Feb. 14, 1933. R. G. KNOWLAND 1,897,392

WEAVING MECHANISM

Filed March 8, 1932 4 Sheets-Sheet 1

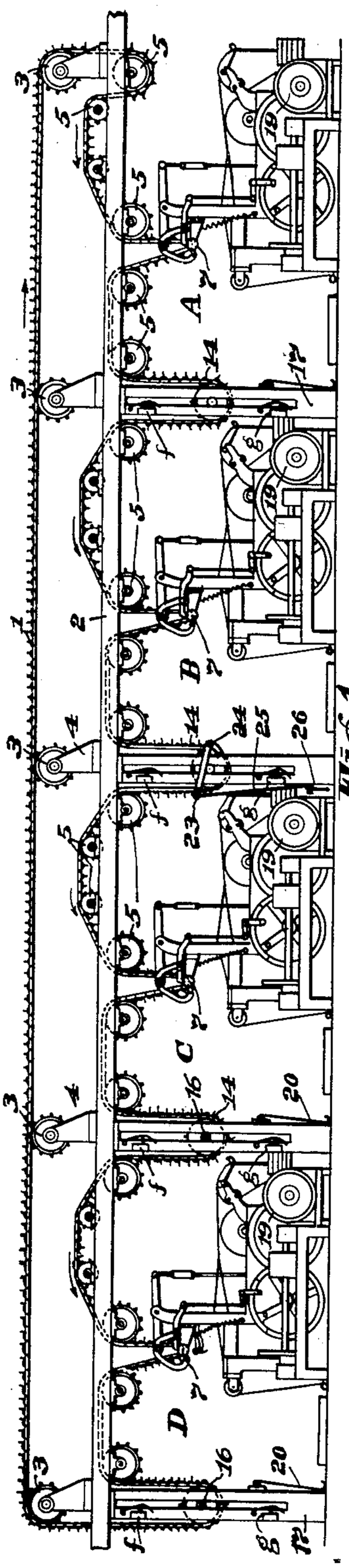


Fig. 1

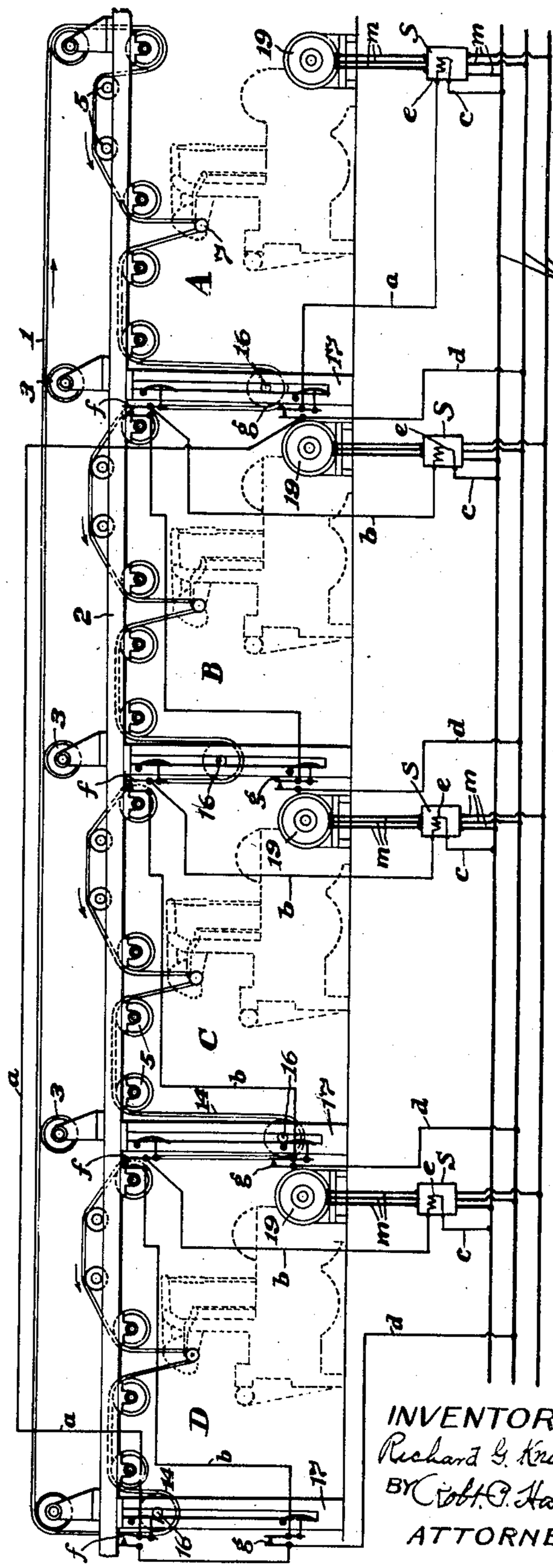


Fig. 2

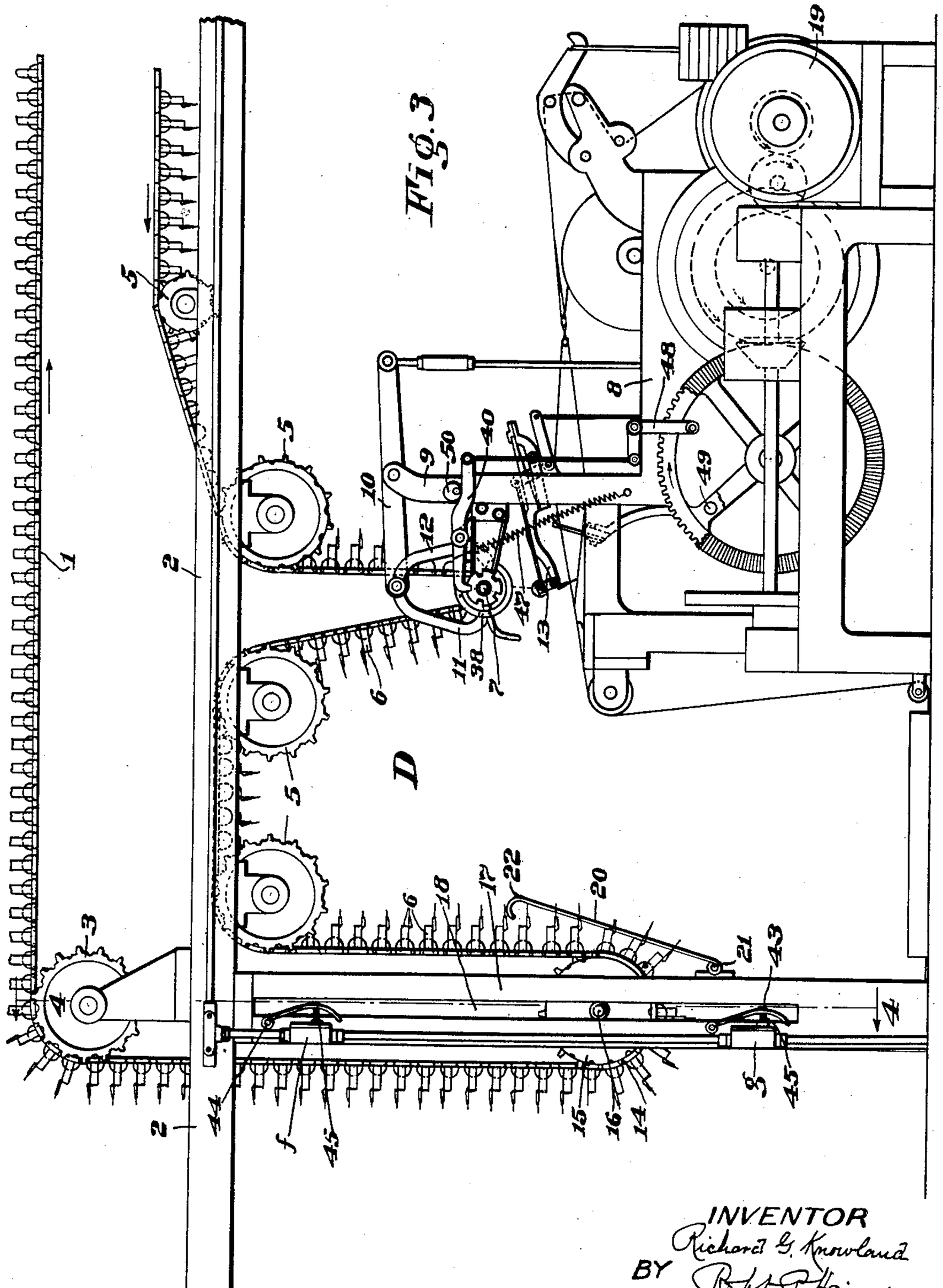
INVENTOR
Richard G. Knowland
BY Robt. G. Haines
ATTORNEY

Feb. 14, 1933. R. G. KNOWLAND 1,897,392

WEAVING MECHANISM

Filed March 8, 1932 4 Sheets-Sheet 2

Fig. 3



INVENTOR
Richard G. Knowland
BY Robt. P. Haines
ATTORNEY

Feb. 14, 1933. R. G. KNOWLAND 1,897,392

WEAVING MECHANISM

Filed March 8, 1932 4 Sheets-Sheet 3

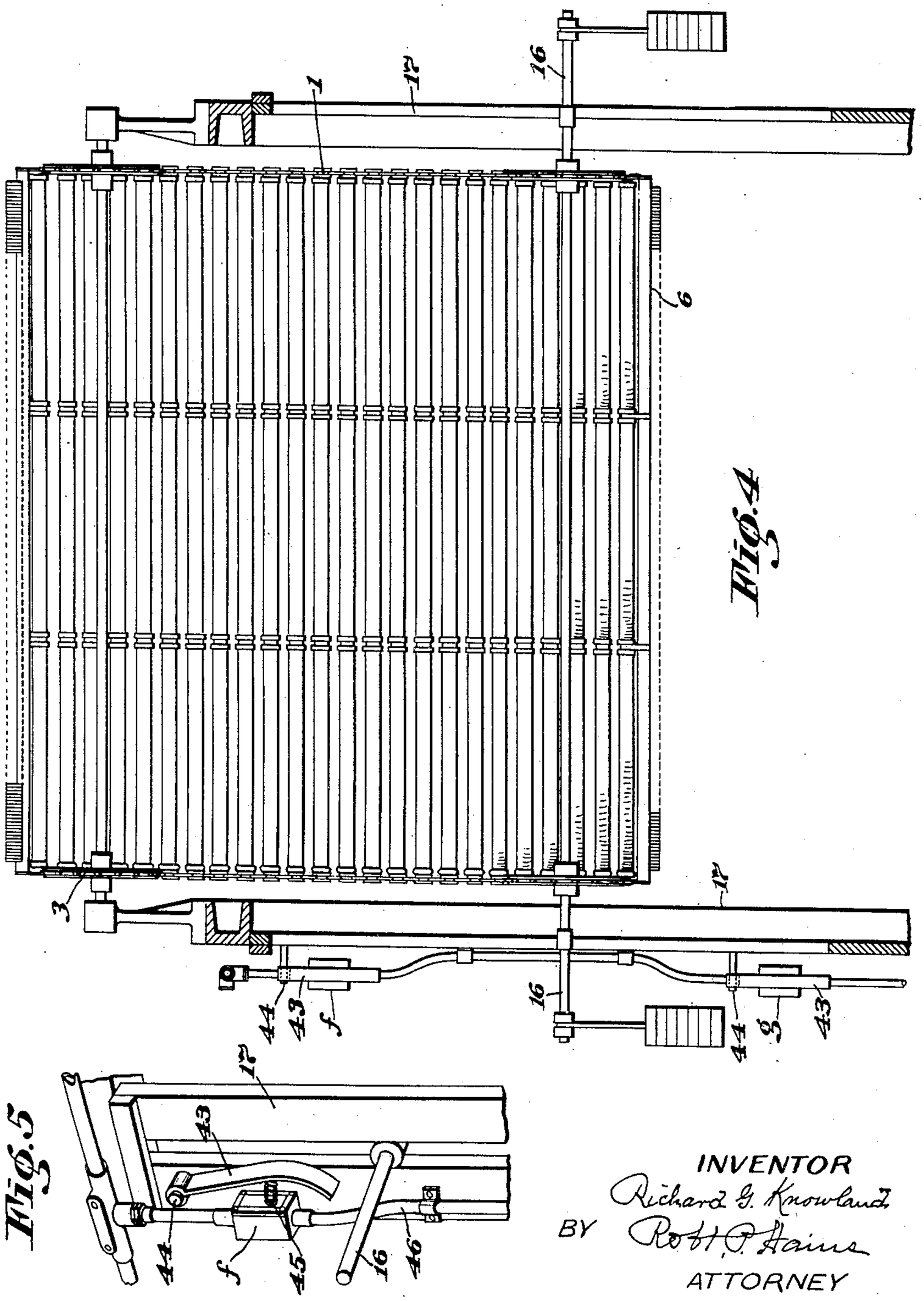


Fig. 4

Fig. 5

INVENTOR
Richard G. Knowland
BY Robt. O. Haines
ATTORNEY

Feb. 14, 1933. R. G. KNOWLAND 1,897,392

WEAVING MECHANISM

Filed March 8, 1932 4 Sheets-Sheet 4

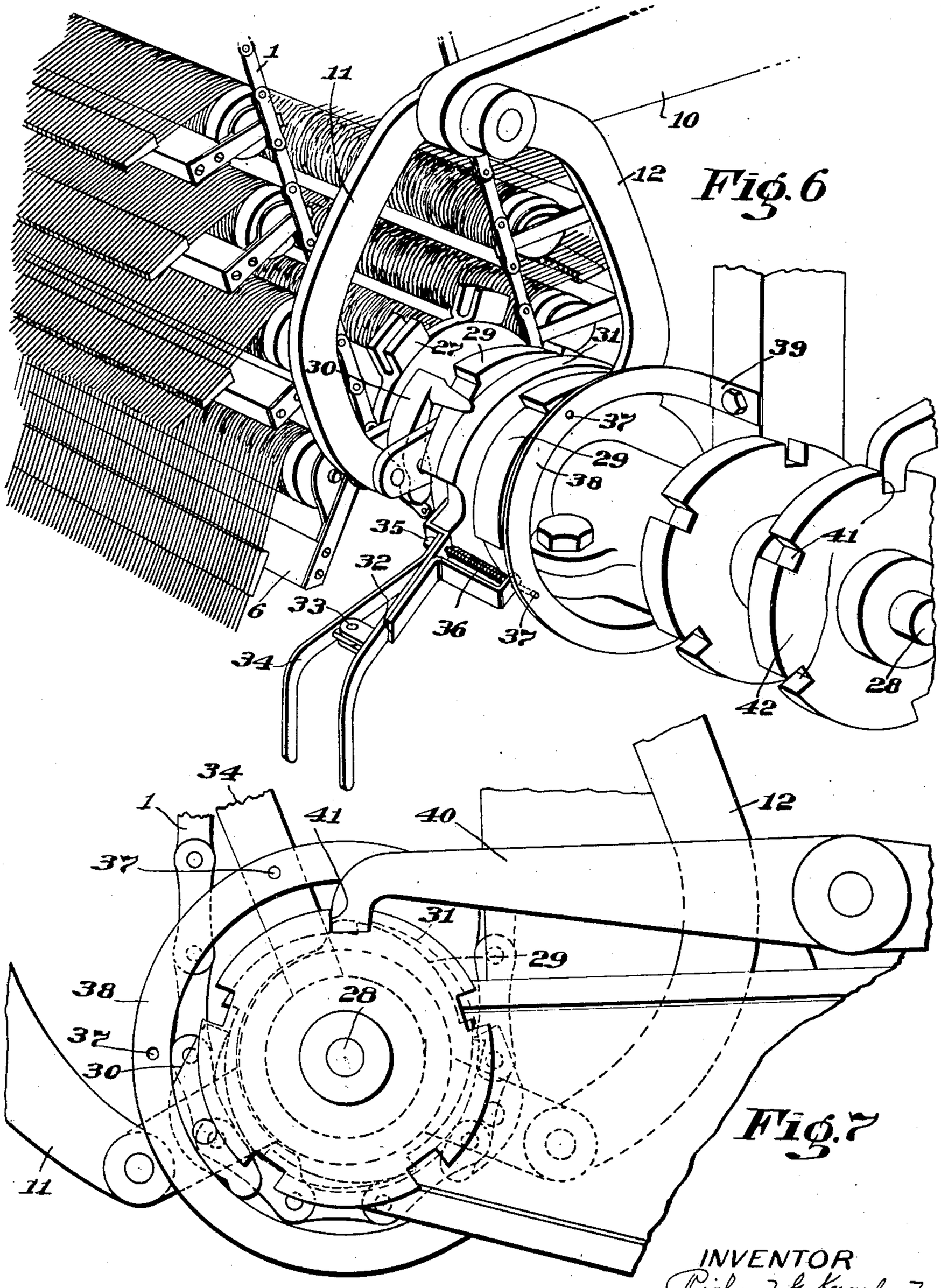


Fig. 6

Fig. 7

INVENTOR
Richard G. Knowland
BY Robt. O. Hains
ATTORNEY

Patented Feb. 14, 1933 1,897,392

UNITED STATES PATENT OFFICE

RICHARD G. KNOWLAND, OF LONGMEADOW, MASSACHUSETTS, ASSIGNOR TO BIGELOW-SANFORD CARPET CO., INC., OF THOMPSONVILLE, CONNECTICUT, A CORPORATION OF MASSACHUSETTS

WEAVING MECHANISM

Application filed March 8, 1932. Serial No. 597,446.

This invention relates to weaving mechanism and more particularly to such mechanism for the production of tuft pile fabrics.

Woven pile fabrics may be divided conveniently into two general classes. First, those in which the pile surface is formed by looping certain of the weaving threads over pile wires during the weaving operation and withdrawing the pile wires to leave either a cut or uncut pile surface. Second, those in which the pile surface is produced by pile forming yarns introduced as tufts into the fabric near the weaving point from an extraneous supply. Pile fabrics of the second class are generally known as tuft pile fabrics, and may be typified in Axminster or similar carpets and rugs or in those of the oriental or knotted character, and it is to the general weaving mechanism for the production of this class of fabrics that the present invention relates.

In weaving tuft pile fabrics, such as carpets and rugs, the pile forming yarns are supplied to the loom from an extraneous source or carrier, and are transferred in predetermined order to the weaving point to be incorporated into the resulting fabric. In cases where the tuft pile surface is to present a figured or pattern effect, the carrier for the pile forming yarns is frequently of great length, occupies much valuable floor space, is difficult to manipulate, and its initial cost is excessive, with the result that the manufacturing cost of the tuft pile fabric produced by the single loom is high.

One of the objects of the present invention is to provide a weaving mechanism of simple construction for the production of tuft pile fabrics which shall be efficient in operation and wherein the difficulties and objections heretofore existing shall be largely eliminated and the resulting tuft pile fabrics be produced at minimum manufacturing cost.

In accordance with the broad aspects of the present invention a multiplicity of tuft pile fabric looms are so associated with the same tuft yarn carrier that each loom of the series is supplied with tuft pile forming yarns from the same carrier with the result that a multiplicity of tuft pile fabrics are produced where only one before was woven.

In carrying the invention into practical effect the tuft yarn carrier is given a movement relative to the looms of the series for presenting the tuft forming yarns successively to each loom and in order that a multiplicity of tuft pile fabrics may be provided simultaneously the invention provides means for synchronizing the operations of the looms. This result may be attained in various ways, but in the present instance of the invention means are provided controlled by or through the carrier for changing the operative condition of any of the looms of the series when the productive capacity of one of the looms of the series varies relative to the productive capacity of others of the series.

The invention and novel features thereof will best be made clear from the following description and accompanying drawings of one good practical form thereof.

In the drawings:—

Fig. 1 is a general side elevation showing a weaving mechanism containing the invention;

Fig. 2 is a similar side elevation showing more particularly in diagrammatic form an electric synchronizing means for controlling the operations of the series of looms;

Fig. 3 is a side elevation of one of the looms of the series and its relation with the tuft yarn carrier and the floating loop thereof;

Fig. 4 is a sectional view on the line 4—4 of Fig. 3;

Fig. 5 is a detached detail on an enlarged scale;

Fig. 6 is an enlarged perspective view of the carrier feed on one of the looms and means for rendering the feed inoperative; and

Fig. 7 is an end view of the carrier feed and lock, some of the parts being omitted for clearness of illustration.

As hereinbefore noted the present invention is concerned with the production of tuft pile fabrics, and while different kinds of looms may be used for this purpose, the invention will be herein exemplified and described in connection with looms of the Axminster type, wherein a carrier is provided

with tube frames, each of which is supplied with tuft pile forming yarns and the carrier is given a feeding movement to present successive tube frames to the weaving instrumentalities.

The carrier 1 for the tuft yarns or tube frames is mounted upon a suitable support, which in the present instance of the invention comprises a raised or overhead frame 2 below which are a multiplicity of Axminster looms, A, B, C, and D arranged in series and while four of such looms are shown, any convenient number may be employed. The carrier 1, as will presently appear, is to be given a feed or step-by-step movement to present the tuft yarns or tube frames successively to each of the looms of the series and is consequently mounted on the rolling elements or sprockets 3 secured to the frame 2 by brackets 4 and where the carrier changes its direction of travel other rolling elements are provided, as shown at 5.

The carrier 1 is provided with tube frames 6 which are arranged on the carrier in a predetermined order and in accordance with the pattern to be produced by the tuft yarns when incorporated with the ground fabric and in order that the carrier may be given its feed or step-by-step movements, each loom of the series is provided with a carrier feeding device 7 about which the carrier is passed, the construction being such that as long as a loom is in operation the carrier will be fed forward by the feed device on that loom to present successive tube frames for transfer to the weaving point.

Since each of the looms of the series may be of the usual and well known construction of the Axminster type only the general features of such looms are shown, and in this respect enlarged Fig. 3 of the drawings is sufficient, wherein the loom frame 8 has a riser 9 on which is mounted the feed lever 10 actuated from a going part of the loom, as usual, to impart a rising and lowering movement to the feed pawl carrying arms 11 and 12 which, except as modified in a manner to be later described, may be of usual construction to impart a step-by-step feed movement to the tube frame carrier 1.

Supported by the loom frame is the transferrer 13 actuated as usual to detach a tube frame from the carrier 1 and "wipe in" the tuft yarns at the weaving point.

As hereinbefore intimated the carrier 1 is provided with a large number of tube frames carrying the pile forming tuft yarns and such tube frames are arranged or mounted upon the carrier in a predetermined order and in accordance with the pattern to be produced, and in combining a number of tuft pile fabric looms with the same carrier under these conditions, due regard must be had to the pattern formation on the several fabrics being woven. Should all of the looms work continuously and at the same speed and be arranged with relation to the travel of the carrier such that as one loom is taking the appropriate tube frame in accordance with the pattern and another loom of the series taking its appropriate tube frame in accordance with the same pattern there will be produced from the same carrier a plurality of fabrics such as rugs, for instance, each of which will present the same pattern effect.

During weaving with the multiplicity of looms, as contemplated by the present invention, it will happen at times that one of the looms of the series may either not run at the same speed as the others or be temporarily shut down for repairs to broken threads and the like, and as an important feature the present invention provides means for synchronizing the operation of the looms, as will now be described.

Each of the looms of the series has associated with it a synchronizing or floating loop of the carrier whereby during ordinary weaving with only momentary shut down or slow operation of any loom of the series, the synchronizing or floating loop of the carrier will compensate for the variation in loom operations and maintain a continuous production of a multiplicity of tuft pile fabrics.

As an embodiment of this feature of the invention the synchronizing or floating loop associated with each loom operates to first maintain the tube frame carrier in a taut condition and upon any abnormal shortening or prolongation of the floating loop it will act to modify the weaving production of the next loom in the series, either the preceding loom or the following one.

In the present instance of the invention, the floating loop 14 has mounted therein a rotating member or sprocket 15, the axle 16 of which extends transversely of the loop and is guided in its up and down movement by the standards 17 which extend from the floor to the carrier support 2. The standards 17 are each provided with a slot 18 through which the axle 16 of the rotating member 15 extends and upon undue shortening of the floating loop, as indicated in Fig. 2 at the D loom, the axle 16 will act upon devices to cause a modification, or it may be stoppage of the next succeeding loom, as loom A under the conditions stated and shown in Fig. 2.

Such shortening of the loop associated with loom D for instance, indicates that loom D is either running too slowly or has been temporarily shut down while loom A has continued to run at normal speed, so that while loom D is not effecting a feed of the carrier 1 loom A is feeding the carrier.

Should the synchronizing or floating loop be abnormally lengthened, as is shown at the left of loom C, Fig. 2, it will indicate that loom D has either slowed down or become inoperative for the time being and such ab-

normal lengthening of the synchronizing or floating loop will effect a modification in the operative capacity of loom C of the series or cause it to stop temporarily.

The means actuated by the floating loop, whether it be abnormally shortened or abnormally lengthened, may be variously contrived, but in the illustrated embodiment of the invention each of the looms of the series is actuated by a three phase motor 19, and the operating current is supplied to each motor from the three wire main line M which is connected to each motor in the series of looms by the wires *m*. The wires *m* lead to the magnetic switch S which may be of well known construction and is provided with a controlling solenoid or electric magnet *e*. The arrangement is such that so long as current is supplied to the electric magnet or solenoid, the switch S will be held closed, as usual, in this well known electric equipment, but should the current be interrupted at any point the switch S will open automatically to stop its connected motor.

As hereinbefore described one important feature of the present invention resides in means controlled by the synchronizing or floating loop of the carrier, for modifying the operation of the looms.

In the present embodiment of the invention this is accomplished by providing an upper switch *f* and a lower switch *g*. Each upper switch *f* controls the motor for operating the succeeding loom. For instance, having reference to Fig. 2 where the synchronizing or floating loop has become abnormally shortened, the switch *f* is opened with the result that the circuit *a*, Fig. 2, leading to the switch S of loom A becomes interrupted with the further result that the motor 19 of loom A is interrupted in its operation.

The lower switch *g* controls the motor of the loom next preceding so that if the switch *g* is opened by an abnormal length of synchronizing or floating loop 14 the current through the circuit *b* leading to the switch S of the preceding loom will be interrupted to modify or stop the motor 19 of the said next preceding loom.

The length of the synchronizing or floating loop will ordinarily not vary to any great extent and when its length is changed, due to a temporary suspension of one of the loom operations, the suspended loom will ordinarily start up again before the loop has reached its abnormal upper or lower position.

It may happen at times that one of the looms of the series may be stopped for a long period of time owing to repairs or otherwise, and in such case it is desirable that the remaining looms of the series shall continue in their productive operations. Where this condition occurs, that is, one of the looms is stopped for a prolonged period of time, the synchronizing or floating loop of the stopped loom will gradually shorten until when the upper switch is opened another loom of the series may be stopped and so on.

To maintain the looms in operation when one of the series has stopped for a prolonged period of time the present invention provides means for preventing shortening of the loop of the stopped loom, and means for throwing out of operation the carrier feeding device of the stopped loom.

Each of the standards 17 is therefore provided with a check device which, when thrown into operative position will prevent the shortening of the synchronizing or floating loop of the stopped loom and means are also provided for throwing out of operation the feeding device for the carrier associated with the stopped loom, with the result that the carrier will be moved step-by-step by reason of the feeding devices of the other looms of the series.

The check device may be variously contrived and as indicated in Fig. 3 it comprises a hook 20 which may be conveniently pivoted at 21 on the standards 17, so that its hook end 22 may be projected into the upward path of movement of the axle 16, thereby preventing any shortening of the synchronizing or floating loop beyond the limits prescribed by the check device.

In Fig. 1 the slightly different form of check device is indicated by the lever 23 pivotally mounted at 24 and having a flexible member 25 which, when the lever is thrown into its operative position, as indicated in Fig. 1 with respect to loom B, the flexible member 25 may be secured at 26 to hold the lever 23 in operative position.

Simultaneously with the limitation imposed upon the synchronizing or floating loop, as described, the carrier feed of the stopped loom has to be thrown out of action, so that the carrier itself may travel past such loom without obstruction.

Having reference more particularly to Figs. 6 and 7 of the drawings the carrier 1 passes about a sprocket 27 which is secured to the feed shaft 28, and mounted upon the feed shaft 28 are the ratchets 29 for normally imparting to the sprocket 27 the step-by-step feed movement under the influence of the usual feed pawls 30. Loosely mounted upon the feed shaft 28 is a throw-out or cam member 31 which constitutes in effect a clutch member such that when moved into one position the feed pawls 30 will be thrown into an inoperative position relative to the ratchets 29, thus releasing the sprocket 27 to free rotative movement.

Connected to the cam member 31 is a manually operable throw-out member 32 which is secured to the cam member 31, whereby it may be given a rotative movement relative to the feed shaft 28 either to permit the feed

pawls 30 to remain active or lift them out of operative position.

Pivotally connected to the throw-out member 32 at 33 is the lock controller 34, to the inner end of which is connected a locking bolt 35 normally under the influence of a spring 36 for moving the locking bolt into locking engagement with either one of two openings or recesses 37 in the locking ring 38 secured at 39 to a stationary support. The construction is such that when the locking pin 35 is withdrawn from one of the locking notches or openings 37 the throw-out member 32 may be moved to render the feed pawls 30 inoperative, thereby releasing the sprocket 27 for free rotative movement by the carrier 1.

When, therefore, the synchronizing or floating loop is obstructed in its upward movement by means hereinbefore described, and the sprocket 27 is free to rotative movement by the carrier 1, the carrier may be moved by the other feed devices associated with the other looms of the series to permit such looms to remain in operation.

When the feed pawls are in operative position and partake of their idle movement it is desirable that any retrograde or back movement of the carrier 1 may be prevented and to this end the present invention provides a locking member 40 which is adapted to engage any one of the series of notches 41, Figs. 6 and 7, provided in a locking disk 42 secured to the feed shaft 28, the construction being such that when the locking member 40 is engaged with a locking notch during the retracting stroke of the feed pawls the feed shaft 28 and perforce the sprocket 27 are prevented from any retrograde movement which might seriously interfere with the presentation of the proper tube frame for the next transfer movement.

The locking members 40 are normally under the influence of a spring 47 and are withdrawn from their locking notches by the bell crank lever 48, Fig. 3, the lower end of which is adapted to engage with a trip pin 49, and to hold the locking members 40 out of locking position when the feed pawls are rendered inoperative, as hereinbefore described, there is an eccentric 50 which may be turned appropriately to hold the locking members inoperative.

The switches *f* and *g* have hereinbefore been generally described as being opened by the axle 16 supported in the synchronizing or floating loop 14 and the conductors associated with each have been graphically illustrated in Fig. 2. In the practical development of the switches *f* and *g* and their electric connections such switches may be enclosed in a switch box, as illustrated on an enlarged scale in Fig. 5, and in order to open the switches when engaged by the axle 16 a trip finger 43 is pivotally mounted on the standard 17 at 44, a spring 45 being provided between the switch box and the finger for normally holding the finger in position with the switch closed.

The finger 43 of each switch is preferably formed with a curved surface for engagement by the axle 16 as the latter rises or falls in response to abnormal variation in the synchronizing or floating loop to open the switch, and as shown the wires of the circuits are preferably enclosed in suitable protecting sheaths 46.

In some cases, as more clearly indicated in Fig. 4, the axle 16 extending through the synchronizing or floating loop 14 may be weighted to impart a stabilizing influence on the loop as it shortens or lengthens under the conditions described.

Applicant believes himself to be the first in the art to provide a weaving mechanism wherein a multiplicity or series of tuft pile fabric looms are so combined with a tuft yarn carrier that each of the looms of the series may be supplied with tuft pile forming yarns from the same carrier in the simultaneous production of a plurality of tuft pile fabrics.

What is claimed is:—

1. In a weaving mechanism, the combination of a series of tuft pile fabric looms, a carrier for presenting tuft forming yarns in succession to each of the looms of the series that a plurality of tuft pile fabrics may be woven from the same tuft yarn carrier, and means for moving the carrier.

2. In a weaving mechanism, the combination of a series of tuft pile fabric looms, a carrier for presenting tuft forming yarns in succession to each of the looms of the series that a plurality of tuft pile fabrics may be woven from the same tuft yarn carrier, means for moving the carrier, and means controlled by the carrier for changing the relative weaving capacity of the looms of the series.

3. In a weaving mechanism, the combination of a series of tuft pile fabric looms, a flexible carrier for presenting tuft forming yarns to each of the looms of the series from the same carrier, means for moving the flexible carrier past each of the looms of the series, and means at each loom for taking tuft forming yarns from the carrier and introducing them into the fabrics being woven that a plurality of tuft pile fabrics may be woven from the same carrier.

4. In a weaving mechanism, the combination of a series of looms for weaving tuft pile fabrics, a single source of supply of tuft forming yarns for the looms of the series, and means for relatively moving the source of supply of the tuft forming yarns and the series of looms to present tuft forming yarns to each of the looms of the series that a plurality of tuft pile fabric may be

woven from the same supply of tuft forming yarns.

5. In a weaving mechanism, the combination of a series of looms for weaving tuft pile fabrics, a carrier for tuft forming yarns, and means for relatively moving the carrier and series of looms to present the tuft forming yarns of the same carrier to each of the looms of the series.

6. In a weaving mechanism, the combination of a series of looms for weaving tuft pile fabrics, a carrier for tuft forming yarns, and means for moving the carrier to present the tuft forming yarns of the same carrier in succession to each of the looms of the series.

7. In a weaving mechanism, the combination of a plurality of looms for weaving tuft pile fabrics, a single source of supply of tuft forming yarns for all of the looms of the series, and means associated with each loom for taking tuft forming yarns from the single source of supply and introducing them into the fabrics woven by each of the looms of the series.

8. In a weaving mechanism, the combination of a series of tuft pile fabric looms, a carrier for the tuft forming yarns for presenting such yarns to each of the looms of the series, and means for synchronizing the operations of the looms of the series that a plurality of tuft pile fabrics may be woven simultaneously from the same tuft yarn carrier.

9. In a weaving mechanism, the combination of a series of tuft pile fabric looms, a carrier for the tuft forming yarns for presenting such yarns to each of the looms of the series, and means controlled by the carrier for synchronizing the operations of the looms of the series that a plurality of tuft pile fabrics may be woven simultaneously from the same tuft yarn carrier.

10. In a weaving mechanism, the combination of a series of tuft pile fabric looms, a carrier for the tuft forming yarns for presenting such yarns in succession to each of the looms of the series, and means controlled by the carrier for synchronizing the operative condition of the looms of the series that a plurality of tuft pile fabrics may be woven simultaneously from the same tuft yarn carrier.

11. In a weaving mechanism, the combination of a series of tuft pile fabric looms, a carrier for presenting tuft forming yarns to each of the looms of the series that a plurality of tuft pile fabrics may be woven from the same tuft yarn carrier, feeding devices for effecting a normal movement to the carrier to present tuft forming yarns to the looms of the series, and means for changing the operative condition of a loom of the series when the carrier is given an abnormal movement.

12. In a weaving mechanism, the combination of a plurality of tuft pile fabric looms, a carrier for tuft forming yarns having a floating loop, means for moving the carrier for presenting the tuft forming yarns to each of the looms of the series that a plurality of tuft pile fabrics may be woven from the same tuft yarn carrier, and means controlled by the length of the floating loop for changing the weaving capacity of a loom of the series.

13. In a weaving mechanism, the combination of a series of tuft pile fabric looms, a carrier for tuft forming yarns having a series of floating loops, means for moving the carrier for presenting the tuft forming yarns successively to each of the looms of the series that a plurality of tuft pile fabrics may be woven from the same tuft yarn carrier, and means controlled by the length of a floating loop for changing the weaving capacity of a loom of the series.

14. In a weaving mechanism, the combination of a series of tuft pile fabric looms, a carrier having a series of tube frames provided with tuft forming yarns and means for moving the carrier for presenting the tube frames successively to each loom of the series that a plurality of tuft pile fabrics may be woven from the same carrier.

15. In a weaving mechanism, the combination of a series of tuft pile fabric looms, a carrier having a series of tube frames provided with tuft forming yarns, a tube frame transfer on each loom for taking a tube frame from the carrier and presenting the tuft forming yarns to the weaving point, and means for moving the carrier for presenting the tube frames successively to each loom of the series that a plurality of tuft pile fabrics may be woven from the same carrier.

16. In a weaving mechanism, the combination of a series of looms for weaving tuft pile fabrics, a single tuft yarn carrier for supplying each of the looms of the series with tuft pile forming yarns, a synchronizing or floating loop of the carrier associated with each of the looms of the series, and means rendered effective by an abnormal length of any of the loops for changing automatically the relative operative condition of the looms of the series.

17. In a weaving mechanism, the combination of a series of looms for weaving tuft pile fabrics, a single tuft yarn carrier for supplying each of the looms of the series with tuft pile forming yarns, a synchronizing or floating loop of the carrier associated with each of the looms of the series, and means rendered effective by an abnormal shortening of the synchronizing or floating loop of one loom of the series for changing the operative condition of the next following loom of the series.

18. In a weaving mechanism, the combination of a series of looms for weaving tuft pile fabrics, a single tuft yarn carrier for supply-

ing each of the looms of the series with tuft pile forming yarns, a synchronizing or floating loop of the carrier associated with each of the looms of the series, and means rendered effective by an abnormal lengthening of the synchronizing or floating loop of one loom of the series for changing the operative condition of a preceding loom of the series.

19. In a weaving mechanism, the combination of a series of looms for weaving tuft pile fabrics, a tuft yarn carrier for supplying each of the looms of the series with tuft pile forming yarns, a carrier feed device connected to each loom of the series, and means for freeing the carrier from the control of the feed device on a stopped loom of the series that the remaining looms of the series may continue to run.

20. In a weaving mechanism, the combination of a series of looms for weaving tuft pile fabrics, a single tuft yarn carrier for supplying each of the looms of the series with tuft pile forming yarns, a synchronizing or floating loop of the carrier associated with each of the looms of the series, and means for preventing abnormal shortening of the synchronizing or floating loop of a stopped loom of the series that the remaining looms of the series may continue to run.

21. In a weaving mechanism, the combination of a series of looms for weaving tuft pile fabrics, a carrier for tuft pile forming yarns having a synchronizing or floating loop associated with each loom of the series, a carrier feed device on each loom of the series, means for preventing abnormal shortening of the synchronizing or floating loop on a stopped loom of the series, and means for freeing the carrier from the feed device of a stopped loom of the series that the carrier may be fed and the remaining looms of the series continue to run.

22. In a weaving mechanism, the combination of a series of Axminster looms for weaving tuft pile carpets and rugs, a carrier having tube frames for supplying each loom of the series with tuft pile forming yarns, and means for feeding the carrier to present the tube frames successively to each of the looms of the series.

In testimony whereof, I have signed my name to this specification.

RICHARD G. KNOWLAND.