such that its impression face is free from contact with a warp thread unit. The resumption of its normal position by each impression lever may be due to the preponderance in weight of that arm of the lever to which the operating cord is connected, or to other equivalent means for effecting the result.

The shaft 22 may be provided with devices for operating the jacquard machine, hence the apparatus will be entirely automatic in its action and will not require the intervention of an attendant from the time it is started until the entire length of warp thread units has been passed through it. As shown in the drawing, the shaft 22 is provided with a pair of cranks 25 and 26 for operating rods 27 and 28, which are connected respectively to the lifter-operating lever 29 and cylinder-operating lever 30 of the jacquard machine, but it should be understood that my invention, in its essentials is independent of any mere operating mechanism for the different parts, hence such operating mechanism can be modified within very wide range without departing from the fundamental features of my invention.

At each step in the forward movement of the warp thread units each of the latter will, by the operation of appropriate impression levers, have one or more

colors imparted to it, depending upon the coloring of the pattern of the fabric or fabrics of which the warp thread or threads constituting said unit is eventually to form part, hence, when each unit leaves the last of the impression devices it will present no portion to which coloring material has not been applied, unless short uncolored spaces have been left between successive colors, in order to prevent "running," the color being finally absorbed by these uncolored portions of the yarn, by reason of the capillary attraction of the same.

As shown in the transverse section Fig. 6, each of the warp thread units consists of a single warp thread, hence if the group of such units comprises as many as there are warp threads to be used in the production of the rug or other fabric, one complete warp for such rug or other fabric may be printed during one complete cycle of operations of the machine, and it will be evident that if each unit comprises two or more warp threads a corresponding number of complete warps may be printed during each cycle, or, before indicated, the group of warp thread units in the machine may constitute but a fraction of a single warp or a fraction of two, three, or more warps, depending upon whether each unit comprises one, two, three or more threads.

The method of printing a warp thread in accordance with my invention will be best understood on reference to Figs. 1, 2 and 3. Supposing that in the section of the pattern sheet shown in Fig. 1, the horizontally lined spaces represent blue, the black spaces red, the cross-hatched spaces green, and the vertically lined spaces yellow, the central line *a* of said pattern, and the corresponding portion of the warp thread shown in Fig. 2, will be colored as follows: two spaces blue, one space red, two spaces green, two spaces yellow, one space red, two spaces yellow, three spaces red, two spaces yellow, one space red, two spaces yellow, two spaces green, one space red and two spaces blue, each space representing a length of warp thread necessary to form one loop of the pile in the finished fabric. Supposing that the impression devices are arranged in sequence, blue, red, green and yellow, the number of successive impressions required to produce the length of warp thread shown in Fig. 2, will be twenty-four, as indicated in Fig. 3. On its first and second forward movements the thread will receive blue impressions; the third and fourth movements will be blank; on the fifth movement the thread will receive a red impression, the sixth and seventh movements will be blank; on the eighth and ninth movements the thread will receive green impressions and on the tenth movement a red impression; the eleventh movement will be blank; on the twelfth movement the thread will receive a yellow impression, on the thirteenth movement yellow and red impressions, on the fourteenth movement a red impression, on the fifteenth movement yellow and red impressions and on the sixteenth movement, a yellow impression; the seventeenth movement will be blank; on the eighteenth movement the thread will receive a red impression; the nineteenth movement will be blank; on the twentieth movement the thread will receive a yellow impression; on the twenty-first movement a yellow impression, on the twenty-second movement a blue impression, on the twenty-third movement yellow, green, red and blue impressions and on the twenty-fourth movement yellow and green impressions. The cutting of the cards for the different colors will therefore be dependent upon the sequence of color impression devices in the machine, and the distance between said impression devices. As shown in Fig. 3, there is a distance of one space between successive impression devices, hence the red impression is two spaces behind the blue, the green impression is two spaces behind the red and four spaces behind the blue, and the yellow impression is two spaces behind the green, four spaces behind the red and six spaces behind the blue, therefore, although, in the pattern illustrated, the first two spaces are blue, the third red, the fourth and fifth green and the sixth and seventh yellow, the first red color is applied on the fifth impression instead of the third, the first green color on the eighth impression instead of the fourth, and the first yellow color on the twelfth impression instead of the sixth, hence, in punching the cards 8 due account must be taken of the sequence and spacing of the color impression devices used in connection with each warp thread unit.

In the operative machine the impression devices will, ordinarily, be further apart than is shown in Fig. 3, the single space being there adopted simply to permit of a compact showing of the parts.

While I prefer, in all cases, to impart movement to the warp thread units and to maintain the impression devices in a relatively fixed relation, the reverse of this might be true, that is to say, the impression devices might be moved and the warp thread units might be relatively fixed. While I also prefer to adopt the intermittent movement of the moving element, continuous movement of the same might be resorted to in some cases, and printing rollers presenting a continuous peripheral surface may, if desired, be employed instead of the ribbed or barred printing rollers which I have shown, although the latter are preferred, because they accurately define the limits of those portions of the warp thread units to which color can be applied on each operation of the machine. My invention may, however, be embodied in a machine in which no printing rollers are used, for instance, each impression lever may constitute, or may be provided with a color box or receptacle, one instance of such construction being illustrated at 31 in Fig. 7, the color being conveyed to the warp thread unit through the medium of a pad or other mass 32 of absorbent or capillary material, which normally prevents the escape of coloring matter from the outlet of the color box but which, being itself saturated with the coloring material will, when it is brought into contact with the warp thread unit serve to properly color the latter.

The steam box *y* may be constructed in any desired manner for the performance of its intended function of subjecting the printed threads to the action of the steam for the fixing of the colors. The box shown in the drawing has a steam inlet pipe 33, and is provided with internal flaps 35 and 36 at the inlet and outlet slots, the inlet flap 35 bearing upon the upper offset web, and extending partly over the first of the rollers 37, with which the steam box is provided, and the inlet flap 36, bearing upon the lower offset web, whereby the pressure of steam within the box will serve to maintain these contacts and prevent any material escape of

steam through the inlet slot. Precisely the same construction is adopted at the outlet slot.

The various rollers 37, over which the printed threads, confined between the offset webs, pass in succession, may be hollow and steam-heated, and when the threads and their enveloping webs leave the steam box, and the said webs are directed away from the threads, the latter may be led to the warp roller 12^a which, when it has received its load of threads, may be transferred directly to the loom.

By confining the threads between the offset webs while they are being subjected to the steaming operation, the tendency of the threads to stretch or contract differentially is intended to be corrected to such an extent as to permit of the direct winding of the threads upon the warp roller without the previous setting or adjusting operation now necessary in order to cause the different parti-colored warp threads to properly register with each other.

The shafts of the different rollers 37 have chain wheels 38, in order that they may be connected with each other, by a chain belt 39, and driven from a similar wheel on one of the draft rolls 9, by means of a chain belt 40, the rollers 37 in such case constituting a supplementary draft mechanism.

Although I have shown and described my invention as embodied in a machine for printing separate warp threads, the term "warp" as used in the claims is not to be construed as a word of limitation since it will be evident that many of the features of the invention are capable of use in machines for printing designs upon the surface of woven or other fabrics hence as to many of the claims the phrase "a plurality of warp thread units side by side" is to be interpreted broadly enough to include such fabric.

I claim:—

1. The combination, in a warp printing machine, of means for maintaining, side by side, a plurality of warp thread units, a frame of color impression devices extending transversely across said warp thread units and having a plurality of independently acting impression devices; a jacquard machine for operating the latter to positively bring them into contact with the warp thread units, and means for changing the longitudinal position of said warp thread units and color impression devices relatively to each other.

2. The combination, in a warp printing machine, of means for maintaining, side by side, a plurality of warp thread units, a frame of color impression devices extending transversely across said warp thread units and having a plurality of independently acting impression devices, a jacquard machine operating to positively bring the latter into contact with the warp thread units corresponding to said frame throughout all of the spaces representing a given color in a row of pile, and means for changing the longitudinal position of the warp thread units and color impression devices relatively to each other.

3. The combination, in a warp printing machine, of means for maintaining, side by side, a plurality of warp thread units, a plurality of sets of color impression devices, means for moving said warp thread units longitudinally in respect to the impression devices by a series of positive and intermittent step-by-step movements without imparting tension to said warp thread units, and a jacquard machine for operating the color impression devices to positively bring them into contact with the warp thread units.

4. The combination, in a warp printing machine, of means for maintaining, side by side, a plurality of warp thread units, a plurality of sets of color impression devices, a support therefor which has no movement from or towards the warp thread units, means for moving said warp thread units longitudinally in respect to the color impression devices, and a jacquard machine for operating the latter to positively bring them into contact with the warp thread units.

5. The combination, in a warp printing machine, of means for maintaining, side by side, a plurality of warp thread units, a plurality of sets of color impression devices, a steaming-box, and means for moving the warp thread units longitudinally through said steaming-box and past said color impression devices by a succession of intermittent step-by-step movements without tension upon the warp thread units.

6. The combination, in a warp printing machine, of means for maintaining, side by side, a plurality of warp thread units, a plurality of sets of color impression devices, draft mechanism for said warp thread units, and offset-webs interposed between said draft mechanism and the warp thread units.

7. The combination, in a warp printing machine, of means for maintaining, side by side, a plurality of warp thread units, a plurality of sets of color impression devices, draft mechanism for said warp thread units, a steaming-box, and offset webs interposed between said draft mechanism and the warp thread units and passing with the latter through the steaming-box.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

CHARLES H. LANDENBERGER.

Witnesses:
WM. E. SHUPE,
JOS. H. KLEIN.