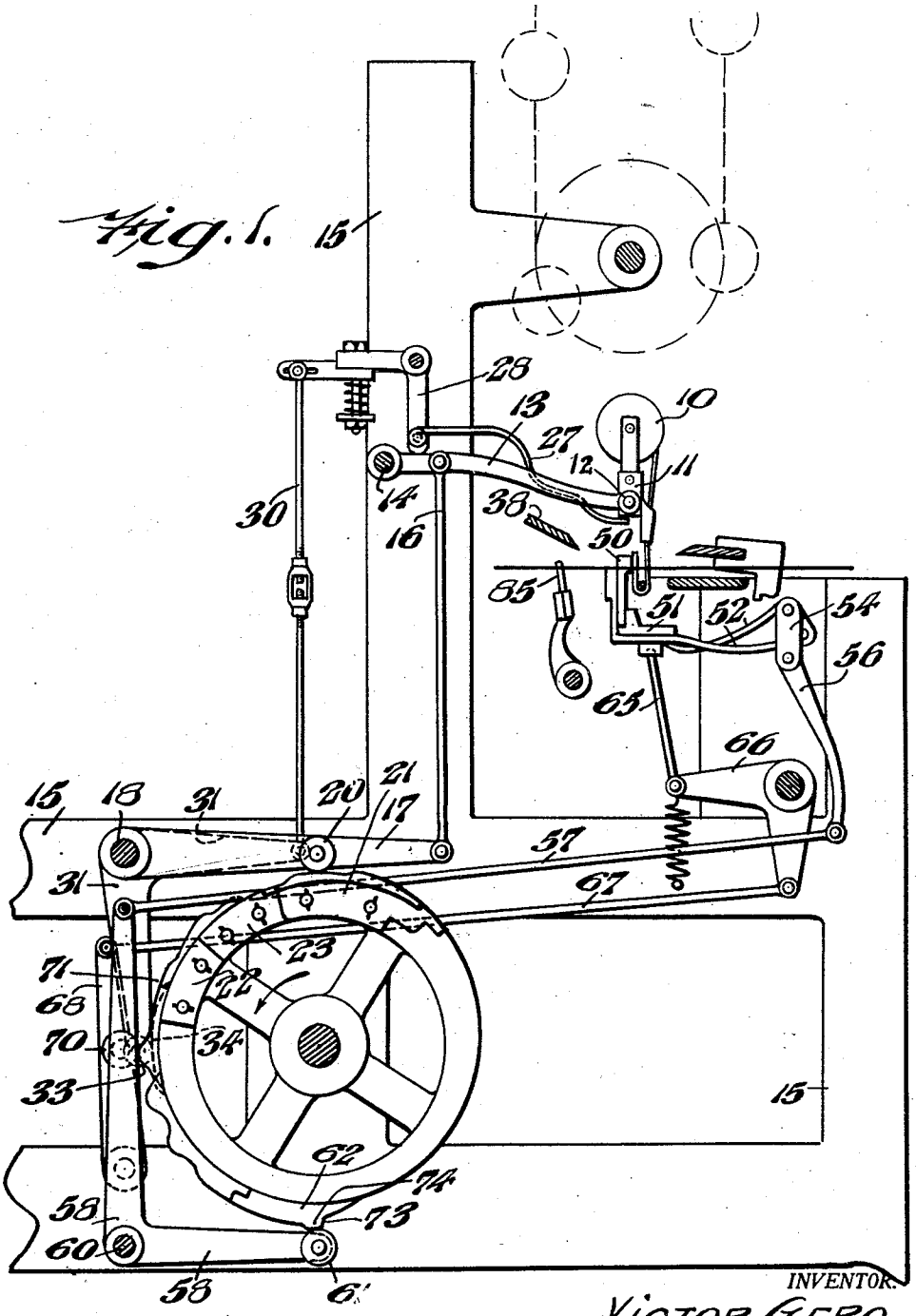
May 31, 1932. V. GERO 1,861,004

PILE FABRIC LOOM

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Fig. 1.



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PILE FABRIC LOOM

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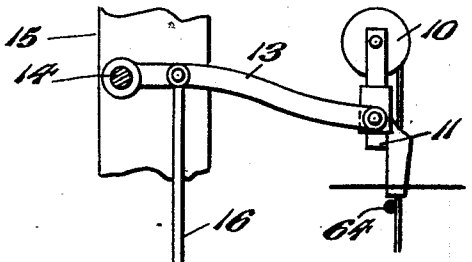
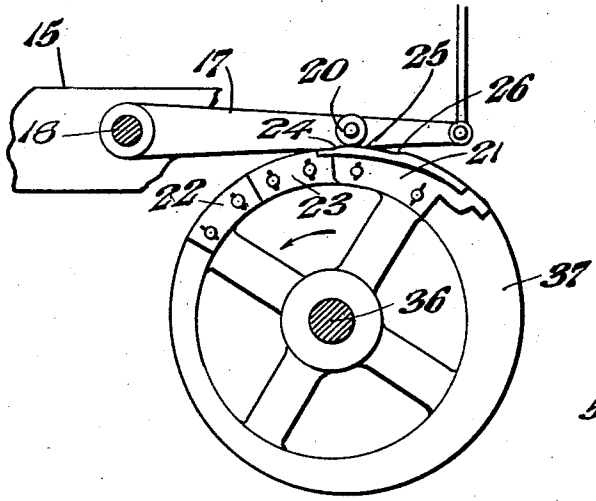


Fig. 2.



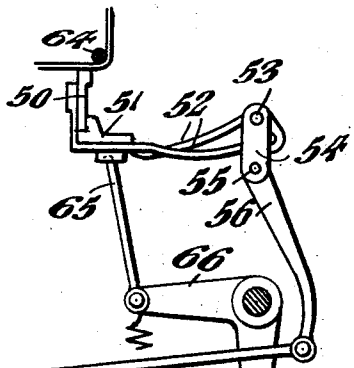
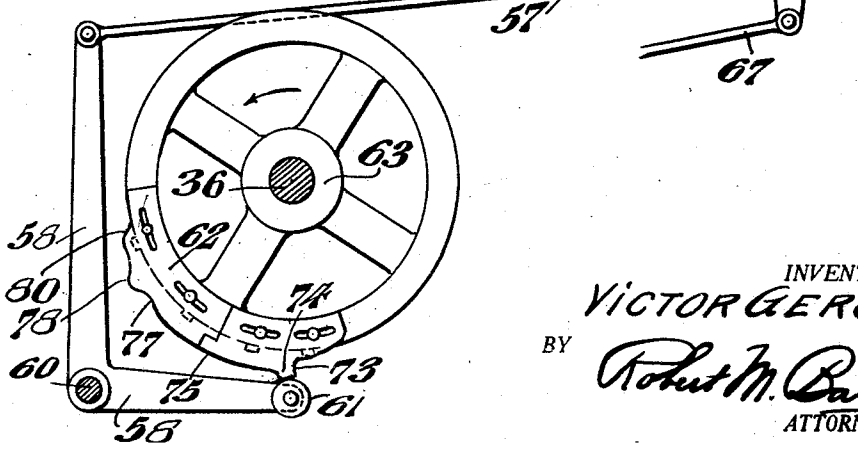


Fig. 3.



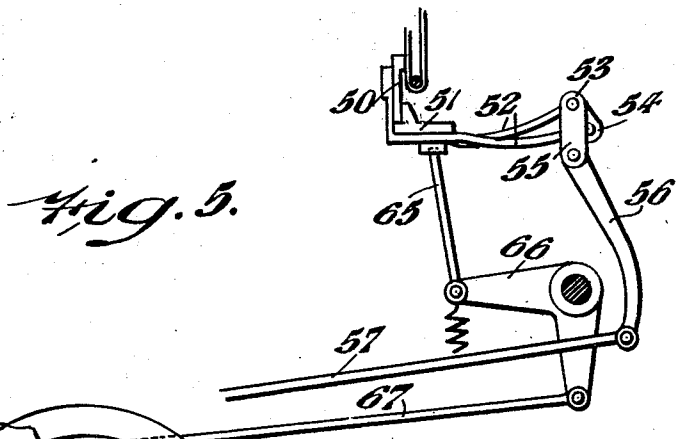
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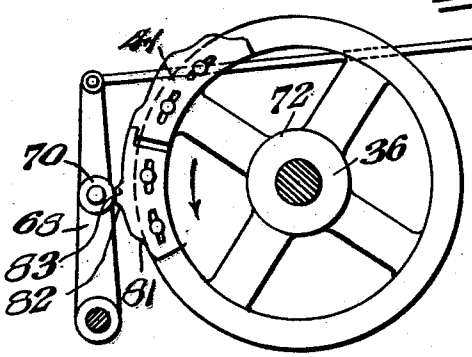
May 31, 1932. V. GERO 1,861,004

PILE FABRIC LOOM

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Fig. 5.





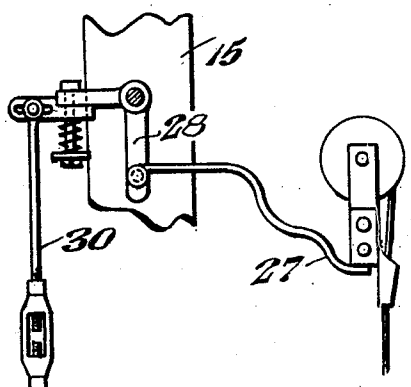
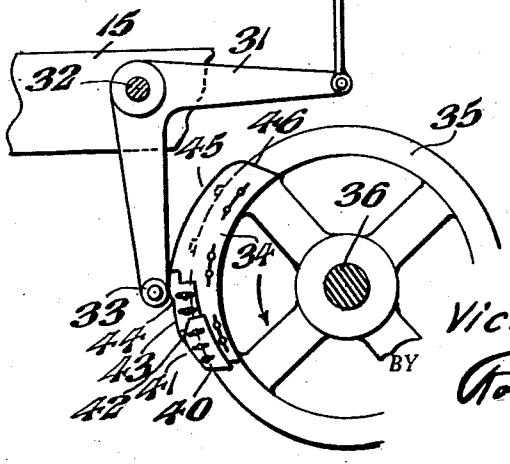


Fig. 4.

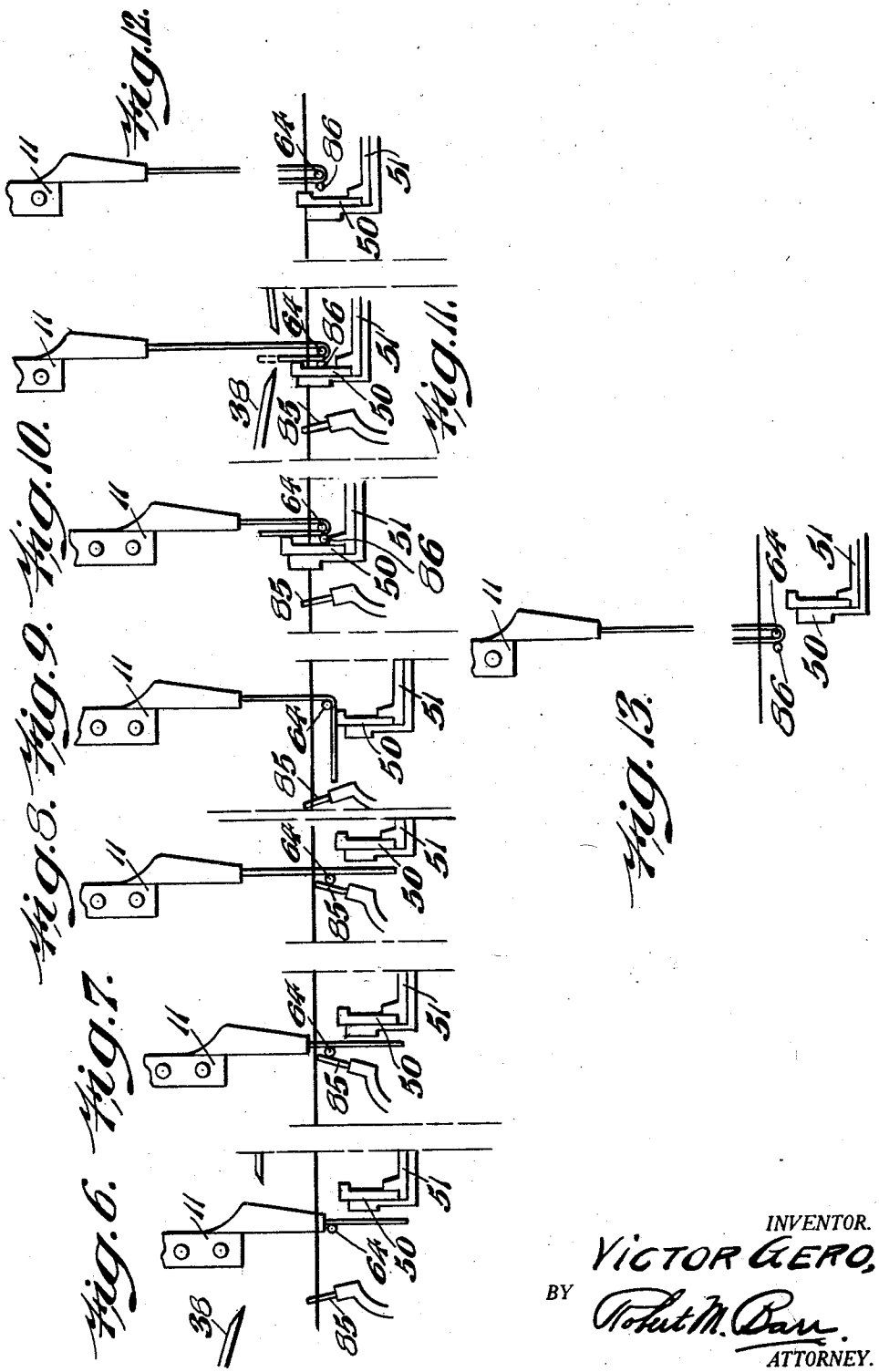


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PILE FABRIC LOOM

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PILE FABRIC LOOM

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Fig. 14.

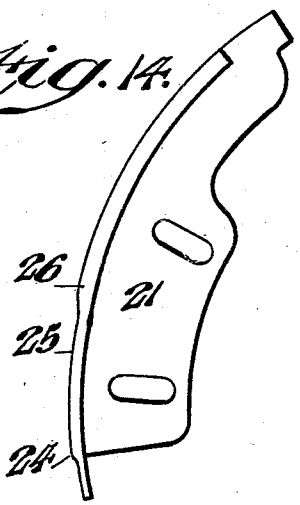


Fig. 15.

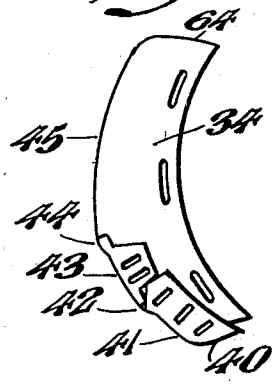


Fig. 16.

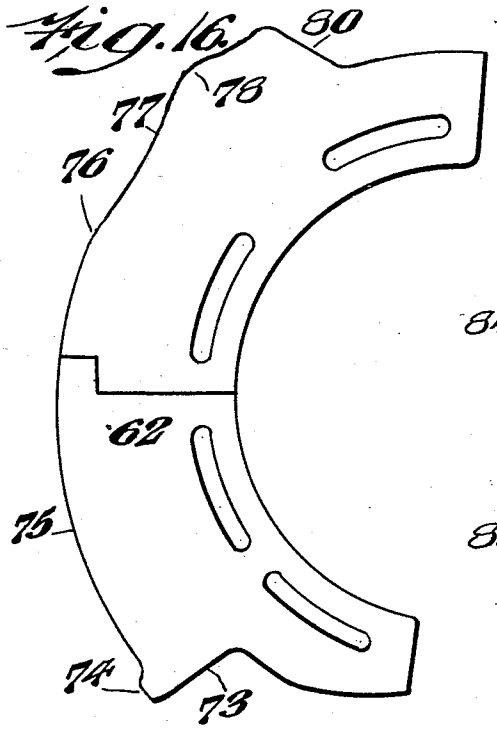
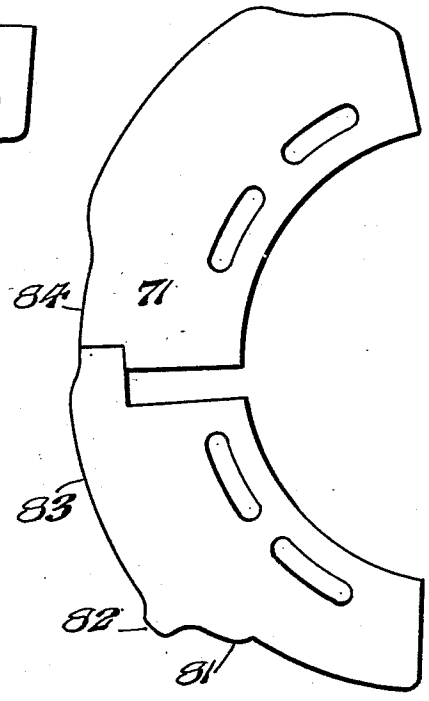


Fig. 17.



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PILE FABRIC LOOM

Application filed May 13, 1931. Serial No. 536,962.

The present invention relates to tufted pile fabrics and more particularly to the introduction of and drawing off of the tufts during the weaving operation.

As heretofore practiced in the art of weaving the more general method of passing the tuft yarn through the warp is by the use of tube frames having guide tubes for the respective yarns, which frames are removed with the spools from the conveyor chains by side clutch operated members under control of cams whereby the tubes are lowered to pass through the warp. The free ends of the tufts protruding from the tubes are then looped about a shot of the weft and held against movement by the action of the reed so that as the tuft frame makes its upward or return stroke the yarns are drawn off from the spool to give the desired length of tuft. The result of this continuous draw-off of the yarn is to leave a portion of the free ends of the tuft above the cutting knife and therefore when the latter comes into action it cuts this portion as waste when severing the strand of yarn which comes out of the tube. This waste portion is seldom less than an eigth of an inch in length and generally more so that the total loss in weaving a large sized rug is a very serious item of expense.

Some of the objects of the present invention are to provide an improved mechanism for drawing off tuft yarns from a tube frame; to provide a yarn drawing-off means wherein waste of yarn end is eliminated; to provide a step by step drawing-off of yarn from a tube frame in place of the usual continuous draw-off now and heretofore in use; to provide a mechanism for locating the end of a turned yarn tuft at substantially the plane of the cutting knife whereby the knife clears the end of the tuft as it moves to cut the other end of the tuft; to provide a tuft looping mechanism capable of varying the tension on the tuft when it is wrapped about a shot of weft; to provide a means for drawing a tuft with a predetermined tightness about a shot of weft while maintaining the pattern on the back; to provide a means for causing a tuft to be reversely drawn after being passed about a shot of weft whereby its free end is located in a predetermined plane; and to provide other improvements as will hereinafter appear.

In the accompanying drawings Fig. 1 represents a fragmentary sectional elevation of a loom embodying one form of the present invention; Fig. 2 represents a detail in side elevation of the spool raising and lowering means for inserting the tuft yarns through the warp; Fig. 3 represents a detail in side elevation of the comb controlling and actuating parts; Fig. 4 represents a detail in side elevation of the controlled lifting means for the middle portion of a spool; Fig. 5 represents a detail in side elevation of the comb put-up or comb raising mechanism; Figs. 6 to 13 inclusive represent respectively the successive steps of drawing off and looping the yarn strands to form the pile tufts; Fig. 14 represents on a larger scale the lifting cam for the ends of the spool; Fig. 15 represents on a like scale the lifting cam for the middle of the spool; Fig. 16 represents on a like scale the control cam for the lateral shifting of the comb; and Fig. 17 represents on a like scale the control cam for raising the comb.

Referring to the drawings one form of apparatus for successfully carrying out the objects of the present invention is shown as applied to a loom of the Axminster type though only such parts as are necessary for a complete understanding of the invention are illustrated. It is to be understood, of course, that all parts necessary for the proper operation of the loom, such as heddle frames, needle shot mechanism, harness control, and all other parts are present and function in the proper manner to carry out a weaving operation in accordance with the present invention.

In accordance with the present invention the yarn spool 10 with its tube frame 11 is removed from the spool conveyor by the clutch members 12 which are arranged to be raised and lowered by the usual cam control in the ordinary way in timed relation to the cycle of operations while the spool and tube frame selected and removed from the chain is now under control of the side arms 13 which are pivoted to a rod 14 fixed to the end frames 15. The arms 13 are operated respectively

by connecting rods 16 which join rock arms 17 pivoted at 18 to the frame 15 and actuated respectively by cam rollers 20 riding upon the peripheral face of the drawing-off cams 21. Preferably the construction just described up to the cam 21 is the same as that now in general use in looms of this type, but similarly ends here because the cams 21 forming a part of the present invention give an entirely different and basically new drawing-off movement to the spools.

By reference to Fig. 2 it will be seen that the roller 20 approaches the cam 21 by riding over the peripheral cam face of the cams 22 and 23 which are radially adjustable so as to locate the level of the spool at the proper place to prevent the tube frame from hitting the reed. Leaving the cam 23 the roller 20 meets the first high point 24 of the cam 21 and consequently the tube frame 11 is lifted to draw-off a predetermined length of yarn from the spool but the cam action is insufficient to give a full draw-off stroke to the tube frame 11 so that only about one half of the ordinary length of yarn is drawn-off. The length drawn-off is not limited however to any specific amount, because the broad scope of the invention comprehends two draw-off steps irrespective of yarn length instead of one draw-off of full length as has heretofore been the practice. When the roller 20 reaches the top of the lift point 24 it then rides on a concentric portion 25 of the cam 21 to allow the tube frame 11 to remain stationary while certain other adjuncts perform their functions in the cycle. At the end of the portion 25 the roller 20 meets the second high point 26 and is given a relatively quick kick to again lift the tube frame 11 to complete the yarn draw-off and bring the frame to the level where its control is taken over by the clutch devices.

Since the aforesaid control for the spool and tube frame acts at the ends of the frame, provision is made for simultaneously supporting and lifting the middle portion of the spool by a lifter 27 which projects forwardly from a pivoted bell crank 28 operatively joined by a connecting rod 30 to an operating lever 31 in the form of a bell crank pivoted at 32 and carrying a cam roller 33. An operating cam 34 is adjustably mounted upon a wheel 35 and has a shape generally conforming to the shape of cam 21. The wheel 35 is fixed to the shaft 36 which also carries wheel 37 upon which the cam 21 is mounted and the relative positions of the two cams 21 and 34 upon the two wheels is such that for each lift of the tube frame ends due to the cams 21 there will be a simultaneous and like lift of the lifter 27. When the lifter 27 is down it rests upon the back cutting knife 38 as a support while its control cam roller 33 is in the path of the cam 34. As this latter turns toward the cam roller 33 its face 40 contacts with the roller 33 and thereby causes the lifter 27 to move upwardly until it is just below the bottom of the tube frame 11 at which time the roller 33 rides onto the first lift cam face 41 to cause the middle part of the frame to be supported at the new level to which its ends are brought by the first step of the draw-off. When the roller 33 reaches the high point 42 it is held at that level by the concentric face 43 for the necessary interval and is then given a quick kick upwardly by the second high point 44 which corresponds to the second draw-off step. Leaving the high point 44 the roller 33 now rides along the concentric face 45 to still support the tube frame and spool so that when the latter is raised by the clutches the roller 33 comes to the drop-off face 46 which allows the lifter 27 to swing down and come to rest again upon the knife 38.

For actuating the comb 50 so that it has the desired oscillatory movement necessary to fold the tuft ends under the shot of weft, it is carried by a frame 51 supported on arms 52 which extend laterally from a pivot shaft 53 supported by links 54. The links 54 are fast at one end to a rock shaft 55 journalled between pivot pins on the frame and arranged to be rocked by an arm 56 which joins a connecting rod 57 leading to the bell crank 58. The bell crank 58 is pivoted at 60 and carries a cam roller 61 held against the face of comb cam 62 which is fast to a wheel 63 on the main shaft 36. The action of this cam 62 is to rock the arm 56 to cause the comb 50 to travel below and past the shot of weft 64 to turn the free end of the tuft yarn and then to return the comb 50 to its initial position. When the comb 50 has moved under and beyond the shot of weft 64 it is rocked upwardly with rocking movement of the pivot shaft 53 by the action of the lift rod 65 which is attached to a bell crank 66 operated by a connecting rod 67 to a rock lever 68 carrying a cam roller 70 associated with the lift cam 71 on wheel 72 keyed to the main shaft 36.

The comb cam 62 has a relatively abrupt cam roller meeting face 73 which throws the comb 50 rearwardly with a quick motion to its furthest position back of the shot of weft and at this point the cam roller 61 rides over the high point projection 74 and then drops back to the concentric face 75 which maintains the comb in proper vertical alinement with its associated parts. During the time the comb is thus controlled as to its lateral position the lift cam 71 functions to bring the comb up to complete the looping of the tufts about the weft shot. When the cam roller 61 reaches the point 76 it rides into a depression 77 so that the comb is drawn toward the folded ends of the tufts and presses against them with sufficient pressure to cause the tuft to resist the pull of the second draw-off step and prevent more of the tuft from

being pulled backward than is intended. With the completion of this second draw-off it is advisable to release the comb and push it away from the tufts so that when the comb goes down or back to its lateral movement level it will not scrape the yarn and to that end the cam 62 has a second high point 78 which gives the comb its second and last backward movement. The face 80 allows the cam roller 61 to ride in the direction to shift the comb forwardly to its starting position.

The lift cam 71 has such a position on the wheel 72 relative to the comb cam 62 that its roller 70 meets the first high point 81 at the instant the comb has been brought to its furthest back position by the high point 74. The high point 81 brings the comb up with a gradual accelleration to the second high point 82 which determines the maximum vertical movement of the comb. This position is but a momentary one and then the roller 70 is lowered slightly to the concentric portion 83 which holds the comb level until the depression 84 is reached. This depression serves to drop the comb down just enough to clear the knife blade as it advances for the cutting of the yarn as otherwise the blade would strike the comb with resulting damage.

In describing the operation of the invention it will be assumed that a tuft frame and spool have been removed from the spool conveyor and lowered so that the tuft frame yarn guides have passed through the warp and located the ends of the yarn in proper position with respect to the comb 50 and other associated parts (see Fig. 6). At this time a shot of the weft 64 passes across the row of yarn ends and immediately thereafter the reed 85 swings toward the row of yarn ends and presses the shot of weft 64 against these ends (see Fig. 7). As soon as this occurs the frame lift cams 21 reach a position where the first high point 24 of each operates through the cam rollers 20 and other connections to raise the tuft frame and thereby draw a predetermined length of yarn from the spool (see Fig. 8), though this length which is drawn off from the spool is considerably less than that drawn off in looms of this type as heretofore constructed. The putting-out cam 62 or cam which controls the lateral movement of the comb 50 now functions to throw the latter quickly to the end of its lateral stroke so that the ends of the yarn are now turned about the shot of weft at right angles to their former position (see Fig. 9). The reed 85 has now moved back to its inoperative position and immediately the comb 50 reaches the end of its lateral stroke the comb lift cam functions to move the comb vertically and thus bring the turned end of the yarn substantially parallel to the portion of the yarn which is still attached to the spool. The position of the parts at this time is shown in Fig. 10 and as soon as the comb 50 reaches this position a second shot of weft 86 is thrown across the yarn as indicated. The free ends of the turned yarn are now substantially at the same level as they are when turned in an ordinary loom and if the cutting-off knives were then actuated in the old manner an eighth of an inch or more of the ends would be cut off as waste because the knives travel transversely below the level of these yarn ends. In accordance with the present invention the spool lift cams 21 and 34 have now reached the places where the second high points 26 and 44 meet their respective rollers 20 and 33 and accordingly give a sudden upward kick of the spool and tuft frame which draws the yarn ends back until they are just below the plane of movement of the knives. At the time this second draw-off of the yarn takes place the comb cam 62 brings the portion 77 opposite the roller 61 and the comb 50 is therefore moved toward the turned tuft yarn ends and acts to squeeze or hold them so that the second draw-off movement will not pull back more than the desired length of the yarn ends. This squeezing action begins immediately the yarn ends are drawn back the predetermined distance and results in the ends being held at the new lower level while the tuft frame moves.

When the yarn ends are located at the new level by the second draw-off, the comb lowers to clear the path for the knife 38 and the cut is made through the length of yarn which is still attached to the raised tuft frame. The knife 38, however, passes over the turned ends, and therefore the length of yarn which has heretofore been cut off is saved. In Fig. 11 the knives are shown advancing to make the cut and the length of tuft end saved is shown in dotted lines. This completes the operation for a single row of tufts and therefore the comb cam 62 has come to the position where the comb release point 78 acts to move the comb away from the tufts (as shown in Fig. 12) in order not to scrape the yarn as the comb lowers and returns to the position shown in Fig. 13. In this latter figure the tuft frame is ready to be carried back with its spool to the chain and be replaced by another frame for the next row of tufts to be moved in the fabric.

In analyzing or describing motions of the comb, the comb lifting mechaism, the yarn draw-off and other movements, it might appear that the actions are comparatively slow and that one operation is delayed while awaiting the completion of another, but as a matter of fact there is almost a simultaneous functioning of the several parts, each in its proper time in the cycle and the result is a relatively fast weaving operation with no time-lag or delays. Furthermore by the elimination of a single draw-off movement

it is possible, not only to eliminate waste of yarn, but also to regulate the tension placed upon the tufts during the weaving and thereby to vary the texture of the finished article. By this is meant that regulation of the comb can take place so that it exerts practically any required pressure against the yarn ends and if pressed tightly thereagainst it will cause the yarn to resist the pull of the upwardly moving tuft frame and give a tight wrapping of the tuft about the weft. Likewise by less pressure the tendency of the yarn to move slightly during the drawing-off is increased and the portion of the tuft looped about the weft is not bound so tightly and it will, therefore, be seen that the fabric can be woven with a soft or a hard back according to requirements, but both showing the complete pattern.

While in the foregoing reference has been made to the saving of yarn as an essential result of the present invention and in order that this may be practically appreciated, it is here stated the first production runs upon a loom weaving nine foot by twelve foot rugs gave the astonishing increase of approximately six per cent saving of yarn. In other words the same loom which heretofore wove eighty, nine by twelve rugs now turned out eighty-five such rugs using exactly the same amount of yarn.

While only a single form is shown in which this invention may be embodied, it is to be understood that the invention is not limited to any specific construction, but might be applied to various forms without departing from the spirit of the invention or the scope of the appended claims.

Having thus described my invention, I claim:

1. In a loom for making tufted pile fabric, a yarn spool, a tube frame carried thereby for passing the yarn ends through the warp, a comb for turning the yarn ends about a shot of weft, means for giving said tube frame two successive lift movements for drawing off lengths of tuft yarn, and means for holding the yarn ends during one of said movements to draw a predetermined length of yarn from said spool.

2. In a loom for making tufted pile fabric, a yarn spool, a tube frame carried thereby for passing the yarn ends through the warp, a comb for turning the yarn ends about a shot of weft, means for giving said tube frame two successive lift movements for drawing the tuft yarn, means for holding the yarn ends during one of said movements to draw a predetermined length of yarn from said spool, and means for releasing said holding means during the other of said frame movements to allow the free ends of the yarn tufts to be drawn back to a predetermined level.

3. In a loom for making tufted pile fabric, a yarn spool, a tube frame carried thereby for passing the yarn ends through the warp, a comb for turning the yarn ends about a shot of weft, means for giving the said tube frame two successive lift movements for drawing the tuft yarn, means for holding the yarn ends during one of said movements to draw a predetermined length of yarn from said spool, and means for releasing said holdink means during the other of said frame movements to allow the free ends of the yarn tufts to be drawn back out of the plane of operation of the loom knives.

4. In a loom for making tufted pile fabric, a yarn spool, a tube frame carried thereby for passing the yarn ends through the warp, a comb for turning the yarn ends about a shot of weft, means operating at the ends of said spool for giving said tube frame two successive lift movements for drawing off lengths of tuft yarn, and means synchronized with said lift means for lifting the middle portion of said spool.

5. In a loom for making tufted pile fabric, a yarn spool, a tube frame carried thereby for passing the yarn ends through the warp, a comb for turning the yarn ends about a shot of weft to locate the ends above the plane of operation of the cutting knives, means to hold said ends so located, cam actuated means for lifting said tube frame to draw off a predetermined length of yarn from said spool while said ends are held, a device for releasing said holding means when said draw-off stops, and means for again lifting said tube frame to draw said ends below the plane of operation of the cutting knives whereby only the connected sides of the tuft loops are severed and waste ends eliminated.

6. In a loom for making tufted pile fabric, a spool of yarn, a tuft frame for passing the yarn ends through the warp, means for drawing off a portion of a tuft length during one portion of the frame stroke, means for drawing-off the remaining portion of said tuft length during the remaining portion of said stroke, and a device for regulating the tension of said yarn ends whereby the texture of the back of the fabric can be varied at will.

7. In a loom for making tufted pile fabric, a spool of yarn, a tuft frame for passing the yarn ends through the warp, means for drawing off a portion of a tuft length in one operation, means for drawing-off the remaining portion of said tuft length in a second operation, a comb, and means to vary the holding action of said comb on said yarn during the second draw-off operation, whereby the texture of the back of the fabric can be varied at will.

Signed at Philadelphia, county of Philadelphia, State of Pennsylvania, this 11th day of May, 1931.

VICTOR GERO.