

Sept. 20, 1960

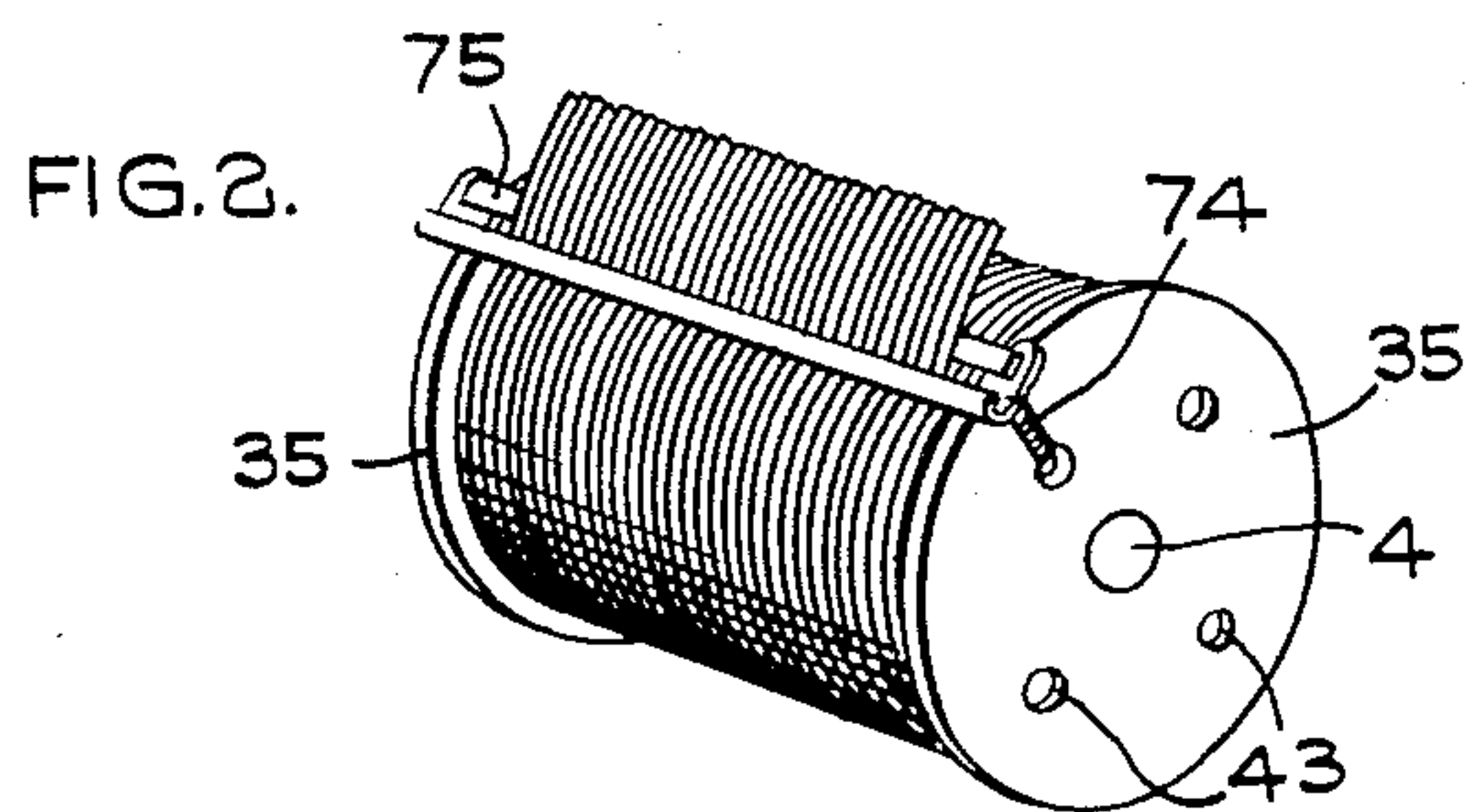
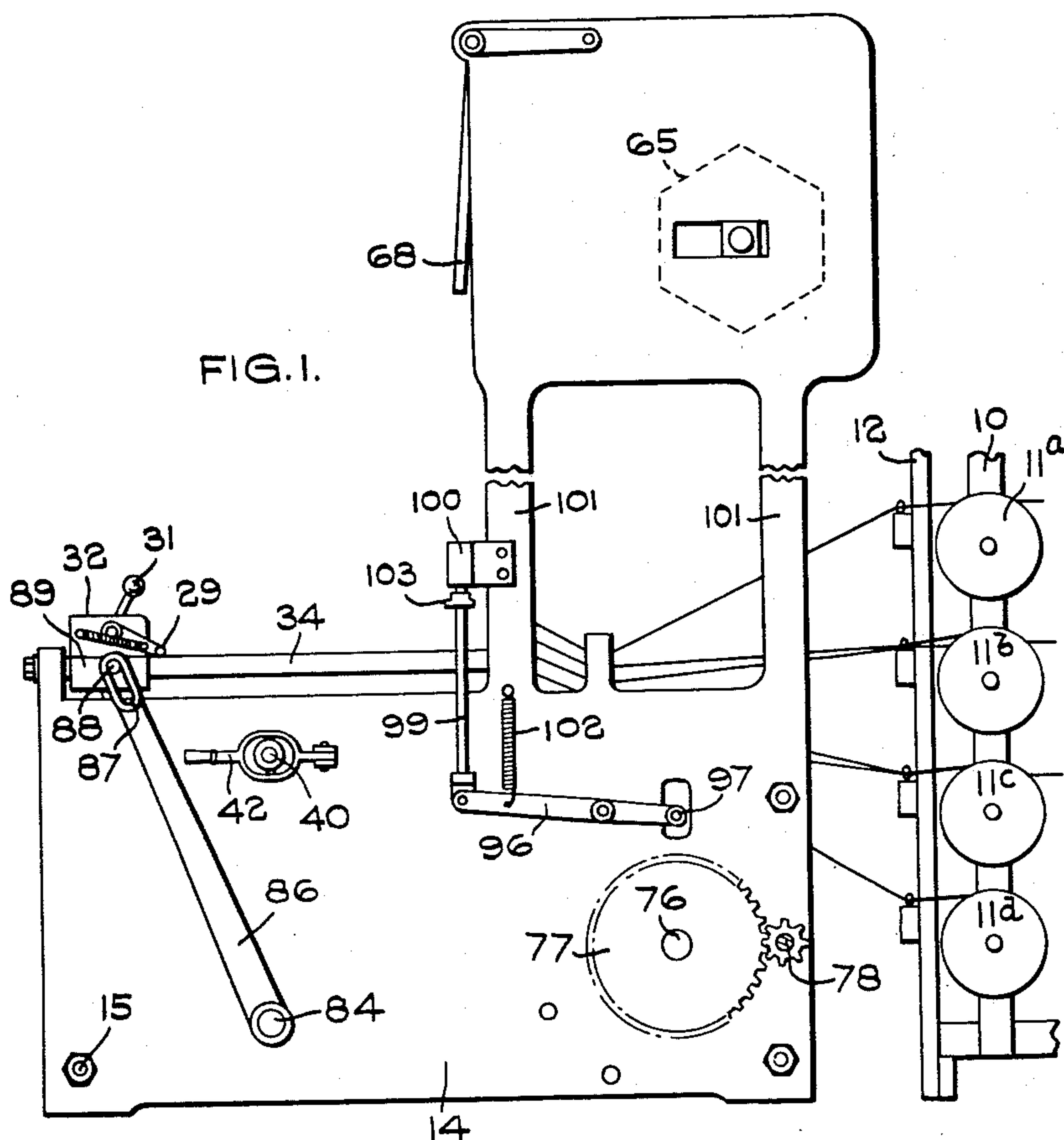
P. W. ROBINSON

2,952,891

SETTING OF AXMINSTER SPOOLS

Filed March 5, 1954

7 Sheets-Sheet 1



INVENTOR
Philip Worth Robinson

BY Richard D. David & Nelson
his ATTORNEYS.

Sept. 20, 1960

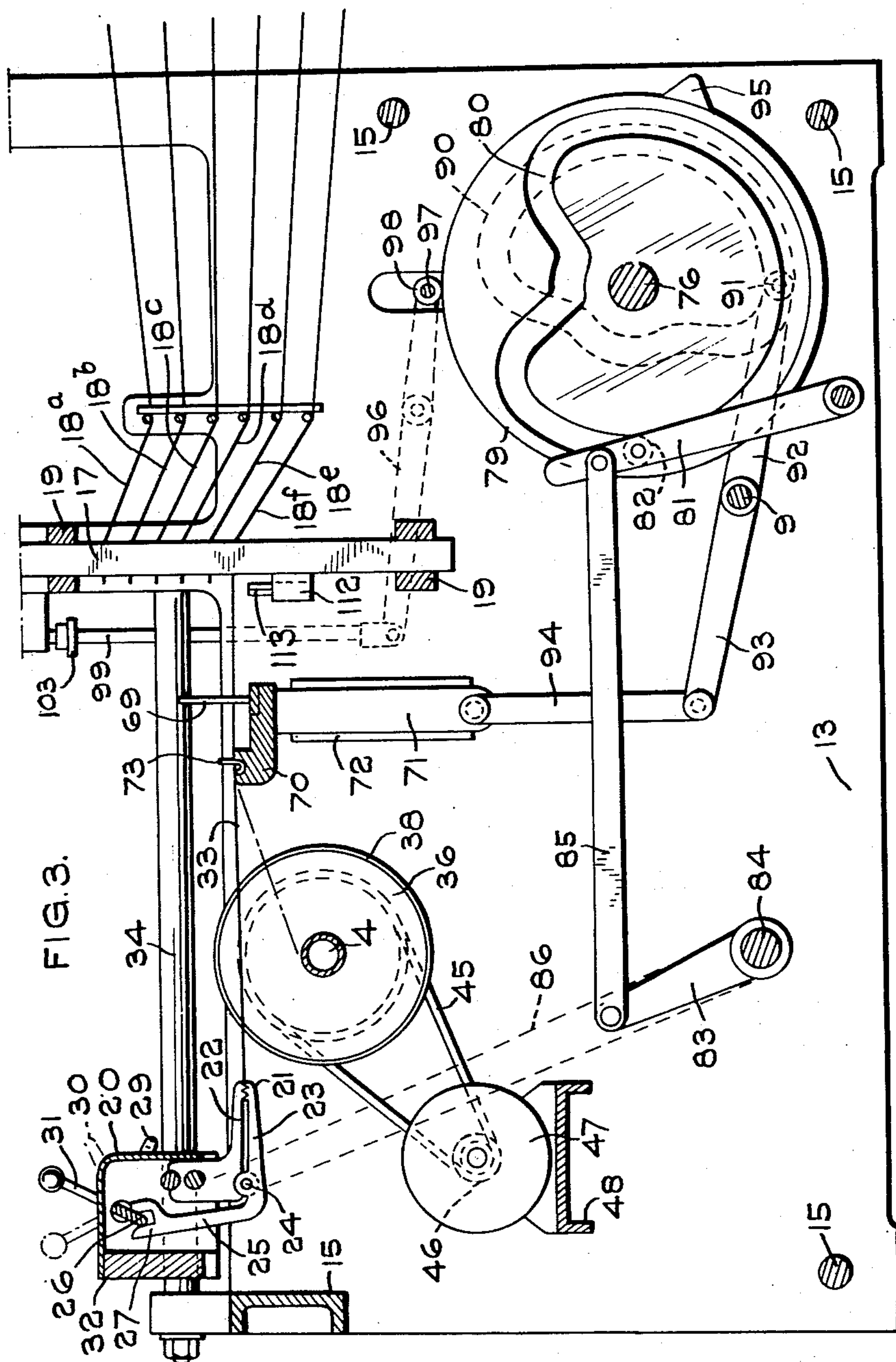
P. W. ROBINSON

2,952,891

SETTING OF AXMINSTER SPOOLS

Filed March 5, 1954

7 Sheets-Sheet 2



INVENTOR
Philip Worth Robinson.

BY *Richardson, David and Norton*
his ATTORNEYS.

Filed March 5, 1954

SETTING OF AXMINSTER SPOOLS

7 Sheets-Sheet 3



INVENTOR
Philip Worth Robinson.
BY ~~Richardson, David and Norton~~
his ATTORNEYS.

Sept. 20, 1960

P. W. ROBINSON

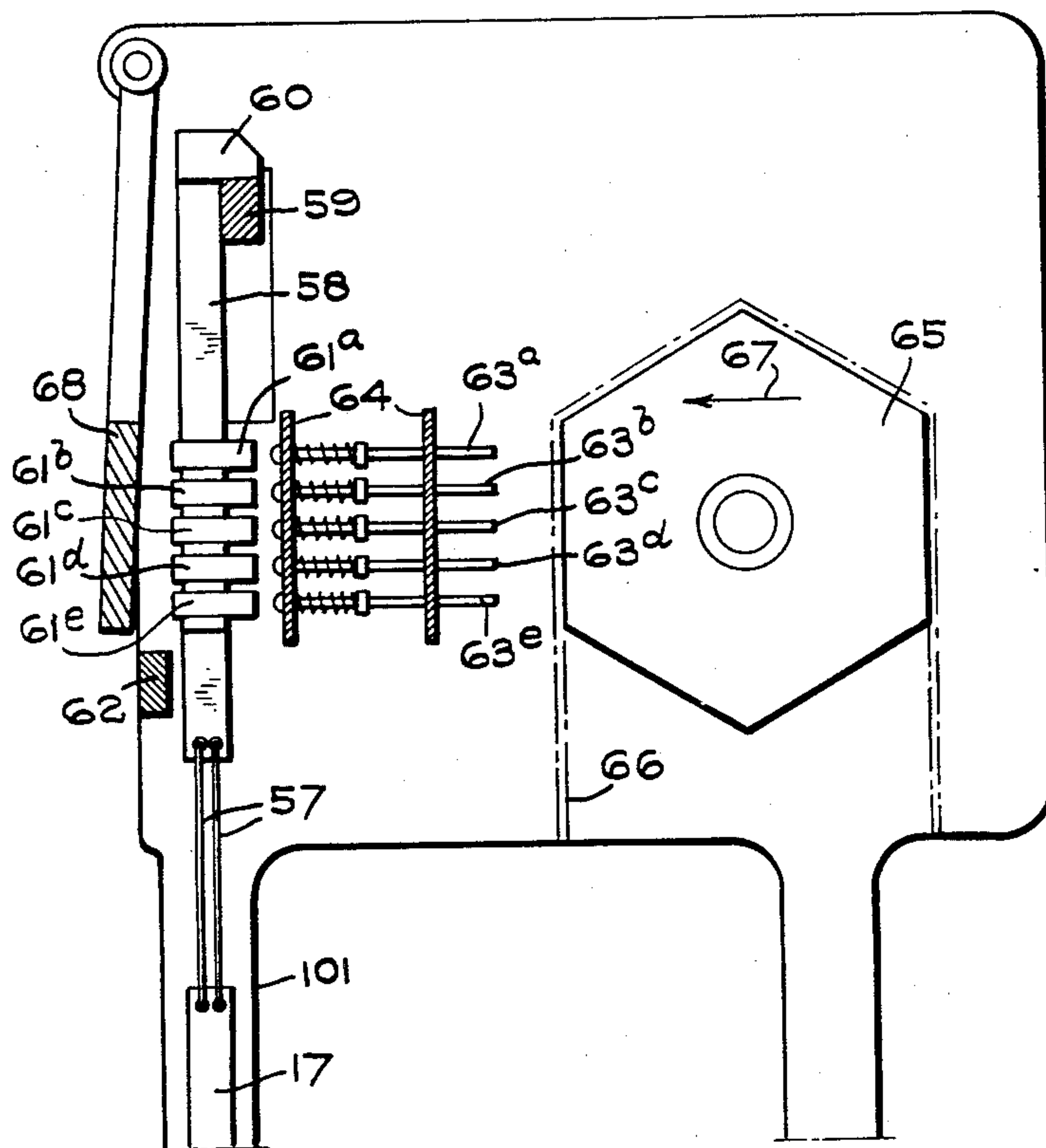
2,952,891

SETTING OF AXMINSTER SPOOLS

Filed March 5, 1954

7 Sheets-Sheet 4

FIG. 5.



INVENTOR
Philip Worth Robinson
BY *Richard D. Norton*
ATTORNEYS

Sept. 20, 1960

P. W. ROBINSON

2,952,891

SETTING OF AXMINSTER SPOOLS

Filed March 5, 1954

7 Sheets-Sheet 5

FIG. 6.

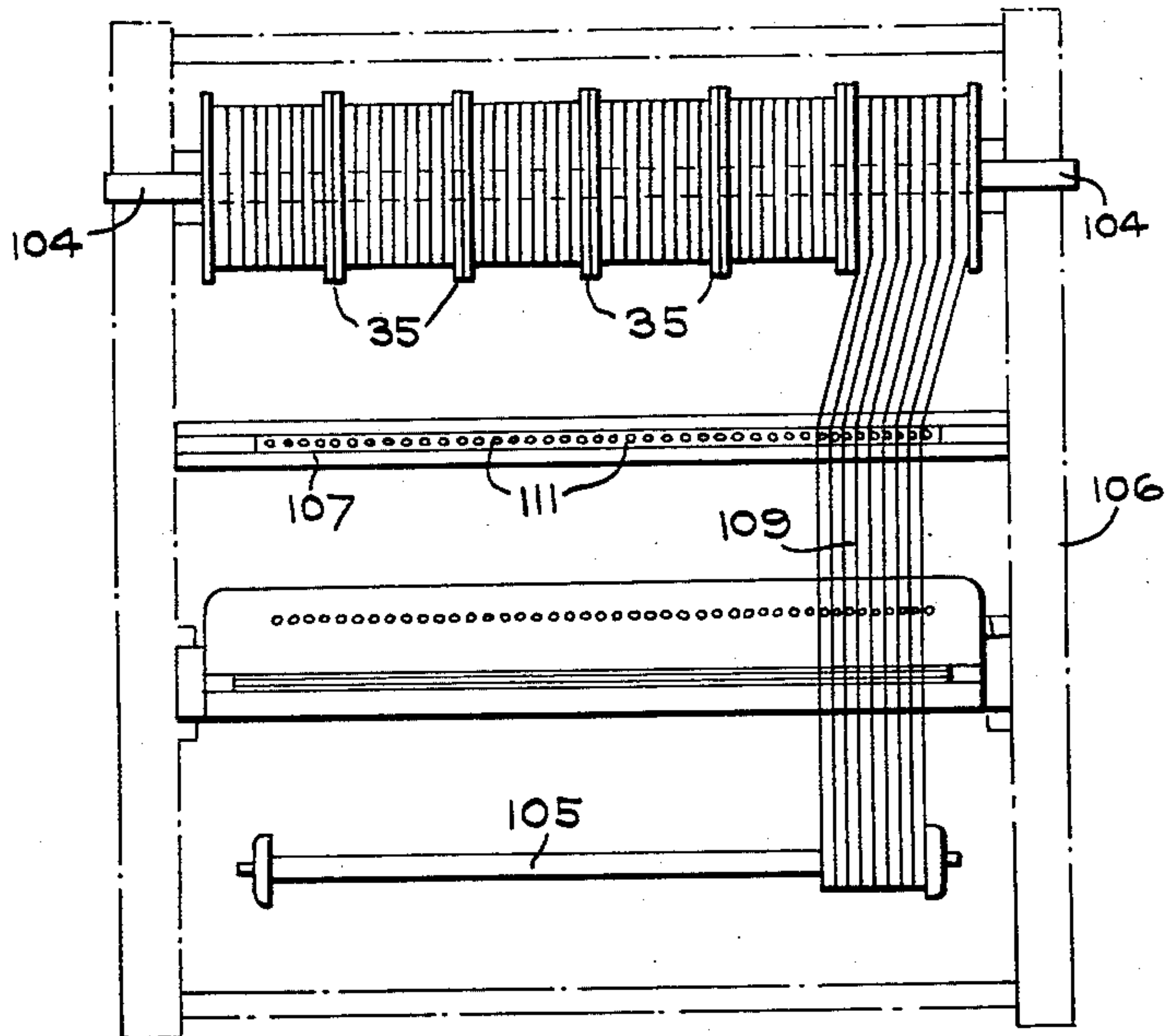


FIG.7.

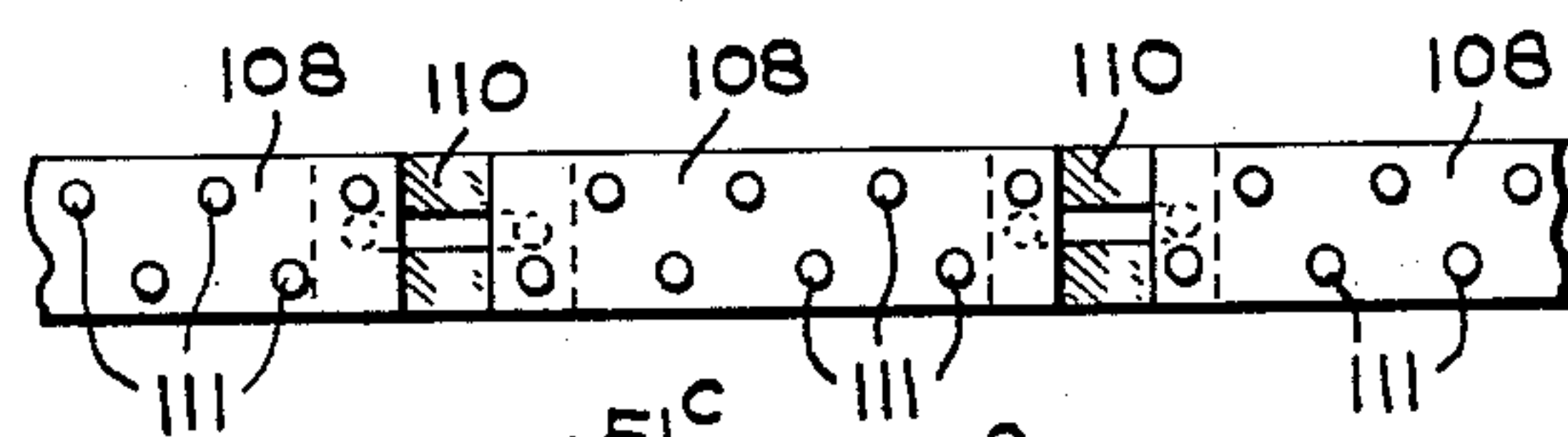
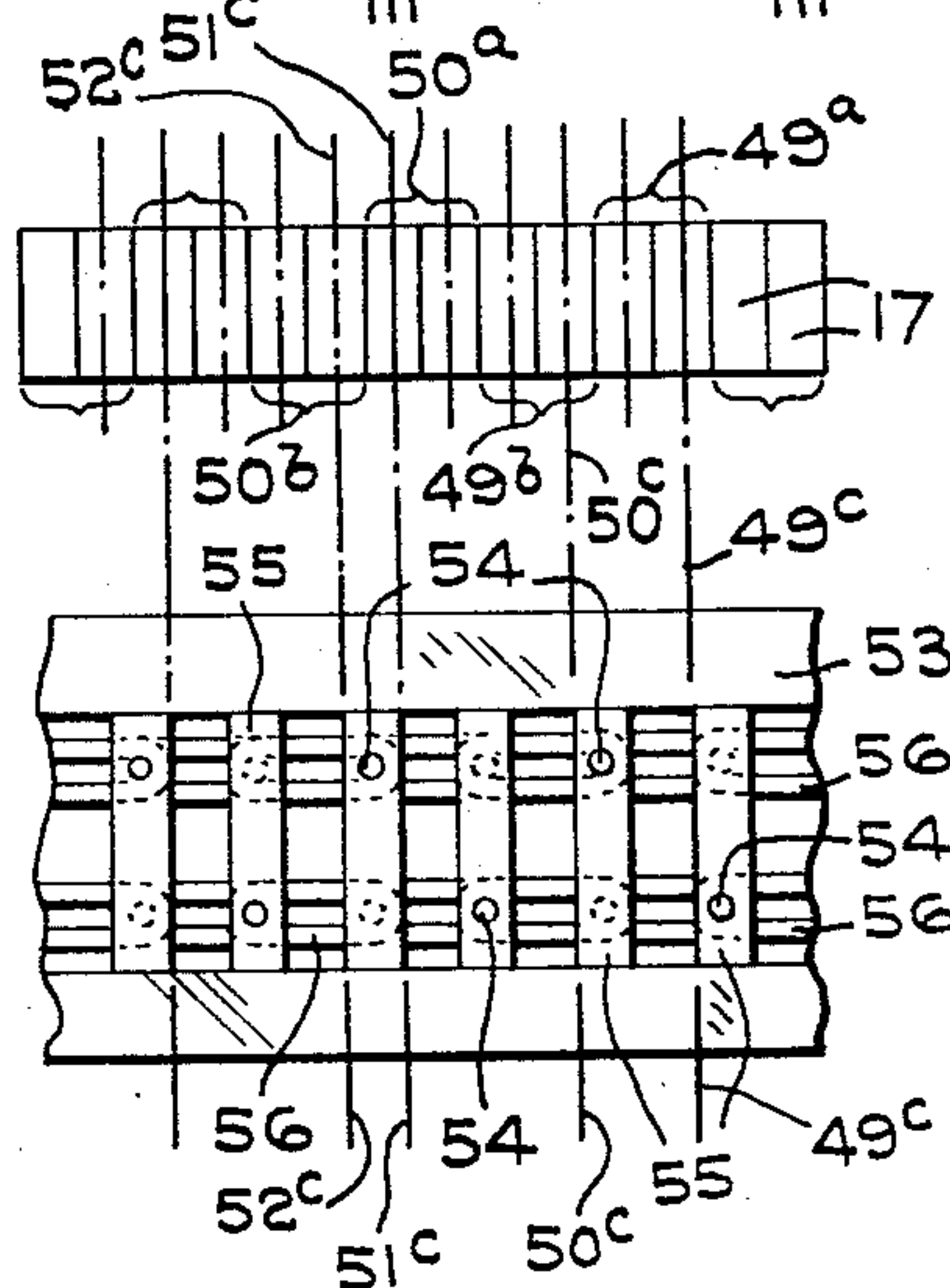


FIG. 8.



INVENTOR
Philip Worth Robinson
BY *Richardson, David & Norton*
ATTORNEYS.

Sept. 20, 1960

P. W. ROBINSON

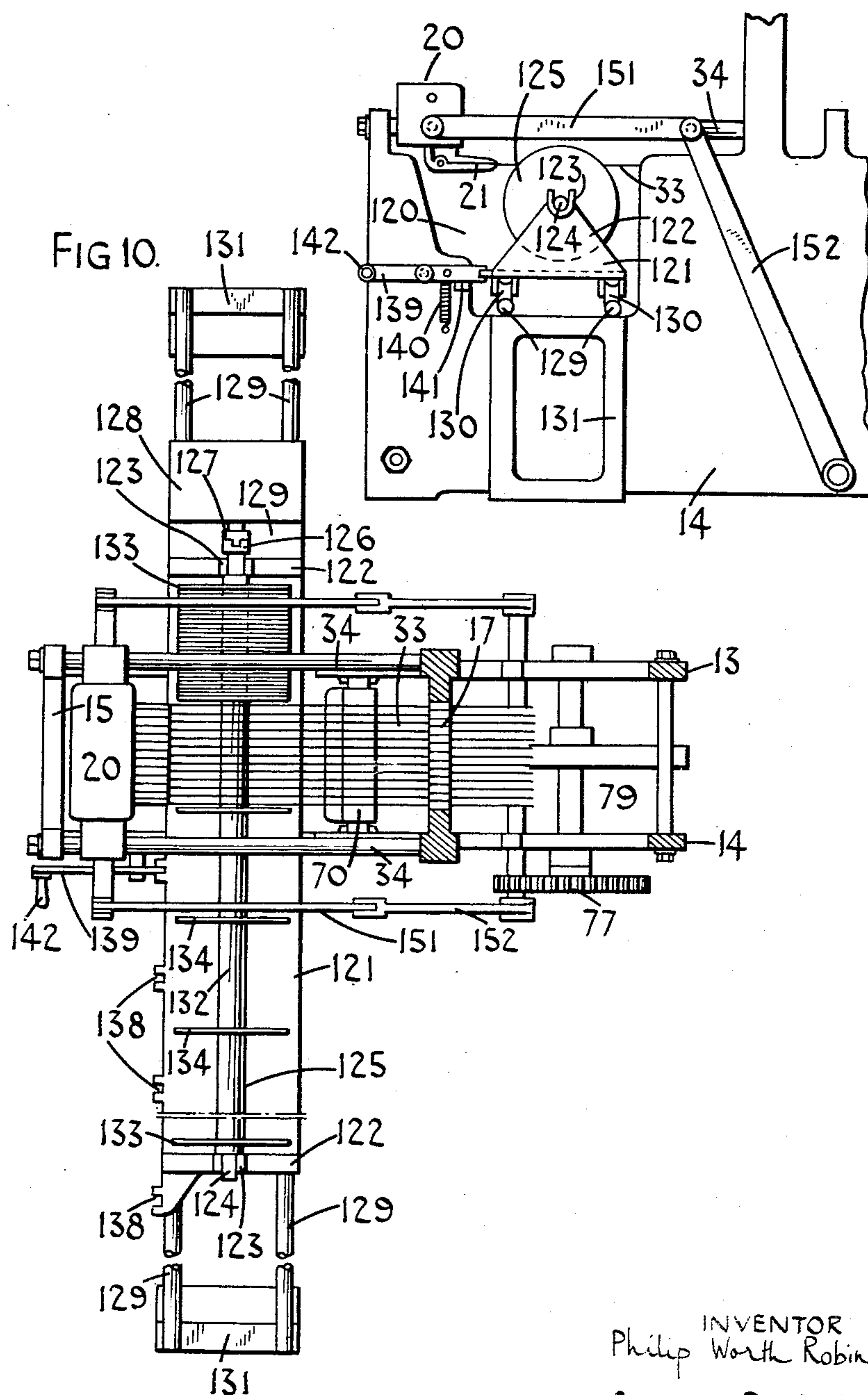
2,952,891

SETTING OF AXMINSTER SPOOLS

Filed March 5, 1954

7 Sheets-Sheet 6

FIG. 9.



INVENTOR
Philip Worth Robinson.
BY Richardson, David and Norton
his ATTORNEYS.

Sept. 20, 1960

P. W. ROBINSON

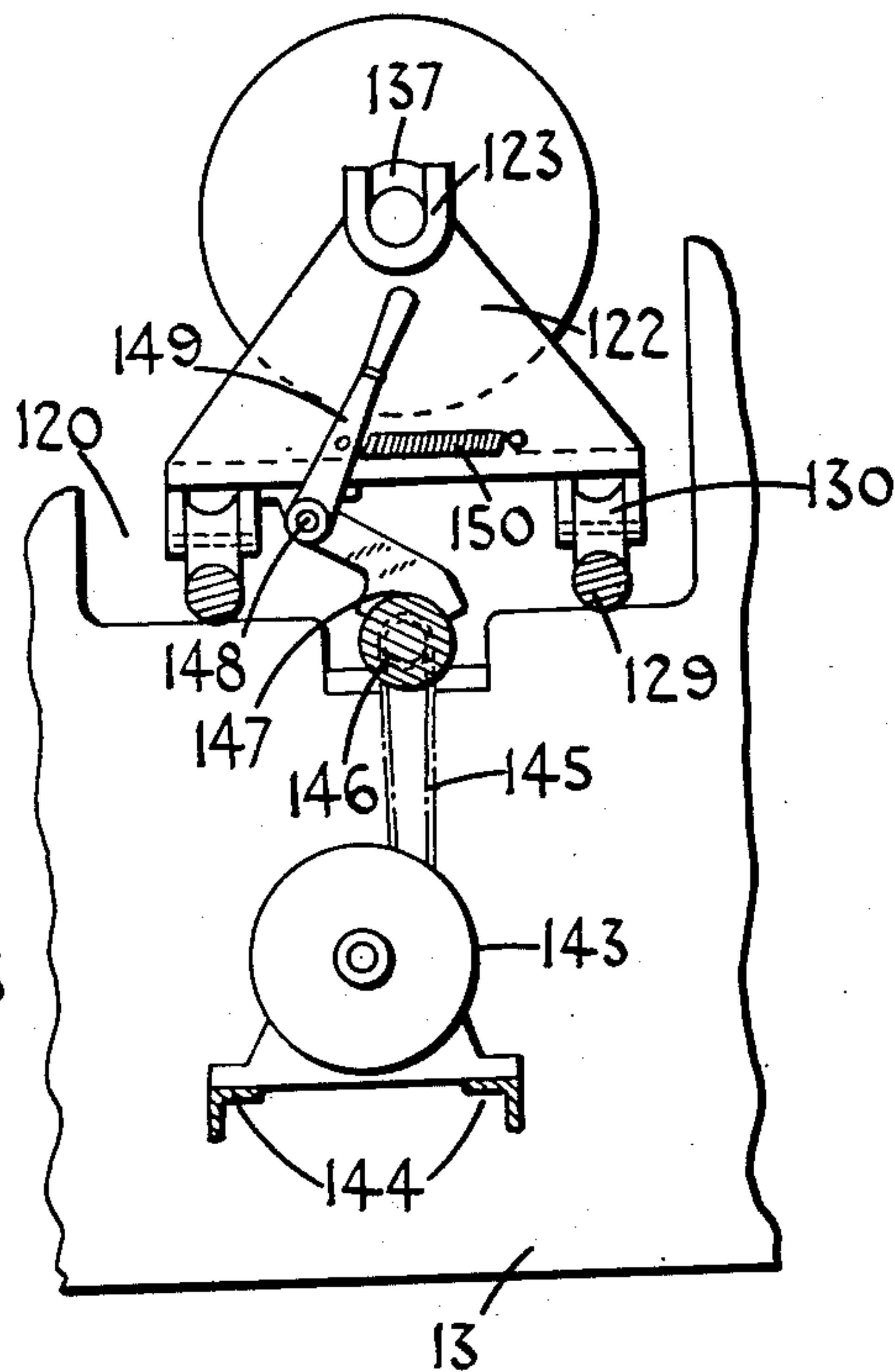
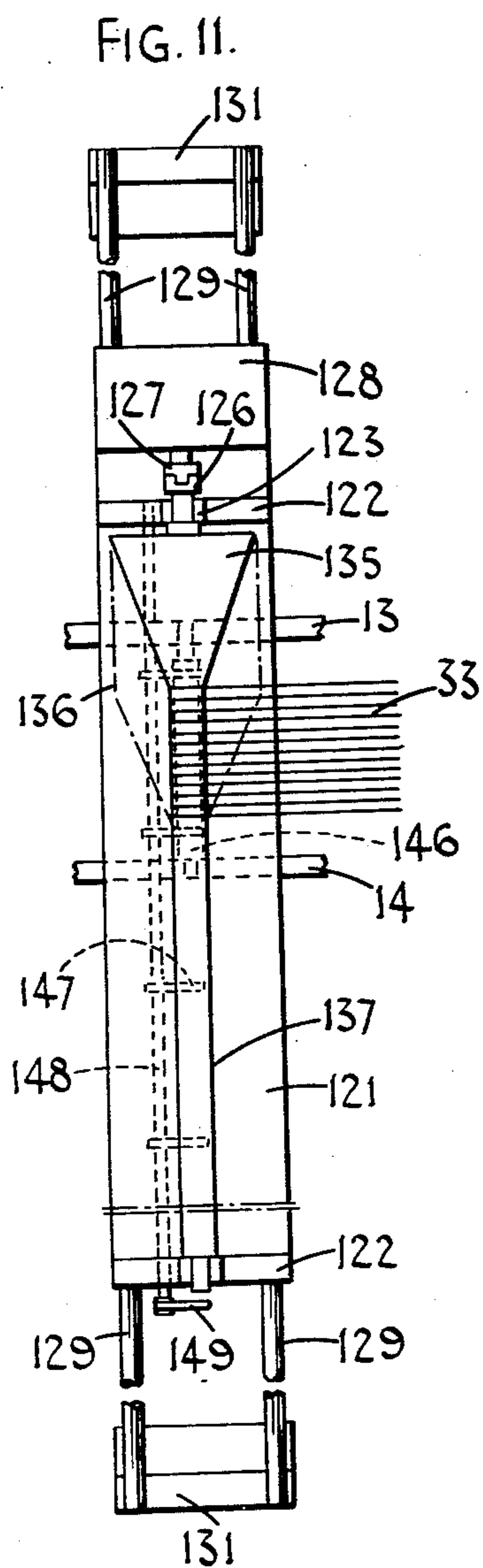
2,952,891

SETTING OF AXMINSTER SPOOLS

Filed March 5, 1954

7 Sheets-Sheet 7

FIG. 12.



INVENTOR
Philip Worth Robinson.
BY *Robert D. ...*
ATTORNEYS.

1

2,952,891

SETTING OF AXMINSTER SPOOLS

Philip Worth Robinson, Woodfield Cedars,
Ombersley, England

Filed Mar. 5, 1954, Ser. No. 414,484

Claims priority, application Great Britain Mar. 20, 1953

4 Claims. (Cl. 28—72.5)

The present invention relates to a method of and means for setting spools for use in manufacture of pile fabrics by the spool Axminster process of weaving. By setting is meant the winding onto such spools of the required number of pile yarns in side-by-side relation and in the particular sequence of colours necessitated by the pile pattern to be produced in the woven fabric.

To produce a given pattern (or a series of repeats thereof) it is necessary to set a group of spools each of which spools is normally utilised to form one weft-wise extending row of pile (but which may be used to form only part of a row in wide fabrics), and each of the spools must therefore be filled with a sequence of coloured yarns corresponding to the sequence of colours for the pile tufts of that row or part row.

The usual method of setting a group of spools is to place in a creel frame the number of bobbins equal to (or not greatly exceeding) the number of yarn ends required on each spool, the particular colours of the bobbins chosen being those required for the first spool. The setter then draws off a length of yarn from each bobbin in turn and passes it through the respective pair of dents of a reed or sley extending parallel to the spool and situated between it and the creel frame which will ensure that the various colours are arranged in the correct sequence along the spool. This operation having been completed the spool is rotated until filled. To set the next spool of the group, which may and often is required to be filled with yarns in a different colour sequence it is necessary for the setter to change the yarns passed between certain dents (and perhaps through all of the dents) of the reed for yarns of a different colour. Further, if the creel frame accommodates only that number of bobbins equal to the number of yarn ends on each spool (or accommodates an insufficient number of bobbins to permit of the selection of the next sequence of colours) it is also necessary for the setter to take out certain bobbins and replace them by some of different respective colour.

It will thus be clear that the operation of setting a group of spools occupies a considerable time and requires close attention and skill on the part of the setter.

Further, unless each row of the pattern requires at least approximately the same number of yarns of each of the different colours involved in the whole pattern (which is very unlikely) a very large creel frame would be required to accommodate sufficient bobbins to avoid removal and replacement thereof in setting each successive spool. Such a creel frame would in most cases be too large to be conveniently used and would be uneconomic in terms of capital expenditure.

It has been proposed to provide a spool setting apparatus wherein means for receiving and retaining yarn ends arranged in rows equal in number to the number of yarns to be wound side-by-side on to a normal length spool, are controlled by selector means which raise and lower the rows of yarn ends, there being as many yarn ends in each row as there are colours which from time-

2

to-time will be required to be set in the position concerned onto one of the spools contained in a complete repeat of the pattern, the yarn ends brought to a datum or selection line being extracted by gripper means and drawn out for winding onto each of the spools in succession.

A normal length spool used in weaving pile fabrics by the known Axminster method is some 27" in length and typically there may be seven yards per inch so that the total number of rows for effecting setting of Axminster spools by the use of an apparatus as above described would be large, i.e. 189, and the number of storage bobbins provided in the creel frame associated with such apparatus would be attained by multiplying this number by the number of different colours required from time-to-time to be set into each position on the spool.

The disadvantage inherent in the method involved in the use of such an apparatus is that for each different pattern to be woven it will usually be necessary to effect a substantial number of changes in the colours of the yarn presented in each of the rows and owing to the large number of rows this conversion will occupy a considerable time and will materially offset the advantages attained by the use of the apparatus in comparison with hand-setting, more especially in cases where manufacturers require to produce a relatively small number of pile fabrics embodying each particular pattern.

To overcome this disadvantage by providing a sufficient number of yarn ends in each row to include all the colours which will be required in the yarn position pertaining to that row for a plurality of patterns, would require a very large increase in the already large number of storage bobbins required in the creel frame, and the capital cost of such apparatus would militate against its use even more strongly than in the case where the number of yarn ends in each row is sufficient normally to deal with only one pattern.

The object of the present invention is to provide a new or improved method of setting spools by which both the operational disadvantages of making a large number of bobbin changes when the pattern of the fabric to be woven is changed, is avoided or materially reduced, and whereby the capital cost of the apparatus for performing the method is so reduced that it becomes economical to employ such apparatus even where comparatively small numbers of the same pattern are to be woven in each run.

A method according to the invention concerns the spool Axminster process of weaving pile fabric involving the setting of a multiplicity of pile yarn carrying spools including spools whereof the yarns are required to be arranged in respectively differing longitudinal sequences of colours; the method comprising the steps of assembling a supply of yarns comprising a plurality of sets of supply bobbins, each set containing bobbins having yarns of different colours and the number of sets being a fraction of the total number of yarns to be set onto each spool, and in respect of each of said differing longitudinal sequences of colours making consecutively a plurality of selections of yarns taking one yarn from each set of supply bobbins, each selection corresponding to the colour combination of yarns to be set onto a particular fractional length section of one of the spools and each selection being made from said supply of yarns, the selections in aggregate providing the whole yarn colour combination to be set onto the spool, and, drawing off consecutively each group of yarns involved in said selections respectively and winding the selected yarn groups onto their respective fractional length sections of the spool.

It is to be understood that the term "bobbins" is used merely as a matter of convenience to signify any appro-

priate bulk source of yarn including bobbins, cheeses and cones and is to be construed to include all such forms as it may be desirable or practicable to utilise.

Preferred embodiment of apparatus in accordance with the invention for carrying out the method thereof will now be described by way of example with reference to the accompanying drawings wherein:

Figure 1 is a general view in side elevation of one construction of apparatus for carrying out the primary stages of the method of the invention.

Figure 2 is a perspective view showing one component of a storage device utilised in the primary stages of the method.

Figure 3 is a sectional view in side elevation and on an enlarged scale of the apparatus shown in Figure 1 with the working parts in the position which they occupy after selection, extraction and drawing-out of a yarn group.

Figure 4 is a plan view on the same scale as Figure 3 showing the working parts of the apparatus in the same position.

Figure 5 is a fragmentary view showing the general arrangement of selector means forming part of the apparatus shown in Figure 1.

Figure 6 is a plan view illustrating diagrammatically one form of apparatus for carrying out the second stage of the method of the invention.

Figure 7 is a fragmentary view on an enlarged scale showing a contractable guiding device forming part of the apparatus shown in Figure 6.

Figure 8 is a fragmentary view illustrating a modification of the yarn receiving and supporting members and associated guiding means intended to be utilised when all the colours required to be potentially available for each yarn position cannot be accommodated in a single receiving member.

Figure 9 is a fragmentary view in side elevation showing an alternative construction of apparatus for carrying out the primary stages of the method of the invention utilising either a yarn beam having a sufficient length to accommodate all the yarn groups required for transference to a spool or for supporting simultaneously a plurality of fractional length storage bobbins upon a common spindle for use in a manner analogous to the yarn beam.

Figure 10 is a fragmentary plan view of the same construction showing a yarn beam in position such yarn beam having separate sections separated by flanges.

Figure 11 is a further plan view similar to Figure 10 but illustrating the use of a different type of yarn beam adapted to produce self supporting yarn group winding, and

Figure 12 is a fragmentary view of the construction shown in Figure 9 on an enlarged scale and partly in longitudinal cross section showing the driving means for traversing or displacing the yarn beam carriage laterally of the apparatus.

In the following description given in relation to the drawings, the method according to the invention will also be described in the particular form in which it is carried out utilising this apparatus but it will be understood that the invention is not limited to the specific manner of operation of this apparatus and various alternatives available in carrying out the method will be indicated throughout the description although these are not to be regarded as necessarily exhaustive of possible variations of the method within the scope of the invention which scope is defined by the claims hereinafter set forth.

Referring firstly to the apparatus illustrated in Figures 1 to 5, this is intended for the carrying out of the primary stages of the method, namely, the selection, arrangement in the required positional sequence, extraction and application of the yarns to a storage device on which

they are wound or stored preparatory to the carrying out of the secondary stage of the method.

In association with the various means and devices for performing these operations there will be provided an assembly of supply bobbins which may be supported in any convenient manner enabling the yarn ends from respective bobbins to be drawn-off to enter the apparatus as shown generally in Figure 1. A portion only of the supporting structure for the supply bobbins is illustrated, it being understood that this may comprise a plurality of posts or frames such as that indicated at 10 upon each of which is carried a vertically extending row of supply bobbins 11a to 11d, there generally being as many of these supply bobbins in each vertical row as is required by the number of differently coloured yarns potentially required to be present at one particular yarn position in each section of the spool length for which an individual primary operation is performed.

Consequently the supply bobbins 11a to 11d will ordinarily be of differing colours although in some cases it may be convenient to include two or more bobbins of the same colour where this colour is known to be required more often in the colour selection to be made than certain of the remaining colours.

The creel frame or equivalent supporting structure of which the member 10 is a part and which is indicated generally at 12 need not contain a total number of supply bobbins equal to the numbers of yarns to be set on to the spool multiplied by the number of possible colours in which each yarn is at some time required to be present on the spools to be set for a complete pattern or repeat but need only contain a fraction of this number of supply bobbins dependent upon the width of the subdivision or section of the spool which is dealt with in each of the primary stages.

The choice of the number of yarns to be selected and stored in each of the primary stages will depend at the upper end of the scale upon the capital expenditure which would be necessary to provide a creel frame or equivalent of the necessary bobbin supporting capacity and upon the complication and number of working parts which would be involved in the selector and extractor means of the apparatus whilst at the lower end of the scale the advantage of the method will clearly be reduced if the number of yarns selected in each primary stage are so few that the resulting multiplication of the primary stages to be carried out for each secondary stage involves almost as much time and manipulative skill as is required for the present conventional method of hand selecting the yarns from the creel frame directly on to the hole of the spool to be set.

In practice the best advantage is believed to be obtained by confining the number of yarns selected in each primary stage to the number contained in a width of fabric to be woven lying in the range 2 inches or thereabouts to 7 inches or thereabouts, these yarns occupying a corresponding width of the spool to be set. In general, Axminster pile fabrics are woven to a closeness such that there are seven pile yarns per inch, measured in the weft-wise direction of the fabric and therefore in general, adherence to the range referred to will involve selecting a number of yarns in each primary stage ranging from fourteen to forty nine. Clearly, there will be some variation in the number of yarns selected when adhering to the preferred range specified in terms of width of fabric according to whether the number of pile yarns per inch is below or above the general figure of seven per inch herein referred to.

In practice the spools are generally 27" in length and a convenient sub-division as illustrated in the drawings is $\frac{1}{6}$ of this length which will result in there being 32 yarns selected in each primary stage although clearly this number may vary somewhat according to the number of yarns per inch in the fabric to be woven.

In the drawings, no attempt has been made to show

consistently this number of yarns, a fewer number being shown in Figures 4 and 6 to simplify the presentation whilst in respect of the number of colours available for each of the three yarns. Figure 3 of the drawings indicates these yarns which may be of different colours again this being purely by way of example and not in any limiting sense.

Referring now more specifically to the construction of the apparatus for carrying out the primary stages, this may be provided with any suitable form of frame or supporting structure comprising, for example, side frame members indicated at 13, 14, connected at suitable positions by transversely extending tie-rods or members 15.

Supported in this frame is a receiving assembly for the yarn ends by means of which they are retained and spaced individually apart in a series of vertical rows arranged side by side, there being one row for each set of supply bobbins.

The receiving assembly may comprise a series of vertically disposed strips or elongated members 17 which are formed with a vertically spaced series of yarn receiving apertures through which respective yarn ends 18a to 18f extend, their extremities protruding somewhat as seen in Figure 3 from the mouths of the apertures from the side frame thereof remote from the supply bobbins.

It will be understood that I have shown in each of the members 17 only six yarn receiving apertures with the object of simplifying the disclosure but it will be understood that I may provide as many apertures as may be required preferably a sufficient number to accommodate the different colours which will occur in a plurality of pile fabric patterns thereby avoiding the necessity for changing the supply bobbins changing from setting operations pertaining to one pattern to setting operations pertaining to another pattern.

The strips 17 are supported in guide 19 permitting the strips to be displaced endwise in a vertical direction so that any of the protruding yarn ends may be brought into registration with extractor means hereinafter described and whereby the strips may thus collectively present to the extractor a transversely extending line of yarn ends of the required colour combination.

Instead of the strips 17 being slidably mounted they could be of arcuate form and supported for angular displacement about their centres of curvature which are arranged co-axially with each other, the yarn ends protruding radially outwards from the convex sides of the strips through spaced apertures therein.

The extractor means indicated generally at 20 may comprise a gripper assembly consisting of a plurality of gripper units arranged side by side as seen particularly in Figure 4 at 21, there being one gripper unit for each yarn to be extracted in the primary stage of the method.

Each gripper unit may be formed of a pair of jaws of which one 22 (Figure 3) is fixed in position and the other 23 can pivot about a spindle 24 and has an upwardly projecting arm 25 co-acting with actuating mechanism for opening and closing the jaws.

This mechanism may comprise a rockable bar 26 extending transversely of all the arms 25 and engaging in the upwardly directed opening afforded by a bifurcated portion 27 at the upper end of each arm, this bar being spring loaded by coiled compression springs 28 for movement through an over dead centre position between a closed position as indicated in Figure 3 and an open position wherein a lever arm 29 occupies the position indicated in broken lines 30, the jaws then being open.

Further, a hand lever 31 may be provided for opening and closing the jaws manually when required.

All these parts of the extractor means are mounted and supported on a slide preferably in the form of a hollow housing as indicated at 32 including laterally extending apertured lugs or bosses 33 which operate on slide bars 34 permitting the whole assembly to be moved from the

withdrawn position illustrated in Figure 3 to an extracting position in which it is disposed with the gripper units adjacent to one line of yarn ends protruding from the members 17.

The purpose of the lever arm 29 is to permit of automatic power closing of the jaws of the gripper units when these have been brought collectively to the extracting position as will be hereinafter more fully described.

It will be understood that in the above described arrangement selection of the transversely extending line of yarn ends is performed by displacing the strips or members 17 vertically to predetermined positions in relation to the stations occupied by the individual gripper units 21 when these are at the extracting position. This represents a satisfactory and convenient method of performing the selection and one which would permit of the use of a common gripper assembly extending transversely of the whole of the strips or members 17 instead of providing individual gripper units 21 as illustrated.

However, it will be understood that if desired I could provide a yarn receiving and retaining member or assembly thereon wherein the yarn end passes through apertures maintained in a stationary position and in this case I might provide individual gripper units for each row of yarn ends movable in a direction lengthwise of this row so as to be capable of extracting a particular yarn end but afterwards retractable to withdrawn positions at or near the same level so that the drawn-out lengths of yarn can conveniently be applied to a storage device in a manner similar to that hereinafter described.

Supported between the side frame members of the apparatus conveniently at a position beneath the extended lengths 33 of the yarns drawn-out by the extractor means upon retraction thereof to its withdrawn position is provided a storage means which in the construction illustrated comprises a storage bobbin of relatively short length in comparison with the length of the spool on to which the yarns are to be set. A storage bobbin with yarns stored thereon in organized positional sequence is illustrated in perspective in Figure 2 of the drawings and may conveniently be formed with a drum in the form of a hollow central spindle affording an aperture 4 permitting a plurality of such bobbins to be afterwards assembled end to end upon a common shaft so that the yarn groups stored on respective bobbins are arranged in a sequence corresponding to that in which their respective yarn groups are required to be arranged along the spool to be set. These supply bobbins may have flanges at their ends of diameter greater than the spool flanges, for example, the end flanges 35 of these bobbins may be of 4" to 6" in diameter or thereabouts permitting a supply of yarn to be stored thereon sufficient to fill several corresponding sections on the spools to be set.

The apparatus includes means for supporting these storage bobbins releasably and power means for rotating them to wind off the required quantity of yarn in each yarn group selected.

For this purpose, the apparatus may include opposed but aligned retaining plates 36 and 37 provided with peripheral flanges 38, 39, to retain a supply bobbin in position between the plates by the seating of its end flanges 35 within these peripheral flanges 38 and 39 as indicated in Figure 4.

The plate 37 may be slidable in an axial direction by mounting it on a spindle 40 movable endwise through a bearing provided in one of the side members 14, a coiled compression spring 41 tending to urge the plate in an inward direction and a pivoted hand lever 42 being provided for withdrawing the plate outwardly to permit of insertion and release of the supply bobbins.

Any suitable form of driving connection between the plate 36 and the bobbin, for example, the plate 36 may have one or more pegs or projections extending inwardly from its inner face to engage in a corresponding hole or holes 43 in the bobbin flange.

The plate 36 may be formed with an integral V-pulley portion 44 with which is engaged a transmission belt 45 passing over a pulley 46 on the spindle of a driving motor indicated at 47 and mounted on a bracket or platform 48 between the side members of the apparatus at a position rearwardly and beneath the bobbin supporting assembly.

In the construction illustrated, the disposition of the plates 36 and 37 which support individual storage bobbins in turn is such that the extended row of yarns drawn-out by the extractor means is positioned by the combination of the latter and the yarn receiving strips 17 so as to lie between the flanges 35 of a bobbin when disposed between the plates 36 and 37. Conveniently, therefore, these yarns may be attached to or otherwise engaged with the bobbin collectively by the provision of suitable means thereon such as a clamping bar associated with the spindle of the bobbin after which the yarns can be released from the extractor by operating the lever 31 and the bobbin rotated to draw-off the required length of yarn.

In any of these arrangements, it is not necessary particularly at the position where the yarn ends are received in their respective apertures in the strips or members 17 that the lateral spacing between adjacent vertical rows of yarns should be as close as that which will ultimately obtain between adjacent yarns when set on to the spool in fact the spacing may advantageously be made deliberately greater at this position to avoid lateral congestion of the yarn receiving and retaining means such as the strips 17 and to avoid any like congestion in the extractor means, on the other hand it is desirable to avoid too great a lateral expansion of the yarns during these stages and during storage on the bobbins or yarn beam since this would ultimately require a corresponding degree of convergence or lateral condensation in the course of their ultimate transference collectively from the storage device to the spool to be set.

I find in practice that a convenient spacing to be adopted between adjacent vertical rows of yarns in the receiving strips or members 17 lies in the range $\frac{3}{8}$ " to $\frac{3}{4}$ " or thereabouts but it is to be understood that these are only preferred spacings and the invention in its broader aspects is not limited thereto.

In order to avoid the necessity for large vertical displacements of the individual receiving strips or members 17 in cases where these are required to present a relatively large number of differently coloured yarn ends, for example, 10, 12 or more, I may adopt a modification illustrated diagrammatically in Figure 8 wherein each set of supply bobbins containing yarns of different colours, one of which is selected for each position in the selected yarn group during the primary stage of the method may be received in apertures provided in two laterally adjacent receiving strips or members instead of apertures in only one such strip or member.

In the fragmentary plan view of Figure 8, the bracketed strips or members 49a, 49b, and 50a, 50b, each afford two vertical rows of apertures and each received one set of differently coloured yarn ends for selective extraction by the extractor means.

These paired strips or receiving members will all ordinarily be lowered or otherwise displaced to a position wherein all their yarn ends are out of registration with the extractor means and the selector means provided will co-operate to raise or displace only one strip or member of each pair during each selection so as to present only one yarn end from each set of supply bobbins to the extractor means.

The lateral spacing in this case may vary across the width of the extracted line of yarns as, for example, is seen in Figure 8 wherein chain lines 49c, 50c, 51c and 52c, represent extractions of yarns made one from each pair of associated strips or members.

To convert these yarns into uniformly laterally spaced

relation, they may be passed through guide means indicated generally at 53 in the form of a reed or sley having dents 54 extending upwardly from laterally slidable bases 55.

To each of these bases may be secured or connected link members 56 so arranged as to permit the bases and associated dents to be expanded laterally to limits determined by the ends of the links wherein adjacent dents are then spaced so as to receive between them yarns extracted from an associated pair of receiving strips or members irrespective of the particular strip or member in this pair from which the yarn is extracted.

After passage through the space between adjacent dents, these may then be contracted laterally from their former double-spaced relationship to a single spaced relationship in which their separation is defined by engagement of adjacent edges of the bases 55 and the lateral spacing of the yarns emerging from the reed or sley will then be uniform and independent of the particular receiving strip or member in each pair from which it proceeds.

Any suitable form of selector device, preferably responsive to perforated record cards or a roll or other record member may be employed to determine the vertical position of each of the yarn receiving strips or members 17 and hence to determine which of the yarns will be extracted by the extractor means.

Such a device may conveniently be in the form of a Jacquard mechanism, known per se which is illustrated in Figure 5.

In this mechanism, the upper end of each of the strips or members 17 is connected by suitable wires 57 to lifter members 58 guided for vertical sliding movement and ordinarily maintained in a raised position as seen in Figure 5 by means of a transversely extending raising bar 59 engaging beneath a head 60 at the upper end of each of the lifter members 58.

Each of the lifter members 58 carries a plurality of vertically spaced stirrups 61a to 61e which may be in the form of U-shaped members of resilient strip metal engaged slidably but frictionally with their lifter member so as to be displaceable transversely thereto from the position shown in Figure 5 to a forwardly projected position in which they would become engaged during downward movement of the lifter member with a stop bar 62.

In register with each of these stirrups are spring-loaded plungers 63a to 63e slidably supported by plates or members 64 and having coiled compression springs disposed on the plungers as illustrated to urge them away from the stirrups.

A Jacquard "cylinder" which may be in the form of a hexagonal prism as indicated at 65 carries a chain of Jacquard cards 66 which are perforated to allow the ends of the plungers nearest the Jacquard "cylinder" to pass through the perforations and through underlying holes in the plates of which the Jacquard "cylinder" is composed when the latter is reciprocated bodily towards the plungers as indicated by the arrow 67.

In each vertical row of holes in the Jacquard cards, there will be one unperforated position so that one of the plungers 63a to 63e will be moved forwardly to project its associated stirrup in the same direction.

Consequently, when the raising bar 59 is lowered each of the lifter members 58 will fall until the particular stirrup therefrom which has been projected forwardly engages with the stop-bar 62 and the yarn receiving strips or members will fall individually to like extents thus bringing a predetermined yarn end into registration with the jaws of the gripper units.

On completion of each cycle of operations a pivotally supported plate 68 moves against the stirrups to cancel the previous selection.

The mechanism for rotating the Jacquard "cylinder" to bring a fresh Jacquard card into the operative position

opposite the rearward ends of the plungers 63a to 63e for reciprocating the Jacquard "cylinder" for moving the raising bar 59 and for operating the cancelling plate 63 may be arranged in any convenient or known manner and has not been illustrated in detail since it is considered that the provision of such mechanism could readily be made without detailed special instructions.

In a case where each set of supply bobbins have their yarn ends brought to paired receiving strips or members 49a, 49b, 50a, 50b, etc. as illustrated in Figure 8, it would be necessary to provide a corresponding number of lifter members 58 for each of the individual receiving strips or members and in this case the Jacquard cards would be so perforated that only one strip or member of each pair would be lowered to an operative position in each cycle of operations the lowest stirrup on each of the members 68 in this case representing a blank position wherein none of the yarn ends are lowered sufficiently to be brought into registration with the gripper units.

For maintaining the proper lateral separation between adjacent yarns when in extended form as indicated at 33 the apparatus is provided with guiding means disposed between the receiving strips or members 17 and the extractor means when in its withdrawn position as seen in Figure 3. The guiding means may be in the form of a reed or sley 69 provided with dents spaced apart in correspondence with the spacing of the yarns obtaining at the receiving strips or members 17. This reed or sley may be supported on a retractable carrier bar 70 itself mounted on slides 71 operating in vertical guides 72 secured to or formed on the inner faces of the side frame members, the carrier bar may also be provided with a seating for receiving the comb 73 of a conventional cap and comb assembly sometimes known as a clamp and guard, the cap being removed to allow the extended yarns 33 to pass between the dents of this comb.

At a convenient position adjacent to the strips 17, we may provide knife or shear means for severing the yarns so that the protruding portions thereof after such severing are of substantially equal lengths and are capable of being seized by the gripper units.

These means may, for example, be in the form of a vertically movable support 112 upon which are carried a pair of toothed or notched shearing blades 113 movable endwise relative to each other so that yarns disposed in between their teeth or in their notches become severed by the sharpened sides of the teeth or notches. The member 112 and the blades 113 may be operated automatically by any suitable form of mechanism not shown in detail.

When drawing-off operations have been completed and the storage bobbin filled to the required extent the comb 73 which is then properly engaged with its dents between adjacent yarns may be removed from the carrier bar 70 and laid across the storage bobbin whereon it can be retained in position by springs or fastening members as indicated at 74 (Figure 2) the cap 75 being placed on the comb to prevent unwinding and displacement of the yarns after the storage bobbin has been removed from the apparatus.

The moving parts of the apparatus may be operated by any suitable form of drive mechanism which may, for example, comprise a main drive shaft 76 journaled between the side frame members of the apparatus and having the gear 77 fixed thereto driven from a pinion 78 which is itself driven from a power unit such as an electric motor.

The drive shaft 76 may have mounted thereon a main cam 79 of which one face is provided with a cam groove 80 controlling movement of the extractor means by a transmission linkage comprising a rocker 81 on which a cam follower 82 is mounted, this rocker being connected by a link 85 to an arm 83 fixed on a transverse shaft 84. The shaft 84 has fixed thereto at each end upwardly ex-

tending crank arms 86 having slotted little ends 87 through which extend pins 88 secured to the bosses 89 of the extractor housing.

The opposite face of the main cam 79 may be provided with a further cam groove indicated in broken lines 90 (Figure 3) for the purpose of controlling vertical movement of the carrier bar 70 which supports the guiding reed or sley 69 and the comb 73. The form of this cam is such that the carrier bar is lowered whilst the extractor means are disposed in the immediate vicinity of the yarn receiving strips or members 17 and upon withdrawal of the extractor means the carrier bar is raised to engage the guiding means with the extended yarns 33.

The cam groove 90 has a follower 91 operating therein which is supported at one end of a lever 92 fixed to a transverse shaft 9 which at each of its ends is provided with further levers 93 coupled by links 94 to the lower ends of the slides 71, the periphery of the main cam 79 is formed with a "pip" or rise 95 for operating automatic closure means for the gripper units when these are in a position to engage with one transversely extending line of protruding yarn ends.

A pair of lever arms 96 pivoted on the outer sides of the side frame members for oscillation about a common axis are connected at one end to a transverse supporting bar 97 for a cam follower 98 mounted thereon to co-operate with the rise 95 and the other ends of these levers are connected to the lower ends of upwardly extending rods 99 guided for endwise movement at their upper ends in brackets 100 secured to one of the pillars 101 supporting the part of the frame which carries the selector device or Jacquard.

The rods and associated levers 96 are urged upwardly by coiled tension springs 102 anchored to the frame and to the levers 96 as seen in Figure 1 and serve also to maintain the cam follower in engagement with the periphery of the cam 79.

Near their upper ends the rods 99 are provided with collars 103 which are adapted to engage with the lever arms 29 of the extractor means to effect closure of the gripper units at the required time when the rise 95 lifts the cam follower 98.

In the alternative construction of apparatus illustrated in Figures 9 to 12 the apparatus is arranged to receive either a yarn beam of a sufficient length to accommodate simultaneously all the yarn groups required to fill a spool or alternatively to accommodate a plurality of fractional width bobbins disposed in coaxial relation for the same purpose such assembly of fractional width bobbins being deemed to constitute a yarn beam.

In this construction wherein like parts are designated by like reference numerals as used in the embodiment described with reference to and as shown in Figures 1 to 5, the side frame members 13 and 14 are formed at their upper edges with recesses 120 in order to permit a laterally extending carriage 121 to lie transversely of the side frame members below the extended lengths 33 of yarns drawn out by the extractor means upon retraction to its withdrawn position.

At opposite ends the carriage 121 is provided with up-standing webs or plates 122 which serve to accommodate bearings 123 for stub spindles or for a shaft 124 upon which a yarn beam 125 is disposed.

The yarn beam is suitably keyed or otherwise fixed to this shaft which at one end is provided with a coupling member such as a dog clutch element 126 for engagement with a complementary dog clutch element 127 mounted upon the spindle of a drive motor 128 supported upon a platform 129 formed as a lateral extension of the carriage.

The carriage itself may be mounted upon laterally extending guides for movement therealong these guides conveniently being in the form of a pair of spaced rails 129

and the carriage at its underside being provided with grooved rollers 130 running on the rails.

The extremities of the rails 129 may be supported by brackets 131 of L shape as viewed in end elevation one limb of each of these brackets being disposed adjacent to the outer side the face of an associated side frame member 13 or 14 and suitably secured thereto.

The yarn beam may be in the form illustrated in Figure 10 wherein the central tubular portion 132 of the yarn beam besides being provided with flange members 133 at its ends has a plurality of intermediate flange members 134 disposed at spaced positions along its length to divide the yarn beam into the requisite number of sections each of which is of a length to accommodate one yarn group containing yarns equal in number to those extracted by the extractor 20.

In an alternative arrangement I might employ in place of this yarn beam a plurality of separate fractional length storage bobbins disposed upon the shaft 124 and suitably keyed or otherwise fixed thereto to enable them to be driven by the motor 128.

In yet another alternative as illustrated in Figure 11 the yarn beam may have at one end a frusto-conical portion 135 and the extended yarns 33 during winding on to the yarn beam may be given by any suitable means such as the reed or sley 69 or a further reed or sley not illustrated, a lateral bias toward the frusto-conical portion so that successive layers or pulleys of each yarn tend to be moved laterally and form a self-supporting winding in the form illustrated by the broken lines 136. The frusto-conical end portion of this winding will then perform a like function for the next succeeding winding to that performed by the frusto-conical portion 135 and ultimately the yarn beam 137 will be filled by a series of windings of the form indicated at 136 arranged end to end.

For retaining the carriage in each of a plurality of positions along the guide members or rails 129 the carriage may be provided with notches or recesses as indicated at 138 into which can enter a detent in the form of a lever arm 139 pivotally secured to one of the side frame members and biased by a coiled tension spring 140 into an operative locking position as seen in Figure 9 wherein it rests against a lug or stop 141. The detent can be displaced to free the carriage for movement to another position by depression of the handle 142 accessible to the operator at the front of the machine.

For displacing or traversing the carriage along the rails 129 power means may be provided such as a drive motor 143 (Figure 12) mounted upon separating brackets or bearers 144 secured to one of the side frame members of the machine.

This motor may through suitable reduction gearing be coupled by a belt or chain drive 145 to a traversing screw 146 extending between the side frame members and supported in bearings mounted at the upper edges thereof.

For co-operation with this traversing screw the carriage may have a nut bar extending for the length of the carriage, this nut being either formed with a continuous nut surface at its underside or a plurality of spaced nut elements as indicated generally at 147. The nut bar may be pivotally mounted at 148 on the underside of the carriage and may have connected therewith a control lever 149 by means of which the operator can disengage the nut surface or nut elements from the traversing screw towards which they are biased by means of a spring 150.

The linkage for effecting movements of the extractor 20 is somewhat modified in comparison with that illustrated in the preceding embodiment, in the present case the extractor having two rearwardly extending draw bars 151 disposed above the recess 120 in the side frame members which accommodates the carriage and yarn beam the rearward ends of these draw bars being pivotally connected to crank arms 152 replacing the crank arms 86.

For carrying out the secondary stage of the method,

apparatus may be provided as illustrated in Figure 6 whereby an assembly of an appropriate number of storage bobbins are arranged end to end in axial succession upon a spindle 104 and the yarn ends drawn-off from all these bobbins are wound on to a spool 105.

The apparatus shown in Figure 6 has been illustrated as a separate entity for convenience but it will be understood that it may either be provided in this form or alternatively it may form part of the apparatus shown in and described with reference to Figures 1 to 5 for carrying out the primary stages of the method or as shown in Figures 9 to 12. In this latter case the apparatus of Figure 6 would be mounted in convenient proximity to the storage yarn beam thereby permitting the direct winding-off from this yarn beam on to the spool of the yarns collectively stored on the yarn beam.

The yarns from only one of the storage bobbins have been shown extending on to the spool 105 to simplify the drawings but it will be understood that in practice all the yarns will simultaneously be wound on to the spool.

Any suitable form of releasable supporting and driving means may be provided for the spool 105 such means being operatively connected with a power source or driving motor preferably through a clutch.

If desired, braking means may be provided in conjunction with the assembly of storage bobbins to regulate the tension of the yarns as they are wound off from the bobbins and wound on to the spool.

This apparatus may have any suitable form of base or frame indicated generally by the chain lines 106 and supported thereon in between the bobbins and the spool are guide means in the form of a reed or sley indicated generally at 107.

This reed or sley is shown in greater detail in Figure 7 and may be constructed so that groups of dents or teeth indicated at 108 are movable relatively to each other laterally of the extended yarns 109 to a controlled extent determination by pin and slot coupling members 110 connecting adjacent groups 108.

In the laterally expanded position as illustrated by the fragment of the reed or sley shown in Figure 7 respective groups of dents or teeth 108 are separated from each other at adjacent ends by the thickness of adjacent and abutting spool flanges 35 whilst the individual dents 111 are spaced apart laterally in accordance with the spacing of the yarns on the storage bobbins.

This arrangement permits the yarns to be engaged between the dents of this reed or sley readily by employing the individual caps and combs attached to individual storage bobbins to draw-out a sufficient length of yarn and lay this across the particular group of dents 108 opposite the bobbin concerned.

Afterwards the individual caps and combs are removed, the reed or sley is moved to its contracted position in which the ends of the dent groups 108 abut each other to provide an overall lateral spacing which is uniform throughout the width of the extended yarns and permits them to be laid on the spool 105 for winding.

A similar arrangement may be adopted where instead of employing individual storage bobbins a single yarn beam is used as the storage device this being provided with partitioning flanges along its length.

Alternatively, if the storage bobbins or the yarn beam have the yarns wound thereon at a spacing which is greater than that required on the spool, a reed or sley may be provided in which the dents or teeth can expand or contract laterally relatively to each other uniformly through the length of the reed or sley as, for example, illustrated in Figure 8.

What I claim then is:

1. A method of setting a spool comprising assembling supply bobbins into a plurality of aligned vertical rows on an appropriate supporting means, each said bobbin bearing yarn of a color differing from that borne by other bobbins in its row, threading the respective yarn ends

13

from the bobbins of each of said vertical rows through guide apertures in a vertically extending vertically movable strip, selectively vertically positioning said strips to provide at a particular level a horizontal row of yarn ends of a selected color combination projecting from said apertures, moving a reciprocable gripper means to a position adjacent said horizontal row of projecting yarn ends and gripping said horizontally aligned yarn ends therewith, reversely moving said gripper means to simultaneously draw said gripped yarns through said apertures and from said supply bobbins to extend them tangentially of and adjacent a storage bobbin, attaching said yarn ends to said storage bobbin and winding them thereon to fill the same, repeating the aforesaid steps with varying positions of said vertical strips to fill a plurality of storage bobbins with variously patterned sectional warps, mounting a plurality of such storage bobbins coaxially to present their yarns in selected longitudinal sequence, and winding the composite warp so formed from said storage bobbins onto a spool.

2. A method of setting a spool comprising assembling supply bobbins into a plurality of aligned vertical rows on an appropriate supporting means, each said bobbin bearing yarn of a color differing from that borne by other bobbins in its row, threading the respective yarn ends from the bobbins of each of said vertical rows through guide apertures in a vertically extending vertically movable strip, utilizing a Jacquard mechanism to vertically position said strips to provide at a particular level a horizontal row of yarn ends of a selected color combination projecting from said apertures, moving a reciprocable gripper means to a position adjacent said horizontal row of projecting yarn ends and gripping said horizontally aligned yarn ends therewith, reversely moving said gripper means to simultaneously draw said gripped yarns through said apertures and from said supply bobbins to extend them tangentially of and adjacent a storage bobbin, attaching said yarn ends to said storage bobbin and winding them thereon to fill the same, repeating the aforesaid steps with varying positions of said vertical strips to fill a plurality of storage bobbins with variously patterned sectional warps, mounting a plurality of such storage bobbins coaxially to present their yarns in selected longitudinal sequence, and winding the composite warp so formed from said storage bobbins onto a spool.

3. A method of setting a spool comprising assembling

14

supply bobbin into a plurality of aligned vertical rows on an appropriate supporting means, each said bobbin bearing yarn of a color differing from that borne by other bobbins in its row, threading the respective yarn ends from the bobbins of each of said vertical rows through guide apertures in a vertically extending vertically movable strip, selectively vertically positioning said strips to provide at a particular level a horizontal row of yarn ends of a selected color combination projecting from said apertures, moving a reciprocable gripper means to a position adjacent said horizontal row of projecting yarn ends and gripping said horizontally aligned yarn ends therewith, reversely moving said gripper means to simultaneously draw said gripped yarns through said apertures and from said supply bobbins to extend them tangentially of and adjacent a storage bobbin, attaching said yarn ends to said storage bobbin and winding them thereon to fill the same.

4. A method of setting a spool comprising assembling supply bobbins into a plurality of aligned vertical rows on an appropriate supporting means, each said bobbin bearing yarn of a color differing from that borne by other bobbins in its row, threading the respective yarn ends from the bobbins of each of said vertical rows through guide apertures in a vertically extending vertically movable strip, utilizing a Jacquard mechanism to vertically position said strips to provide at a particular level a horizontal row of yarn ends of a selected color combination projecting from said apertures, moving a reciprocable gripper means to a position adjacent said horizontal row of projecting yarn ends and gripping said horizontally aligned yarn ends therewith, reversely moving said gripper means to simultaneously draw said gripped yarns through said apertures and from said supply bobbins to extend them tangentially of and adjacent a storage bobbin, attaching said yarn ends to said storage bobbin and winding them thereon to fill the same.

References Cited in the file of this patent

UNITED STATES PATENTS

880,169	Smith et al. _____	Feb. 25, 1908
1,096,702	Fleisher _____	May 12, 1914
1,478,082	Whitlock _____	Dec. 18, 1923
1,718,273	Baylis _____	June 25, 1929
1,791,373	Pearsall _____	Feb. 3, 1931
2,342,265	Garritty _____	Feb. 22, 1944
2,578,017	Rovas _____	Dec. 11, 1951