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PROCESS OF MANUFACTURING FIGURED PILE CARPETS.

Patented Feb. 10, 1891.

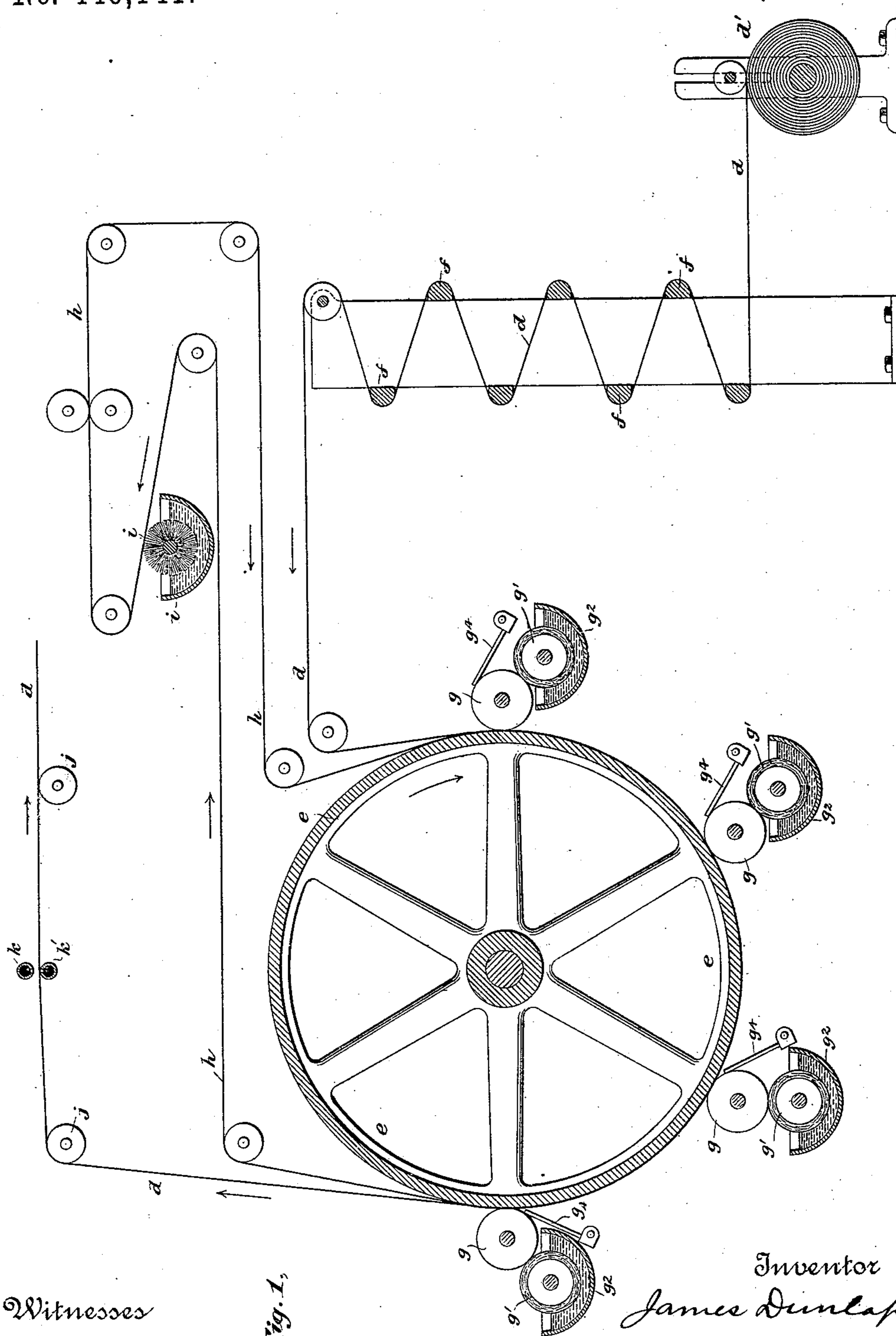


Fig. 1.

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(No Model.)

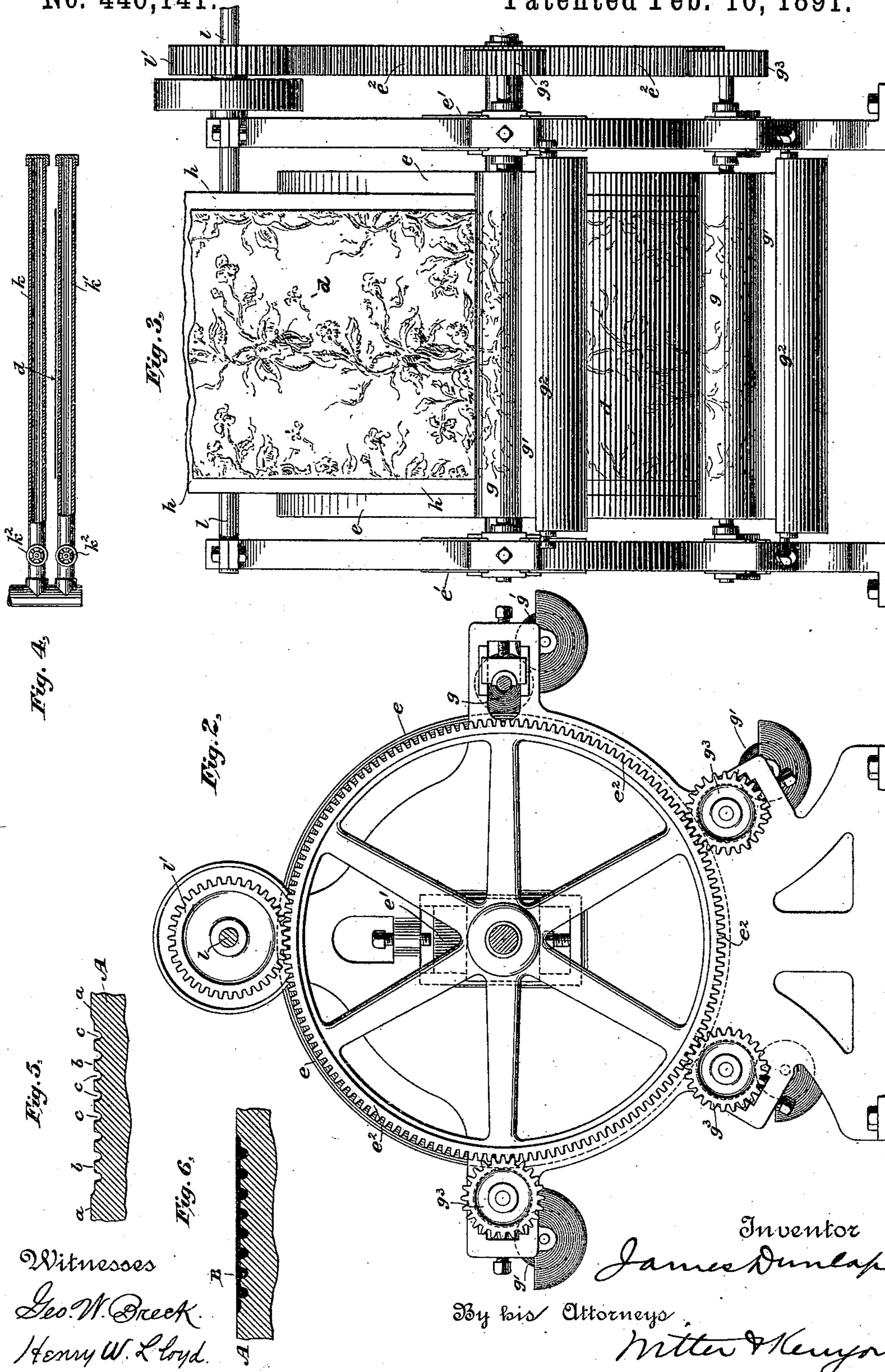
2 Sheets—Sheet 2.

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PROCESS OF MANUFACTURING FIGURED PILE CARPETS.

No. 446,141.

Patented Feb. 10, 1891.



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UNITED STATES PATENT OFFICE.

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PROCESS OF MANUFACTURING FIGURED PILE CARPETS.

SPECIFICATION forming part of Letters Patent No. 446,141, dated February 10, 1891.

Application filed May 10, 1890. Serial No. 351,216. (No model.)

To all whom it may concern:

Be it known that I, JAMES DUNLAP, a citizen of the United States, residing in the city of Philadelphia, in the State of Pennsylvania, have invented a new and useful Improvement in Processes of Manufacturing Figured Pile Carpets, of which the following is a full, clear, and exact specification, reference being had to the accompanying drawings, and to the letters of reference thereon, which form a part hereof.

My invention relates to that class of carpets in which the face consists of a cut or uncut pile, like velvet, tapestry, Wilton, Brussels, &c.

It has for its object to produce a carpet of that class which shall show upon its face more perfect and more varied patterns or designs than it has been possible to produce heretofore, and to do this even more economically than the present relatively imperfect patterns can be produced.

The invention consists of the process herein described and claimed.

Heretofore patterns have been produced commercially in pile fabrics in one of two ways. A Brussels carpet is an exemplar of the first and a tapestry carpet of the second way.

A Brussels carpet is woven of face-warp threads, of which each one is dyed one solid color from end to end. Usually four or five colors appear in the warp, there being also usually an equal number of threads of each color, all the threads of one color being carried in one frame. At any given point in the pattern the jacquard can select any one of the four or five colors and bring it to the top, the other three or four threads at that point being buried in the heart of the fabric. This gives thickness and body to the fabric, but makes it expensive in material.

A tapestry carpet is woven of face-warp threads, each one of which is dyed with various colors along its length, and the entire body of face-warp threads, when properly drawn in, ready for weaving, exhibits varying colors across its width as well as along its length; but these variations of color are such and are so placed that when the simple predetermined tapestry fabric is woven, without jacquard and without variations of weave so

far as the face warps are concerned, the woven fabric exhibits upon its face the desired pattern or design.

The pattern of a Brussels carpet is produced by variations of the weave in conjunction with uniform or simple dyeing of the yarns. The pattern of a tapestry carpet is produced by variations in the dyeing of the yarns in conjunction with uniform or simple weaving.

A Brussels carpet is expensive in the weaving as well as expensive in the quantity of yarn necessarily consumed in its manufacture. A tapestry carpet is expensive in the necessary operations of dyeing the yarns.

A Brussels carpet is economical in the operations of dyeing the yarns. A tapestry carpet is economical in the operation of weaving and in the quantity of material required. My improved process of manufacturing combines both economies, and at the same time produces more perfect and varied patterns.

In carrying out my invention I discard the complicated and expensive yarn-dyeing operations of tapestry-carpet manufacture, and I also discard the complicated and expensive Jacquard operations of Brussels weaving, and instead of dyeing the yarns for the pattern effects before weaving, as is done in both tapestry and Brussels, I weave the yarns first and then dye them to produce the pattern. I preferably weave the yarns in the gray—that is, undyed; but they may be all dyed of a uniform basic color or tone, if desired. I preferably weave as a tapestry or velvet carpet is woven—that is to say, without a Jacquard machine—and of a simple and uniform and continually-repeating weave, and with the same continuous warp-threads forming the loops or piles throughout the fabric from end to end, although this is not essential. I weave, preferably, an exact tapestry carpet, except that the yarns are all undyed. In this way I employ simple loom mechanism and produce a simple fabric. After the fabric is woven (the pile being cut or uncut, as desired) I submit it, after suitable preparation, to the action of a color-printing machine, and then treat it in a suitable manner, as hereinafter described, the color-printing machine resembling in its general features the machines employed in calico-printing—that is to say, a

machine embodying a large pressure drum or roller, on which and with which the undyed carpet revolves, face outward, and pattern-rollers, one for each color, mounted so as to
5 be supplied with color from color-boxes and to revolve in contact with the face of the undyed carpet, and engraved to produce the pattern desired.

By careful trial I have discovered that the
10 ordinary machines and processes employed in calico-printing are utterly unsuccessful and useless as pattern-producing devices and methods in the manufacture of tapestry and velvet and other pile carpet fabrics. By care-
15 ful and long-continued experiments I have discovered that complete success can be attained and economically, but only by applying the coloring-matter in a peculiar and novel state of mass distribution and in a peculiar
20 way and by peculiar and novel instrumentalities, and preferably by supplementing this application by a peculiar and novel treatment. I am aware that it has frequently been suggested to print the patterns upon pile
25 fabrics, including carpet fabrics, and that both block and roller printing devices have been described for that purpose, and I do not broadly claim that herein; but pile carpets have never been successfully printed for the
30 market and for commerce, and, so far as I am aware, no efficient or successful method or apparatus has ever been devised or described to that end.

Pile carpet fabrics—such as tapestry or velvet carpets and Brussels or Wiltons—present peculiar difficulty when the attempt is made to print a pattern upon them. The pile, whether cut or uncut, is a comparatively
40 soft yielding mass. To be successfully colored or dyed it must be colored or dyed not only on the exposed tips of the pile, but down deep to the very roots of the pile and even into the back—that is to say, it must be a dyeing of the woven yarn rather than of
45 the surface of a woven fabric, for the pile in use will be trodden and exposed in every direction and on every side, and will be gradually worn down by use. Every side of a given tuft of pile must be thoroughly colored
50 and dyed, and the same is true of the entire pile throughout its mass and down into its roots. Moreover, the color must be so applied that the yielding or wearing of the pile in use will not distort the pattern. Great
55 pressure must be employed in order to force the color into and through the pile, and coloring-matter must be employed in considerable quantity; but it must be so employed and applied as not to “flush” or “bleed” under the great pressure—that is, not to squirt or
60 fly or run laterally in the pile beyond the exact and predetermined limits of the particular figure of the pattern being printed at that point.

65 In carrying out my invention in the best form known to me I proceed as follows, mentioning here all the steps which I employ,

both those which I deem essential and those which I do not deem essential, and distinguishing between the two hereinafter. 70

First. I weave a simple tapestry fabric with face warps or worsteds that are in the gray or undyed and on an ordinary tapestry-loom. If velvet carpet is desired, I cut the pile in the usual way. The face warps may
75 of course be dyed, if desired; but it is unnecessary, as the pattern is produced at a later stage of the process.

Secondly. To prepare the yarn for the reception of the color, I dampen the surface of the
80 carpet by means of a revolving brush with a preparation as follows: Mix nine gallons olive-oil with nine gallons oil of vitriol. Let it stand forty-eight hours. Take three forty-gallon casks. Put into each thirty pounds
85 common salt and ten gallons hot water. Add twenty gallons cold water and three and three-eighths gallons of first mixture. Stir briskly and fill with water. Let it stand two or three
90 days. Take the oil rising to the surface. Add to each gallon of such oil one gill of caustic soda and use on the carpet in the proportions of one of the mixture to twenty of water.

Thirdly. I run the carpet over hot cylinders or coils of pipe to dry it. 95

Fourthly. I apply the coloring-matter (called for by the predetermined pattern) in liquid or semi-liquid masses of a medium consistency, said masses resembling in cross-section a pellicled layer or sheet—that is, a
100 solid layer or sheet of coloring-matter with pellicles or piles projecting from its main mass arranged close together like the piles of the fabric, but with definite spaces between them. This cross-section is illustrated in Fig. 105
6 of the drawings to that end.

Fifthly. I run the carpet at suitable speed through a suitable printing-machine having a large drum to carry and support the carpet and having copper or other suitable rollers,
110 one for each color and each revolving in a color-box of its own, and each previously cut or engraved (according to that part of the predetermined pattern which is to be represented by that color) as follows: The figure—
115 say that of a leaf or part of a flower—is marked out by the engraver on the surface of the copper cylinder and is cut out first to an even depth of about one one-hundredth of an inch, and preferably with a beveled cut at
120 the edges—that is, the cut gradually, not at once, attaining the full depth of one one-hundredth of an inch. Then further and deeper cuts are made in the forms of cells or cups or depressions, evenly distributed over the
125 entire figure, of a uniform depth of about one thirty-second of an inch below the general surface of the roller, of about one-sixteenth to one thirty-second of an inch in diameter, circular or otherwise in shape, about
130 one-sixteenth of an inch apart, and preferably beveled like the outline cuts of the figure. The character of this cut is clearly shown in the drawings, Fig. 5, where A rep-

resents a portion of an axial section of a roller, *a a* being the original surface of the roller, *b b* being the cut or engraved portion, showing the cells or cups *c c*. The usual
 5 doctor-blades are arranged so as to scrape the surfaces *a a* of the roller clean and clear of all coloring-matter, but to leave the engraved portions *b b c c* full of the coloring-matter flush with the general surface *a a*, so that the
 10 appearance of the engraved roller with the coloring-matter disposed upon it ready to be pressed into the pile of the carpet would be as illustrated in Fig. 6, where A, as before, represents the roller, and B represents the
 15 pellicled mass or body of coloring-matter held by the roller and ready to be pressed into the pile of the carpet by the roller. This pellicled mass of coloring-matter, when applied to the pile of the carpet with the great pressure which I employ, strikes down into and
 20 through the pile and to the very bottom of the same, and the solid walls of the roller between the pellicles of coloring-matter drive the coloring-matter down deep into the pile, and the heads of the pile press into the cells
 25 *c c* of the roller and take up all the coloring-matter. Thus all parts of the pile are certainly and thoroughly colored and dyed, and nevertheless the great pressure does not
 30 force the coloring-matter sidewise in the pile, but produces sharp true outlines and of a pure free character of drawing hitherto unattainable in either Brussels or tapestry carpets, for in both the latter fabrics all pattern outlines
 35 are necessarily rectilinear and all angles right angles, and the crude appearance of other angles and of curves is produced, as it would be in fine mosaic work, only by a manipulation of short straight lines and right
 40 angles. Again, the indefiniteness of pattern outline almost necessarily incidental to tapestry carpets as made at present, and due to the impossibility of continuously and absolutely accurate registering of the dyed yarns
 45 of the warp, is wholly avoided by my process.

Sixthly. I employ very heavy pressure—many thousand pounds—between the color-rollers and the large drum (and directed perpendicularly of the fabric) to effect the intimate and absolute application of the coloring-matter to the yarn of the pile. This pressure is preferably a pressure of several
 50 tons.

Seventhly. I blow free steam directly and
 55 forcibly on and into the face of the pile or directly and forcibly against and through the back of the carpet, or both, after the carpet has passed the printing-rollers. This drives the coloring-matter deeper into the pile and
 60 distributes it through the pile without causing the color to flush or run, and at the same time tends to raise and restore the pile from the crushing effect of the great pressure employed in the printing. This steam I blow
 65 forcibly from a steam pipe or pipes perforated with holes about an inch apart, the

pipes being placed close to the pile face or to the back of the carpet.

Eighthly. I pass the carpet, both front and back, over drying-cylinders until it is about
 70 half dry.

Ninthly. I suspend it in a steam-room, where it is steamed about an hour under five to ten pounds pressure.

Tenthly. I wash the carpet by passing it
 75 over a revolving brush that is wet with water.

Eleventhly. I stiffen the back by passing the back over a revolving brush running in a mixture of starch and glue. This stiffening may be done before the printing.
 80

Twelfthly. I dry thoroughly, and then the carpet is ready for rolling and shipping and use.

Of the above-recited steps of my usual method of manufacture those which I deem
 85 essential and which, for the purposes of the broad claim hereinafter made, I desire to describe as alone essential, are, first, the weaving of the pile fabric irrespective of pattern; secondly, the arranging the masses or bodies
 90 of coloring-matter for the pattern in thin pellicled layers or sheets; thirdly, the forcing the same in that form upon and into the pile by heavy perpendicular pressure, and, fourthly, the steaming of the pile or of the fabric
 95 either before or after drying or partial drying.

In the accompanying drawings I have shown a machine well adapted to be employed in carrying out my process and diagrams illustrating the process.
 100

Figure 1 is a diagrammatic view showing in vertical section the essential working parts of the printing and steam-blowing devices. Fig. 2 is a side elevation of the printing-machine, and Fig. 3 is a front elevation of the same.
 105 Fig. 4 is a front elevation, partly in section, of the steam-blowing pipes. Fig. 5 is an enlarged longitudinal section of a part of one of the pattern-rollers, showing the engraved portions and the depressions; and Fig. 6 is a
 110 similar view, except that the engraved portions and depressions are here shown charged with color.

The mechanism for weaving the carpet as well as the mechanism for drying the same
 115 after the preparatory dampening are not shown in the drawings, as such mechanisms are of ordinary construction and well known in the art.

The next step of the process—that of applying the color—and several succeeding steps are illustrated in the drawings. The carpet (marked *d* in the drawings) is fed into the color applying or printing machine from a roll *d'*, and passes over a series of rounded
 125 bars *f f*, which afford the resistance necessary to hold it tightly against the large drum *e* of the printing-machine. From the bars *f* the carpet passes around the large drum *e* and is successively operated upon by the various
 130 pattern-printing rollers *g g*. A thick elastic blanket *h* is interposed between the carpet

and the surface of the drum and forms an elastic surface to distribute and equalize the pressures between the drum and the pattern-printing rollers. This elastic blanket h is
 5 endless, passing around the drum, and then over guide-rollers through a washing device i to remove any color its surface may have received and back to the drum. The pattern-printing rollers g are engraved in the manner
 10 heretofore described, each roller being adapted to print all parts of one color in the pattern, and the number of rollers corresponding to the number of colors in the design. Each printing-roller g revolves in contact
 15 with a color-roller g' , and each color-roller dips into a box or trough g^2 , which is charged with the desired color. Doctor-blades g^4 g^4 are arranged to bear upon and scrape the surfaces of the pattern-printing rollers g , and
 20 thus remove all superfluous color from these rollers. The large drum e rotates in bearing-boxes $e' e'$, fitted to slide vertically in the side frames of the machine. Adjusting-screws are provided to regulate the positions of these
 25 boxes; but I prefer to adjust the screws so that they do not touch the boxes e' , and thus to allow the entire weight of the large drum e , amounting to several tons, to bear upon the pattern-printing rollers g g . The pattern-printing rollers rotate in boxes fitted in radial guides in the frame and pressed by adjusting-screws against the drum e . These
 30 devices permit great perpendicular pressure upon the carpet during the application of the color and allow a nice adjustment and distribution of the pressure. The pattern-printing rollers g are caused to rotate by pinions g^3 , one on each roller-shaft, meshing into a large gear e^2 , secured on the shaft of the large
 40 drum e . Motion is imparted to the drum-shaft from the driving-shaft l by means of a gear l' thereon meshing into the large gear e^2 . The carpet passes from the printing-machine upward and over guide-rollers $j j$. Between
 45 these guide-rollers are placed the steam-blowing devices, consisting of the two perforated steam-pipes k and k' , arranged, respectively, above and below the carpet. The perforations in these pipes are placed so that steam

will blow directly and forcibly against the
 carpet. The steam-blowing pipes k k' are
 each provided with a valve k^2 (see Fig. 4) to
 control and regulate the supply of steam. I
 have found it advisable at times to shut off
 the lower pipe and blow steam only from the
 55 upper pipe directly against and into the pile.
 At other times I shut off the upper pipe and
 blow the steam only against the back of the
 carpet. The control of this steam-supply depends largely upon the consistency and character of the color employed. When the color
 60 does not readily diffuse through the pile, I find it advisable to blow the steam from both pipes k and k' directly against both the back and the face of the carpet.

The subsequent drying, steaming, washing, and stiffening processes are performed in a manner well understood, and the means employed are of ordinary construction and are therefore not shown in the drawings.

What I claim as new, and desire to secure by Letters Patent, is—

1. The method of manufacturing patterned tapestry, velvet, or other pile carpet, which consists in first weaving the pile fabric, then
 75 disposing the masses or bodies of coloring-matter called for by the pattern or design in thin pellicled layers or sheets, then forcing the same in that form on and into the pile by heavy perpendicular pressure, and then
 80 applying steam to the pile or fabric, substantially as and for the purposes set forth.

2. The method of manufacturing patterned tapestry, velvet, or other pile carpet, which consists in first weaving the pile fabric, then
 85 disposing the masses or bodies of coloring-matter called for by the pattern or design in thin layers or sheets, then forcing the same on and into the pile by heavy perpendicular pressure, then blowing free steam forcibly on
 90 and into the fabric, then partially drying the fabric, and then subjecting it to the continued action of steam in a steam-room, substantially as and for the purposes set forth.

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Witnesses:

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