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TERRY PILE WEAVING

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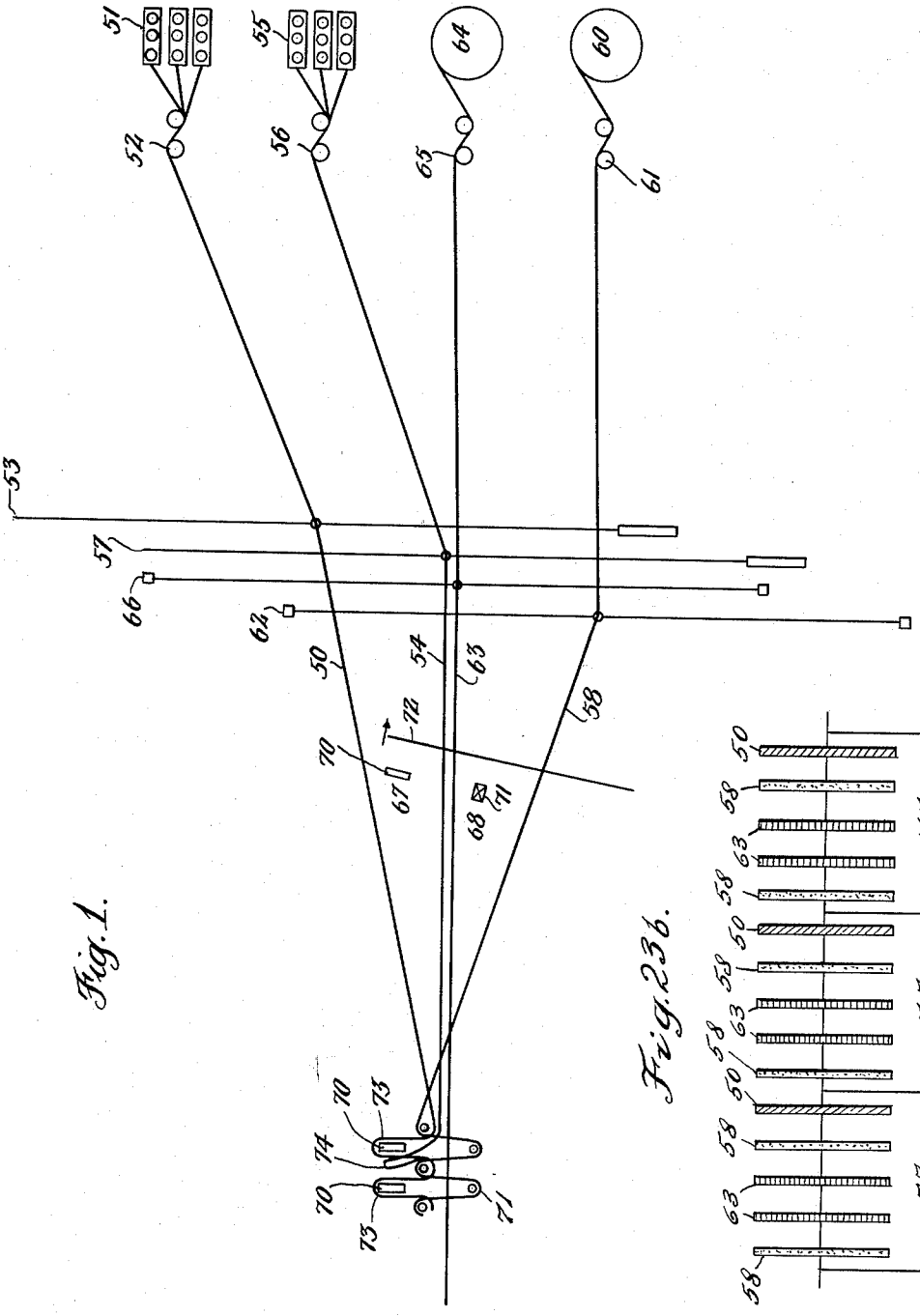


Fig. 1.

Fig. 2b.

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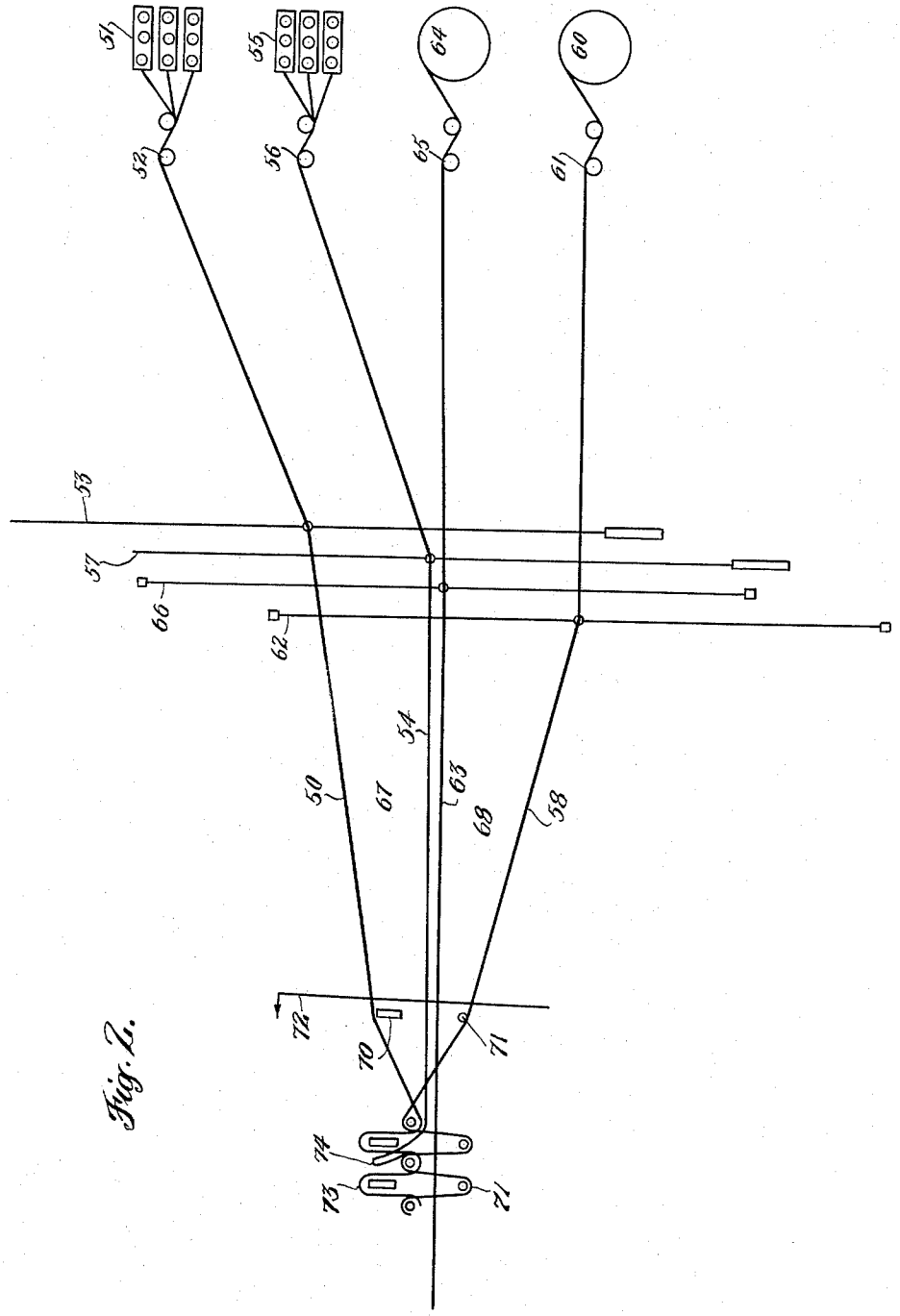


Fig. 2.

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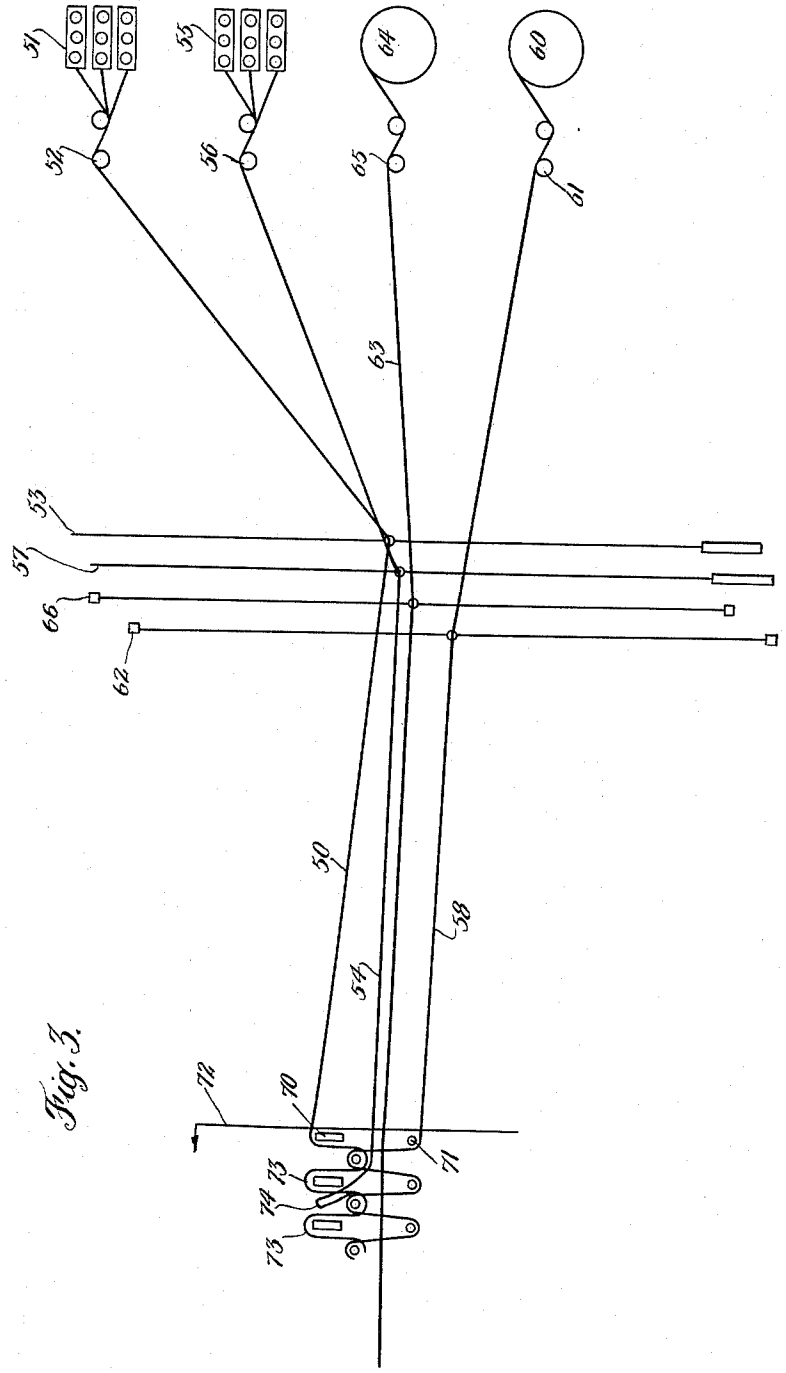


Fig. 3.

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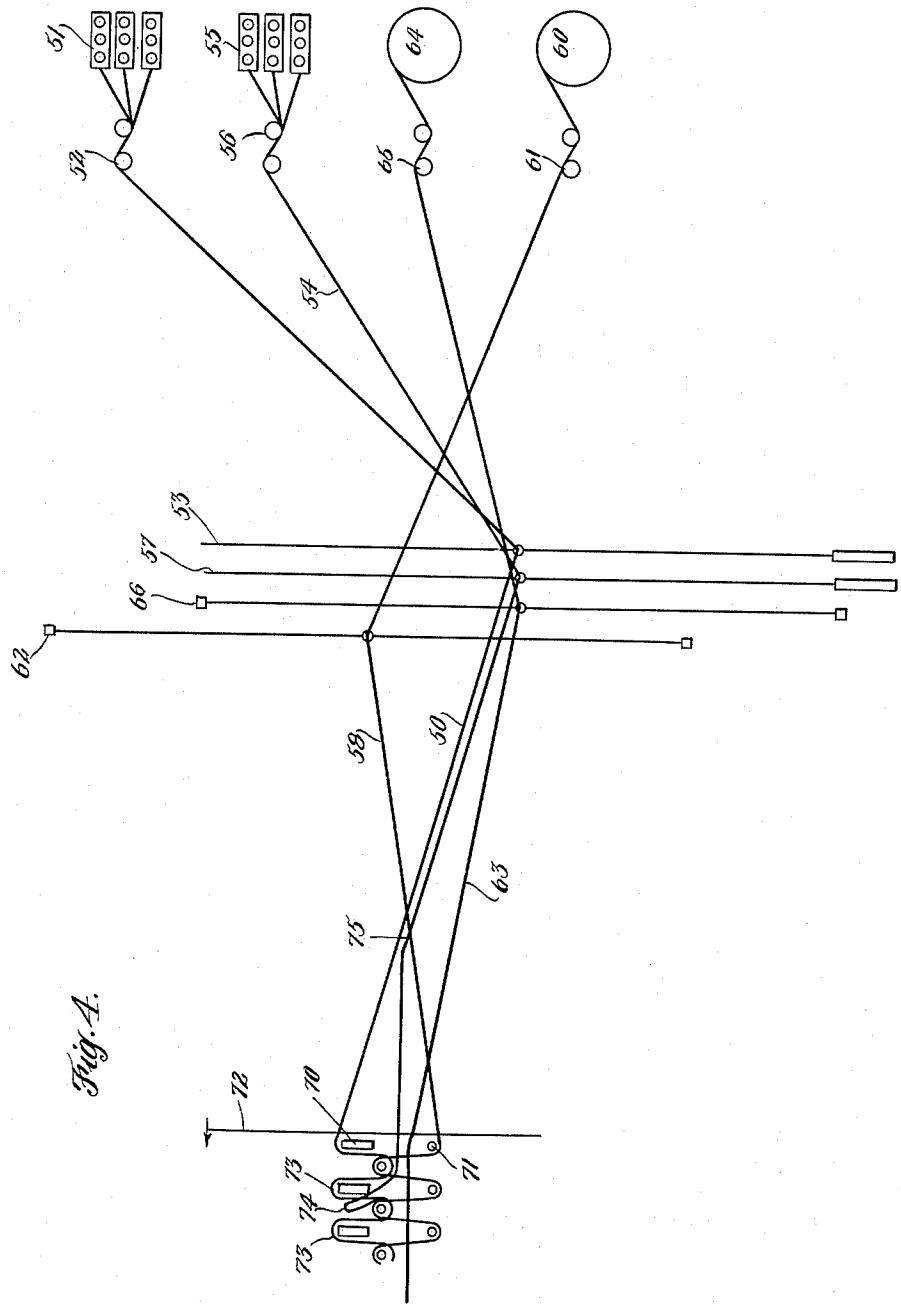


Fig. 4.

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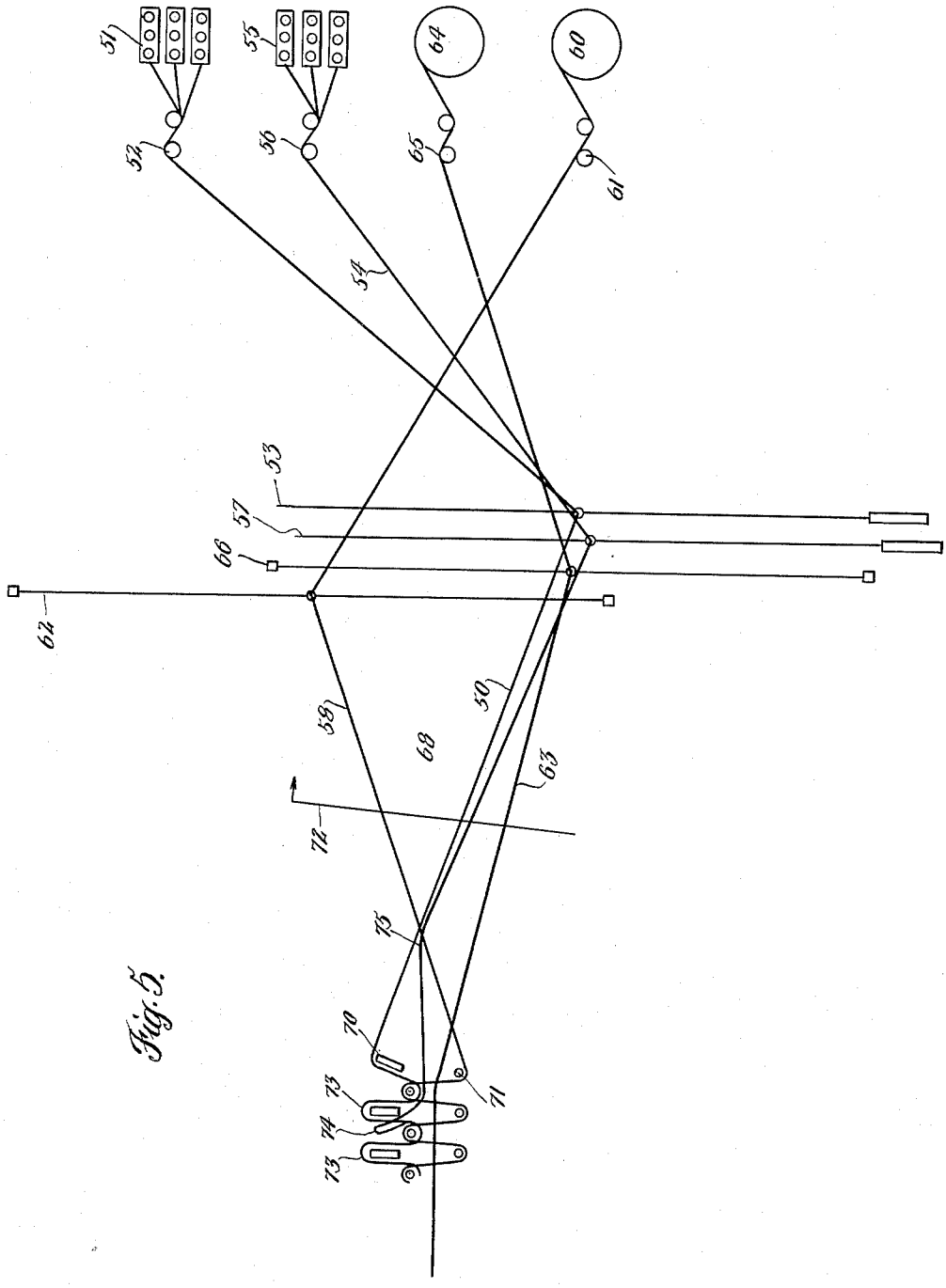


Fig. 5.

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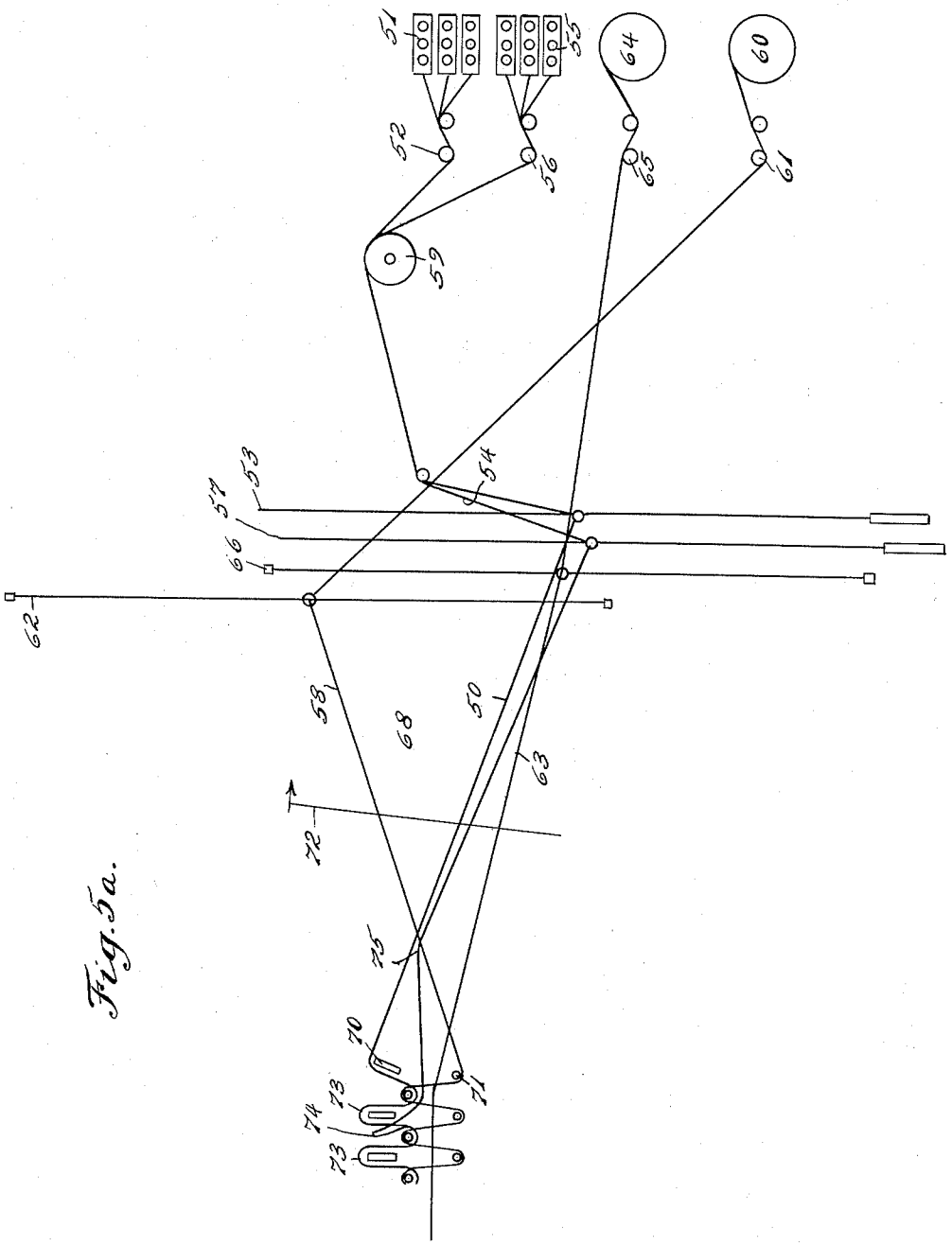


Fig. 5a.

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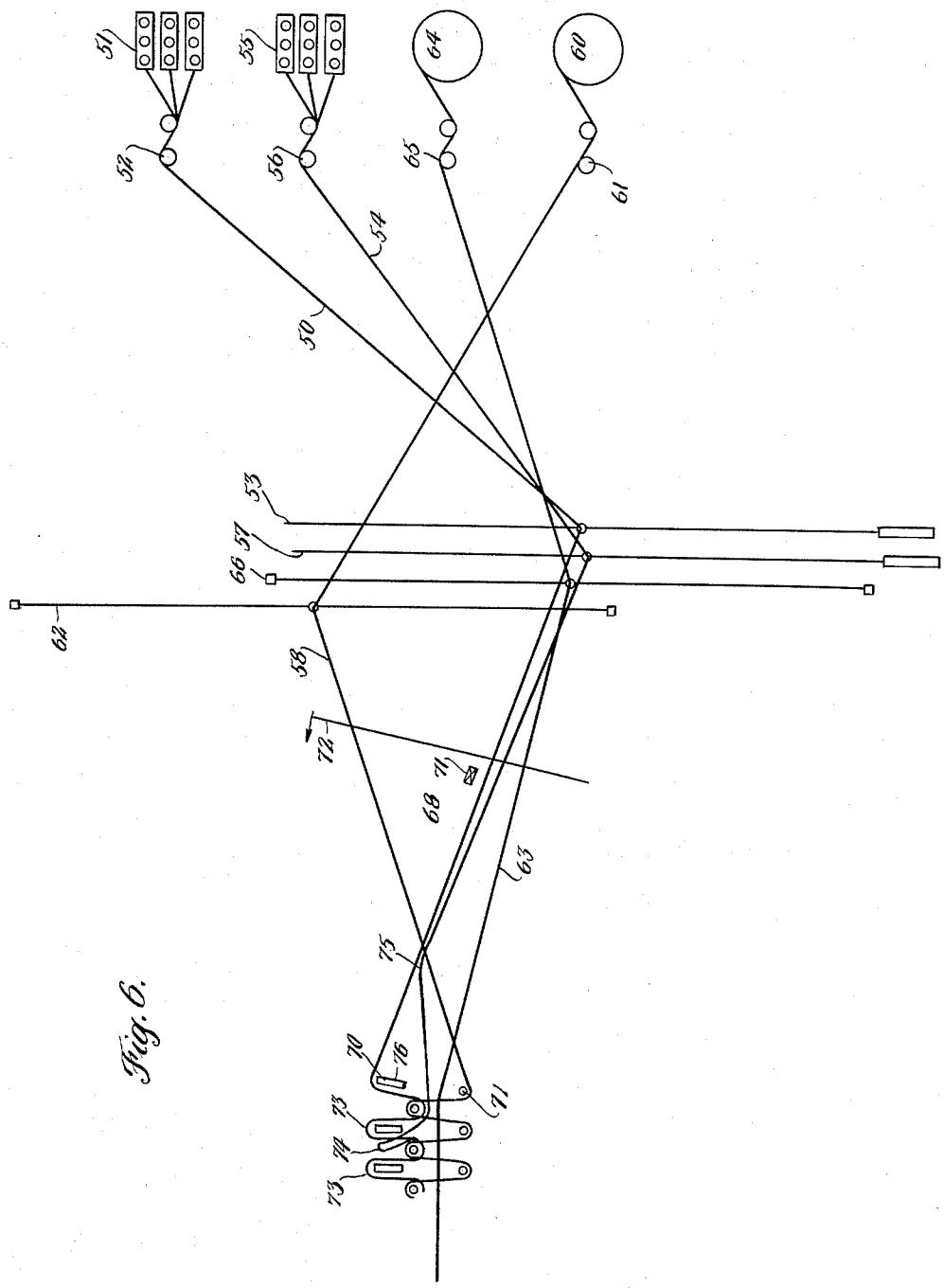


Fig. 6.

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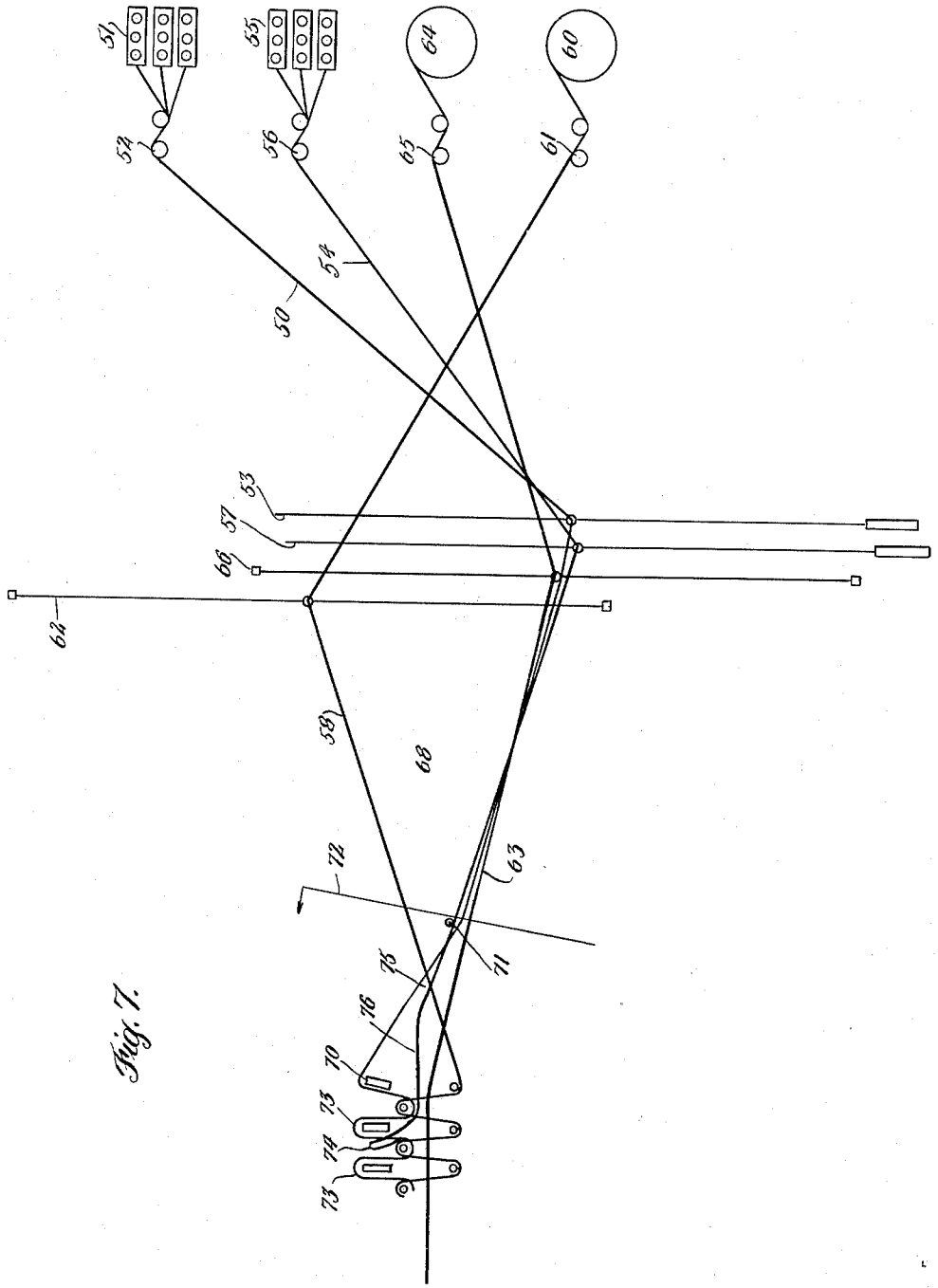


Fig. 7.

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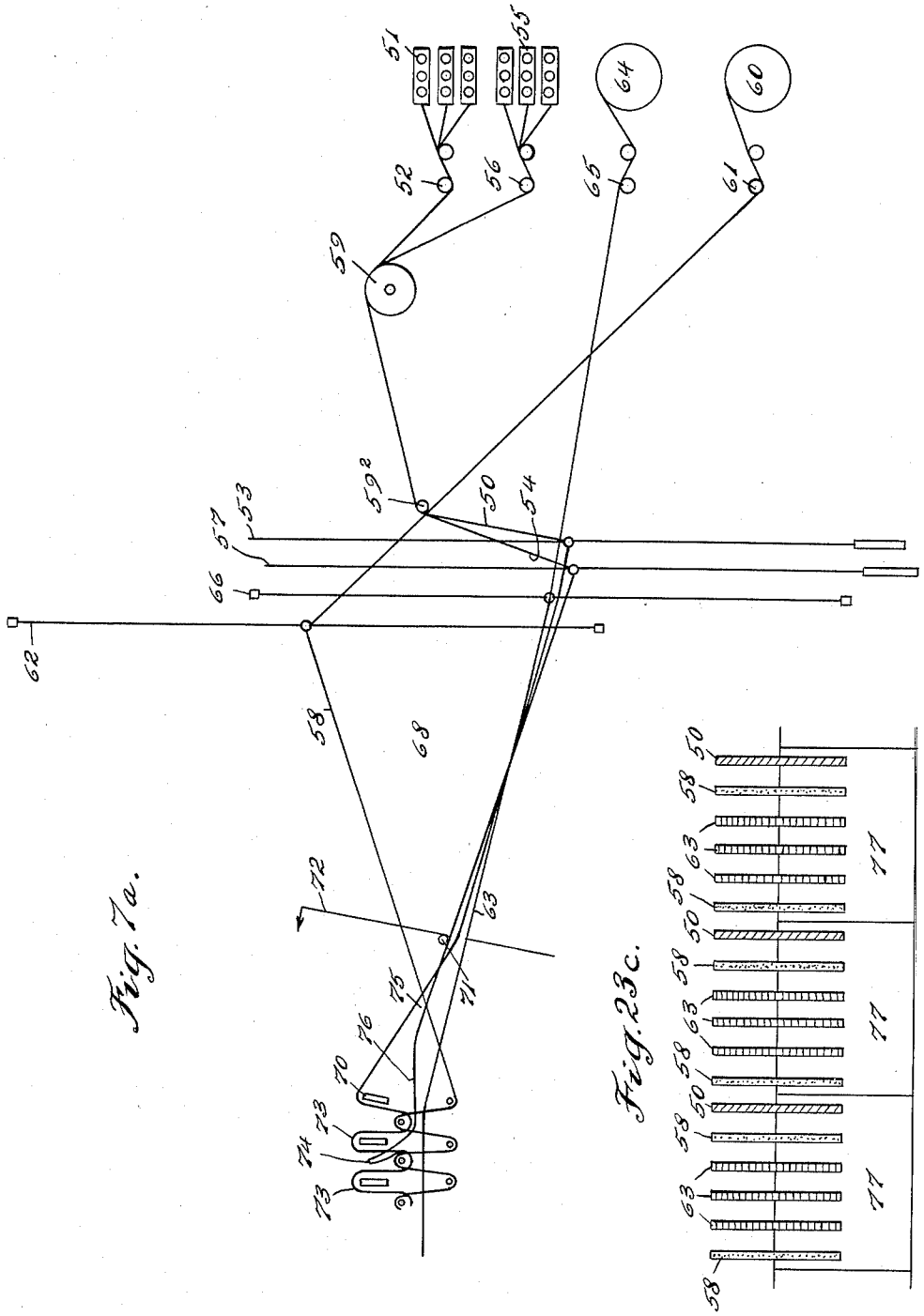


Fig. 7a.

Fig. 23c.

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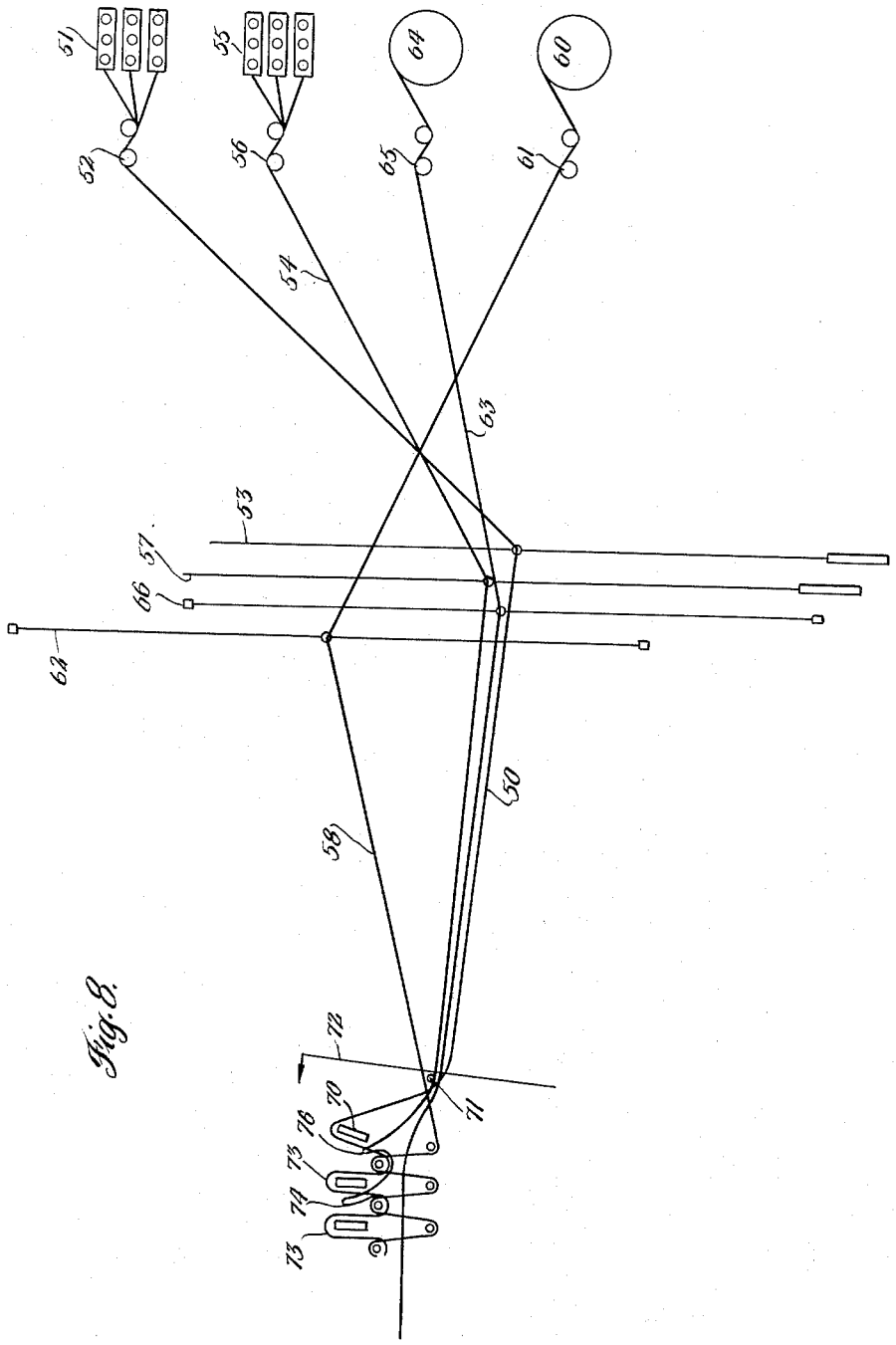


Fig. 8.

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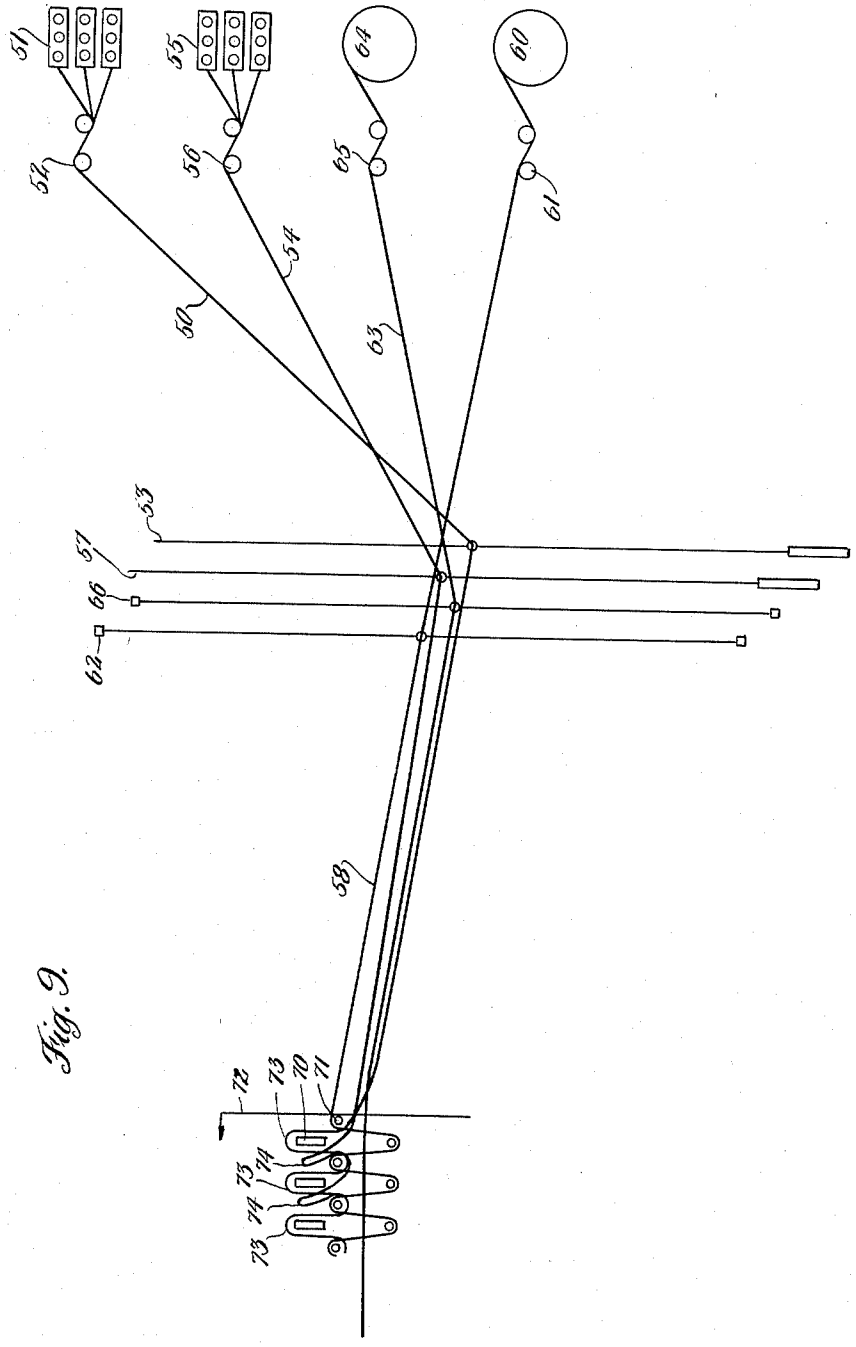


Fig. 9.

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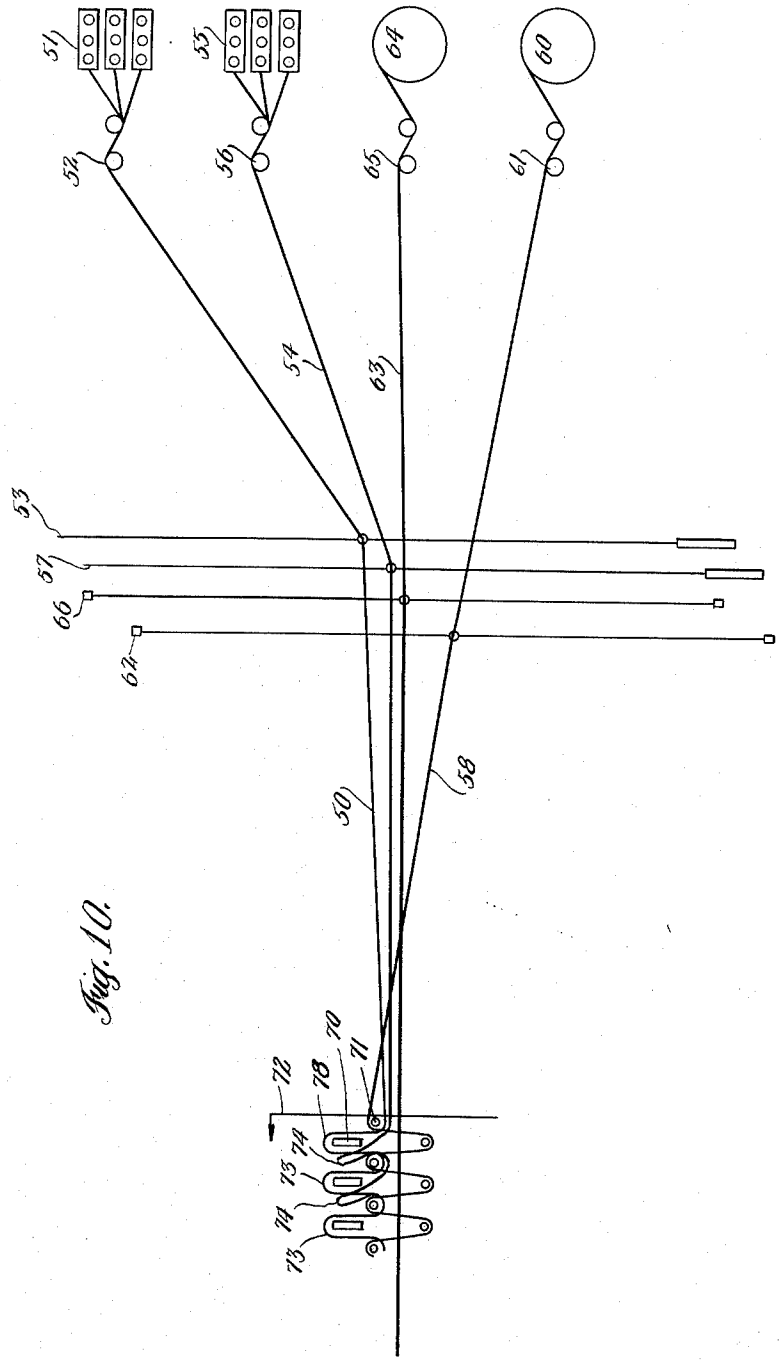


Fig. 10.

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Fig. 11.

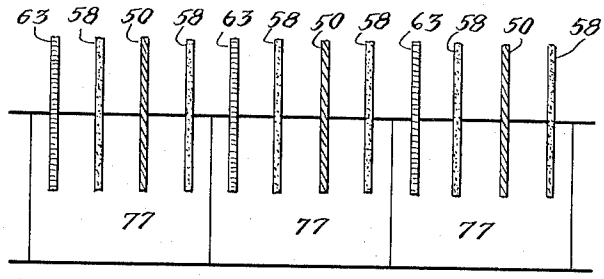


Fig. 12.

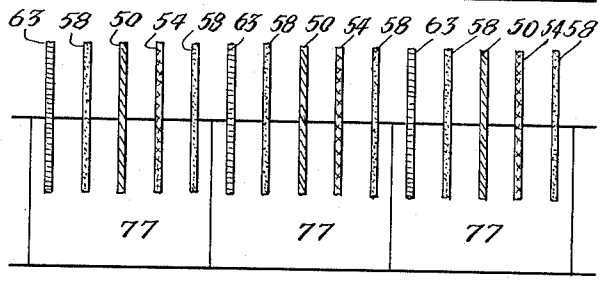


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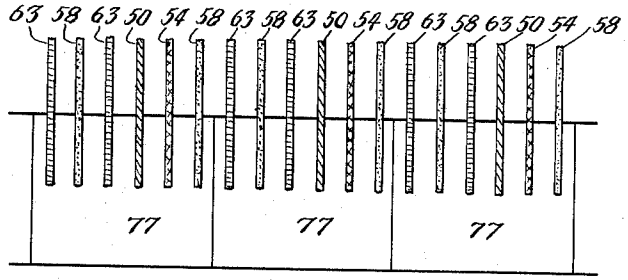


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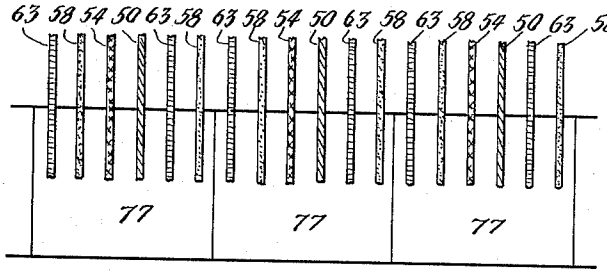
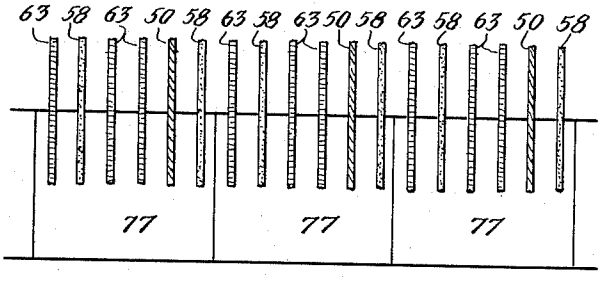


Fig. 15.



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Fig. 16.

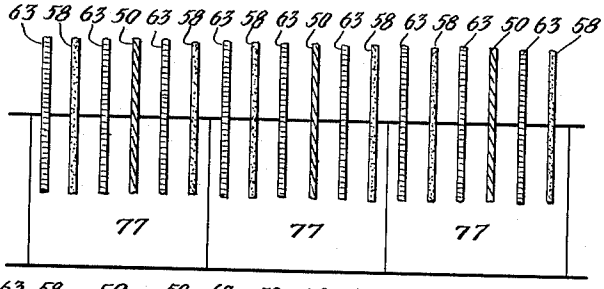


Fig. 17.

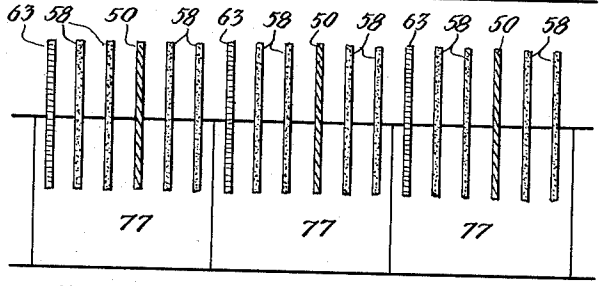


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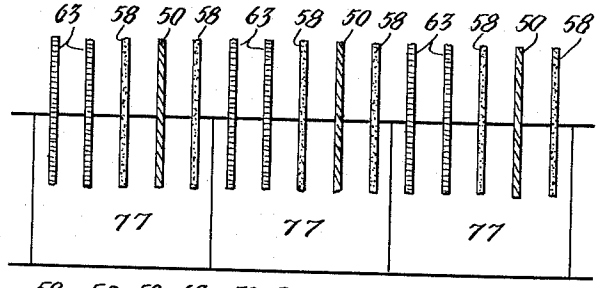


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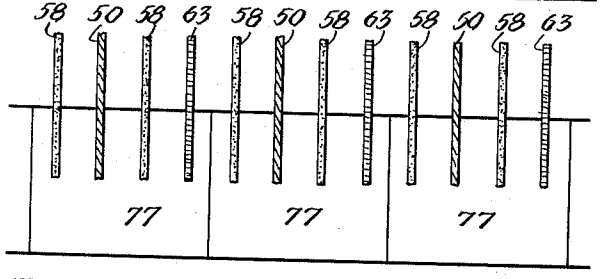
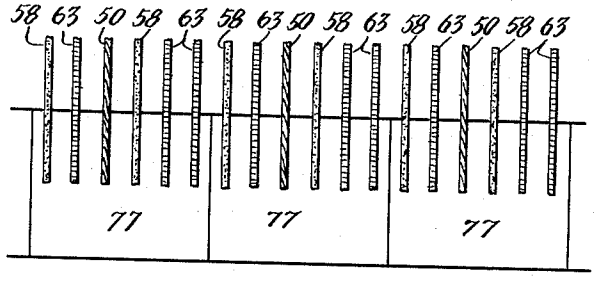


Fig. 20.



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Fig. 21.

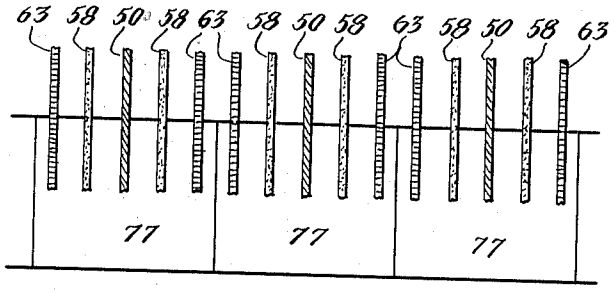


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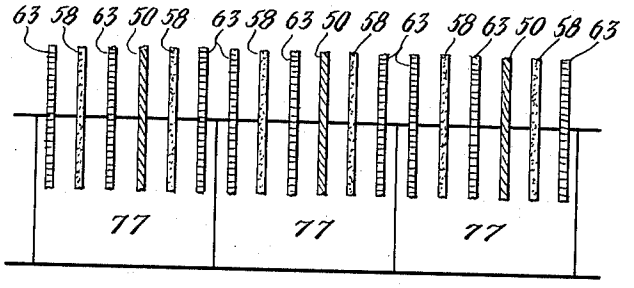


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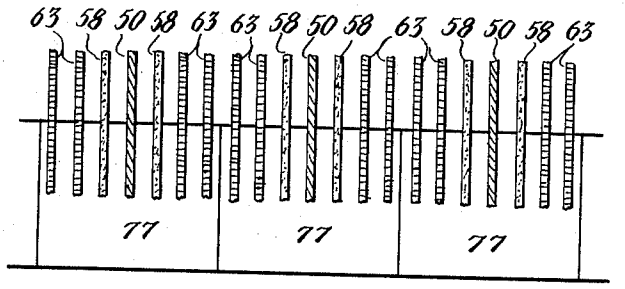
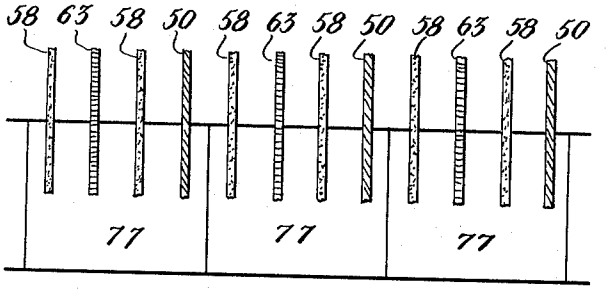


Fig. 23a.



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Fig. 24.

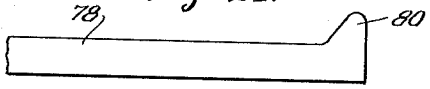


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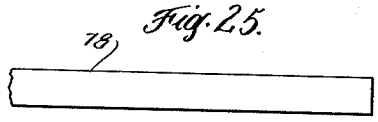


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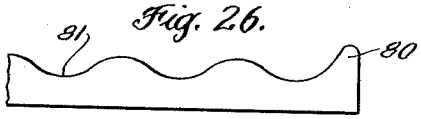


Fig. 27.



Fig. 28.

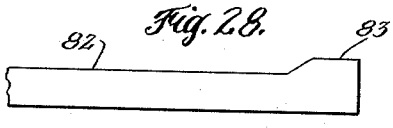


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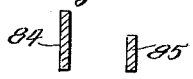


Fig. 30.

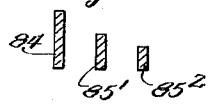


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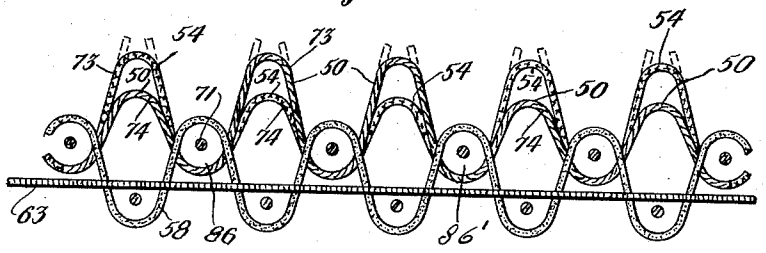


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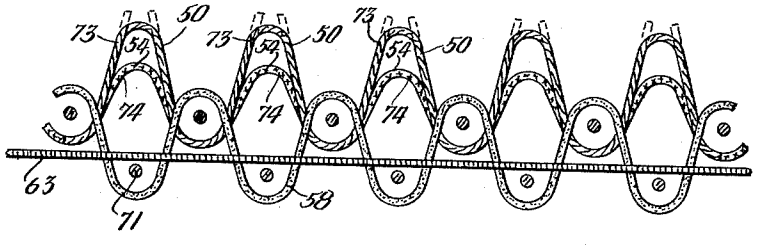
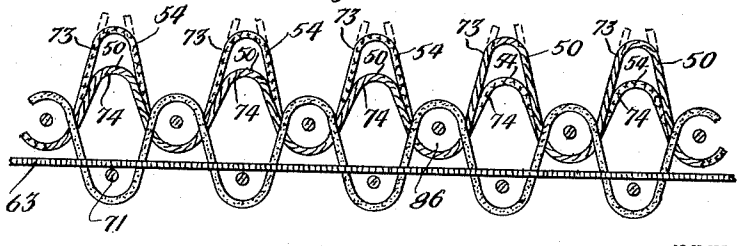


Fig. 34.



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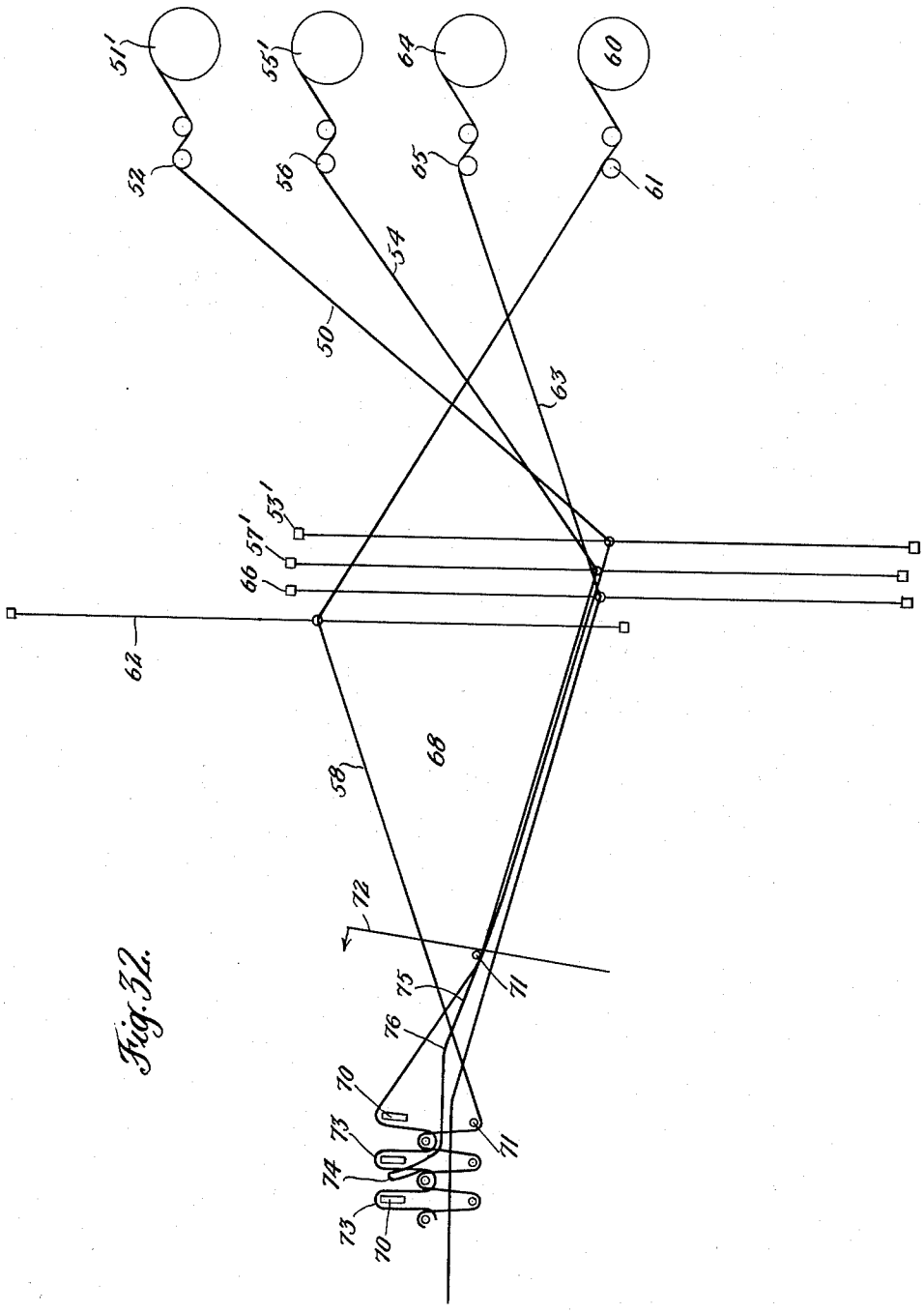


Fig. 52.

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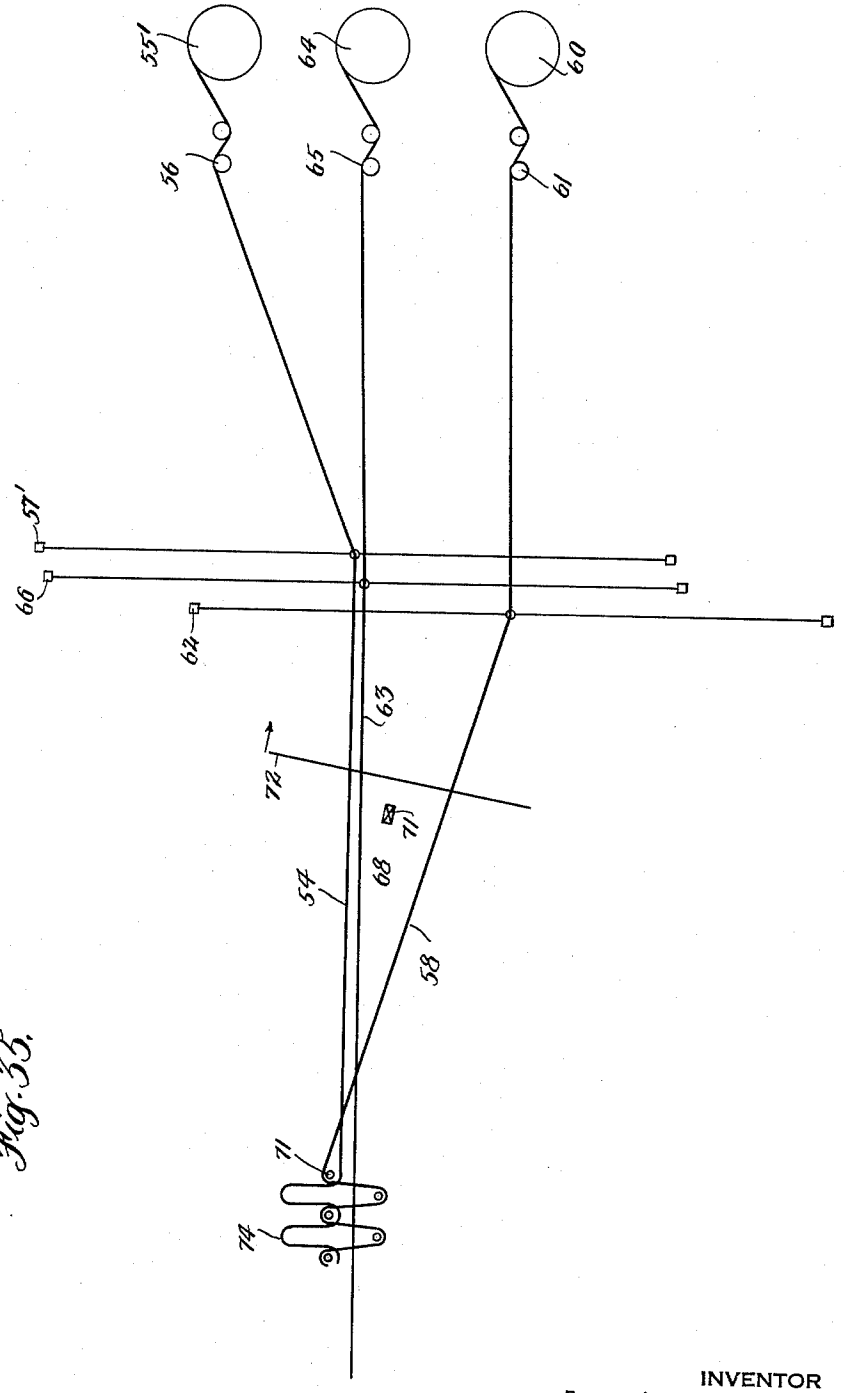


Fig. 55.

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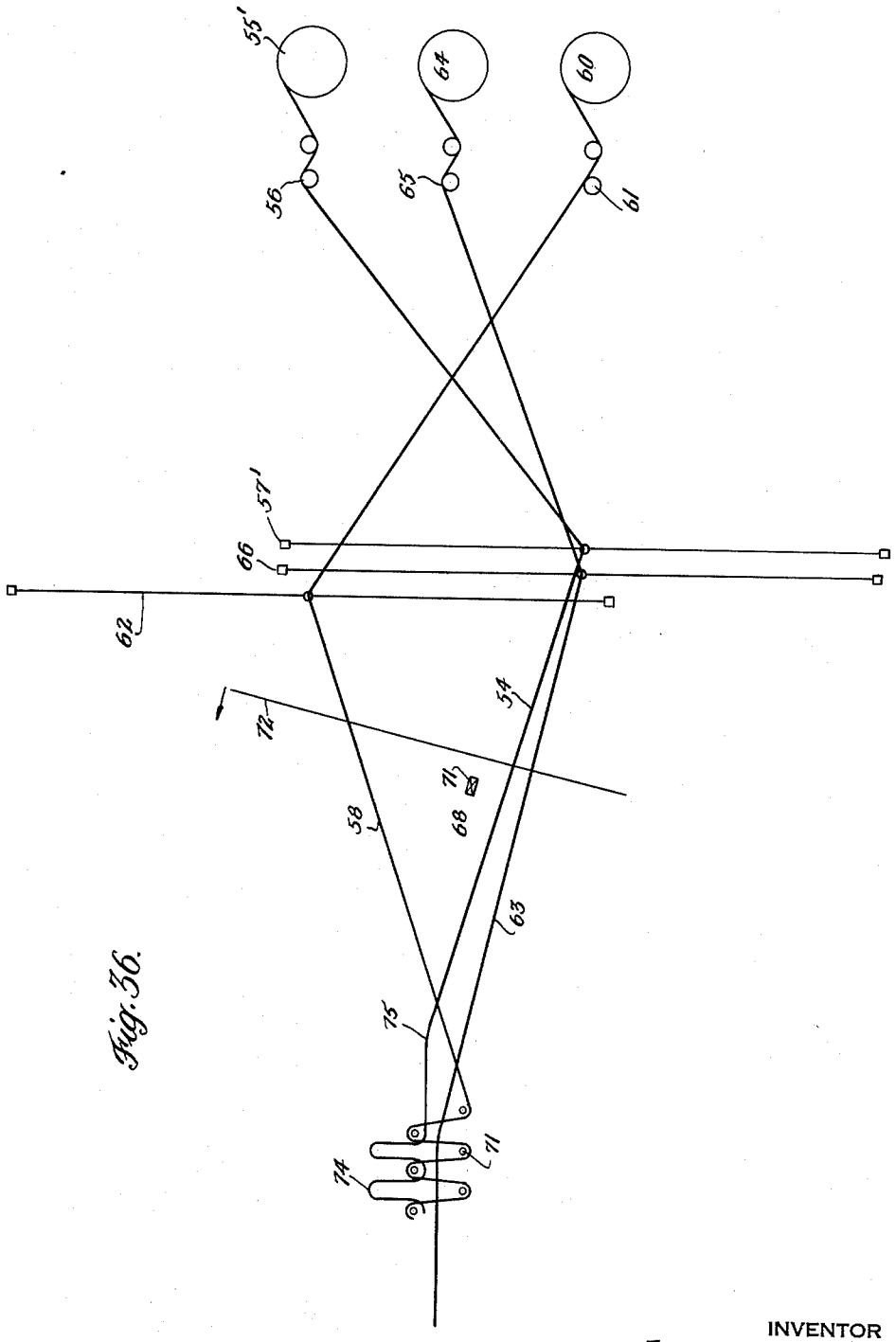


Fig. 36.

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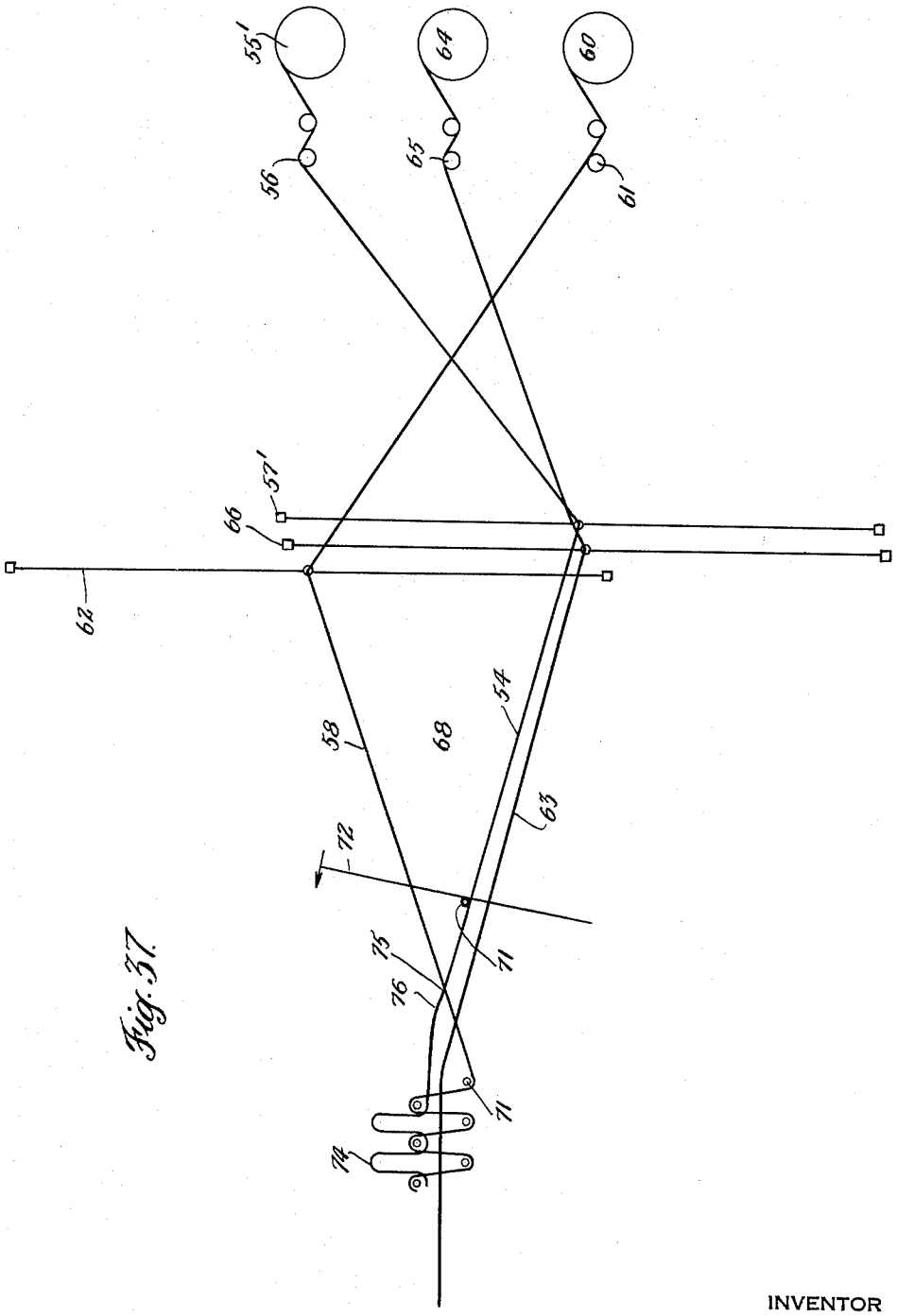


Fig. 57.

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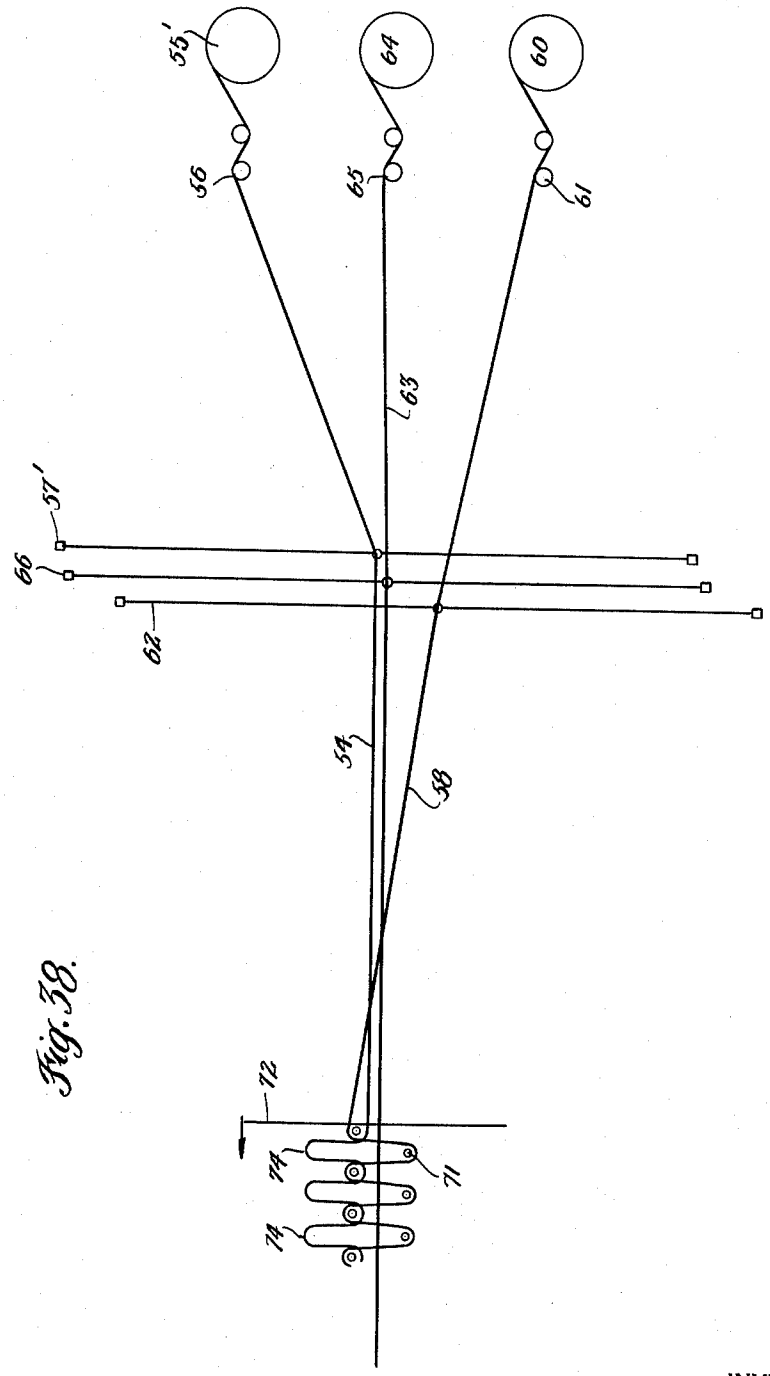


Fig. 58.

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Fig. 39.

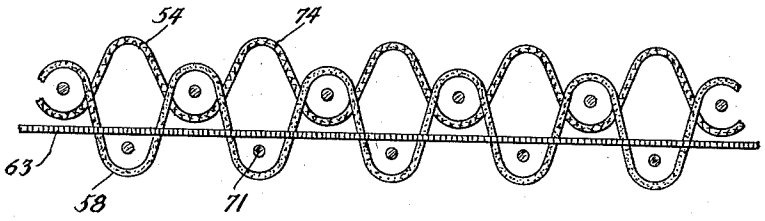


Fig. 48.

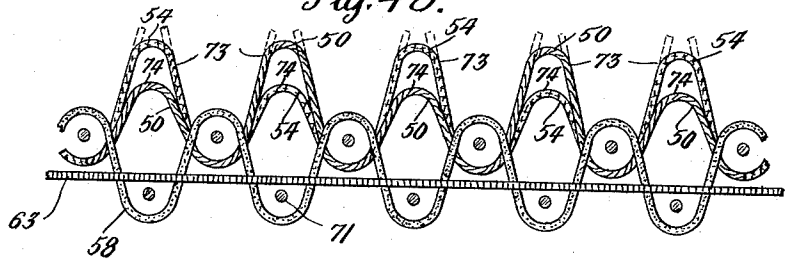
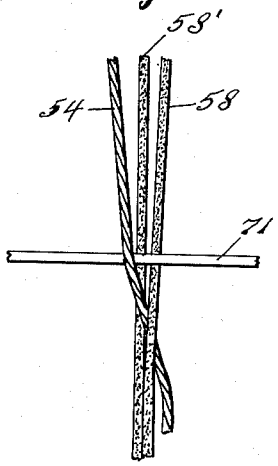


Fig. 49.



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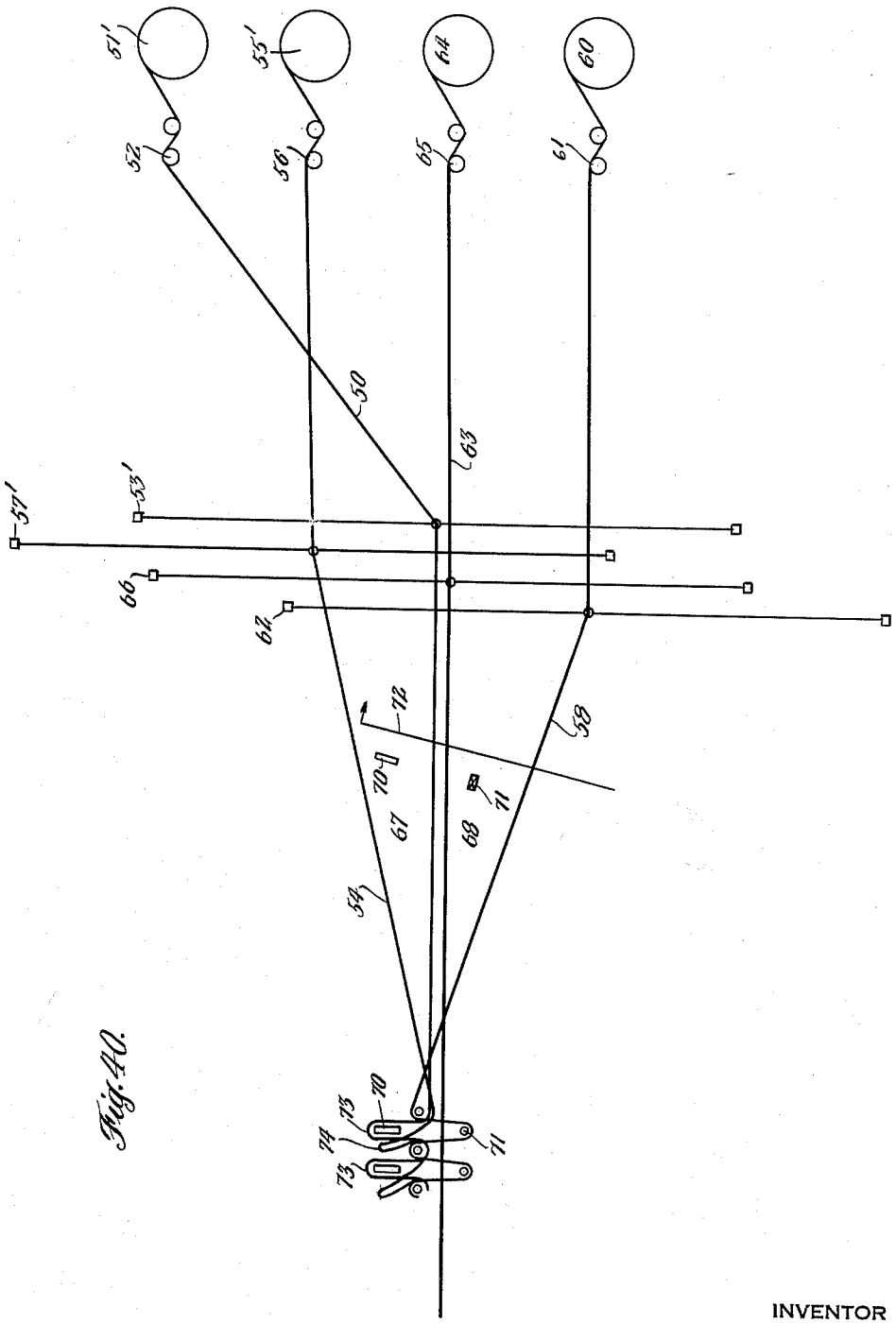


Fig. 40.

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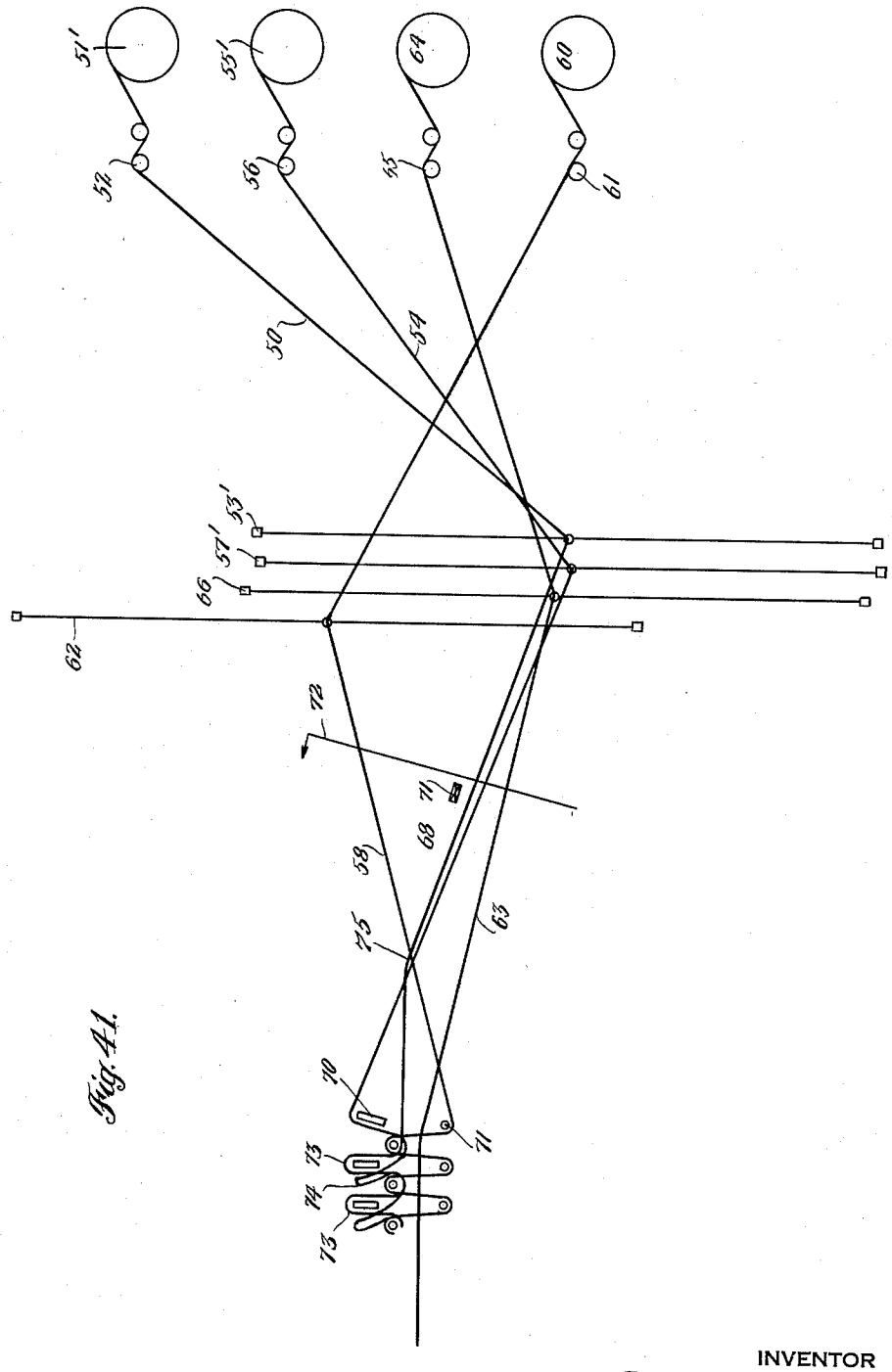


Fig. 4.1.

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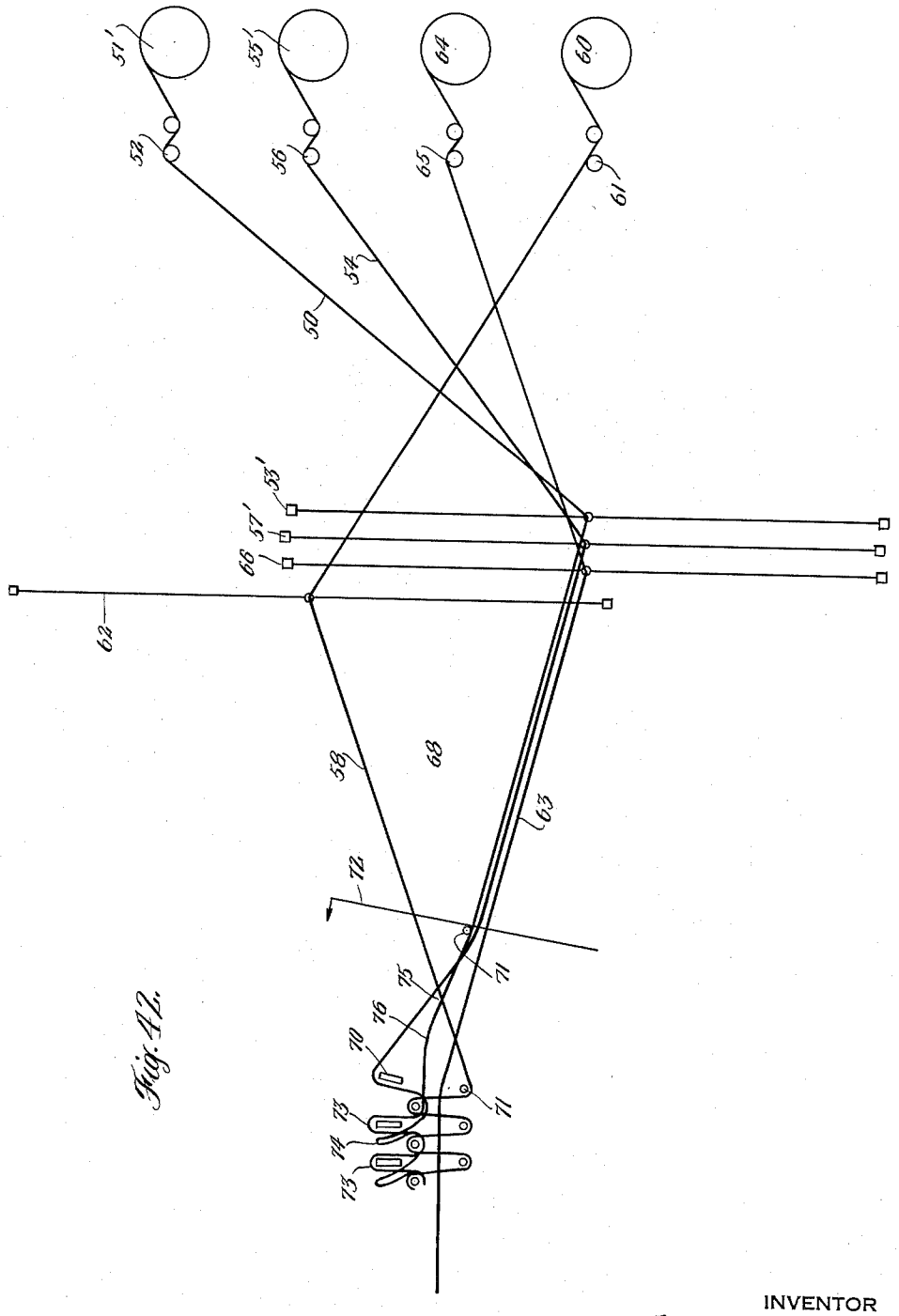


Fig. 12.

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TERRY PILE WEAVING

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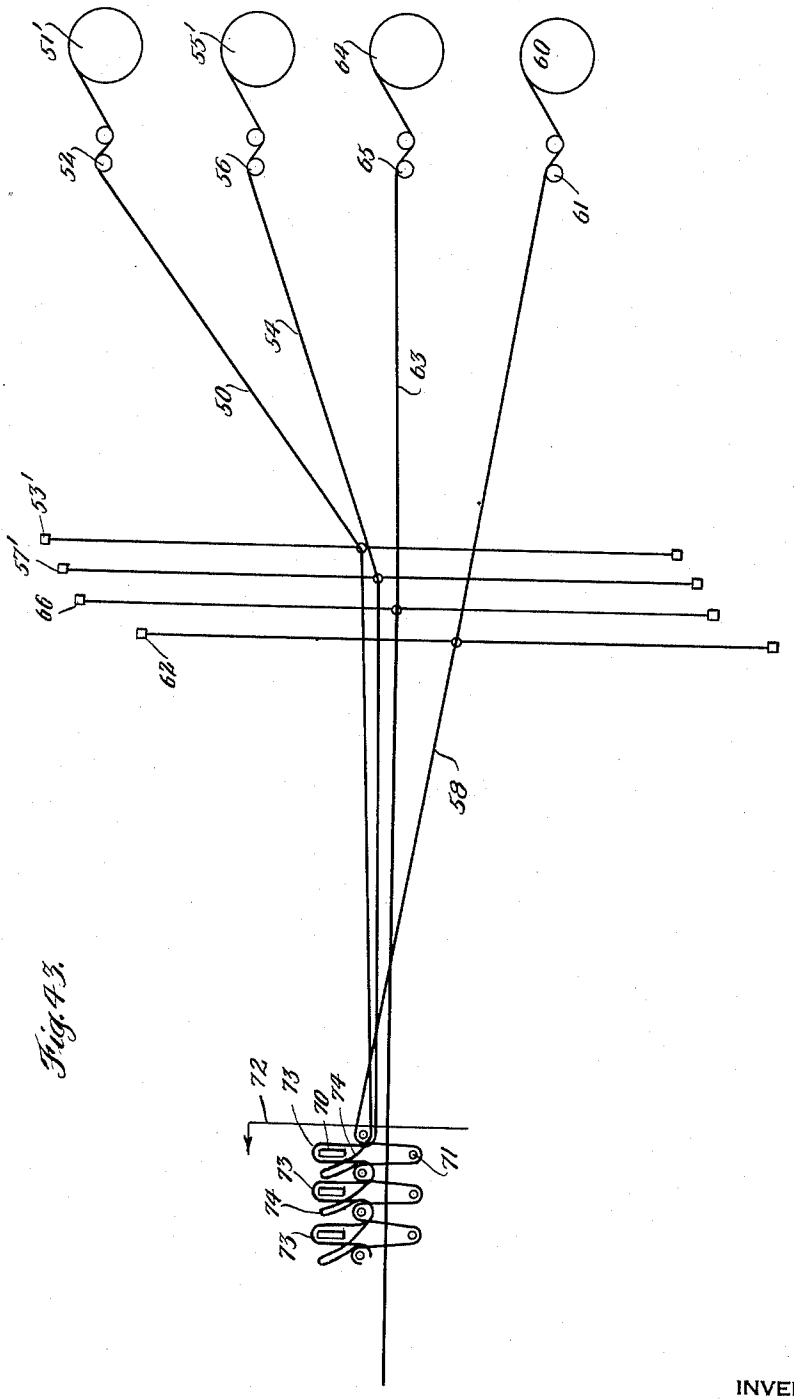


Fig. 4.3.

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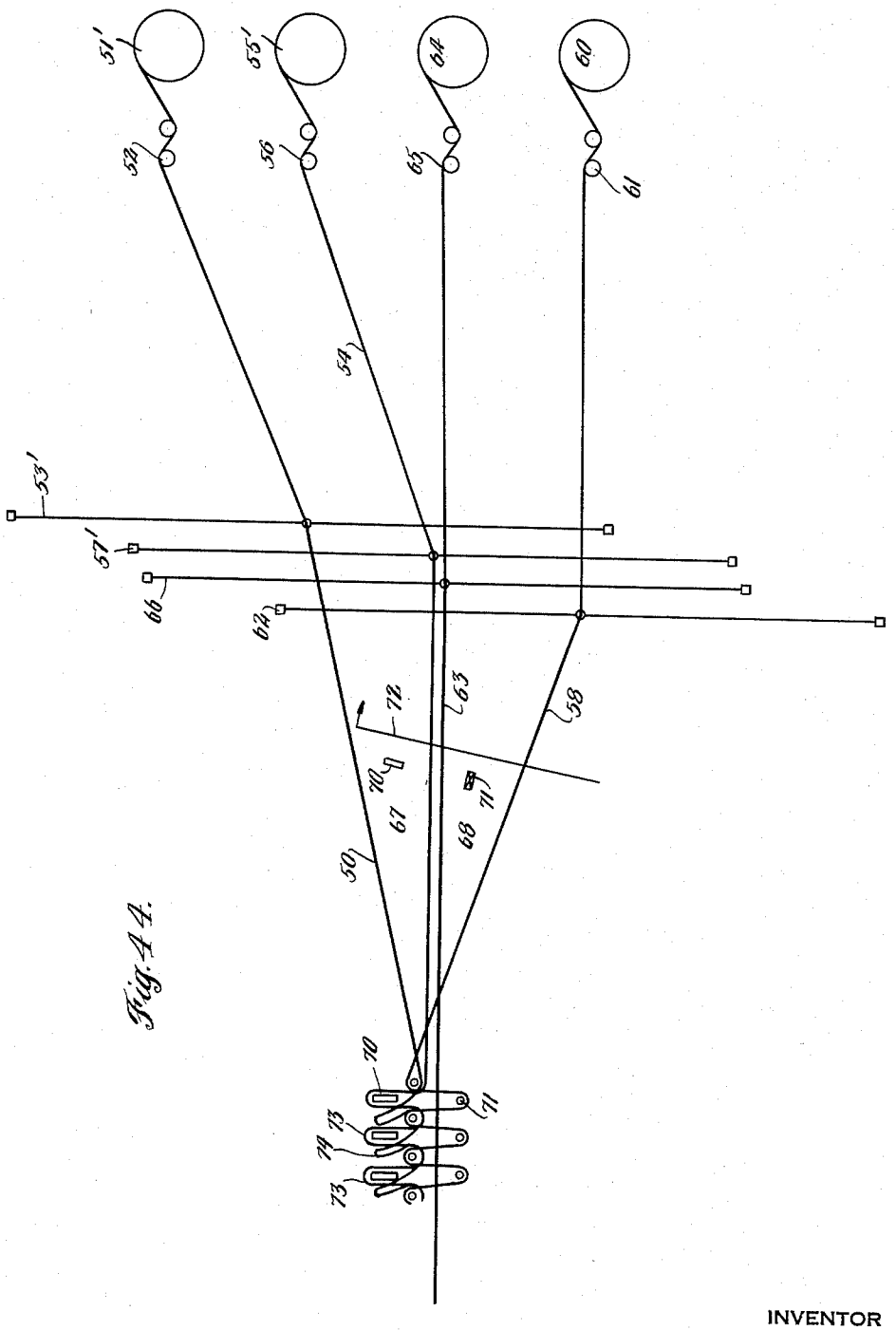


Fig. 4 4.

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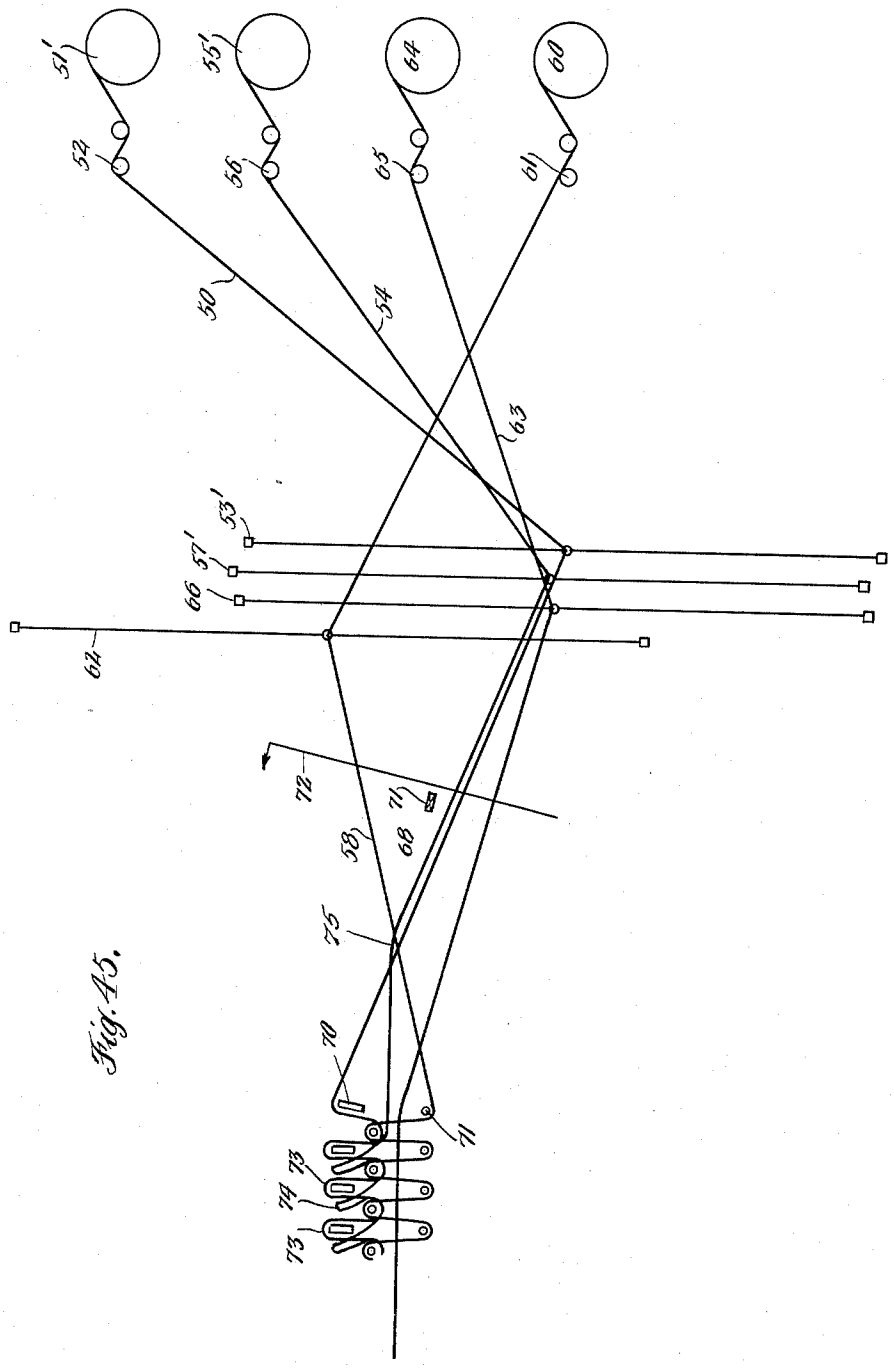


Fig. 45.

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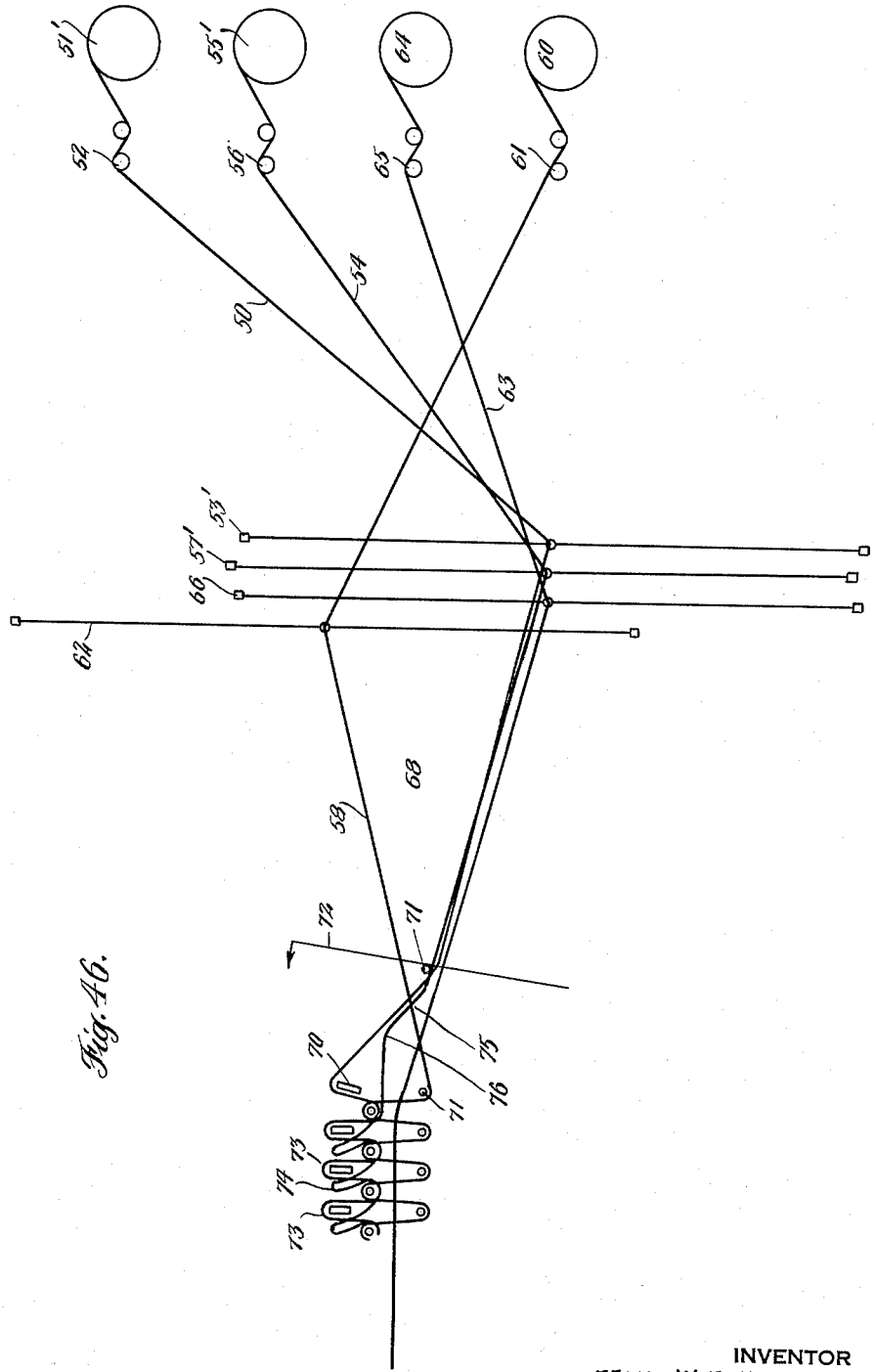


Fig. 46.

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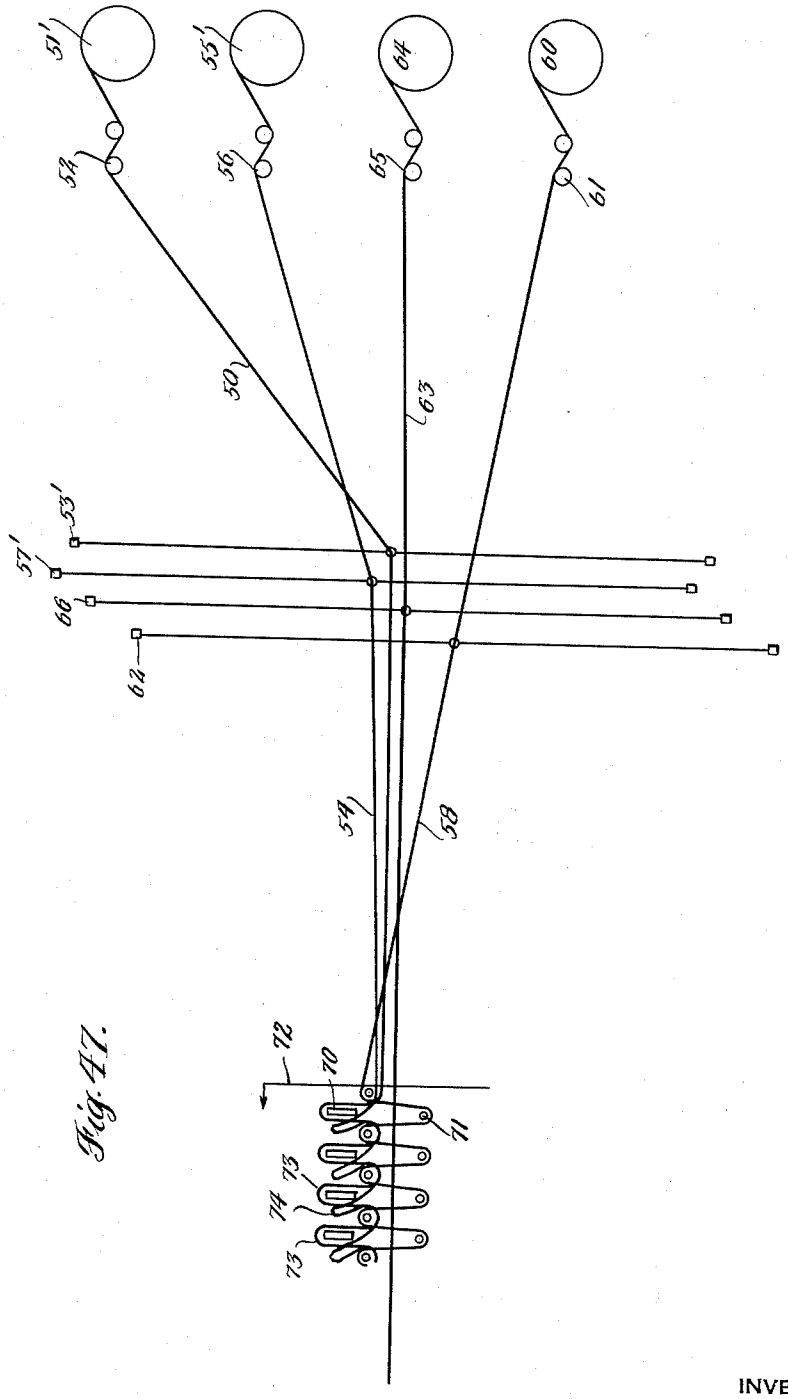


Fig. 47.

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TERRY PILE WEAVING

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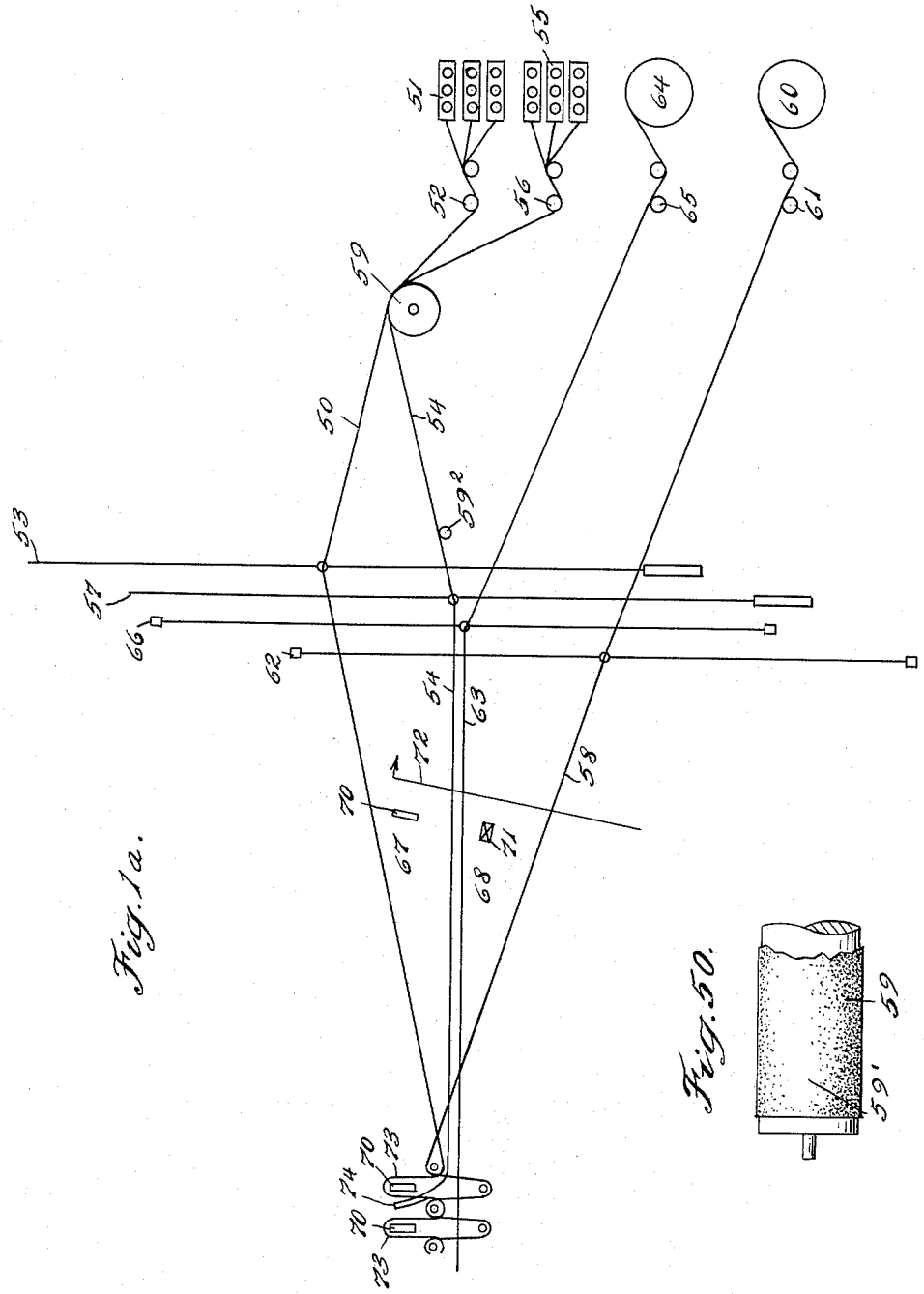


Fig. 1a.

Fig. 5a.

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United States Patent Office 2,714,399 Patented Aug. 2, 1955

2,714,399

TERRY PILE WEAVING

Frank W. E. Hoeselbarth, Carlisle, Pa., assignor to C. H. Masland & Sons, a corporation

Application May 29, 1952, Serial No. 290,733

28 Claims. (Cl. 139—39)

The present invention relates to pile fabrics and their weaving and particularly to pile floor coverings such as carpets and rugs.

This application has been divided and the subject matter relating to the fabric is embodied in application Serial No. 369,815, filed July 23, 1953, for Terry Pile Weave.

A purpose of the invention is to produce pile by threading-in pile warp ends between binder warp ends, slack tensioning the pile warp ends, forming a shed in which the binder warp ends are up and the pile warp ends or at least certain pile warp ends suitably also with stuffer warp ends are down, inserting a weft and beating up the weft to force pile warp ends gripped between spaced binder warp ends up into the pile.

A further purpose is at each transverse row in a pile fabric such as a carpet or a rug to raise certain pile warp ends over a wire and in weaving the same transverse row to force other pile warp ends up into the pile by gripping them between spaced binder warp ends per dent and then beating up a weft.

A further purpose is to produce cut or uncut pile projections such as tufts or loops over a wire with certain pile warp ends in a transverse row and to raise all other pile warp ends into pile loops in the same transverse row by gripping them between spaced binder warp ends per dent, slack tensioning them, and beating up a weft.

A further purpose is to make relatively higher pile projections over a wire and relatively lower pile loops by gripping slack tensioned pile warp ends between spaced binder warp ends per dent and beating up a weft.

A further purpose is to tension each pile warp end between 0.10 and 0.35 pound and preferably between 0.15 and 0.25 pound, to grip the pile warp end thus tensioned between spaced binder warp ends and to beat up a weft to raise a pile loop.

A further purpose is to slack tension pile warp ends by feeding them toward the fell without corresponding take-up at the fell, and braking them against reversal of movement toward the source.

A further purpose is to feed the pile warp ends forward and retard them against reverse motion by a support positioned above the level of the mid position of the pile warp heddles and between the heddles and the tensioning devices. The support will preferably be a roughened roll, suitably a roll covered with abrasive such as sand paper.

A further purpose is to prevent the pile warp ends raised over the support just mentioned from sagging by providing a second support positioned horizontally along the line between the top of the first support and the positions of the pile warp ends at mid position of the pile warp heddles and also positioned adjacent to the pile warp heddles on the side from which the warps are fed.

A further purpose is to interpose pile warp ends of each of two or more pile warps between spaced binder warp ends per dent woven in opposition to the pile warp ends and desirably also to the stuffer warp ends, optionally to interpose one or more stuffer warp ends in the

bracket between the binder warp ends per dent, and optionally to position one or more stuffer warp ends outside the bracket per dent, preferably employing one or more stuffer warp ends inside the bracket and one or more stuffer warp ends outside the bracket per dent.

A further purpose is to place stuffer warp ends inside the bracket between the pile warp ends and the binder warp ends.

A further purpose is to position the stuffer warp ends outside the bracket on either side of the bracket per dent.

A further purpose is to employ the principles of the invention in Wilton and Brussels carpet, and in velvet or tapestry carpet.

A further purpose is to create, in each transverse row of pile projections, pile projection of one pile warp formed over wires and pile loops of another pile warp formed by gripping slack tensioned pile warp ends between spaced binder warp ends and beating up a weft, and to reverse the warps forming respectively the pile projections formed over wires and the pile loops formed by grip of the binder warps either in each succeeding row or after several rows to obtain pattern effects.

A further purpose is to produce a staggered W-weave in which between every pair of pile projections raised over wires, a pile projection is obtained by beating up a weft against a slack tension pile warp gripped by spaced binder warps in each dent.

Further purposes appear in the specification and in the claims.

In the drawings I have chosen to illustrate one only of the numerous embodiments in which my invention appears, selecting the form shown from the standpoints of convenience in illustration, satisfactory operation and clear demonstration of the principles involved.

Figures 1 to 10 inclusive are conventional warpwise weave step diagrams showing steps of weaving a Wilton pile carpet in accordance with the invention.

Figures 1*a*, 5*a* and 7*a* are views corresponding to Figures 1, 5 and 7 respectively, showing a variation.

Figures 11 to 23*c* inclusive are conventional threading-in diagrams showing the thread-ins applicable to any suitable weaves, such as Wilton, Brussels, velvet, terry or staggered W carpet weaves in accordance with the invention.

Figures 24 to 28 are fragmentary elevations showing various types of wires applicable to any of the weaves of the invention.

Figures 29 and 30 are transverse sections of adjoined wires showing variations in height.

Figure 31 is a standard warpwise weave diagram showing a complete Wilton fabric produced in accordance with the weave of Figures 1 to 10 with any of the thread-ins of Figures 11 to 23*c*, and using any of the wires of Figures 24 to 30, it being understood that peculiarities individual to wires of different heights have been eliminated for the sake of simplicity.

Figure 32 is a standard warpwise weave diagram showing one of the steps in weaving a velvet or tapestry pile carpet in accordance with the invention.

Figure 33 is a standard warpwise weave diagram of a complete velvet or tapestry carpet produced in accordance with the weave of Figure 32.

Figure 34 is a standard warpwise weave diagram showing a completed velvet or tapestry pile carpet in accordance with the invention.

Figures 35 to 38 inclusive show standard warpwise weave step diagrams illustrating the application of the invention in weaving a pile fabric without wires.

Figure 39 is a standard warpwise weave diagram of the completed fabric of Figures 35 to 38 inclusive.

Figures 40 to 47 inclusive are standard warpwise weave step diagrams showing the application of the inven-

tion in weaving a staggered W velvet or tapestry pile carpet and also showing the invention applied to weaving a velvet which raises alternate pile warps over wires in alternate rows.

Figure 48 is a standard warpwise weave diagram of a complete staggered W-weave produced in accordance with Figures 40 to 47 inclusive.

Figure 49 is a fragmentary enlarged bottom plan view of a pile warp end gripped by spaced binder warp ends and about to be raised in the pile by the beat up of a weft.

Figure 50 is a fragmentary side elevation of a brake as used in Figures 1*a*, 5*a* and 7*a*.

In the drawings like numerals refer to like parts throughout.

In the prior art, efforts have been made to create wire pile fabrics in which additional loops are raised by changing of the timing of the shedding motion, and closing each shed when the weft being beaten up is at a substantial distance from the fell of the fabric. This has the disadvantage of requiring substantial changes in the weaving technique, and complicating the procedure. It also results in producing a fabric which except for the pile loops has no advantage over the existing pile carpets.

In accordance with the present invention, pile loops are obtained without the necessity of using wires and preferably in addition to those secured over wires, so that pile warp ends, which in an ordinary fabric would be rejected pile warp ends, in the fabric of the invention rise in the pile, add to the coverage and the density of the pile, and laterally support the normally higher pile projections raised over the wires.

Furthermore by the modifications in the thread-in employed in the present invention I obtain a tighter bind on the pile yarn at the back of the fabric by increasing the number of oppositions obtained in the weave.

I also obtain better control of pile and stuffer warp ends by more frequent interposition of binder warp ends at spaced points in each dent.

In the resulting fabric I increase the number of crossings weftwise of the fabric.

Another important advantage of the weave of the present invention is that lateral shrinkage of the pile fabric is reduced.

In accordance with the invention I preferably create in each transverse row of the pile, pile projections which may be cut tufts or uncut loops which are raised over wires and which constitute the selected pile warp ends in a wilton or brussels weave, or which constitute a selected warp in the case of velvet carpet (in velvet I include tapestry) and I also raise all the rejected pile warp ends, which in the case of wilton or brussels will be those not selected by the jacquard mechanism and in the case of velvet constitute the pile warp ends which are not raised over the wire, by slack tensioning the rejected pile warp ends, gripping them between spaced binder warp ends per dent, and beating up a weft. Thus all of the pile warp ends which would normally be in the back in an ordinary carpet are raised in pile loops suitably lower than the wire pile projections in each transverse row.

By the way in which I vary the warps which are raised over wires and the warps which are forced up in pile loops, pattern effects are achieved. Thus in a wilton or brussels weave the jacquard determines which pile warp ends are raised over a wire, and all other pile warp ends are forced up into loops at each transverse row. In a velvet weave, however, the manipulation of the pile warp heddles determines which pile warp is raised over a wire and which pile warp is forced up into loops at any position, and the fabric can be woven throughout with one pile warp as the wire pile warp and the other pile warp as the pile warp forced up into loops, or the pile warps can reverse at each wire position, or they can reverse at any predetermined number of wire positions

to create the pattern effects desired. These features can be embodied in any of the carpet weaves of the character of wilton, brussels, velvet and tapestry.

The invention is applicable to constructions in which an individual pile warp end is bound behind two binding wefts between two positions at which it rises in the pile over wires (a W-weave), in which case the invention adds the interesting feature of forcing up a pile loop at the base of the W instead of leaving the yarn in the back at the base of the W.

While in the best aspects of the invention, the primary pile projections will be formed over wires, I will in some cases make fabrics in which the pile projections are entirely those forced up by the grip of the binder warps.

The thread-ins used are of special significance in the present invention. In all of them the pile warp end or pile warp ends representing the pile warps present are placed in a bracket per dent of the particular pattern area between spaced binder warp ends which are woven in opposition to the pile warp ends and suitably also to the stuffer warp ends, instead of being woven in opposition to one another as in usual practice.

The positioning of the stuffer warp ends is important. Where stuffer warp ends are employed, I will very desirably place one or a plurality of stuffer warp ends outside the bracket per dent and also desirably place one or a plurality of stuffer warp ends inside the bracket per dent.

The stuffer warp ends which are outside the bracket per dent may permissibly be on either side of the bracket, but will preferably be on both sides of the bracket per dent.

The stuffer warp ends which are inside the bracket per dent may permissibly be on either side of the group of pile warp ends but preferably will be on both sides of the group of pile warp ends. I do not, however, recommend placing any stuffer warp end inside the group of pile warp ends as the pile warp ends should be kept together in the bracket.

Considering now the wilton or brussels carpet weave shown in Figures 1 to 10 inclusive, I illustrate in Figure 1 a pile warp **50** withdrawn from a suitable source such as creel **51** through tensioning device **52** and manipulated by lingoe heddles **53** from a suitable pattern control mechanism such as a jacquard not shown, and a second pile warp **54** drawn from a suitable source such as creel **55** over tensioning device **56** and manipulated by lingoe heddles **57**. The pile warps **50** and **54** in the weave of Figures 1 to 10 will suitably differ only with respect to the fact that one is selected and one is rejected by the jacquard mechanism, although additionally they will suitably differ in color, material, twist, weight or construction.

One of the important aspects of the present invention is the employment of slack tension or abnormally low tension on the pile warp ends which are to be pushed up into the pile by the grip of the binder warp ends at the time they are pushed up. It will be understood that the exact tension to be employed on the pile warp ends will vary with the individual character of the pile warp ends, the height of the loops desired, the bulk and frictional coefficient of the pile warp ends, the tension on the binder warp ends and the particular thread-in which is used. I find however that for best results a tension of about one-half that which is normally used is desirable in this embodiment. In one loom which may be used in the present invention the pile warp ends rest on a wooden bar as they come from the creel. The usual transverse weight employed on each pile warp end is 0.4 pound or above. I find that in order to slack tension the pile warp ends according to the invention the transverse weight on each individual end should be between 0.10 pound and 0.35 pound and preferably between 0.15 pound and 0.25 pound in accordance with the preferred

embodiment, the most suitable transverse weight being 0.2 pound.

It will be evident that factors which influence the pull of one pile warp end on adjoining pile warp ends, such as closeness of placement, wooliness, size and material will somewhat modify the tension and cause it to vary on different looms.

A binder warp **58** is withdrawn from a suitable source such as beam **60** over tensioning device **61** and manipulated by binder warp heddle **62**. The binder warp tension in accordance with the invention will suitably be normal tension, desirably in the range between 0.75 and 1.25 pounds on a particular end and most desirably about 1 pound.

A stuffer warp **63** is withdrawn from a suitable source such as beam **64** over tensioning device **65** and manipulated by stuffer warp heddle **66**. The tension on the stuffer warp ends will suitably be normal tension, desirably in the range between 0.75 and 1.25 pounds on a particular end and most desirably about 1 pound.

In the first step as shown in Figure 1, an upper shed **67** is formed between pile warp **50** raised by lingoe heddles **53** selected by the jacquard mechanism on the one hand, and pile warp **54** raised one-half way by lingoe heddles **57** and rejected by the jacquard mechanism, and stuffer warp **63** raised one-half way by stuffer warp heddle **66**, on the other hand, and lower shed **68** is formed between rejected pile warp **54** and stuffer warp **63** on the one hand and binder warp **58** lowered by binder warp heddle **62** on the other hand. Wire **70** is inserted in the upper shed and a weft **71** is inserted in the lower shed. Lay **72** is moving away from the fell in Figure 1.

The nearest pile warp end of pile warp **54** is shown in the foreground forming a pile projection **73** over a wire **70** in the second row from the fell and forming a relatively lower pile loop **74** pushed up by the grip of the binder warps **58** and shown in the last transverse row. The nearest pile warp end of pile warp **50** is behind the nearest pile warp end of pile **54** and is shown raised over a wire **70** to form a pile projection **73** in the last transverse row.

Figure 2 illustrates the same heddle positions as Figure 1, and shows the weave after the lay has moved toward the fell in the process of beating up the wire and weft which have just been inserted.

In Figure 3 the first beat of the lay has been completed. Binder warp heddle **62** has begun to move up and stuffer warp heddle **66** and all lingoe heddles have begun to move down. The weft last inserted lies under the stuffer warp **63** and above the binder warp **58**. The rejected pile warp **54** is underneath the wire **70** last inserted and the selected pile warp **50** is over the wire **70** last inserted.

As shown in Figure 4, binder warp heddle **62** is moving up and all other heddles are lowered, causing binder warp **58** to engage and grip at **75** slack tensioned pile warp ends **54** which are not raised over a wire. Thus an upward deflection occurs in pile warp ends **54**, and they do not extend straight from the fell to the lingoe heddles **57** in this position. I will preferably employ a double beat of the lay, the second beat of the lay being shown at the fell in Figure 4.

In Figure 5 binder warp heddle **62** has moved up to the half-way raised position and engages and grips the ends of rejected pile warp **54** at **75** a substantial distance in front of the fell. Pile lengths of pile warp ends of pile warp **54** have been forced up above the level of the binder warp between the point **75** and the fell. All other heddles are lowered in this position. The lay **72** is moving away from the fell.

As shown in Figure 6, the heddle positions are the same as in Figure 1, a shot of weft **71** having been inserted in the lower shed **68**, and the lay **72** moving toward the shed. It will be noted in Figure 6 that the selected pile warp ends have moved down but the surplus pile of the rejected pile warp ends remains held up squeezed between pairs of binder warp ends. The wire **70** leans away from the completed fabric at **76** somewhat due to the pull of the selected pile warp ends.

In Figure 7 the lay **72** is shown moving toward the fell and the filler is moving over the pile and stuffer warp ends and under the binder warp ends. There is no possibility of pushing slackness into the binder warp ends because of their relatively high tension. The tightness of the grip of the binder warp ends on the rejected pile warp ends prevents pushing pile warp from the side of gripping point **75** away from the fell through the binder warp ends, but at the same time the surplus which is humped up at **76** between the point **75** and the fell remains to form pile projections in the next step.

Figure 8 shows the weft **71** forced in closer to the fell by the lay to raise humped material **76** even higher and force it in under the last pile wire. In this step, binder warp heddle **62** has begun to move down bringing the binder warp toward the lower position. The stuffer warp heddle and both sets of lingoe heddles are moving up.

Figure 9 shows the first beat of lay **72** which forces weft **71** against the fell and raises pile loops **74** wherever rejected pile warp ends gripped between binder warp ends are forced up by the movement of the weft toward the fell. The binder warp ends have continued downward movement and the stuffer warp ends and all pile warp ends have continued upward movement until the warps are almost but not quite in parallelism. Wire **70** has been erected from its former leaning and slightly raised position by the beat of the lay.

Figure 10 shows an optional but desirable second beat-up, by which time binder warp heddle **62** is lowered and stuffer warp heddle **66** and lingoe heddles **53** and **57** have raised until the warps have passed parallelism and the next shed is being formed.

It will be noted that the double beat-up is optional.

As seen in Figure 10, the pile projections **73** formed by raising pile warps over wires are suitably substantially higher than the pile projection **74**, formed by forcing rejected pile warp ends up into the pile through the clamping of such slack tensioned ends between binder warp ends and beat-up and weft. The relative heights of the pile projections from the two sources can be adjusted.

Lingoe heddles **53** (the lingoe heddles which are selected to be raised in the pile in the next cycle) are moving further up toward the fully raised position of Figure 1 while the lay is about to move away from the fell to the position of Figure 1. The binder warp ends are about to move down to the position of Figure 1 and the stuffer warp ends are about to be raised half-way to the position of Figure 1 immediately beneath the rejected pile warp ends.

It will be evident, of course, in Figures 1 to 10 that the pile warp ends forming the pile projections **74** forced up are in different vertical longitudinal planes from the pile warp ends forming the pile projections **73** raised over wires. In the assumed condition of the drawings, the pile warp end forming the pile projection **74** forced up is in front of the pile warp end forming the pile projection **73** raised over the wire at the particular weftwise position shown in Figures 1 to 10.

Any one of a variety of different thread-ins may be employed in making up the weaves of the present invention, different embodiments being shown in Figures 11 to 23*c*, each of which illustrates a variation which will upon occasion be employed in the weave of Figures 1 to 10 or in any other weaves as described herein. As shown in each of these views, the reed has several dents **77** side by side and illustrated conventionally in the position as seen by an observer looking from the front. The thread-in illustrated in each of the Figures 11 to 23*c* is the same in all of the dents of a particular figure.

It will be evident that the thread-in in some cases will be the same in all dents, or in other cases it will be the same in certain dents and different in other dents. For example, the thread-in of one of Figures 11 to 23*c* will in some cases be used in one dent and the thread-in of another of Figures 11 to 23*c* will be used in the next dent or the thread-in of one of Figures 11 to 23*c* will be used in one group of dents and the thread-in of another of Figures 11 to 23*c* will be used in the next group of dents and so on with recurrence of the previous thread-in or selection of another one of the thread-ins of Figures 11 to 23*c* in the next dent or group of dents. In this way very attractive banding effects across the fabric can be obtained, creating differences which are unusual and attractive.

In the form of Figure 11, the bracket formed by binder warp ends **58** in each dent includes only one pile warp end **50**, while one stuffer warp end **63** is outside the bracket at the same side of the bracket in each dent. Thus in accordance with the weave of Figures 1 to 10, the binder warp ends are placed on either side of the single pile warp end and will grip it to force it up in a pile projection where the particular pile warp end is not raised in the pile.

Of course the employment of a single pile warp end per dent will not well serve the demands of Figures 1 to 10 where at least two pile warp ends are desirably present per dent. This is illustrated in Figure 12 where the bracket includes pile warp ends **50** and **54** between binder warp ends **58**, with a stuffer warp end **63** outside the bracket and on the same side in each dent.

It is preferable to employ a stuffer warp end inside the bracket as well as to employ one outside the bracket. This is shown in Figure 13 where a stuffer warp end **63** inside the bracket is at the side of pile warp ends **50** and **54** which is adjoining the stuffer warp end **63** outside the bracket in each dent. Where desired, the stuffer warp end inside the bracket will be placed on the side of the pile warp ends in the bracket which is remote from the stuffer warp end outside the bracket in each dent, as shown in Figure 14.

The stuffer warp ends inside the bracket will in many cases be multiple ends rather than single ends. Thus in Figure 15 I illustrate a pair of stuffer warp ends **63** side by side inside the bracket and arranged on the side of pile warp end **50** which is adjacent stuffer warp end **63** outside the bracket in each dent.

Where a plurality of stuffer warp ends are to be used inside the bracket it is preferable to place one on each side of the pile warp end or ends as illustrated in Figure 16. In this form the bracket consists of one or more pile warp ends which are surrounded on the two sides by one or more stuffer warp ends, which are in turn surrounded on the two sides by the binder warp ends. This draw-up provides two stuffer warp ends which cover the back against showing a pile end and one stuffer warp end which leans against the split and pushes one binder warp end against the pile end.

In some cases the binder warp may appear as multiple ends woven together as shown in Figure 17, where the bracket is made up of a pair of binder warp ends on either side of a pile warp end in each dent, with a stuffer warp end in each dent outside the bracket.

In some instances it is desirable to employ a plurality of stuffer warp ends side by side outside the bracket as illustrated in Figure 18. This has no stuffer warp end to cover the pile at the back but two stuffer warp ends push from the split against one of the binder warp ends and the other binder warp end in each dent is pushed against the next split.

The stuffer warp end outside the bracket may be on either side of the bracket, Figure 19 showing the stuffer warp end on the opposite side of the bracket from the showings in Figures 17 and 18, for example.

In some cases it is desirable to employ double stuffer warp ends outside the bracket along with a single stuffer warp end inside the bracket in each dent, as shown in Figure 20. In this form two stuffer warp ends outside the bracket lean against the split and push against one of the binder warp ends while the other binder warp end is leaning against the next split. There is one stuffer warp end in the bracket to cover the pile at the back.

In some cases the independent stuffer warp ends are desirably divided and placed on opposite sides of the bracket as shown in Figure 21 where each stuffer warp end adjoins one of the opposite splits and pushes against one of the binder warp ends.

The employment of spaced independent stuffer warp ends along with a stuffer warp end inside the bracket is very desirable and is regarded by me as the preferred embodiment of the various thread-ins shown. As illustrated in Figure 22, in each dent there is a stuffer warp end **63** between one of the binder warp ends and the pile warp end or ends, and there is also a stuffer warp end outside each of the binder warp ends. Each of the stuffer warp ends is squeezed by a split and pushes against one of the binder warp ends which squeezes the pile warp end or ends, suitably through a stuffer warp end in the bracket at one side.

Figure 23 shows multiple independent stuffer warp ends at each side of the bracket in each dent.

In some cases the split of the reed is placed between parts of the bracket, so that the bracket is partly in one dent and partly in the other dent. Thus in Figure 23*a* the pile warp end in each dent is adjoining the split, and the binder warp ends on either side are one in one dent and the other in the next dent. The independent stuffer warp end or ends outside the bracket is placed between the binder warp end in a particular dent just mentioned and a second binder warp end adjoining the opposite split in that dent, which functions as part of the next bracket.

This same arrangement is shown in Figure 23*b* with two independent stuffer warp ends **63** per dent placed together outside the bracket, and it is shown in Figure 23*c* with three independent stuffer warp ends **63** per dent placed together outside the bracket.

The wires employed in the weave of Figures 1 to 10 and in any other of the weaves of the invention may be of any of the characters as well known, being suitably cutting or non-cutting straight or wavy, high or low, in any sequence or combination. Merely to suggest various wire combinations which may be used, wires are illustrated in Figures 24 to 30. Figure 24 shows a straight wire **78** having a cutter **80** at the end remote from the head. Figure 25 shows a straight wire **78** of round or non-cutting character.

Figure 26 shows a wavy wire **81** having a cutter **80** at the end remote from the head and provided with a plurality of high and low portions distributed along the length of the wire as well known in the art. Any desirable slopes between the low and the high portions in both directions may be used on the wires, the angles preferably not exceeding 15° to the longitudinal axis. Figure 27 shows a wavy wire **81** which is non-cutting.

In some cases flag wires **82** will be employed, which are straight within the shed and have non-cutting high portions **83** with gradual approach portions at the ends remote from the head and beyond the shed. It will be understood that any combinations of wires in pairs or sets will desirably be used, such as straight cutting wires of Figure 24 alternating with straight non-cutting wires of Figure 25, or with wavy cutting or non-cutting wires of Figures 26 or 27 or with flag wires of Figure 28, or wavy wires of cutting or non-cutting character alternating with straight non-cutting wires of Figure 25 or with flag wires of Figure 28, or any other combination or arrangement with the wires of different types. The wires used, whether straight or wavy, and cutting, non-cutting

or flag, may suitably be successively of different heights as illustrated in Figure 29 where high wires 84 alternate with low wires 85, or in Figure 30 where high wires 84, intermediate wires 85′ and low wires 85² successively alternate.

The resulting fabric produced in Figures 1 to 10 using one of the thread-ins of Figures 11 to 23c and one of the wires of Figures 24 to 30 will suitably be of the character shown in Figure 31 where the pile projections 73 formed over wires and cut or uncut as the case may be, are suitably substantially higher than the pile projections 74 forced up by the grip of the binder warp ends on slack tensioned rejected pile warp ends. Points of pattern change 86 and 86′ are shown in Figure 31, where to the left of point 86, pile warp 54 forms the wire pile projections and pile warp 50 forms the pile projections which are forced up by the grip of the binder warps. To the right of the point of pattern change 86 due to a change in the jacquard card, pile warp 50 forms the pile projections over wires and pile warp 54 forms the pile projections forced up by the grip of the binder warp ends. At point 86′ the pile warps again reverse. Of course it will be evident that as normal in wilton practice pattern change may occur in each transverse row, if desired.

The slack tensioning of the pile warp ends which are to be raised in the pile by the grip of the binder warp ends will in some cases be accomplished by forward feed of the pile warp ends which are thus to be raised at a stage when corresponding take-up does not occur at the fell, and therefore when the forward feed slackens the tension. It will of course be understood that to make the forward feed effective where a tensioning device is pulling on the pile warp ends, the pile warp ends must be braked or restrained against corresponding return toward the tensioning device.

This type of mechanism will be applicable in any of the weaves in the invention and is shown in Figures 1a, 5a and 7a applied to the weave of Figures 1 to 10.

In Figure 1a, conforming generally to Figure 1, the creels and tensioning devices for the pile warp ends are moved down far enough so that between the mid or halfway raised position of the heddles and the tensioning devices the pile warp ends will always rise over a horizontal support 59 placed intermediate between the tensioning devices 52 and 56 on the one hand and the pile warp heddles 53 and 57 on the other hand, and placed above the level of the eyes of the pile warp heddles at the mid position. The support in the preferred embodiment is a roll 59 shown in detail in Figure 50, turning freely on pivots, and having a roughened surface 59′ suitably of abrasive, desirably sand paper, with the abrasive side out. The effect of raising the lingoe heddles 53 selected by the jacquard is to pull forward on the pile warp ends 50, and since all pile warp ends are carried over the support or sand paper roll 59, the rejected pile warp ends 54 are carried forward a corresponding amount. But the fell is not taking up this forward feed at this step and therefore there is a net relaxation in tension on the rejected pile warp ends 54 as compared with the selected pile warp ends 50. The tension of the selected pile warp ends 50 is further increased by raising them over a wire which is inserted in Figure 1a. The remaining features of Figure 1a are similar to those of Figure 1.

Likewise in Figure 5a I illustrate the grip of the rejected pile warp ends 54 in the bind of the weave, the remaining features being as shown in Figure 5.

In Figure 7a as in Figure 7 I show the forcing up of the hump of pile warp 76 by the beat-up of the weft while the pile warp is held between the binder warp ends of the bracket.

It is preferable to prevent sagging of the rejected pile warp ends and with this in view I place a suitably stationary and suitably smooth horizontal metallic rod support 59² immediately adjoining the heddles on the side from which the warp ends are fed, at a level as shown in Figure 1a which is substantially of the line between the top of the support 59 and the positions of the eyes of the lingoe heddles in mid position. This prevents the rejected pile warp ends from tangling due to excessive sag in the position of Figure 1a.

The remainder of the weave of Figures 1a, 5a and 7a will suitably conform to Figures 1 to 10.

The invention is applicable to velvet or tapestry pile carpet as well as to wilton. To illustrate this I show in Figure 32 only the step corresponding to Figure 7, it being understood that the other steps will similarly conform to Figures 1 to 10 except that the pile warps are drawn from beams 51′ to 55′ respectively instead of creels, and pile warp heddles 53′ and 57′ are employed instead of lingoe heddles. The resulting velvet fabric, using any one of the thread-ins of Figures 11 to 23c and any one of the wires of Figures 24 to 30 inclusive is shown in Figure 33, where pile warp 50 always forms pile projections 73 over wires and pile warp 54 always forms pile projections 74 forced up by the grip of the binder warps. As in the wilton, the wire pile projections in the velvet weave of Figure 33 are suitably high and the pile projections forced up by the binder warp grip are relatively low. The cut or uncut character and other contour features of the wire pile projections 73 depend of course upon the character of the wires, any of the types referred to being employed.

In some cases it is desirable to vary the pile warp which is raised over the wires and the pile warp which is forced up by the grip of the binder warps at intervals throughout the fabric. This will be done for example by applying a pattern change mechanism of any well known character to the mechanism for manipulating the pile warp heddles, or by modifying the pile warp heddle cams to reverse the pile warp to be raised over the wires with each first, second, third, etc., successive row. This is illustrated in Figure 34 where a pattern change is indicated at 86, all of the immediate rows of pile projections to the left of the pattern change having pile warp 54 raised over the wires and pile warp 50 forced up into pile projections by the binder warp grip, while to the right of pattern change point 86 pile warp 50 is raised over the wires and pile warp 54 is forced up into pile projections by the binder warp grip.

It will be evident that in all of the weaves thus far discussed, the pile loops forced up by the binder warp grip eventually lie to one side of the center of the space between adjoining front wefts because they are forced to one side by the presence of the wire, but as soon as the wire is withdrawn they line up symmetrically at the center of the row as illustrated in Figures 31, 33 and 34 so that truly there are high and low pile projections and suitably cut and uncut pile projections or pile projections of other different characters in the same transverse row.

The weave of the invention is also applicable to force up pile loops even where wires are not employed. For this purpose the weave of Figures 1 to 10 will suitably be employed with the thread-in of any one of Figures 11 to 23c, except that the pile warp is suitably drawn from a beam 55′ instead of a creel and pile warp heddle 57′ is used instead of lingoe heddles 57. To avoid undue duplication, only certain positions are being shown, Figure 35 corresponding to the position of Figure 1, and showing the insertion of a weft, and Figure 36 corresponding to the position of Figure 6 and showing the insertion of another weft while the binder warp 58 is raised, and pile warp 54 is gripped at 75.

Figure 37 corresponds with Figure 7 and shows the movement of the lay beating up weft 71 toward the shed while pile warp 54 is gripped by the binder warps at 75 and a hump is forced up at 76.

Figure 38 corresponds to Figure 10 and shows the second beat-up of the lay, raising pile loop 74 by the pushing action of the weft against the pile warp ends

while they are gripped at a substantial distance away from the fell by the binder warp ends.

The remaining steps will be understood from Figures 1 to 10 inclusive.

It will be evident that the weave of Figures 35 to 38 is applicable to produce attractive fabrics by employing a jacquard mechanism to raise certain ends (even though they are not raised over wires) and raising the rest of the pile warp ends differently by gripping them between the binder warp ends.

The fabric produced in the weave of Figures 35 to 38 inclusive is shown in Figure 39 in which pile loops **74** appear for each pile warp end in each transverse row.

The principles of the invention are applicable to W-weaves in which the pile warp is bound behind two front wefts between each row in which it rises in the pile and also in staggered W-weaves where alternate warps alternately rise in the pile. The invention is also applicable to such weaves in which a single binder warp or a pair of binder warps is woven in opposition to the pile warps and the stuffer warp.

A weave of this character is shown in Figures 40 to 47 inclusive, which illustrate positions corresponding to Figures 1, 6, 7 and 10 for raising one pile warp over the wire and forming pile projections forced up by the grip of the binder warps from the other pile warp, and then positions corresponding to Figures 1, 6, 7 and 10 for raising the other pile warp over a wire and forcing up pile projections of the one pile warp by the grip of the binder warps. These figures illustrate a velvet or tapestry weave in which the pile warps are withdrawn respectively from beams **51'** and **55'** and are manipulated by velvet weave heddles **53'** and **57'**.

In Figure 40 the warps are disposed as in Figure 1 and a shot of weft is inserted in the lower shed and a wire is inserted in the upper shed. Pile warp **54** is raised over the wire and pile warp **50** is rejected.

Figure 41 illustrates a position corresponding to Figure 6 in which a weft is inserted and rejected pile warp **50** is gripped at **75** between binder warp ends **58**.

Figure 42 shows the position of Figure 7, and pile warp **50** is pushed up at **76** by the partially completed beat-up of the weft acting on pile warp ends gripped between the binder warp.

Figure 43 shows a position corresponding to Figure 10 in which the wire raises pile projections **73** of pile warp **54** in the last row and rejected pile warp ends **50** are forced up into pile loops **74** which are suitably lower.

Figure 44 shows a position corresponding to Figure 1, and also similar to Figure 40 except that pile warp **50** is now raised over the wire and pile warp **54** is rejected.

Figure 45 shows a position corresponding to Figure 6, in which rejected pile warp ends **54** are gripped at **75** between binder warp ends **58**.

Figure 46 shows a position corresponding to Figure 7 in which the rejected pile warp ends have again to be raised in hump **76** by the partially completed beat-up of weft **71** and the grip of the binder warps at **75**.

Figure 47 is a view similar to Figure 10 and also similar to Figure 43 except that in this case pile warp **50** is raised over the wire and pile warp **54** is forced up by the grip of the binder warps into loops **74**.

It will be understood that the omitted views showing the intermediate steps will correspond to the remaining views of Figures 1 to 10 inclusive.

The final result is a staggered W-weave as shown in Figure 48 in which each alternate pile projection has a different one of the pile warps raised over the wire and a different one of the pile warps forced up by the grip of the binder warps into lower pile loops. The binder warp is woven in opposition to the stuffer warp and the pile warps. Of course the weave of Figures 40 to 48 may be produced with three or more pile warps alternating.

Figure 49 shows the grip of the pile warp end by the binder warps of the bracket and the way in which the beat-up of the weft **71** tends to force the pile warp ends **54** up into the pile.

In all of the weaves of the invention, the comparative slack tensioning of the pile warp ends or at least of the pile warp ends which are to form the pile projections by the grip of the binder warp ends is employed as already discussed, along with any of the thread-ins referred to. The height of the pile warps forced up into loops by the grip of the binder warp will be determined by a number of factors, including the tension on the pile warp ends, the tension on the binder warp ends, the particular thread-in or draw-up to be used, the density of the fabric in wires per inch, the thickness, coarseness and roughness of the pile yarn, and the pitch of the reed. The user will therefore determine a wide variety of desirable characteristics and vary them to suit the requirements. The main criterion however is the slackness of the pile warp ends, which should have a tension as already specified preferably about half that normally used.

It will be evident that the invention is applicable to any suitable material, such as wool, rayon, nylon or cotton in the pile, or blends thereof, and cotton or other suitable fiber in the binder warp ends and wefts, and jute, cotton, paper or the like in the stuffer warp ends.

The invention may be applied to weaves having different thread-ins in different pattern areas in accordance with the principles of my application Serial No. 191,830, filed October 24, 1950, for Weaving Pile Fabric Having High and Low Loops. The invention may also be applied in weaving in accordance with my application Serial No. 190,280, filed October 16, 1950, for Multiple Pile Staggered W-Weaving.

One of the aspects of the invention is that where wells exist between pile projections, these are filled by a suitably relatively low loop.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the process and fabric shown, and I therefore claim all such insofar as they fall within the reasonable spirit and scope of my claims.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end between spaced binder warp ends per dent to form a bracket, tensioning at least one pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends in opposition to all binder warp ends, and in the weaving forming a shed with slack tensioned pile warp ends down and all binder warp ends up, inserting a weft, and forcing said slack tensioned pile warp ends up into the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

2. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end between spaced binder warp ends per dent to form a bracket, threading-in at least one stuffer warp end per dent outside the bracket, tensioning at least one pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends and stuffer warp ends in opposition to all binder warp ends, and in the weaving forming a shed with slack tensioned pile warp ends down and all binder warp ends up, inserting a weft, and forcing said slack tensioned pile warp ends up into the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

3. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end and at least one stuffer warp end between spaced binder warp ends per dent to form a bracket, tensioning at least one

pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends and the stuffer warp ends in opposition to all binder warp ends, and in the weaving forming a shed with slack tensioned pile warp ends down and all binder warp ends up, inserting a weft, and forcing said slack tensioned pile warp ends up into the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

4. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end and at least one stuffer warp end between spaced binder warp ends per dent to form a bracket, threading-in at least one stuffer warp end per dent outside the bracket, tensioning at least one pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends and stuffer warp ends in opposition to all binder warp ends, and in the weaving forming a shed with slack tensioned pile warp ends down, the stuffer warp ends down and all binder warp ends up, inserting a weft, and forcing said slack tensioned pile warp ends up into the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

5. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end and a plurality of stuffer warp ends between spaced binder warp ends per dent to form a bracket, tensioning at least one pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends and the stuffer warp ends in opposition to all binder warp ends, and in the weaving forming a shed with slack tensioned pile warp ends down and all binder warp ends up, inserting a weft, and forcing said slack tensioned pile warp ends up into the pile as they are gripped between the raised spaced binder warp ends in the same dent by beating up the weft.

6. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end with spaced stuffer warp ends on either side thereof and spaced binder warp ends on either side of the stuffer warp ends per dent to form a bracket, tensioning at least one pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends and stuffer warp ends in opposition to all binder warp ends, and in the weaving forming a shed with slack tensioned pile warp ends and the stuffer warp ends down, and all binder warp ends up, inserting a weft, and forcing said slack tensioned pile warp ends up into the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

7. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end between spaced binder warp ends per dent to form a bracket, threading-in a plurality of stuffer warp ends per dent outside the bracket, tensioning at least one pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends and stuffer warp ends in opposition to all binder warp ends, and in the weaving forming a shed with slack tensioned pile warp ends and the stuffer warp ends down, and all binder warp ends up, inserting a weft, and forcing said slack tensioned pile warp ends up into the pile as they are gripped between the raised spaced binder warp ends in the same dent by beating up the weft.

8. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end and at least one stuffer warp end between spaced binder warp ends per dent to form a bracket, threading-in at least one stuffer warp end per dent on each side of the bracket, tensioning at least one pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends and stuffer warp ends in opposition to all binder warp ends, and in the weaving forming a shed with slack tensioned pile warp ends down, the stuffer warp ends down, and all binder warp ends up, inserting a weft, and forcing said slack tensioned pile warp ends up into the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

9. The process of weaving a warp pile fabric, which comprises threading-in at least two pile warp ends between spaced binder warp ends per dent to form a bracket, tensioning at least one pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends in opposition to all binder warp ends, in the weaving raising certain pile warp ends in a particular transverse row over a wire to form pile projections, in weaving the same transverse row forming a shed with slack tensioned pile warp ends down and all binder warp ends up, inserting a weft, and forcing said slack tensioned pile warp ends up into the pile in the same transverse row as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

10. The process of weaving a warp pile fabric, which comprises threading-in at least two pile warp ends between spaced binder warp ends per dent to form a bracket, threading-in at least one stuffer warp end per dent outside the bracket, tensioning at least one pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends and stuffer warp ends in opposition to all binder warp ends, in the weaving in each transverse row raising certain pile warp ends over a wire to form pile projections, in weaving in the same transverse rows forming a shed with slack tensioned pile warp ends down, the stuffer warp ends down and all binder ends up, inserting a weft and forcing said slack tensioned pile warp ends up into the pile in the same transverse rows as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

11. The process of weaving a warp pile fabric, which comprises threading-in ends of at least two pile warps and at least one stuffer warp end between spaced binder warp ends per dent to form a bracket, tensioning at least one pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends and stuffer warp ends in opposition to all binder warp ends, in the weaving in each transverse row raising one pile warp end per dent over a wire to form pile projections and in weaving each transverse row forming a shed with slack tensioned pile warp ends and the stuffer warp ends down and all binder warp ends up, inserting a weft and forcing said slack tensioned pile warp ends up into the pile in each transverse row as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

12. The process of weaving a warp pile fabric, which comprises threading-in pile warp ends of at least two pile warps and a plurality of stuffer warp ends between spaced binder warp ends per dent to form a bracket, tensioning at least one pile warp end per dent at an abnormally low tension, interweaving with wefts the pile warp ends and the stuffer warp ends in opposition to all binder warp ends, in the weaving in each transverse row raising certain pile warp ends over a wire to form pile projections, in weaving each transverse row forming a shed with slack tensioned pile warp ends down and all binder warp ends up, inserting a weft and forcing said slack tensioned pile warp ends up into the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

13. The process of weaving a warp pile fabric, which comprises threading-in pile warp ends of at least two pile warps between spaced stuffer warp ends which are between spaced binder warp ends per dent to form a bracket, tensioning at least one pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends and the stuffer warp ends in opposition to all binder warp ends, in the weaving raising certain pile warp ends in each transverse row over a wire, in the

weaving of each transverse row forming a shed with slack tensioned pile warp ends and the stuffer warp ends down and all binder warp ends up, inserting a weft and forcing said slack tensioned pile warp ends up into pile projections lower than those formed over the wire in the same transverse row as the slack tensioned pile warp ends are gripped between the spaced binder warp ends in the same dent by beating up the weft.

14. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end of each of two pile warps between spaced binder warp ends per dent to form a bracket, threading-in a plurality of stuffer warp ends per dent outside the bracket, tensioning at least one pile warp end per dent under abnormally low tension, interweaving with wefts the pile warp ends and the stuffer warp ends in opposition to all binder warp ends, in the weaving raising one of the pile warp ends per dent over a wire in each transverse row, in the weaving of each transverse row forming a shed with slack tensioned pile warp ends and the stuffer warp ends down and all binder warp ends up, inserting a weft in the shed and forcing said slack tensioned pile warp ends up into the pile in each transverse row as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

15. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end of each of two pile warps between spaced binder warp ends per dent to form a bracket, threading-in at least one stuffer warp end on each side of the bracket per dent, tensioning at least one pile warp end per dent under abnormally low tension, interweaving with wefts the pile warp ends and the stuffer warp ends in opposition to all binder warp ends, in the weaving raising one of the pile warp ends per dent over a wire in each transverse row, in the weaving of each transverse row forming a shed with slack tensioned pile warp ends and the stuffer warp ends down and all binder warp ends up, inserting a weft in the shed and forcing said slack tensioned pile warp ends up into the pile in each transverse row as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

16. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end of each of at least two pile warps between spaced binder warp ends per dent to form a bracket, tensioning at least one pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends in opposition to all binder warp ends, in the weaving selecting certain pile warp ends according to a pattern in each transverse row and raising them over a wire while rejecting all other pile warp ends in that transverse row, the rejected pile warp ends being under the slack tension, in the weaving of each transverse row forming a shed with the rejected pile warp ends down and all binder warp ends up, inserting a weft, and forcing the rejected pile warp ends up into the pile in each transverse row as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

17. The process of weaving a velvet warp pile carpet, which comprises threading-in at least one pile warp end of each of at least two pile warps between spaced binder warp ends per dent to form a bracket, tensioning at least one pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends and stuffer warp ends in opposition to all binder warp ends, in the weaving raising the ends of each pile warp in successive transverse rows over wires and rejecting the other pile warp ends, and in the weaving of the successive transverse rows forming a shed with the rejected pile warp ends and the stuffer warp ends down and all binder warp ends up, inserting a weft, and forcing rejected slack tensioned pile warp ends up into the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft, thereby producing pile projections raised over the wire and pile projections created by the beat-up in each transverse row.

18. The process of weaving a velvet warp pile fabric, which comprises threading-in at least one pile warp end of at least two pile warps between spaced binder warp ends per dent to form a bracket, tensioning at least one pile warp end per dent under an abnormally low tension, interweaving with wefts the pile warp ends and stuffer warp ends in opposition to all of the binder warp ends, in the weaving raising the ends of the first pile warp over wires in every second transverse row and raising the ends of the second pile warp over wires in the alternate transverse rows, in weaving each row forming a shed with slack tensioned rejected pile warp ends and the stuffer warp ends down and all binder warp ends up, inserting a weft, and forcing rejected slack tensioned pile warp ends up into the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft, the pile warp ends raised over the wires from different pile warps being staggered to occupy different transverse rows, thereby creating pile projections raised over wires and pile projections formed by the grip of the binder warp ends in each transverse row.

19. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end of each of at least two pile warps between spaced binder warp ends per dent to form a bracket, tensioning the pile warp ends under an abnormally low tension, interweaving with wefts the pile warp ends and stuffer warp ends in opposition to all binder warp ends, and in the weaving in each transverse row raising the ends of one pile warp over a wire and in the same transverse row forming a shed with the ends of the other pile warp and the stuffer warp ends down and all binder warp ends up, inserting a weft, and forcing the ends of the other pile warp up into the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft, and at intervals following a plurality of transverse rows reversing the pile warp which is raised from the wires and the pile warp which is forced up into the pile by the grip of the binder warp ends.

20. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end between spaced binder warp ends per dent to form a bracket, interweaving with wefts the pile warp ends in opposition to all binder warp ends, and in the weaving forming a shed with certain pile warp ends down and all binder warp ends up, advancing the certain pile warp ends from outside the shed toward the fell at a stage at which they are not taken up in the fell and thereby relaxing the tension on the certain pile warp ends, inserting a weft, and forcing the certain pile warp ends up into the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

21. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end between spaced binder warp ends per dent to form a bracket, threading-in at least one stuffer warp end per dent outside the bracket, interweaving with wefts the pile warp ends in opposition to all binder warp ends, and in the weaving forming a shed with certain pile warp ends down and all binder warp ends up, advancing the certain pile warp ends from outside the shed toward the fell at a stage at which they are not taken up in the fell and thereby relaxing the tension on the certain pile warp ends, inserting a weft, and forcing the certain pile warp ends up into the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

22. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end and at least one stuffer warp end between spaced binder warp ends per dent to form a bracket, interweaving with wefts the pile warp ends in opposition to all binder warp ends, and in the weaving forming a shed with certain pile warp

ends down and all binder warp ends up, advancing the certain pile warp ends from outside the shed toward the fell at a stage at which they are not taken up in the fell and thereby relaxing the tension on the certain pile warp ends, inserting a weft, and forcing the certain pile warp ends up into the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

23. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end between spaced binder warp ends per dent to form a bracket, interweaving with wefts the pile warp ends in opposition to all binder warp ends, in the weaving in each transverse row raising certain pile warp ends over a wire to form pile projections, in weaving in the same transverse rows forming a shed with certain other pile warp ends down and all binder warp ends up, advancing the certain other pile warp ends from outside the shed toward the fell at a stage at which they are not taken up in the fell and thereby relaxing the tension on the certain pile warp ends, inserting a weft, and forcing the certain other pile warp ends up in the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

24. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end between spaced binder warp ends per dent to form a bracket, threading-in at least one stuffer warp end per dent outside the bracket, interweaving with wefts the pile warp ends in opposition to all binder warp ends, in the weaving in each transverse row raising certain pile warp ends over a wire to form pile projections, in weaving in the same transverse rows forming a shed with certain other pile warp ends down and all binder warp ends up, advancing the certain other pile warp ends from outside the shed toward the fell at a stage at which they are not taken up in the fell and thereby relaxing the tension on the certain other pile warp ends, inserting a weft and forcing the certain other pile warp ends up into the pile as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

25. The process of weaving a warp pile fabric, which comprises threading-in at least one pile warp end between spaced binder warp ends per dent to form a bracket, interweaving with wefts the pile warp ends in opposition to all binder warp ends, in the weaving in each transverse row raising certain pile warp ends over a wire to form relatively high pile projections, in weaving in the same transverse rows forming a shed with certain other pile warp ends down and all binder warp ends up, advancing the certain other pile warp ends from outside the shed toward the fell at a stage at which they are not taken up in the fell and thereby relaxing the tension on the certain other pile warp ends, inserting a weft, and forcing the certain other pile warp ends up into the pile in relatively lower pile projections as they are gripped between the spaced binder warp ends in the same dent by beating up the weft.

26. A carpet loom having a source of pile warp ends, a source of binder warp ends and a source of stuffer warp ends, tensioning devices for each of the warp ends, heddles by which the tensioned warp ends are manipulated, and frictional drag means extending horizontally and engaging the pile warp ends intermediate between the tensioning device for the pile warp ends and the heddles for manipulating the pile warp ends, supporting the pile warp ends above the level of the mid position of the heddles and applying retardation against pull back by the tensioning device of pile yarn fed forward over the support.

27. A carpet loom having a source of pile warp ends, a source of binder warp ends and a source of stuffer warp ends, tensioning devices for each of the warp ends, heddles by which the tensioned warp ends are manipulated, frictional drag means extending horizontally and engaging the pile warp ends intermediate between the tensioning device for the pile warp ends and the heddles for manipulating the pile warp ends, supporting the pile warp ends above the level of the mid position of the heddles and applying retardation against pull back by the tensioning device of pile yarn fed forward over the support, and a second support positioned between the first support and the heddles, immediately adjoining the heddles, engaging the pile warp ends along a line substantially interconnecting the points of engagement of the pile warp ends and the first support with the positions of the pile warp ends in their heddles in mid position.

28. In a carpet loom, sources of pile warp ends, binder warp ends and stuffer warp ends, tensioning devices for the respective warp ends, heddles for manipulating the respective warp ends and a roll pivotally mounted on a horizontal axis, having a rough surface, engaging the pile warp ends between the tensioning devices for pile warp ends and the heddles and above the level of the mid position of the pile warp heddles.

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2,430,559	Dacey	Nov. 11, 1947
2,546,261	Groat	Mar. 17, 1951
2,553,303	Crawford	May 15, 1951
2,573,841	Groat	Nov. 6, 1951
2,576,791	Jackson	Nov. 27, 1951