5 Sheets--Sheet 1.

R. EICKEMEYER & G. NARR.

Looms for Weaving Pile Fabrics.

No. 150,011. Patented April 21, 1874.

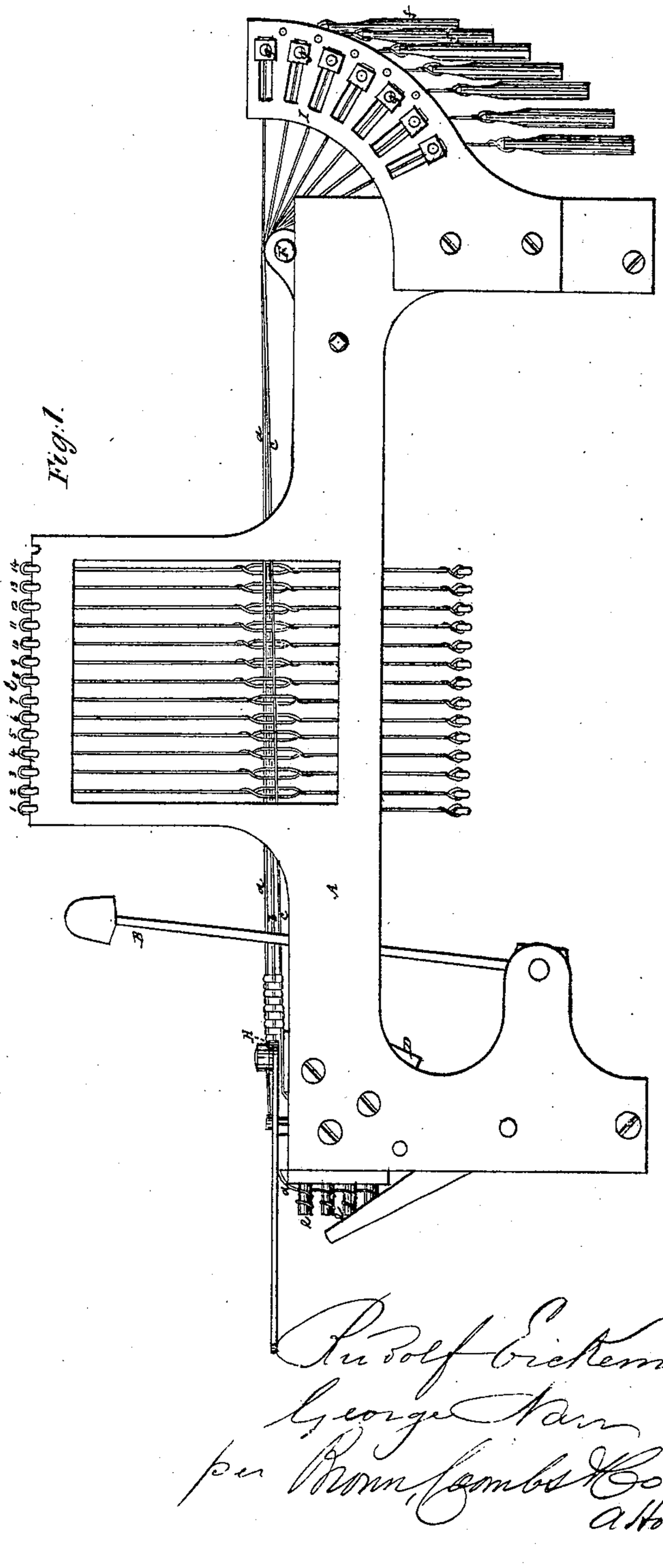

Fig. 1.

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5 Sheets--Sheet 2.

R. EICKEMEYER & G. NARR.

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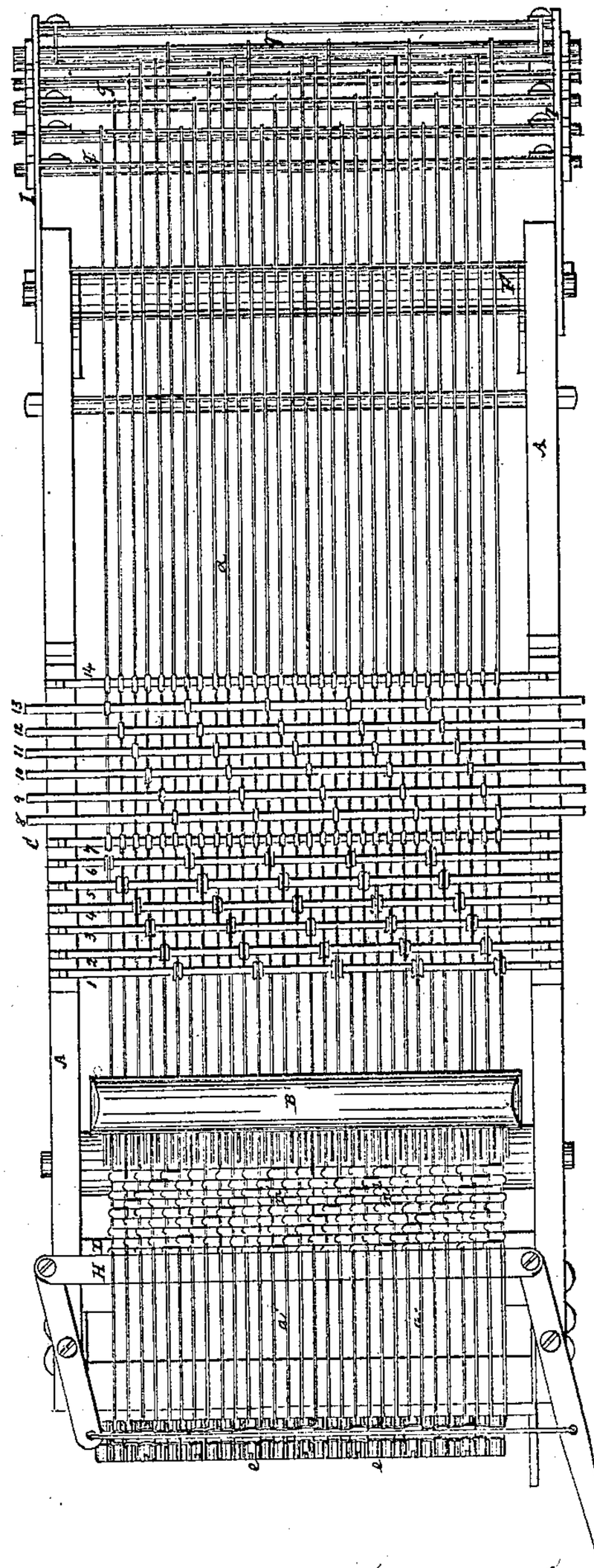

Fig. 2.

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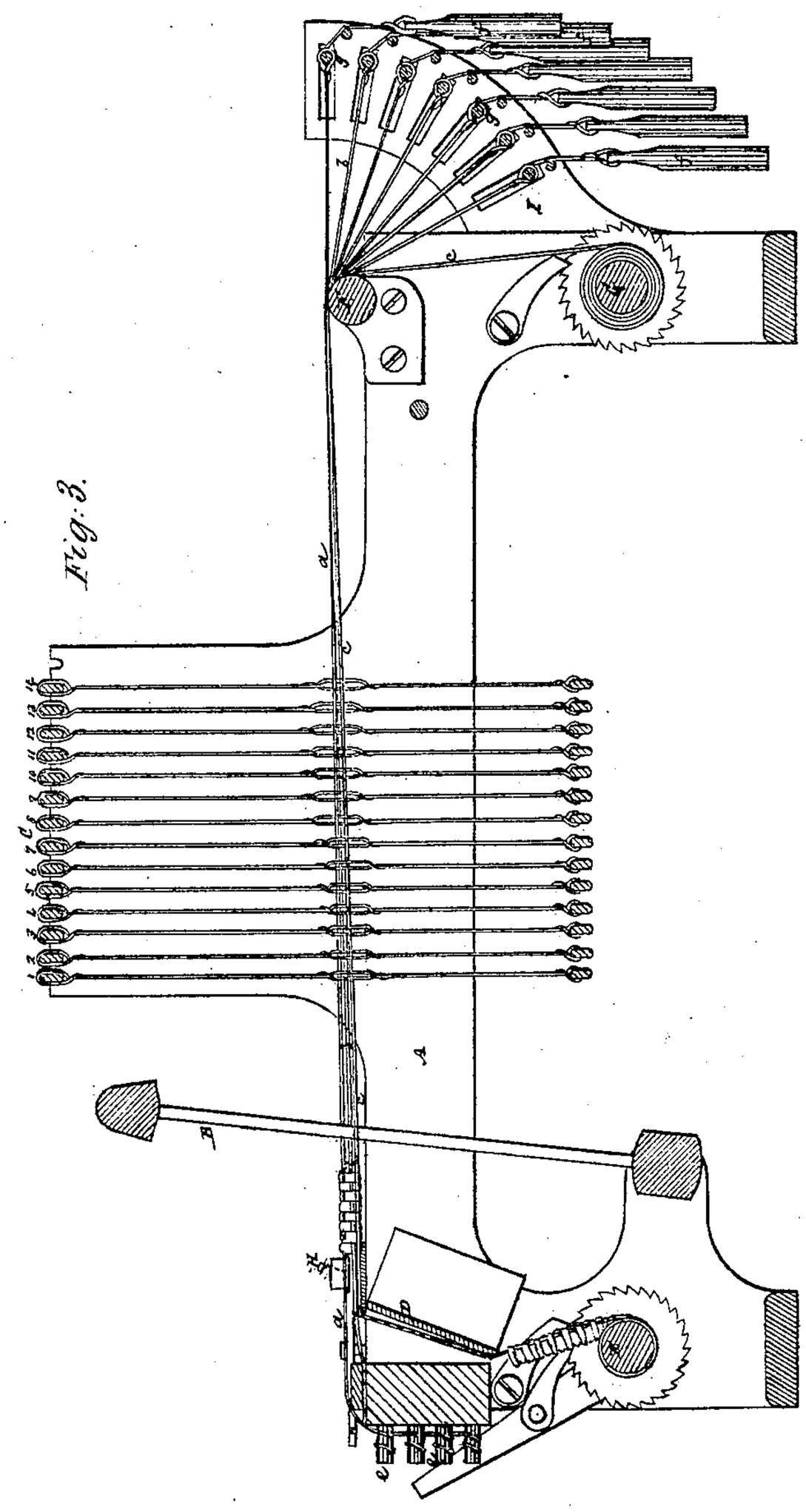
Fig. 3.



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5 Sheets--Sheet 4.

R. EICKEMEYER & G. NARR.

Looms for Weaving Pile Fabrics.

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Fig: 4.

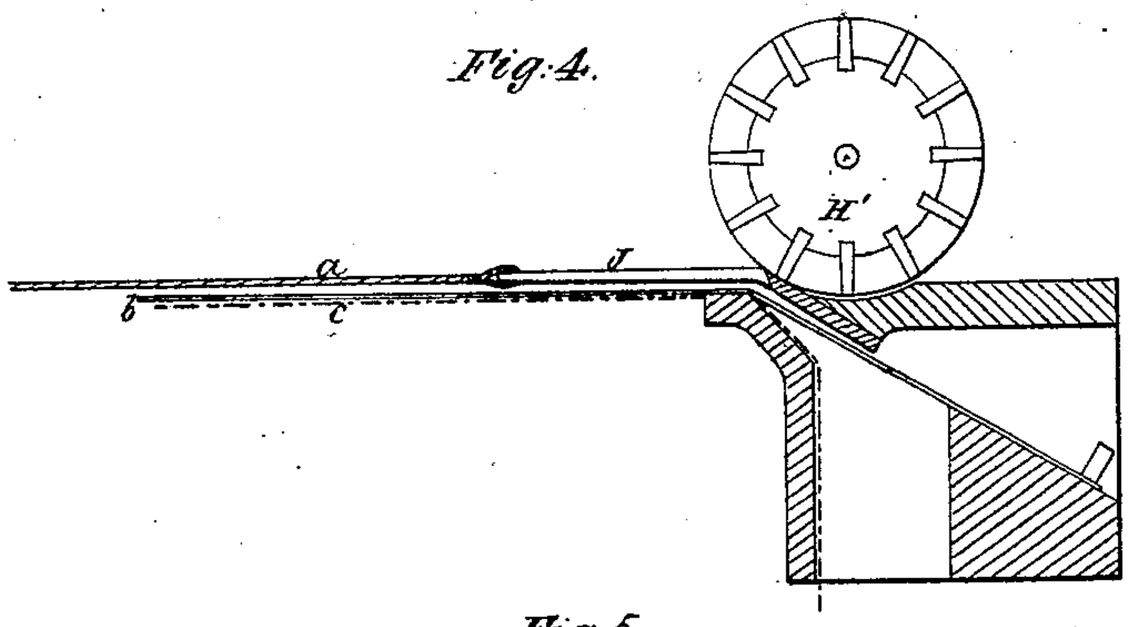


Fig: 5.

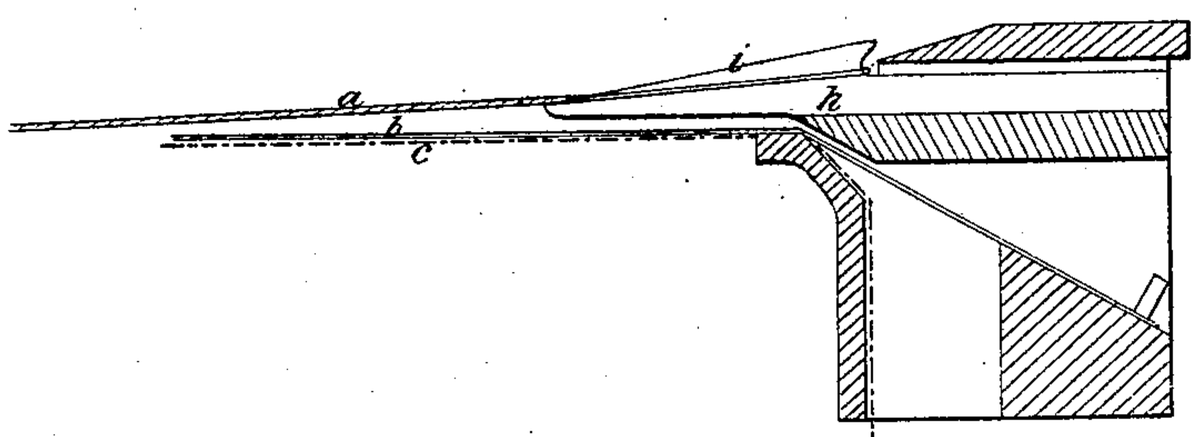


Fig: 6.

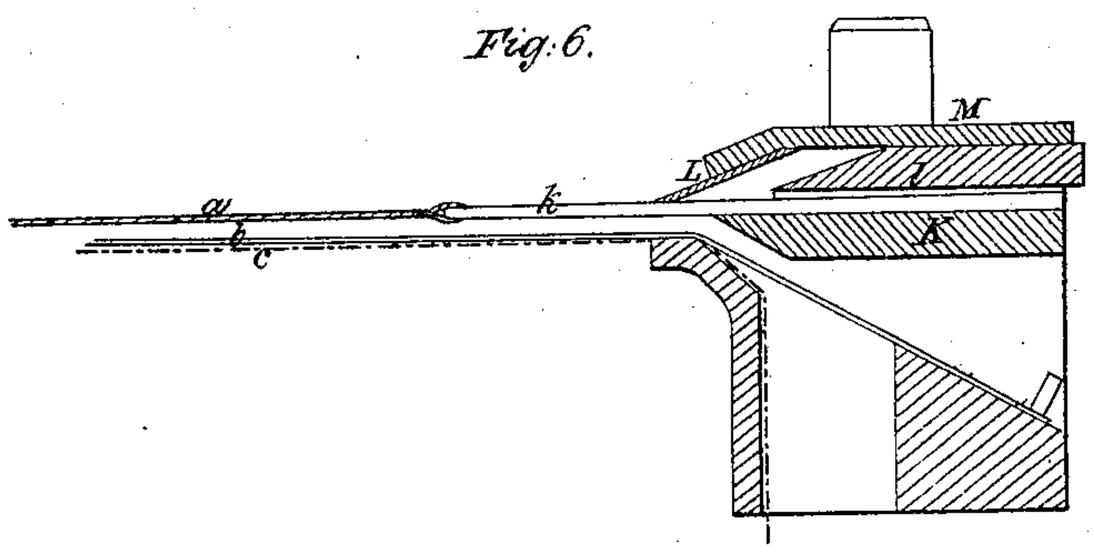
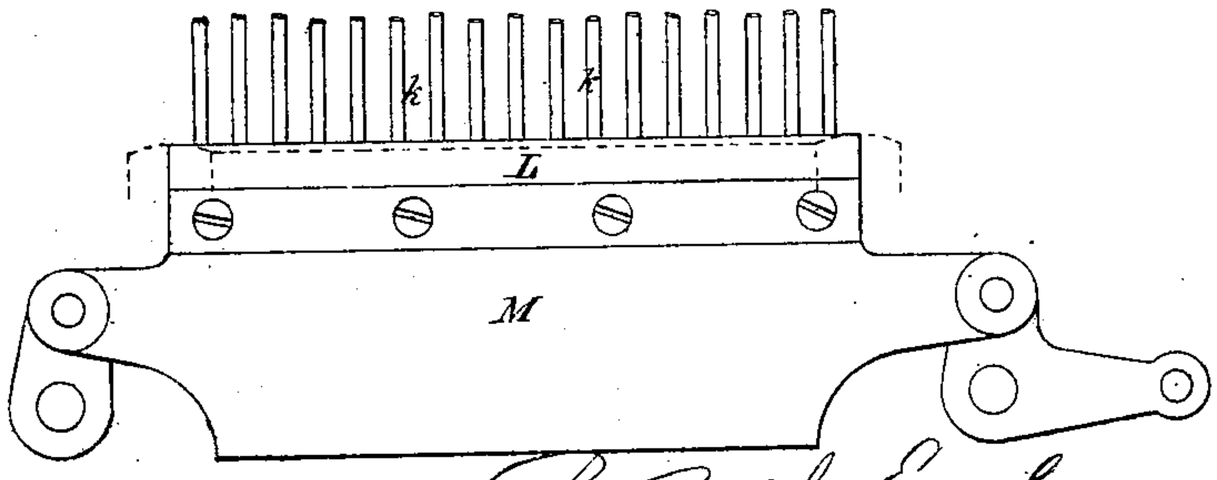


Fig: 7.



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5 Sheets--Sheet 5.

R. EICKEMEYER & G. NARR.

Looms for Weaving Pile Fabrics.

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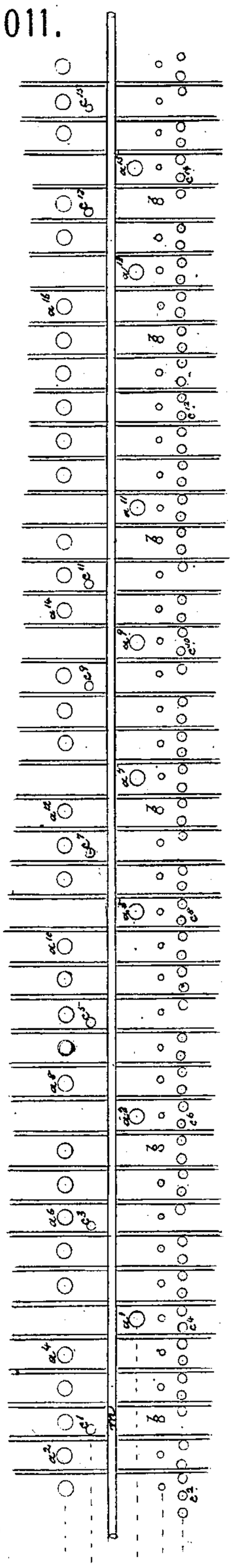

Fig. 8.

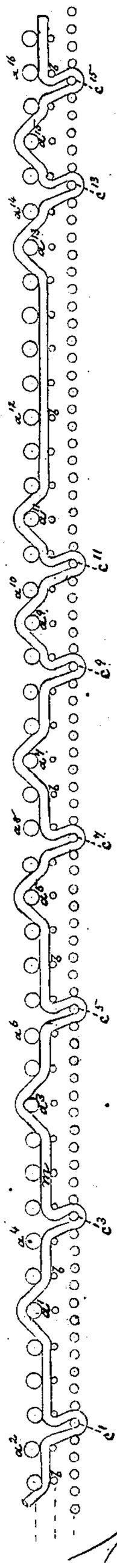

Fig. 9.

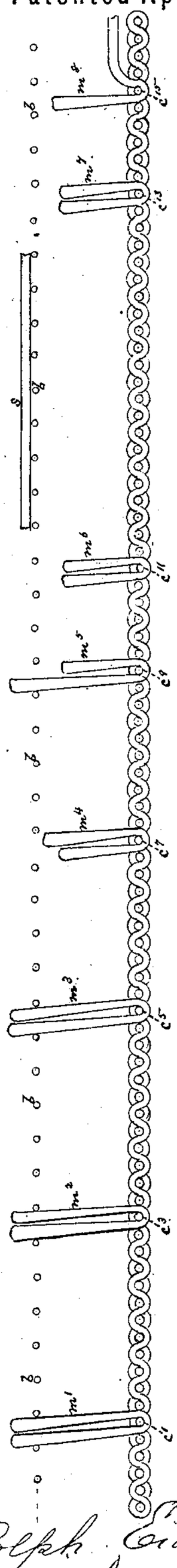

Fig. 10.

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UNITED STATES PATENT OFFICE.

RUDOLF EICKEMEYER AND GEORGE NARR, OF YONKERS, NEW YORK.

IMPROVEMENT IN LOOMS FOR WEAVING PILE FABRICS.

Specification forming part of Letters Patent No. **150,011**, dated April 21, 1874; application filed April 4, 1872.

To all whom it may concern:

Be it known that we, RUDOLF EICKEMEYER and GEORGE NARR, both of Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Looms, of which the following is a specification:

This invention relates more particularly to looms for the manufacture of tufted or pile fabrics, such as carpets, rugs, mats, cloakings, imitations of skins and velvets, and all kinds of fabrics in which a nap is formed by the shuttle-thread on the face of the goods; but the invention is also applicable to looms for the manufacture of goods in which part of the shuttle-thread is cut off from the surface of the goods, such as shawls, or fabrics having tufts or threads of a different color, length, or material, put or arranged at intervals on the surface of the goods, which may either be fancy or plain.

The ordinary process heretofore adopted for making these and other like kinds of goods consisted in floating the shuttle-thread on the surface or face of the fabric, binding it at certain points, and afterward cutting it with a knife run by hand in the spaces between the rows of tufts. This requires a great deal of care and skill, and by such process it is impossible to make longer tufts than half the space between each row of tufts.

It is common to use leading wires or strings, operated either by the ordinary or any suitable harness-motion, or by the jacquard-machine of the loom, and so connected with a cutting mechanism that each tuft is fed to the cutter or cutters by the action of the lay, and is cut at the required point to produce the desired length.

Our invention consists in a system of lifting wires or strings operated by the action of the loom, said wires setting up the tufts at right angles, or thereabout, with the surface of the fabric after the tufts have passed the cutting mechanism. It is preferred to operate these leading and lifting wires by the treadles.

Whenever the loops or floats are of unequal length, or the leading-wires are so operated that the loops are cut into tufts of unequal length, then the goods will present an unequal surface, which latter can be modified and arranged to present any desired raised figure.

Whenever the leading-wires are in the middle between the points where the tufts are fastened to the back, then the tufts will present a smooth and level surface.

The pile may also be made in patterns of different colors, as well as of different lengths. Thus, supposing a certain color is to appear in a pattern in the middle of a set of tufts of another color, the shuttle-thread is fastened into the fabric in the proper place, and each end is cut off at the proper point, thereby cutting out a piece of the shuttle-thread whenever the distance from one tuft of the same thread to the next is greater than necessary to produce the length of the tuft required.

We are thus enabled not only to produce tufts of unequal length, but of any desired or different color at any point, without covering the shuttle-thread in the body of the fabric any farther than is necessary to properly secure the tufts.

In the accompanying drawing, which forms part of this specification, Figure 1 represents a side view of a loom, in part, having our improvement applied to it. Fig. 2 is a plan of the same; Fig. 3, a longitudinal vertical section thereof. Figs. 4, 5, and 6 are vertical sections, representing three different modifications of the cutting apparatus as substitutes for that shown in Figs. 1, 2, and 3 of the drawing. Fig. 7 is a plan of the cutting device or apparatus shown in Fig. 6. Figs. 8, 9, and 10 are sectional views of the pile fabric during the process of manufacture, showing the relative positions of the leading and lifting wires or strings; also, of the warp and filling, respectively.

Referring, in the first instance, or more particularly to Figs. 1, 2, and 3 of the drawing, A is the frame of the loom; B, the lay; C, the harness; D, the breast-beam; E the cloth-beam; F, the whip-roll, and G the warp-beam. H is a cutting blade or knife, arranged over the breast-beam, for cutting the tufts before the fabric passes through or over said beam. This cutting-blade is automatically moved by means of a lever or levers set in motion by any convenient portion of the loom, and so

that it makes a curved path across the fabric, to produce what is commonly called a "draw-cut."

The leading-wires *a* are passed over the top of the cloth-warp *c*, and are fastened at their one end to pins *e* at back of the breast-beam, and held taut or stretched at their other end by weights *f*, connected with cross bars or rods *g*, made capable of sliding in slotted side brackets I. These leading-wires are operated by the heddles, or certain of them. The lifting-wires *b* are arranged to extend between the leading-wires and warp, and are similarly held and stretched at their ends by pins *e* and sliding cross-bars *g*, with attached weights *f*; and they also are operated by the heddles, or one of them. The weights *f* serve to produce uniformity of tension on the several wires as the shed is opened and closed.

As the loops formed by the action of the harness or jacquard motion and laid over the leading-wires are pushed by the lay along over said wires to the cutter H, said cutter cuts off, and thus separates, the tufts.

The heddles marked 1, 2, 3, 4, 5, 6, and 7 in Figs. 1, 2, and 3 carry the warp-threads, while the heddles marked 8, 9, 10, 11, 12, and 13 carry the leading-wires, and the heddle 14 the lifting-wires. By raising one of the heddles carrying the warp-threads, a certain number, say five threads, are lifted high enough to pass the shuttle underneath. Lifting five of the heddles to which the leading-wires are attached, (one heddle remaining down,) five leading-wires, corresponding with the warp-threads which have been lifted, are left down, thereby allowing the shuttle, with its thread, to pass over them. As soon as the shuttle has passed, and the shuttle-thread to form the tufts is in the proper position, the shed is closed, and, as the leading-wires and warp-threads previously raised are carried downward, the weft-thread is looped over the leading-wires already down, the distance between which determining the length of the loop so formed. As the warp-threads are arranged a little below the leading-wires, they depress the weft-thread lower than the leading-wires, and, in this manner, tend to increase the length of the loop, as shown in Fig. 9. The tuft-thread is next beaten up by the lay, it having, in the above manner, been passed under a number of threads in the warp, and also passed over a number of the leading-wires, and the next ground-shot binds the tuft-thread in the back. As the weaving proceeds, making three figure shots or motions of the shuttle for the tuft, and one or two ground-shots for the back, the tufts are pushed forward by the lay, and, as the finished cloth is taken away by the take-up, the tufts are cut, and the pile or plush separated by the cutting apparatus, and, as the cloth leaves the cutting apparatus, the tufts are raised by the lifting-wires, the use of which will be understood when it is remembered, as hereinbefore explained, that the loops are floated on the surface, and bound into the back by one warp-thread, so that the tufts would, when cut, lie matted and packed tight on the surface of the goods, and would require gigging and brushing to set them up. To obviate this the lifting-wires *b* are introduced under and between each row of tufts.

It will be seen that the distance between the fabric and the leading-wires is gradually increased as the fabric is fed along, and, in this manner, each tuft is raised up and left standing when the fabric leaves the lifting-wires.

To operate the lifting-wires, one heddle only, numbered 14, is necessary, when the tuft-thread is looped around but one warp-thread, as all the lifting-wires have, in such case, to remain under the shuttle, while two or more heddles, applied to the lifting-wires, are necessary when the tuft-thread is passed under two or more warp-threads.

When a jacquard-machine is used, any one of the warp-threads or lifting and leading wires can be lifted or let down.

Referring, in the next instance, or more particularly, to Figs. 4, 5, 6, and 7 of the drawing, instead of the reciprocating blade or cutting-knife H, a rotating cylinder, H′, and a comb-shaped cutting-blade, J, as shown in Fig. 4, might be used.

Fig. 5 shows another modification of cutting apparatus, consisting of a number of cutters, *h*, corresponding to the number of leading-wires. These cutters are of a hook shape, and the leading-wires are looped around them in such a way that each tuft-loop slides over the cutting-edges *i* of said cutters, and, as the lay pushes the fabric along, the loops are drawn tight over the cutting-edges and ultimately cut in two or separated, the lifting-wires operating as hereinbefore described.

Another mode of cutting the tufts is shown in Figs. 6 and 7. The cutting apparatus there represented consists of a number of steel needles, *k*, like common darning-needles, clamped upon a metal plate, K, by means of a plate, *l*. A thin strip of rubber is put in between the needles and plate *l* to firmly secure the needles in their proper places. Through the eye of each needle is fastened one of the leading-wires, while on top of all the needles rests a cutting-blade, L, fastened to a plate, M, and extending from two to three inches beyond the width of the fabric. This cutting blade or knife is automatically moved by means of a bell-crank, which derives its motion from any suitable attachment with the loom, and has a curvilinear action as it reciprocates, to produce a draw-cut. As the tufts are pushed up by the lay, and each row comes toward the cutting-edge of the blade, the part of the tuft on top of the needles is cut off, and the tufts thus separated, while the lifting-wires, as in the other cases, straighten out the tufts and set them up.

We do not restrict ourselves, however, to any particular kind of cutting apparatus, but prefer, as a general thing, to use the simple

reciprocating cutter H, as shown in Figs. 1, 2, and 3 of the drawing.

To explain more minutely the operation of the invention, and its adaptability to cut different lengths of tufts, reference will now be made more particularly to Figs. 8, 9, and 10 of the drawing. Fig. 8 shows a section through the shed of the loom when open, and after the tuft-thread *m* has been introduced. In this figure a^2 a^4 a^6 a^8 a^{10} a^{12} a^{14} a^{16} represent the leading-wires lifted up, while a^1 a^3 a^5 a^7 a^9 a^{11} a^{13} a^{15} represent the row of leading-wires left down. Thus there are shown eight wires under the tuft-thread *m*, while the warp-threads left down are represented by the row of circles c^2 c^4 c^6 c^8 c^{10} c^{12} c^{14} c^{16}, and those raised up to fasten the thread *m* are shown by c^1 c^3 c^5 c^7 c^9 c^{11} c^{13} c^{15}, and are here also eight in number, corresponding with the number of leading-wires under the tuft-thread. Fig. 9 shows the shed closed, with the tuft-thread *m* bent, as there represented, and passing under the warp-thread c^1, between the lifting-wires *b* and the leading-wires, over the leading-wire a^1, under adjacent leading-wires, and over the lifting-wires, to and under the warp-thread c^3, and so on over the leading-wires a^3 a^5 a^7 a^9 a^{11} a^{13} a^{15}, and under the warp-threads c^5, c^7, c^9, c^{11}, c^{13}, and c^{15}. If, under this disposition of the several wires and threads, a ground-shot be now put in, and the tuft-thread *m*, thus fastened in the fabric, be pushed by the lay to the cutting mechanism, and the thread *m* be cut at the points a^1, a^3, a^5, a^7, a^9, a^{11}, a^{13}, and a^{15}, there will then be formed tufts of the length of threads between the warp-threads to which the tufts are fastened and the top of the leading-wires.

In Fig. 10 the lifting-wires *b* are represented in their raised condition for straightening the tufts, said figure also showing a section of the fabric in front of the tufts; of which, in accordance with the disposition of the several leading-wires and warp-threads in Figs. 8 and 9, there are here represented three double tufts, m^1 m^2 m^3, of equal length, owing to the thread *m* being passed over leading-wires in the middle between the binding warp-threads, next two tufts, m^4 m^5, having one long and one short portion each, and following these three tufts, m^6 m^7 m^8, of equal length again, but shorter than the first three, while the piece *s* of the tuft-thread is clean cut out and left on the lifting-wires, and thus separated from the fabric.

These changes in the disposition and lengths of the tufts and the portions composing them illustrate the variable character and extent of the invention, and its adaptability to weave tufted or pile fabrics, or to cut out and remove threads that are wanted only at one point, as it were, of a fabric, for the purpose of producing a spot of a different color, shade, or material, and where it is impossible to conceal the thread in the body of the fabric, as, for instance, in the manufacture of shawls. Again, in cloakings, it is often desirable to produce lines or patterns of tufts of different length, some curled and cut in two, while other rows are curled and not cut, as in certain imitations of goods known as "astrachan," while in some cases it is desirable to loop the tuft-thread around more than one warp-thread, and leave openings between the tufts, to show a different-colored ground. Our invention is capable of producing all these modifications by simply changing the pattern chain or chains in harness-motion looms, or the pattern-card of the jacquard-machine.

In recapitulation of the various changes which the invention is capable of producing, those skilled in the art to which the invention relates will readily perceive that a tuft may be looped around each warp-thread, or it may be looped around two or more, and yet it can be cut at any point, to produce any desired length of tuft. Furthermore, it is not necessary to separately or additionally secure the tufts, as when cutting them by the methods heretofore practiced, because, in the present case, the whole length of the tuft-thread is firmly held down on the surface of the back, while it is severed by the cutting apparatus. Another advantage is, that the tufts are raised gradually from the back, and not pulled up from the surface, as when gigged or brushed up. This protects or preserves the tufts, so that a filling which is very loosely twisted can be used when a fur-like surface is wanted, as, for instance, in making imitation seal-skin. By being able, also, to entirely cut out a piece or pieces of the tuft-thread or filling, as hereinbefore described, a variety of patterns can be made, and which it would be very expensive to produce under previous methods. Thus, supposing it is required to have a tuft of black one inch long in or on a surface of white one-half inch long, and yet keep the tufts six inches apart, we would then float the black thread six inches, and cut within one inch of the points where the thread is fastened, leaving at each point a tuft one inch long, while a piece of the black thread four inches long is removed. The lifting-wires, too, set up all the tufts, thus producing a finished fabric, ready for the market, without any further manipulation or handling, which is very important in goods formed of delicate materials and shades.

Our invention is, of course, applicable to any loom for producing a number of different shades of color; a shading-loom with changeable shuttles is best adapted, however. For ordinary plain pile fabrics, such as plain velvets, a loom with three figure-shuttles and one ground-shuttle is preferable; but even a loom with only two shuttles will answer, by making three shots for the figure with one shuttle, and one or two ground-shots with the other shuttle. In a hand-loom it would be necessary for the weaver to change his shuttle as the pattern required. For carpets or rugs, a loom with a jacquard-machine is necessary

to produce the number of changes required for the work to be done.

What is here claimed, and desired to be secured by Letters Patent, is—

1. The leading-wires and cutting apparatus, in combination with the lifting-wires, essentially as described.

2. The lifting-wires, in combination with the heddles, for operation by the latter, in the manner and for the purpose set forth.

3. The combination of the leading-wires, the lifting-wires, and the heddles, arranged to operate both sets of wires, substantially as specified.

4. The combination of the cutting apparatus, the leading-wires, the lifting-wires, and the heddles, essentially as herein described.

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