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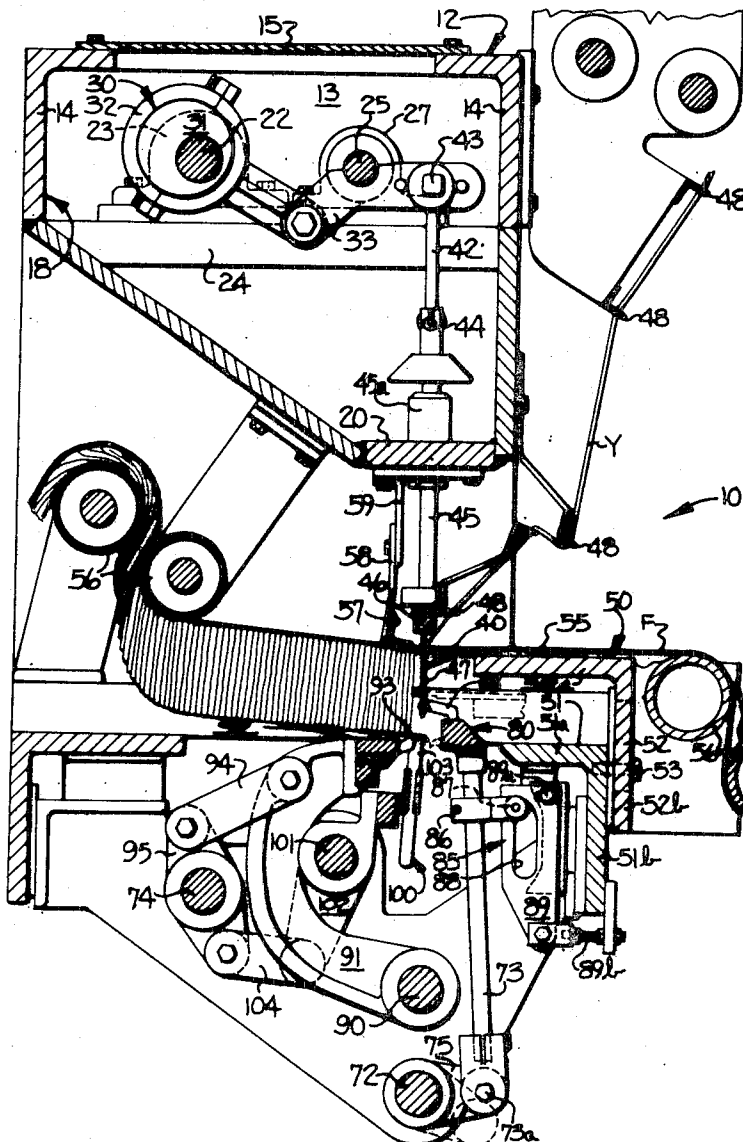
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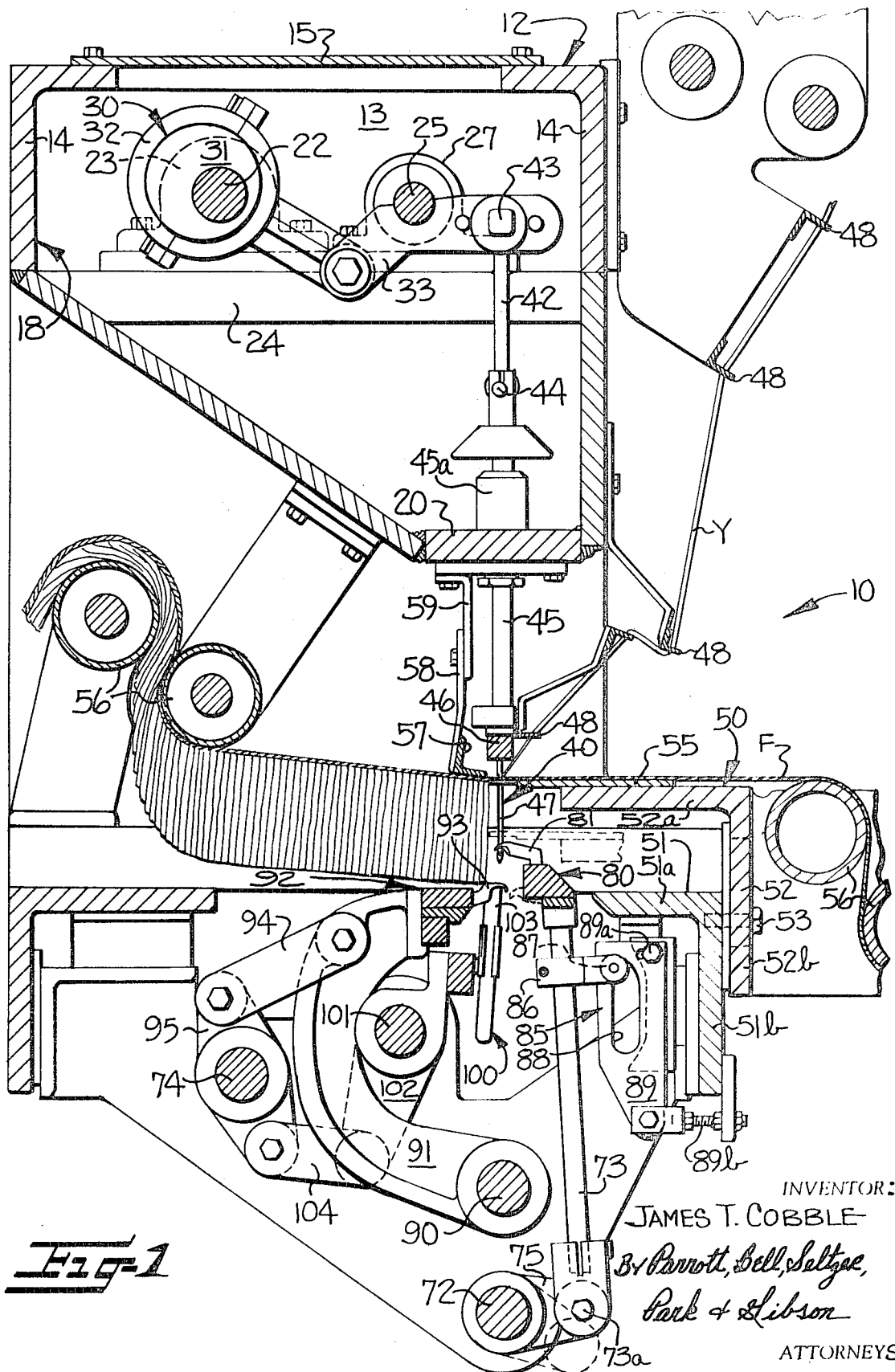
[54] **TUFTING MACHINE FOR FORMING SHAG-TYPE PILE FABRIC**
1 Claim, 6 Drawing Figs.

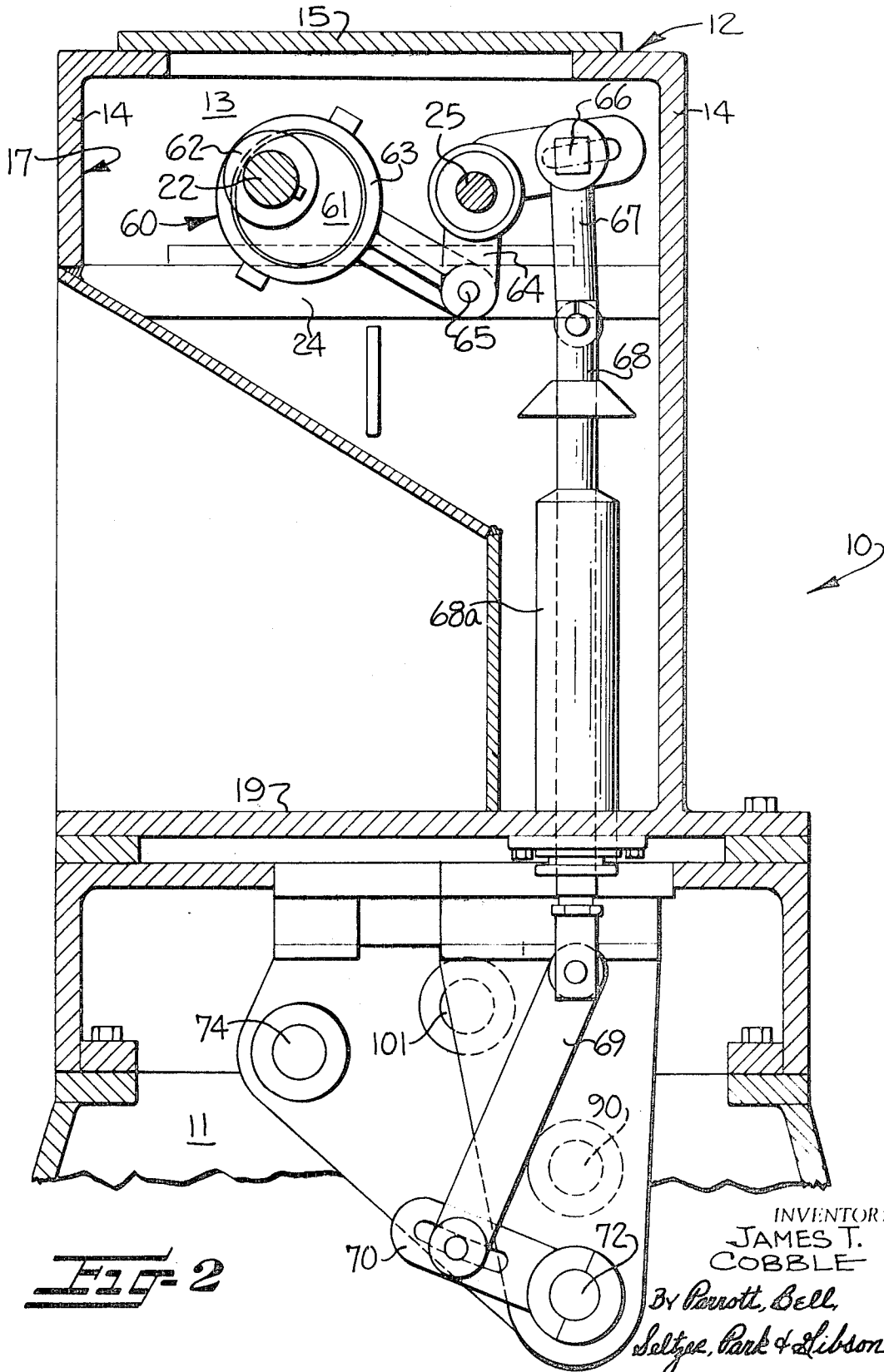
[52] U.S. Cl..... 112/79 R
[51] Int. Cl..... D05c 15/22
[50] Field of Search..... 112/79 R
79 A, 266, 410

[56] **References Cited**
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ABSTRACT: This disclosure relates to a tufting machine for and method of forming a pile fabric of the shag-type. The apparatus includes means for supporting a backing fabric, means for feeding backing fabric across the supporting means and at least one tufting needle mounted above the supporting means for reciprocation and adapted to penetrate and carry a yarn through the backing fabric to successively form tufting loops therein. A first looper engages the tufting loops formed by the needle and reciprocates substantially perpendicular to the supporting means to elongate the tufting loops to shag pile length and a second looper cooperates with the first looper for receiving the elongated loops from the first looper and holds the elongated loops thereon and cooperates with a knife for severing these loops.







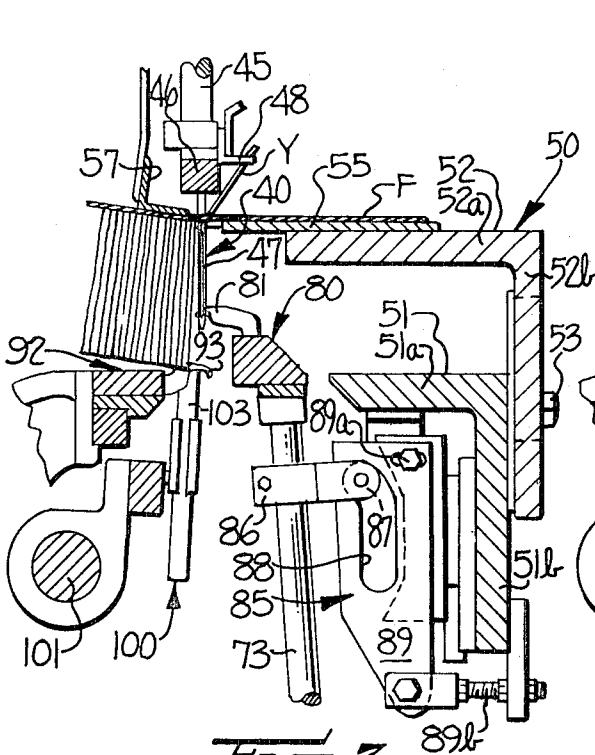


Fig-3

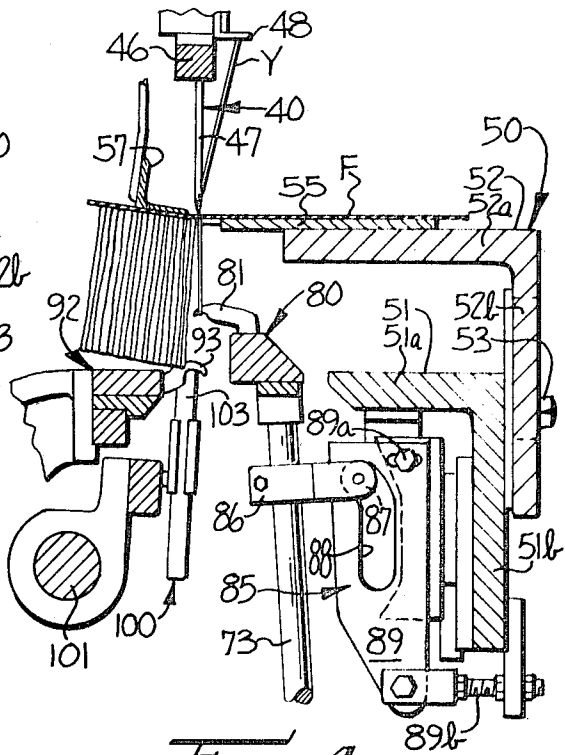


Fig-4

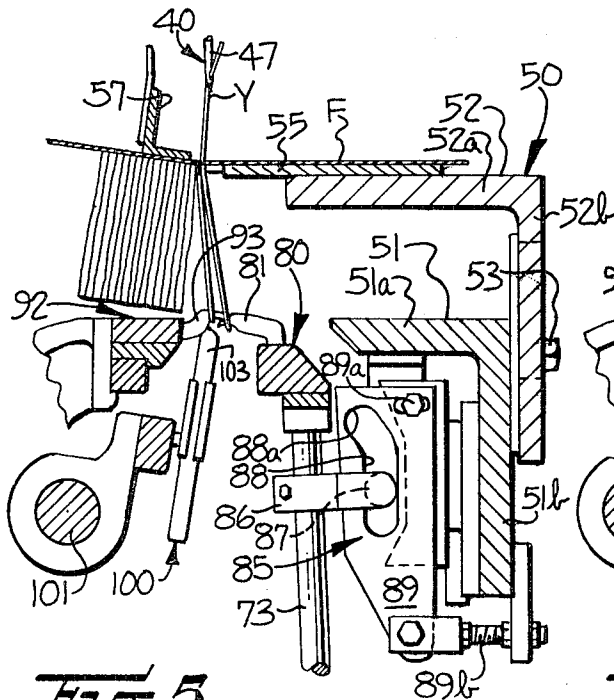


Fig-5

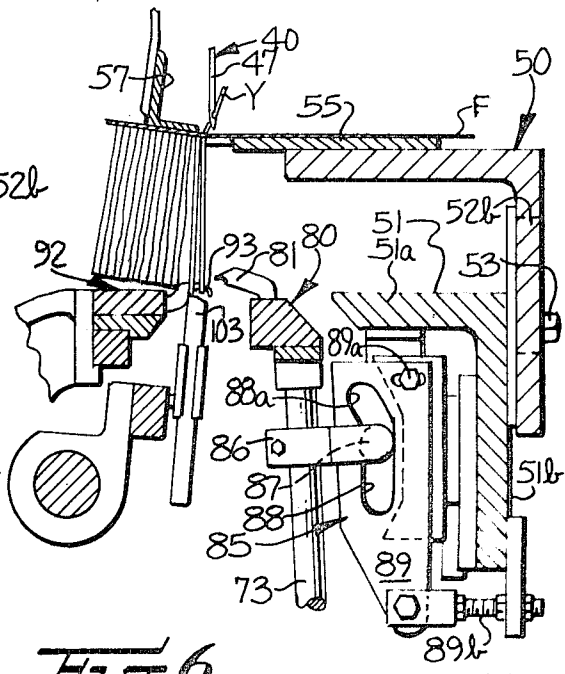


Fig-6

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TUFTING MACHINE FOR FORMING SHAG-TYPE PILE FABRIC

This invention relates to a tufting machine for forming pile fabric and more particularly to a tufting machine for forming pile fabric of the shag type.

In the tufting industry many and varied tufting machines have been provided for forming pile fabric in which the pile length may vary within relatively narrow limits. Typically, these tufting machines are constructed wherein tufting needles penetrate the backing fabric to form tufting loops of the desired length and in most instances, the depth of penetration of the needles determines the length of the pile loops. However, many problems are presented by tufting machines of this type such as frequent breaking of the tufting needles which is costly and time consuming, nonuniformity in the pile fabric and limitations in length of pile formable therewith.

Other tufting machines have been provided for forming pile loops of greater length or shag pile and these machines rely on movement of loopers for elongating the tufting loops formed by the tufting needles. By way of example, such a tufting machine is disclosed in McCutchen, U.S. Pat. No. 2,423,607, issued July 8, 1947, and employs three cooperating oscillatable loopers for receiving loops formed by the tufting needles and elongating the loops to the desired length. Such a multiplicity of loopers requires extensive and complicated drive means and other instrumentalities which consume valuable space and present numerous maintenance problems which add to the cost of manufacture and operation of such a tufting machine. Furthermore, due to the spacing requirements and cooperation between such a multiplicity of loopers, problems are encountered in cooperation of the loopers in the transfer of the loops between loopers, and the production of the tufting machine is severely curtailed.

Thus, it is an object of the present invention to provide an improved tufting machine for forming pile fabric of the shag type which employs a single elongating looper to elongate the tufting loops to the desired length, and thus, eliminates the multiplicity of loopers heretofore required and which alleviates the transfer problems between loopers.

It is a further object of this invention to provide a tufting machine of the above type wherein the length of the pile fabric formable thereby may be controlled by minor adjustments.

Briefly, the above objects are accomplished by providing a tufting machine including means for supporting a backing fabric, means for feeding backing fabric across the support means and at least one tufting needle mounted above the supporting means for reciprocation and adapted to penetrate and carry a yarn through the backing fabric to successively form tufting loops. To elongate the tufting loops formed by the tufting needle, a first looper is operatively associated with the tufting needle for engaging the tufting loops formed thereby and is mounted for reciprocation in a plane substantially perpendicular to the supporting means to elongate the tufting loops to shag type pile length. A second looper is operatively associated with the first looper for receiving the elongated loops from the first looper and holds the elongated loops thereon until they are severed by severing means. In order to adjust the length of tufting loops formed by the tufting machine, the supporting means is rendered adjustable relative to the loopers.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which

FIG. 1 is a vertical sectional view with portions broken away taken through a tufting machine constructed in accordance with the present invention;

FIG. 2 is a vertical sectional view through the same tufting machine as FIG. 1 at a different location and illustrates the drive for the first looper; and

FIGS. 3 through 6 are enlarged elevational views of a portion of the tufting machine of FIG. 1 and illustrate the successive steps in the formation of shag type pile fabric in accordance with the apparatus of FIGS. 1 and 2.

Referring more specifically to the drawings wherein like reference characters are used to indicate like parts, there is illustrated in FIGS. 1 and 2 a tufting machine, generally indicated at 10 incorporating the features of the present invention. The tufting machine 10 includes spaced apart vertical frame members 11 supportable from any horizontal surface such as the floor of a building or the like which provide support for a housing 12 extending horizontally therebetween. Housing 12 comprises end walls 13, side walls 14 and top wall 15 and is divided by vertical partitions, not shown, to include end portions 17, FIG. 2, and a central portion 18, FIG. 1. Each of the end portions 17 additionally include a bottom wall 19 and the central portion additionally includes a bottom wall 20, with walls 19 and 20 being disposed at different elevations.

A drive shaft 22 hereinafter referred to as the "main drive shaft" extends through the housing 12 and is journaled in the end walls 13 by suitable bearings and is additionally supported throughout the central portion 18 of housing 12 by other suitably spaced bearings 23 which may be mounted from a suitable support member 24. The main drive shaft 22 is continuously driven by any conventional drive means, not shown, and preferably at both ends to insure positive rotation thereof at all times.

An additional rotatable shaft 25 is disposed parallel to the main drive shaft 22 on one side thereof and is mounted within the housing 12 by suitably spaced bearings 27 also which may be carried by support member 24.

The main drive shaft 22 has mounted thereon a plurality of spaced needle drive cams 30 and each includes, FIG. 1, an eccentric disc 31 mounted on the main drive shaft 22 for rotation therewith and strap or cam follower 32 surrounding eccentric disc 31. Each of the cams 30 has the strap 32 pivotally connected to one end of a needle rocker arm 33, which rocker arms 33 pivot about shaft 25 so that rotation of main drive shaft 22 oscillates rocker arms 33 and imparts a reciprocating motion to the needle mechanism to be hereinafter described.

The needle mechanism of the tufting machine 10 of the present invention comprises a row 40 of tufting needles mounted for reciprocation. More particularly, the other end of the rocker arms 33 are adjustably connected to a needle drive bar connecting link 42 as at 43 which links 42 are pivotally connected as at 44 to needle drive bars 45 which are mounted through the bottom wall 20 of the central portion 18 of housing 12 in needle drive bar housing 45a for reciprocating linear movement. A needle bar 46 having a plurality of conventional tufting needles 47 carried thereby is mounted on the free ends of needle drive bars 45 with the needles 47 arranged in a row for reciprocation upon rotation of main drive shaft 22. Preferably, the needles 47 are uniformly and equally spaced along the row 40 with yarns Y being continuously fed thereto from any conventional source, not shown, through conventional guide members 48.

A backing fabric F is fed beneath the reciprocating tufting needles 47 from right to left in FIG. 1 in operative relation to the tufting needles 47 so that the needles 47 penetrate and carry the yarns Y through the backing fabric F to successively form tufting loops. With reference to FIG. 1, the backing fabric F is fed over means, generally indicated at 50 for supporting the backing fabric F in operative relation to the tufting needles 47. The supporting means 50 comprises a bed plate 51 which is fixedly secured by conventional means between frame members 11 forwardly of and beneath the reciprocating tufting needles 47. The bed plate 51 is an angle member having a generally inverted L-shaped cross section and includes a vertical leg member 51a and a horizontal leg member 51b, the latter of which extends inwardly toward the tufting needles 47. A needle plate support 52 having a cross-sectional area substantially identical to bed plate 51 and including a vertical leg member 52a and a horizontal leg member 52b has the vertical leg member 52a thereof secured in side-by-side relation with the vertical leg member 51a of bed plate 51 by means such as bolts 53 with the horizontal leg member 52b extending inwardly toward the tufting needles 47. Preferably, as illus-

trated, the vertical leg member 52a of needle plate support 52 includes transversely spaced elongate vertically extending slots through which bolts 53 are disposed to provide means for adjusting the vertical position of needle plate support 52 relative to the tufting needles 47. It will be apparent that horizontal leg member 51b of bed plate 51 provides a stop for limiting the downward movement of needle plate support 52 by abutment therewith.

Superimposed on the horizontal leg member 52a of needle plate support 52 is a needle plate 55 which extends inwardly from needle plate support 52 and has a plurality of projecting fingers, not shown, which are positioned between tufting needles 47 to support the backing fabric F adjacent the point of tufting.

The backing fabric F is tautly gripped and advanced along a predetermined path of travel across the needle plate 55 beneath the reciprocating needles 47 by means of feed rolls 56, which are preferably disposed on opposite sides of the tufting machine 10. The feed rolls 56, FIG. 1, which are disposed forwardly of the tufting needles 47 are preferably, as shown, carried by needle plate support 52 and are thus, adjustable therewith so that the backing fabric F is fed across the needle plate 55 in the same manner irrespective of the adjusted position of needle plate support 52. Accordingly, in addition to the supporting means 50 supporting the backing fabric F, the position of the backing fabric F relative to the pile forming means to be hereinafter described may be adjusted to adjust the length of pile formable with the tufting machine 10.

To facilitate withdrawal of the tufting needles 47 from the backing fabric F, a needle stripper 57 in the form of an angle iron is secured to the bottom wall 20 of the housing 12, as shown, by conventional adjustable brackets or links 58 and 59. The needle stripper 57 is positioned slightly rearwardly of tufting needles 47 and may be adjusted by links 58 and 59 so that it is just above the upper surface of the backing fabric F and just below the end of needles 47 at the upper extent of their reciprocating paths for stripping the backing fabric F from the needles 47.

In accordance with the present invention pile forming means are disposed beneath the path of the backing fabric F and cooperate with the tufting needles 47 for receiving and elongating the tufting loops formed by the tufting needles 47 to shag length. The drive for the pile forming means comprises a pair of pile forming drive cams 60, FIG. 2, mounted on main drive shaft 22 in each of the end portions 17 of housing 12 and each includes an eccentric disc 61 having a boss reinforcing portion 62 mounting the same on shaft 22 and a strap or cam follower 63 surrounding the disc 61 which is pivotally connected to one end of a rocker arm 64 as at 65. The rocker arms 64, are freely pivotal intermediate their lengths about shaft 25 and have the free ends thereof adjustably attached as at 66 to connecting links 67 which are in turn pivotally connected to drive rods 68. The drive rods 68 are mounted through the bottom wall 19 of end portions 17 of housing 12 in drive rod housings 68a for reciprocating linear movement in a vertical direction transverse to the path of the backing fabric F. The end of the drive rods 68 have links 69 pivotally connected thereto which are in turn adjustably and pivotally connected to jack levers 70 that are carried by opposite ends of a first looper drive shaft 72 for oscillation thereof upon rotation of main drive shaft 22.

With reference to FIG. 1, looper arms 73 are pivotally connected as at 73a to eccentrics 75 oscillatable with first looper drive shaft 72 and extend upwardly therefrom slightly forward of the tufting needles 47, the free ends of which have looper heads 80 mounted thereon. A plurality of looper bills 81 are adjustably mounted in each of the looper heads 80 and extend from the looper heads 80 rearwardly toward the path of the tufting needles 47.

In order to guide the looper bills 81 during oscillation of first looper shaft 72 for engaging and elongating the tufting loops formed by the tufting needles 47, the looper arms 73 are connected intermediate their ends to guide means, generally indicated at 85.

Each of the guide means 85 includes a collar 86 mounted on a looper arm 73 for movement therewith which includes a follower 87 that is disposed in a trackway 88 defined in a guide plate 89 which is connected by suitable means, as shown, to the vertical leg member 51a of bedplate 51. The trackway 88 is substantially parallel to the tufting needles 47 and perpendicular to the backing fabric F throughout the greater portion thereof but includes an upper portion 88a which deviates rearwardly toward the tufting needles 47. Thus, oscillation of first looper drive shaft 72 will cause the looper arms 73 to move with the followers 87 of collars 86 following the trackways 88 so that the looper bills 81 reciprocate in a plane substantially perpendicular to the backing fabric F. Due to the upper portions 88a of trackways 88, the looper bills 81 are shifted rearwardly toward the tufting needles 47 at the upper end of their reciprocating stroke in timed relation to the needles 47 for passing between the needles 47 and the yarns Y carried through the backing fabric F therewith and engaging the tufting loops as shown in FIG. 1. During the downward stroke of the reciprocating looper bills 81, the tufting loops are elongated the length of the downward stroke. It will be apparent that in addition to elongating the tufting loops, the loops are maintained directly beneath the tufting needles 47 for reasons soon to become apparent. To insure that the looper bills 81 operate properly, the guide plates 89 may be adjusted as at 89a and 89b parallel to the direction of feeding of the backing fabric F.

Disposed above and to the left as viewed in FIG. 1 of the first looper drive shaft 72 is a second oscillatable looper drive shaft 74 which is journaled at opposite ends in frame members 11 and is driven in accordance with conventional techniques, not shown. A second looper shaft 90 is disposed for free rotation by suitable means not shown parallel to second looper drive shaft 74. Bell crank looper arms 91 are carried at one end thereof by the second looper shaft 90 and extend rearwardly of the path of the tufting needles 47. The bell crank looper arms 91 have looper heads 92 mounted thereon in which are mounted a plurality of looper bills 93 which extend forwardly toward the path of the tufting needles 47 in opposed relation to the looper bills 81 at the lower end of their downward stroke. Connecting links 94 are pivotally connected at opposite ends, respectively, to an intermediate portion of bell crank looper arms 91 and one end of rocker arms 95 that are mounted on second looper drive shaft 74 so that oscillation of shaft 74 causes looper bills 93 to reciprocate substantially parallel to the direction of feeding of the backing fabric F and in cooperation with the looper bills 81 so that looper bills 93 receive the elongated loops from looper bills 81 at the lower end of their downward stroke and hold the same.

After the elongated loops are received on looper bills 93 the looper bills 81 are free to engage successive loops formed by the tufting needles 47. With the elongated loops being held by looper bills 93, means are provided that cooperate therewith for severing the elongated loops. The severing means is generally indicated at 100 and comprises a knife drive shaft 101 which is also journaled at opposite ends in frame members 11 for free rotation by suitable means, not shown, parallel to second looper drive shaft 74. Rocker arms 102 are carried by knife drive shaft 101 and have a plurality of knife blades 103 adjustably mounted in one end thereof in cooperation with looper bills 93. Connecting links 104 are pivotally connected at opposite ends, respectively, to the other end of rocker arms 102 and the free end of the rocker arms 95 that are carried by second looper drive shaft 74 and interconnect the knife drive shaft 101 for oscillation so that the knife blades 103 cooperate with the looper bills 93 for severing the loops held thereby. Preferably, as illustrated the knife blades 103 cooperate with the portion of the looper bills 93 spaced from the ends thereof receiving the elongated loops from the first looper bills 81 so that the elongated loops are not severed as they accumulate on the looper bills 93, the reason for which will be shortly explained.

With reference to FIGS. 3-6, there is illustrated in successive steps the formation of pile fabric of shag type with the

tufting machine 10 of this invention. As the tufting needles 47 reciprocate, they carry yarns Y through the backing fabric F to form tufting loops. As the tufting needles 47 approach the lower end of their downward stroke, the looper bills 81 approach the upper end of their upward stroke and are caused to move by the upper portions 88a of trackways 88 between the needles 47 and engage the loops as illustrated in FIG. 3. As the tufting needles are withdrawn and stripped from the backing fabric F, the looper bills 81 are moved downward in a plane substantially perpendicular to the backing fabric F, FIG. 4, or needle plate 55 to elongate the loops to shag pile length. At the lower end of the downward stroke of looper bills 81, FIG. 5, looper bills 93 move into the loops and receive the same from looper bills 81 and hold the elongated loops. It will be noted that looper bills 81 maintain the loops directly beneath the path of the tufting needles 47 so that upon transfer of the elongated loops from looper bills 81 they will have a tendency due to the feeding of the backing fabric F to be fed onto looper bills 93, as best illustrated in FIG. 5. As shown in FIGS. 3 and 6, the knife blades 103 cooperate with a portion of looper bills 93 spaced from the portion thereof which receives the elongated loops from looper bills 81. This is of particular importance in that the elongated loops are not severed upon receipt by looper bills 93 and thus, looper bills 93 are allowed to hold the elongated loops during the formation of the next elongated loops, as shown in each of FIGS. 3-6. Thus, yarn Y in a loop previously formed is not consumed or drawn back through the backing fabric F in the formation of successive loops and insures that the pile is of uniform length.

When it is desired to change the length of the pile being formed in the backing fabric F by the tufting machine 10, the position of the backing fabric F relative to the loopers may be

adjusted by proper adjustment of the supporting means 50.

What is claimed is:

1. In a tufting machine for forming a pile fabric of the shag type including means for supporting a backing fabric, means for feeding backing fabric across said supporting means, and at least one tufting needle mounted above said supporting means for reciprocation and adapted to penetrate and carry a yarn through the backing fabric to successively form tufting loops, the combination therewith of

a first looper operatively associated with said needle for engaging the tufting loops formed thereby and mounted for reciprocation in a plane substantially perpendicular to said supporting means to elongate the tufting loops to shag pile length, said first looper comprising an oscillatable shaft disposed below said supporting means and the path of said at least one needle, a looper having one end thereof pivotally connected eccentrically to said shaft, and guide means mounted between said oscillatable shaft and supporting means and connected to said looper for guiding said looper so that oscillation of said shaft reciprocates said looper in a plane substantially perpendicular to said supporting means for engaging tufting loops formed by said needle and elongating the tufting loops to shag pile length,

a second looper operatively associated with said first looper for receiving the elongated loops from said first looper and holding the elongated loops thereon, and

severing means operatively associated with said second looper for severing the elongated loops held by said second looper.

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