June 5, 1951 A. CRAWFORD 2,556,068

TUFTING APPARATUS

Filed Aug. 23, 1947 5 Sheets-Sheet 1

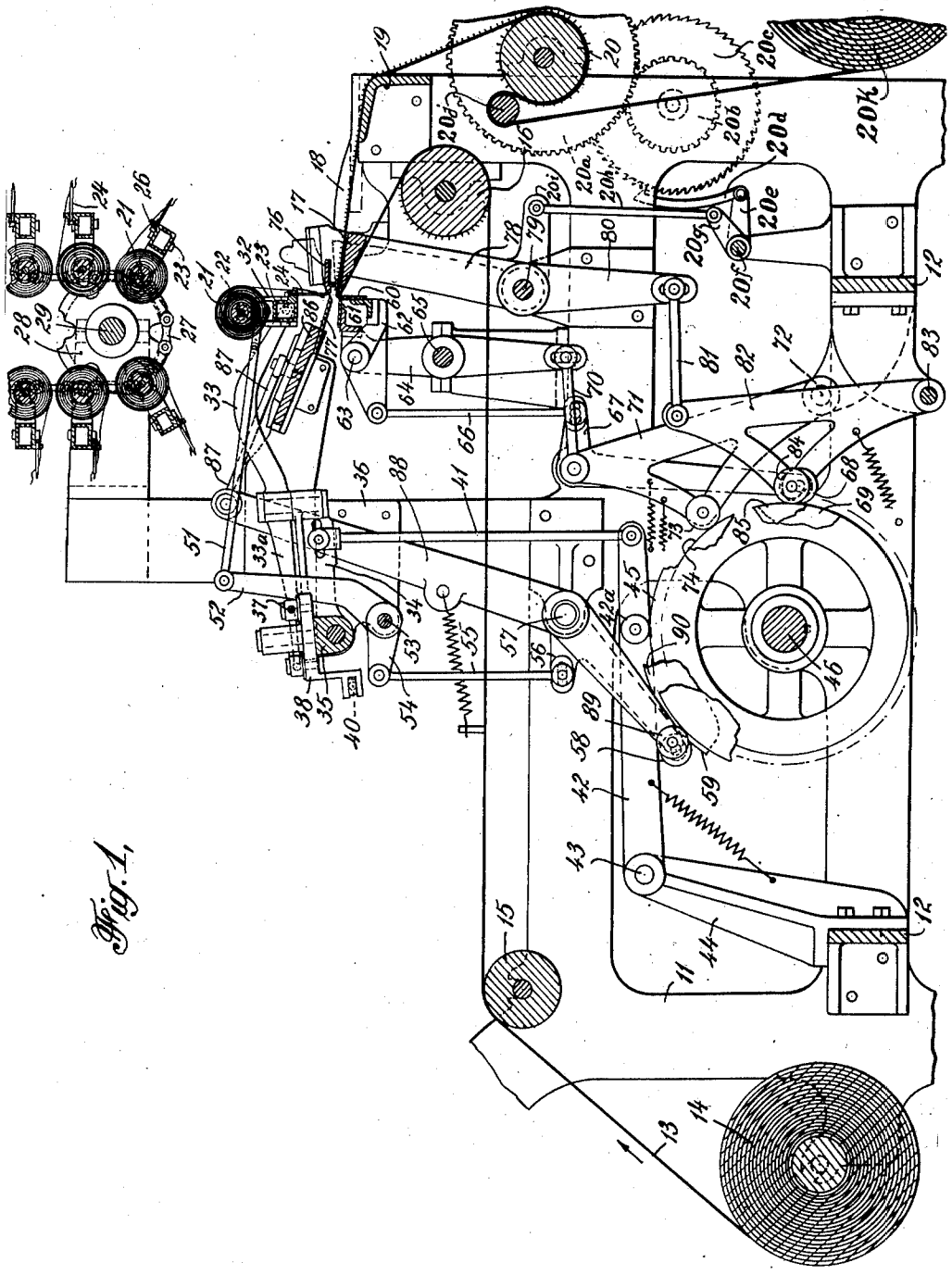


Fig. 1.

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TUFTING APPARATUS

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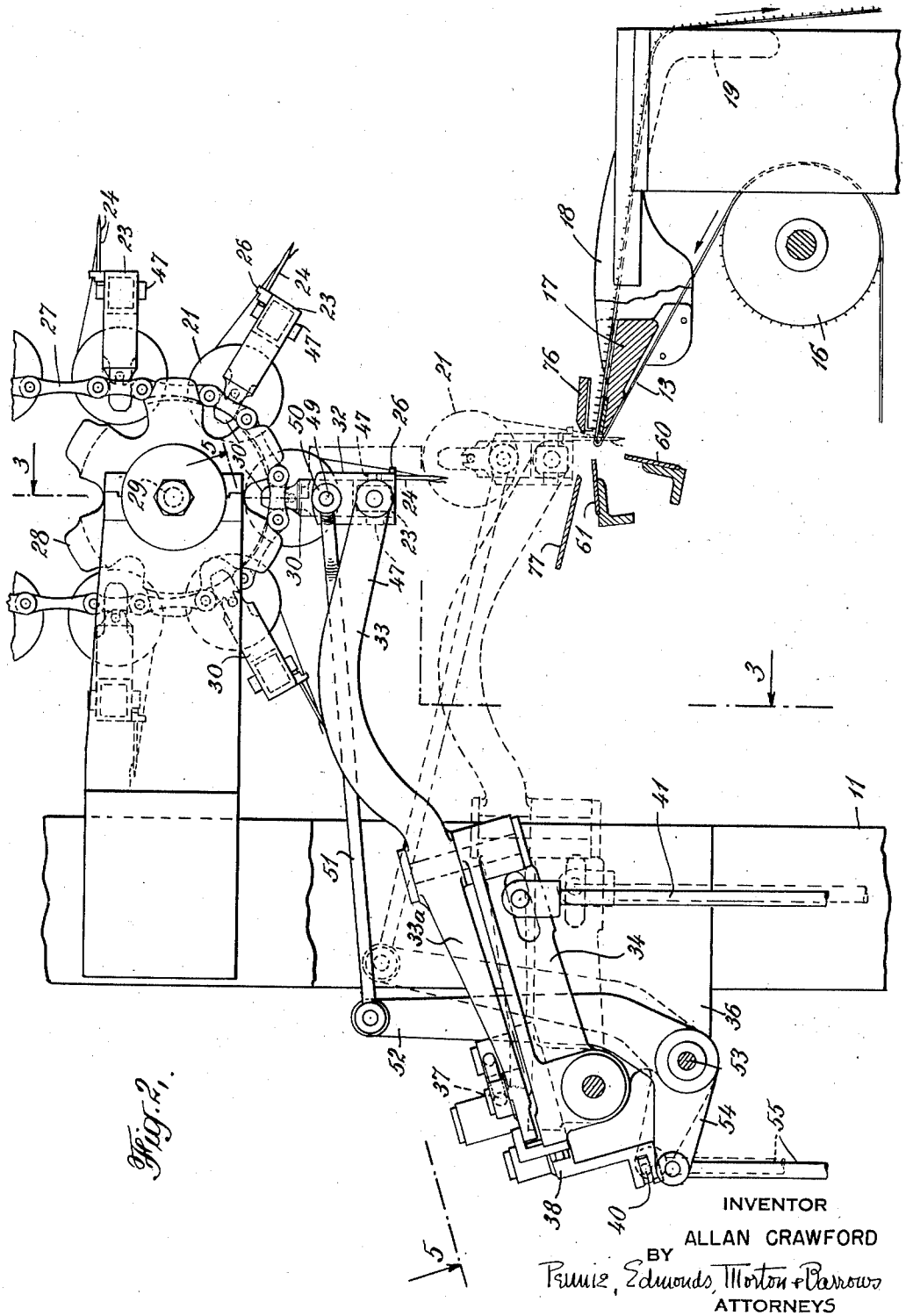


Fig. 2.

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TUFTING APPARATUS

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Fig. 3,

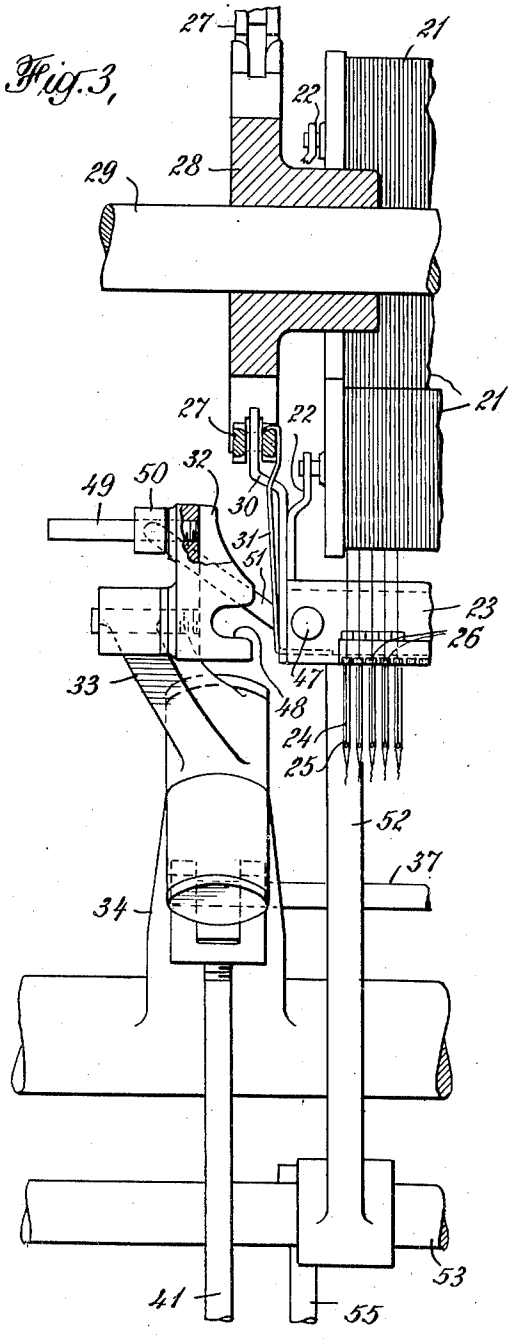
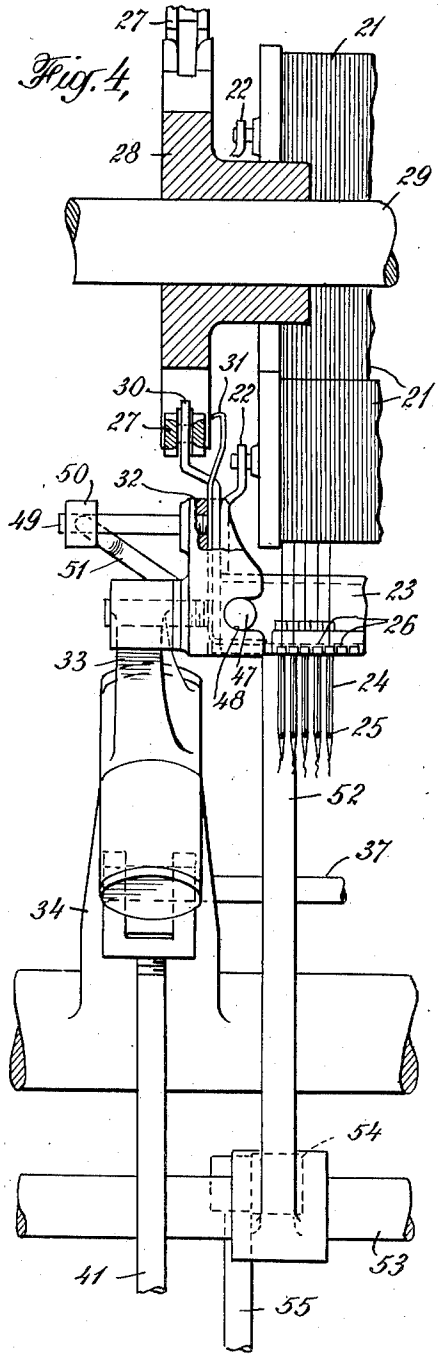


Fig. 4,



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TUFTING APPARATUS

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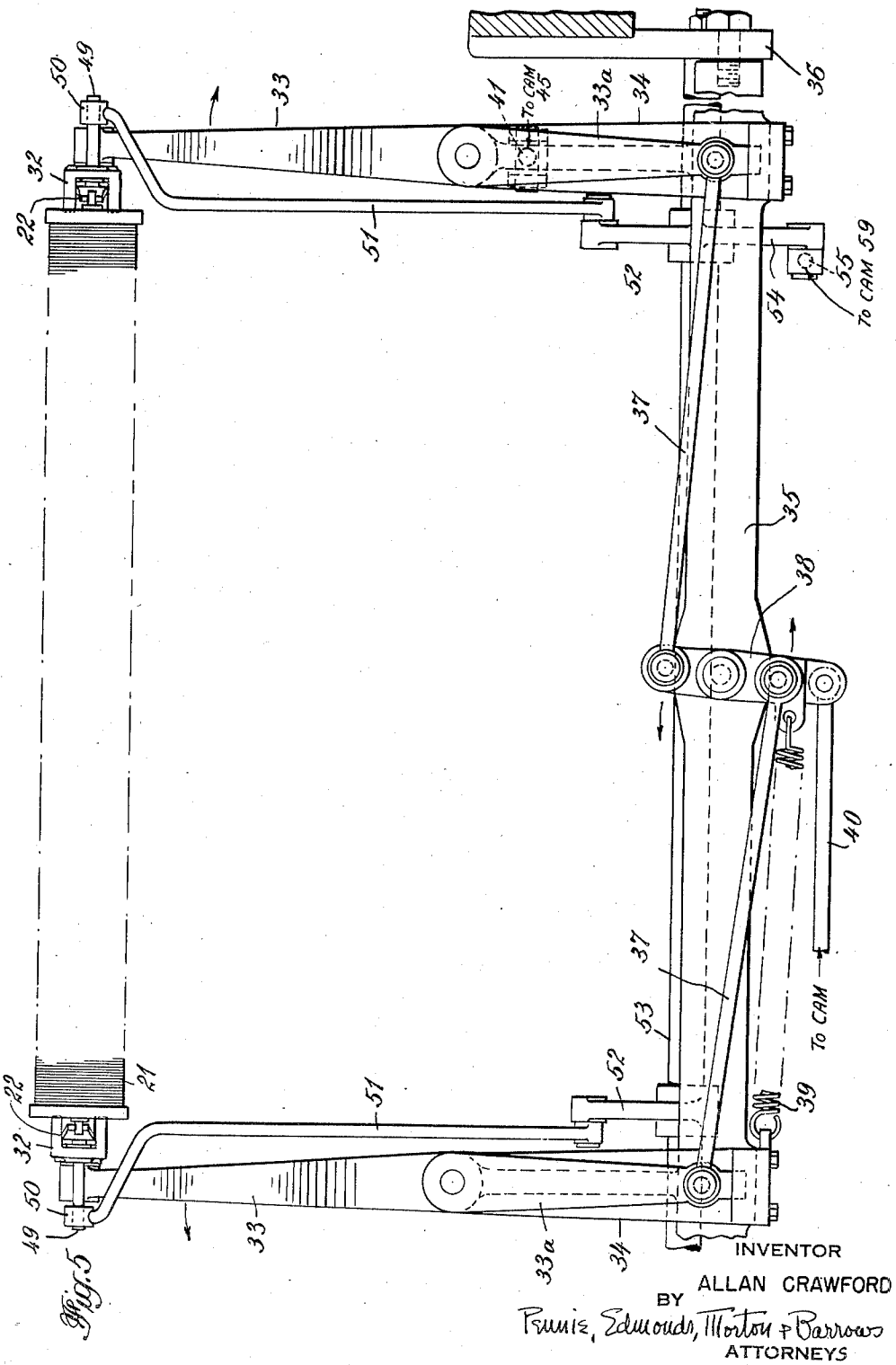


Fig. 5

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TUFTING APPARATUS

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Fig. 6,

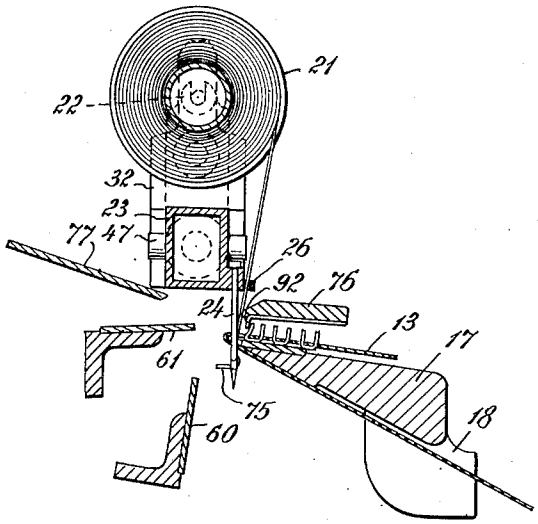


Fig. 7,

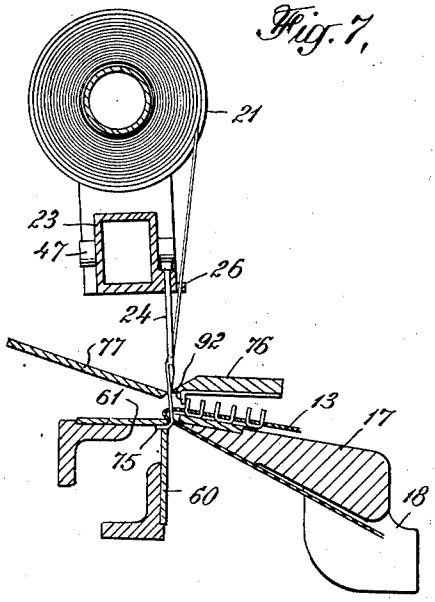


Fig. 8,

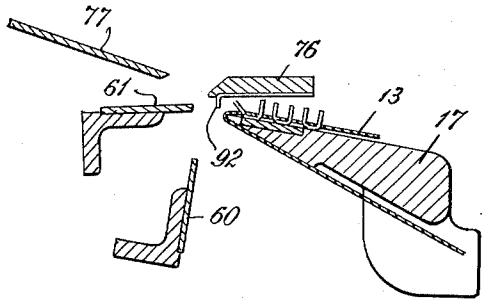


Fig. 9,

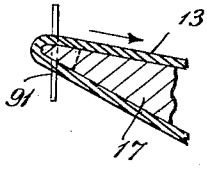
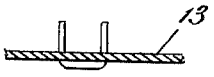


Fig. 10



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2,556,068

UNITED STATES PATENT OFFICE

2,556,068

TUFTING APPARATUS

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Application August 23, 1947, Serial No. 770,315

9 Claims. (Cl. 112—79)

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This invention relates to tufting machines, by which lengths of yarn are passed through a web to form tuft loops having bights lying against the back of the web and legs extending through the web to produce a tufted face. More particularly, the invention is concerned with a novel tufting machine, which can be employed for the production of tufted products having tufts of different colors arranged in accordance with a pattern.

In the new machine, tufts are inserted in the web in successive transverse rows by groups of needles, the needles in each group being mounted to lie in a line and threaded with yarns drawn from separate supplies, one for each needle. The supplies of yarn provided for the needles of each group are determined by the requirements of the pattern and the groups of needles are arranged in a series as determined by the pattern and utilized successively for tufting. The completed product thus carries tufts forming a single design or may consist of a number of units, each carrying a repeat of the design.

For a better understanding of the invention, reference may be made to the accompanying drawings, in which

Fig. 1 is a longitudinal section through a tufting machine constructed in accordance with the invention;

Fig. 2 is a view in side elevation, on an enlarged scale, of certain parts of the apparatus with other parts shown in section;

Fig. 3 is a sectional view on an enlarged scale on the line 3—3 of Fig. 2;

Fig. 4 is a view similar to Fig. 3 but showing the parts in different relative positions;

Fig. 5 is a sectional view on the line 5—5 of Fig. 2;

Figs. 6, 7 and 8 are sectional views showing the operation of the tufting elements; and

Figs. 9 and 10 are sectional views illustrating the relative positions of the tuft yarn and the backing in different stages in the tufting operation.

The tufting machine illustrated in the drawings comprises frame sides 11 connected by a number of girts 12. The backing material 13 to be tufted is supplied from a roll 14 mounted on an arbor in suitable supports on the frame sides and passes about a guide roll 15 and then around a driven spike roll 16. From the spike roll, the backing is led along the under surface of a cloth board 17 supported at its ends on brackets 18 attached to the frame sides. The cloth board tapers in thickness toward one edge and that edge is formed with a plurality of closely spaced

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slots extending inwardly from the edge. The backing is drawn about the thin edge of the cloth board and over the top thereof to pass about a breast beam 19 to a driven spike roll 20. A gear 20*a* mounted on the shaft of roll 20 meshes with a gear 20*b* on the same shaft as a ratchet wheel 20*c* driven by a pawl 20*d* attached to an arm 20*e* fast on a shaft 20*f*. An arm 20*g*, which is fast on shaft 20*f*, is connected by rod 20*h* to an arm 20*i* on the rock shaft 79. The fabric passing around the spike roll 20 travels about a roll 20*j* and is thence directed to a take-up roll 20*k*. The mechanism for advancing the fabric step by step by the spike roll is of the standard type used in an Axminster loom.

The supplies of yarn for tufting purposes are wound on spools 21 rotatably mounted in arms 22 of needle frames 23. Each spool is wound with a number of differently colored yarns, one for each tuft in a particular row across the finished fabric, the arrangement of the yarns on the spool being determined by the pattern. Each frame 23 carries a row of needles 24 projecting downwardly therefrom and there is one needle for each of the different yarns on spool 21. The needles have openings 25 near their lower ends and the yarns are drawn from the spools and pass through guides 26 on the frame and then through the eyes of their respective needles.

The needle frames are transported to and from active tufting position on a carrier comprising a pair of conveyor chains 27 and the arrangement of the needle frames with their spools on the chains is determined by the pattern. The chains pass about sprocket wheels 28 on a shaft 29 supported on the machine frame members and the links of each chain are double. Each frame 23 is provided with upstanding arms 30 at its opposite ends, which may pass between the links of a pair on each chain, and each frame also has a spring hook 31 at each end. The hooks are adapted to overhang the inner links of the pairs, between which arms 30 extend, and thus support the needle frame from the chains.

In the tufting operation, a needle frame, which is at the lowest point of chains 27 beneath sprocket wheels 28 is removed from the chains and lowered, until the needles thereon penetrate both legs of the bight of backing material led around the thin edge of the cloth board. The mechanism for removing the needle frames from the chains and lowering them toward the cloth board comprises a pair of clutches 32, each mounted on one end of a transfer arm 33 pivotally mounted on an arm 34 to swing in a gen-

erally horizontal plane. The arms 34 and a member 35 connecting them form a spool clutch frame, which is pivoted on studs in brackets 36 attached to the frame sides. The end 33a of each transfer arm 33 is connected by a link 37 to a lever 38 pivoted on member 35 and a spring 39 attached at one end to lever 38 and at the other to a fixed part of the spool clutch frame urges lever 38 in a clockwise direction. The lever 38 is swung counter-lockwise at the proper times during operation by a rod 40 moved endwise by a cam (not shown). The spool clutch frame may be swung in a vertical plane by rods 41, each attached at its upper end by a pin and slot connection to one of the arms 34 of the frame. At its lower end, each rod 41 is connected to the end of a lever 42 pivoted at 43 on bracket 44 attached to one of the girts 12. Each lever 42 is provided with a roller 42a, which bears against the surface of a cam 45 on a driven cam shaft 46.

In the operation of the spool clutch frame, it is swung counter-clockwise by its cams to bring the clutches 32 opposite the ends of a needle frame carried by chains 27 and lying at the bottom of sprocket wheels 28. When the clutches are in this position, they are moved inwardly by the swinging of the transfer arms 33, until studs 47 on the needle frames are received in notches 48 in the clutches and the inner faces of the clutches abut the ends of the needle frame. Just before the end of their inward movement, the clutches engage the spring hooks 31 on the needle frame and release them from the links of chains 27. The needle frame is then free of the chains 27 and supported by the clutches. The spool clutch frame is then swung clockwise to lower the needle frame toward the backing fabric folded about the thin edge of the clothboard, until the needles penetrate the bight of the backing fabric, the needles passing through the slots in the clothboard in their penetrating movement.

During the downward swinging of the spool clutch frame, the needle frame carried by the clutches must be guided so that the needles will penetrate the bight of backing fabric with a vertical movement. To insure the proper travel of the needle frame, each clutch is provided with a pin 49 extending outwardly therefrom, and the pin is encircled by a collar 50 on the end of a rod 51 connected to an arm 52 on a transverse shaft 53. The shaft is provided with another arm 54 connected by a rod 55 to one arm of a bell crank lever 56 mounted for rocking movement on a transverse shaft 57. The other arm of the bell crank lever 56 is provided with a roller 58 bearing against a cam 59 on shaft 46. As the spool clutch frame swings clockwise to lower the needle frame carried thereby, cam 59 operates through the parts described to maintain the needle frame in position, so that the needles 24 thereon will properly penetrate the bight of backing fabric.

When the needles have passed through the bight of backing fabric and carried the ends of the tuft yarns therewith, the ends of the yarns exposed beyond the eyes of the needles are gripped and held, so that when the needle frame is raised, the inserted yarns will be retained in position and appropriate lengths drawn from the spool 21 in the needle frame. The inserted ends of the yarns are gripped by means of a pair of grippers 60, 61. Gripper 60 is mounted on levers 62 pivoted on a cross rod 63 held in the upper ends of levers 64 on a shaft 65 and each lever 62 is connected by a rod 66 to one arm of a bell crank lever 67, the other arm of which is provided with a roller 68 bearing against cam 69 on shaft 46. Gripper 61 is mounted on brackets fast on rod 63. Each lever 64 is connected by a rod 70 to one end of a lever 71 pivotally mounted at 72 and provided with a roller 73 engaging cam 74 on shaft 46. During the tufting operation, the grippers are actuated by their cams to move from the open position, shown in Fig. 6, to the closed position, shown in Fig. 7. In the latter position, the grippers hold the ends 75 of the yarns projecting through the eyes of the needles, as the needle frame is raised.

When the needle frame has been moved upwardly so that the ends of the needles are well above the backing fabric, the yarns are severed between the fabric and the ends of the needles. The severing of the yarns is effected by a front knife 76 and a co-operating rear knife 77. The front knife is mounted on a cross member supported on the upper ends of levers 78 fast on the rock shaft 79. The shaft is provided with an arm 80, which is connected by a rod 81 to one end of a lever 82 pivoted at 83 and provided with a roller 84 bearing against a cam 85 on shaft 46. The rear knife 77 is attached to a plate 86 movable in guideways on brackets attached to frame sides and actuated by a rod 87 attached to one arm of a bell crank lever 88 pivotally mounted on shaft 57. The other end of the bell crank lever is provided with roller 89 running in contact with cam 90 on shaft 46.

In the operation of the tufting machine described, the backing fabric 13 is advanced stepwise by the take-up mechanism and the carrier for the needle frames is similarly advanced. At each period of rest of the backing fabric and carrier, an untufted portion of the fabric encloses the slotted edge of the cloth board and the carrier has stopped with a needle frame 23 in active position at the bottom of sprocket wheels 28. During the period of rest, the spool clutch frame is swung counter-clockwise to bring its clutches opposite the ends of the needle frame in active position, and the transfer arms 33 are then swung inwardly, so that their clutches engage the needle frame and release it from the chains. The spool frame is then swung clockwise toward the fabric and the needle frame carried thereby is maintained in proper position by arms 51 during such movement. Near the end of the downward movement of the needle frame, its needles penetrate the bight of backing fabric about the clothboard and, when the ends of the yarns have been carried through the fabric, grippers 60, 61 seize the free ends of the yarns. The spool frame then raises the needle frame and the yarns are drawn off the spools by the action of the grippers. When the needle frame has risen to the desired extent, knives 76, 77 sever the yarns above the fabric, so that a straight length 91 of each yarn has been passed through the bight of the fabric. The spool clutch frame continues its upward movement, until the arms 30 on the needle frame pass between links on chains 27, after which the transfer arms swing the clutches away from the ends of the needle frame. Before the clutches have entirely disengaged studs 47 on the needle frame, the spring hooks 31 on that frame pass over the links of chains 27, so that the needle frame is again restored to the chains. The fabric is now advanced another step, so that the portions of the inserted yarns lying within the bight bear against

the upper surface of the clothboard and a new length of the fabric is led around the slotted edge of the clothboard. During such movement of the fabric, the carrier advances the next needle frame to active position. The transfer arms swing in to remove that needle frame from the carrier, and the sequence of operations is repeated.

The front knife 76 is provided with rake teeth 92 on its lower surface and, when the yarns have been severed by the action of knives 76, 77 and knife 77 moves back, knife 76 moves in the same direction, until the rake teeth 92 lie beyond the slotted edge of the clothboard. Knife 76 remains in this position, until the fabric has been advanced another step and the last inserted lengths of yarn 91 lie above the clothboard. The knife 76 then moves back to its original position and, in that movement, the teeth 92 engage the legs of the last inserted tufts and straighten them up, so that they will not interfere with the insertion of the next set of tufts by the needles.

I claim:

1. A tufting machine, which comprises means for advancing a web stepwise in the direction of its length, guide means engaging the web and forming a transverse fold therein having legs lying close together, a carrier movable stepwise, a plurality of frames mounted on the carrier, each frame carrying a plurality of supplies of yarn and having a row of needles projecting from it, the needles being adapted to be threaded with yarns from the respective supplies, transfer arms operable during a period of rest of the carrier to remove one of said frames from the carrier, move said one frame with a substantially rectilinear movement only to cause its needles to pierce the legs of the web and pass the yarns therethrough, and restore said one frame to the carrier, means for operating the transfer arms, means for holding the ends of the yarns passed through the web by the needles and drawing lengths of the yarns from the supplies, as said one frame is being restored to the carrier, and means for severing the yarns between the web and the needles.

2. A tufting machine, which comprises means for advancing a web stepwise in the direction of its length, guide means engaging the web and forming a transverse fold therein having approximately horizontal legs lying close together, a carrier movable stepwise along a path, a part of which lies above the web, a plurality of frames mounted on the carrier, each frame carrying a plurality of supplies of yarn and having a row of needles projecting from it, the needles being adapted to be threaded with yarns from the respective supplies, transfer arms operable during a period of rest of the carrier to remove one of said frames from the part of the carrier above the web, lower said one frame with a substantially vertical movement only to cause its needles to pierce the legs of the web and pass the yarns therethrough, and restore said one frame to the carrier, means for operating the transfer arms, means for holding the ends of the yarns passed through the web by the needles and drawing lengths of the yarns from the supplies, as said one frame is being restored to the carrier, and means for severing the yarns between the web and the needles.

3. A tufting machine, which comprises means for advancing a web stepwise in the direction of its length, a plate extending transverse to the web and having a slotted free edge, guide means engaging the web and directing it along one face of the plate, over the free edge thereof, and along the other face, a carrier movable stepwise, a plurality of frames mounted on the carrier, each frame carrying a plurality of supplies of yarn and having a row of needles projecting from it, the needles being adapted to be threaded with yarns from the respective supplies, transfer arms operable during a period of rest of the carrier to remove one of said frames from the carrier, move said one frame with a substantially rectilinear movement only to cause its needles to pass the yarns through the web on opposite sides of the plate and through the slots in the plate, and restore said one frame to the carrier, means for operating the transfer arms, means for holding the ends of the yarns passed through the web by the needles and drawing lengths of the yarns from the supplies, as said one frame is being restored to the carrier, and means for severing the yarns between the web and the needles.

4. A tufting machine, which comprises means for advancing a web stepwise in the direction of its length, a plate extending transverse to the web and having a slotted free edge, guide means engaging the web and directing it along one face of the plate, over the free edge thereof, and along the other face, a carrier movable stepwise, a plurality of frames mounted on the carrier, each frame carrying a plurality of supplies of yarn and having a row of needles projecting from it, the needles being adapted to be threaded with yarns from the respective supplies, transfer arms operable during a period of rest of the carrier to remove one of said frames from the carrier, move said one frame with a substantially rectilinear movement to cause its needles to pass their yarns through the web on opposite sides of the plate and through the slots in the plate, and to restore said one frame to the carrier, means for operating the transfer arms, cooperating grippers for holding the ends of the yarns passed through the web by the needles and drawing lengths of the yarns from the supplies, as said one frame is being restored to the carrier, and cooperating knives operable to sever the yarns between the web and the needles.

5. A tufting machine, which comprises means for advancing a web stepwise in the direction of its length, a plate extending transverse to the web and having a slotted free edge, guide means engaging the web and directing it along one face of the plate, over the free edge thereof, and along the other face, a carrier movable stepwise and having a portion lying above the plate, a plurality of frames mounted on the carrier, each frame carrying a plurality of supplies of yarn and having a row of needles projecting downwardly from it, the frames on the carrier lying transverse to the web and the needles being adapted to be threaded with yarns from the respective supplies, transfer arms operable during a period of rest of the carrier to remove one of said frames from the part of the carrier above the plate, lower said one frame, while maintaining the needles vertical, to cause the needles to pass their yarns through the web on opposite sides of the plate and through the slots in the plate, and restore said one frame to the carrier, means for operating the transfer arms, cooperating grippers for holding the ends of the yarns passed through the web by the needles and drawing lengths of the yarns from the supplies, as said one frame is being restored

to the carrier, and cooperating knives operable to sever the yarns between the web and the needles.

6. A tufting machine, which comprises means for advancing a web stepwise in the direction of its length, a plate extending transverse to the web and having a slotted free edge, guide means engaging the web and directing it along one face of the plate, over the free edge thereof, and along the other face, a carrier movable stepwise and having a portion lying above the plate, a plurality of frames mounted on the carrier, each frame carrying a plurality of supplies of yarn and having a row of needles projecting downwardly from it, the frames on the carrier lying transverse to the web and the needles being adapted to be threaded with yarns from the respective supplies, transfer arms operable during a period of rest of the carrier to remove one of said frames from the part of the carrier above the plate, lower said one frame, while maintaining the needles vertical, to cause the needles to pass their yarns through the web on opposite sides of the plate and through the slots in the plate, and restore said one frame to the carrier, means for operating the transfer arms, cooperating grippers for holding the ends of the yarns passed through the web by the needles and drawing lengths of the yarns from the supplies, as said one frame is being restored to the carrier, and cooperating knives operable to sever the yarns between the web and the needles, one of the knives moving over the web as it leaves the edge of the plate and being provided with means for adjusting the positions of the yarns previously inserted in the web.

7. In a tufting machine, the combination of means for advancing a web in the direction of its length, guide means engaging the web to maintain a transverse fold therein, a frame carrying a plurality of supplies of yarn and having a row of needles projecting from it, the needles being adapted to be threaded with yarns from the supplies, means for moving the frame with a substantially rectilinear movement only toward and away from the web adjacent the fold to cause the needles to pass their yarns through the web at opposite sides of the fold line, gripper means for gripping the ends of the yarns passed through the web to cause lengths of the yarns to be drawn from the supplies as the frame moves from the web, and knives operable to sever said lengths of yarn between the web and the needles.

8. In a tufting machine, the combination of means for advancing a web in the direction of its length, guide means engaging the web to maintain a transverse fold therein, a frame carrying a plurality of supplies of yarn and having a row of needles projecting from it, the needles being adapted to be threaded with yarns from the supplies, means for moving the frame with a substantially rectilinear movement only toward and away from the web adjacent the fold to cause the needles to pass their yarns through the web at opposite sides of the fold line, gripper means for gripping the ends of the yarns passed through the web to cause lengths of the yarns to be drawn from the supplies as the frame moves from the web, and cooperating knives for severing said lengths of yarn between the web and the needles, one of the knives having projections operable to adjust the positions of yarns previously inserted in the web.

9. In a tufting machine, the combination of means for advancing a web in the direction of its length, guide means engaging the web to maintain a transverse fold therein, a frame carrying a plurality of supplies of yarn and having a row of needles projecting from it, the needles being adapted to be threaded with yarns from the supplies, means for moving the frame with a substantially rectilinear movement only toward and away from the web adjacent the fold to cause the needles to pass their yarns through the web at opposite sides of the fold line, gripper means for gripping the ends of the yarns passed through the web to cause lengths of the yarns to be drawn from the supplies as the frame moves from the web, and cooperating knives for severing said lengths of yarn between the web and the needles, one of the knives lying above the web leaving the fold line and having projections on its undersurface engaging the free ends of lengths of yarns previously inserted and moving said ends to erect position.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
272,697	Huff	Feb. 20, 1883
1,845,614	Mason	Feb. 16, 1932
1,865,221	Stone	June 28, 1932
2,213,589	Montgomery	Sept. 3, 1940

FOREIGN PATENTS

Number	Country	Date
17,044	Great Britain	1887