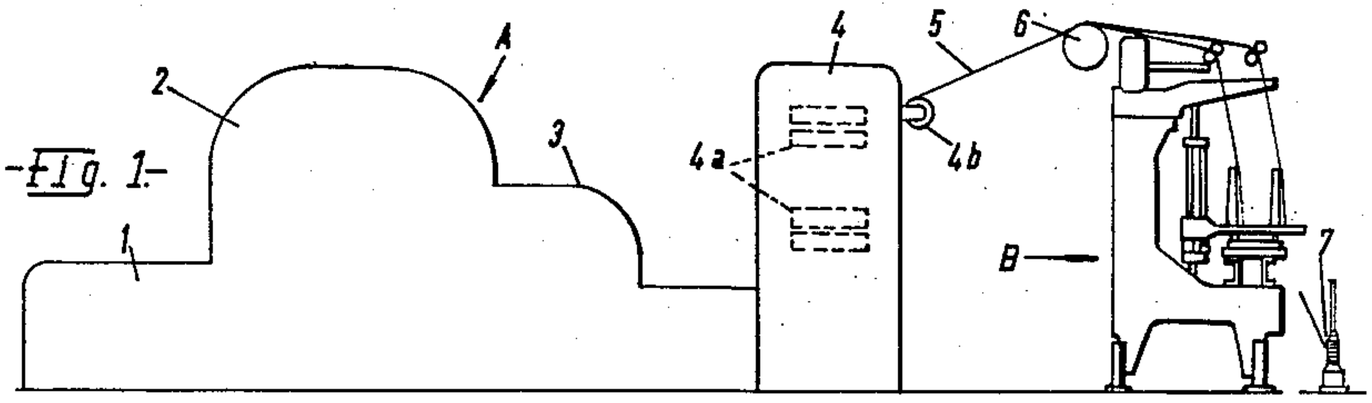
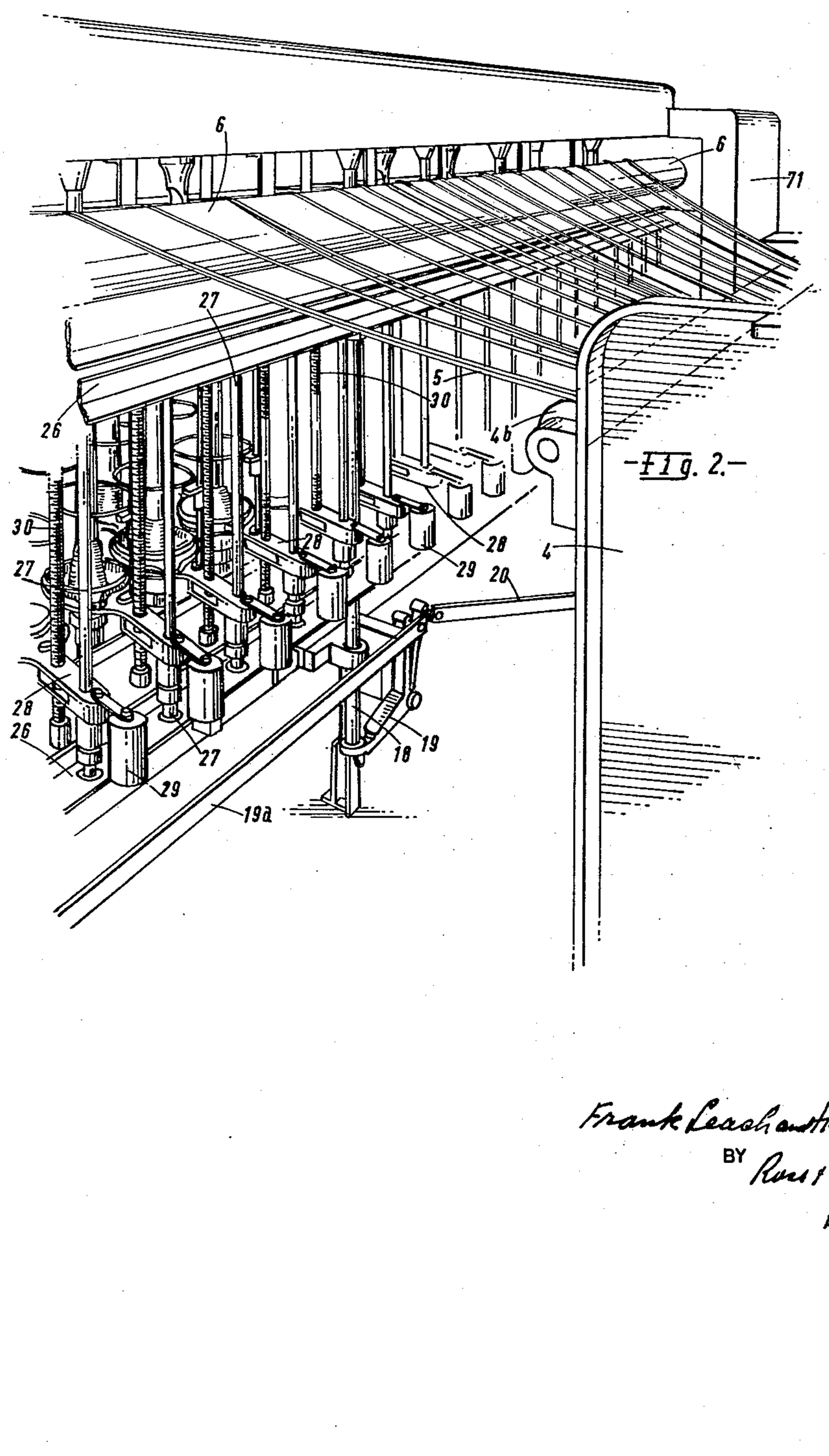
Aug. 8, 1961 F. LEACH ET AL 2,995,002

DIRECT SPINNING OF CONDENSER YARN

Filed March 3, 1959 10 Sheets-Sheet 1

-Fig. 1.-





-Fig. 2.-

INVENTOR
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ATTORNEYS

Aug. 8, 1961 F. LEACH ET AL 2,995,002

DIRECT SPINNING OF CONDENSER YARN

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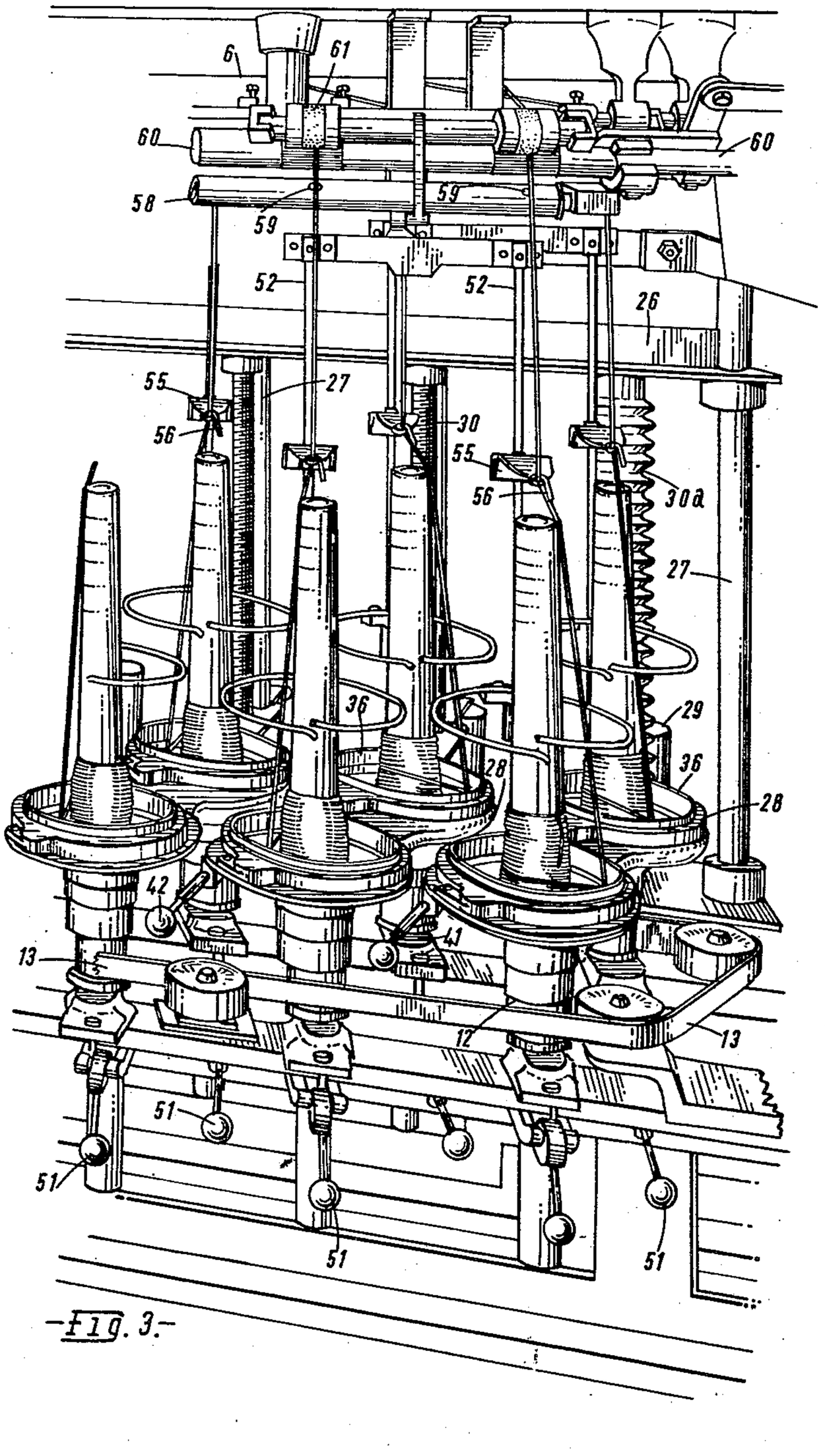

Fig. 3.

INVENTOR
Frank Leach and Harry Shenton
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DIRECT SPINNING OF CONDENSER YARN

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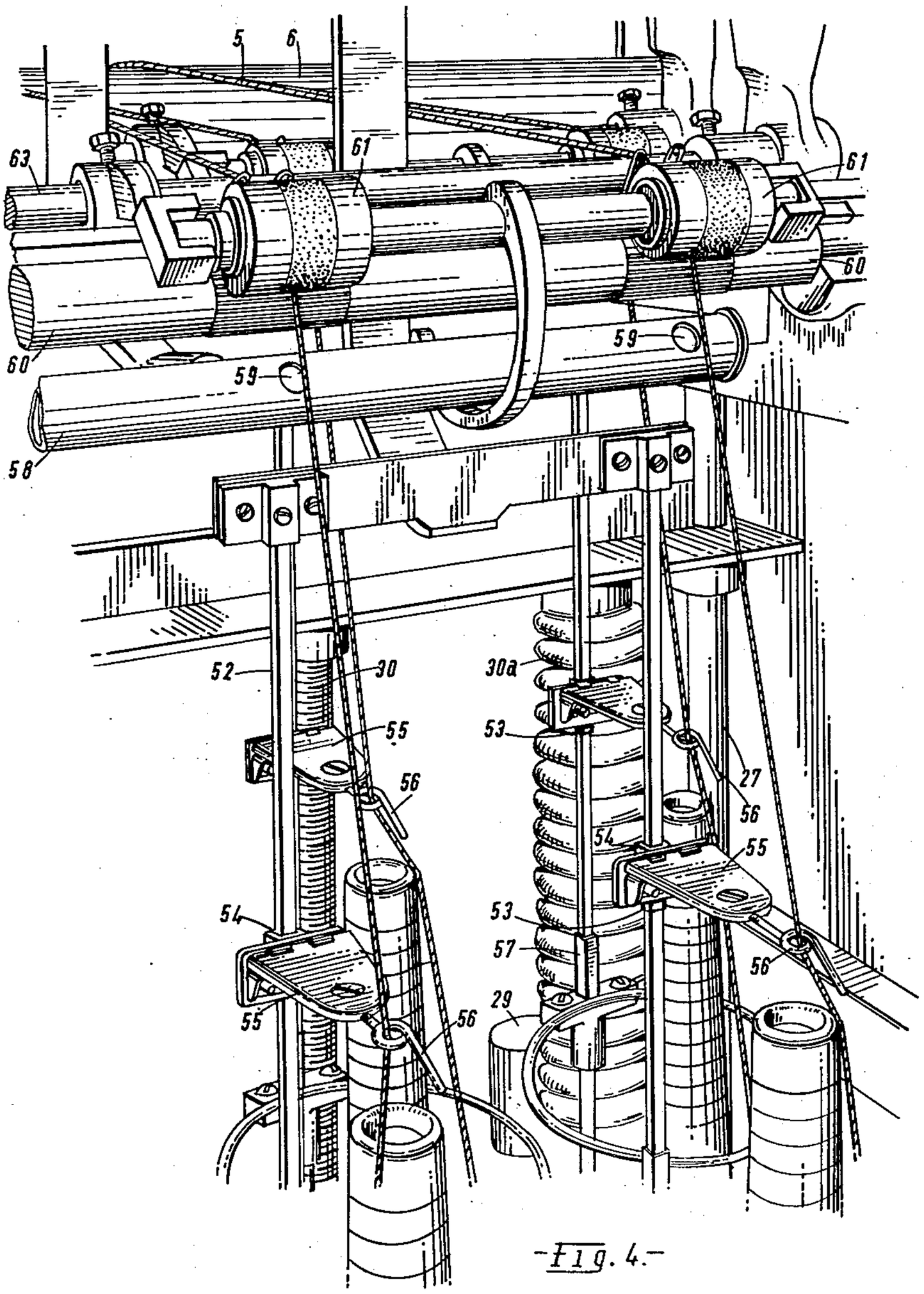

-Fig. 4.-

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Aug. 8, 1961 F. LEACH ET AL 2,995,002

DIRECT SPINNING OF CONDENSER YARN

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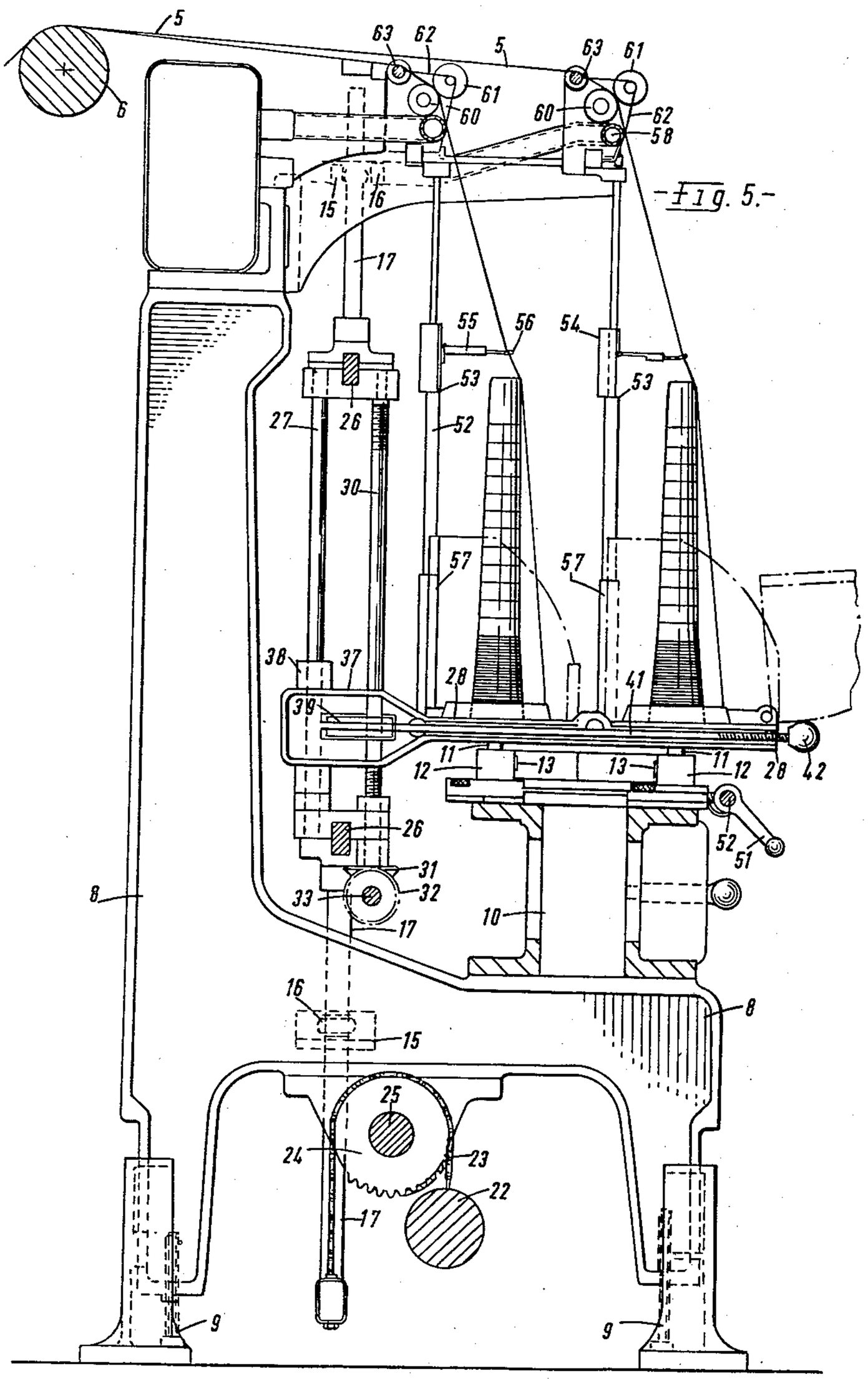

-Fig. 5.-

INVENTOR
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Aug. 8, 1961 F. LEACH ET AL 2,995,002

DIRECT SPINNING OF CONDENSER YARN

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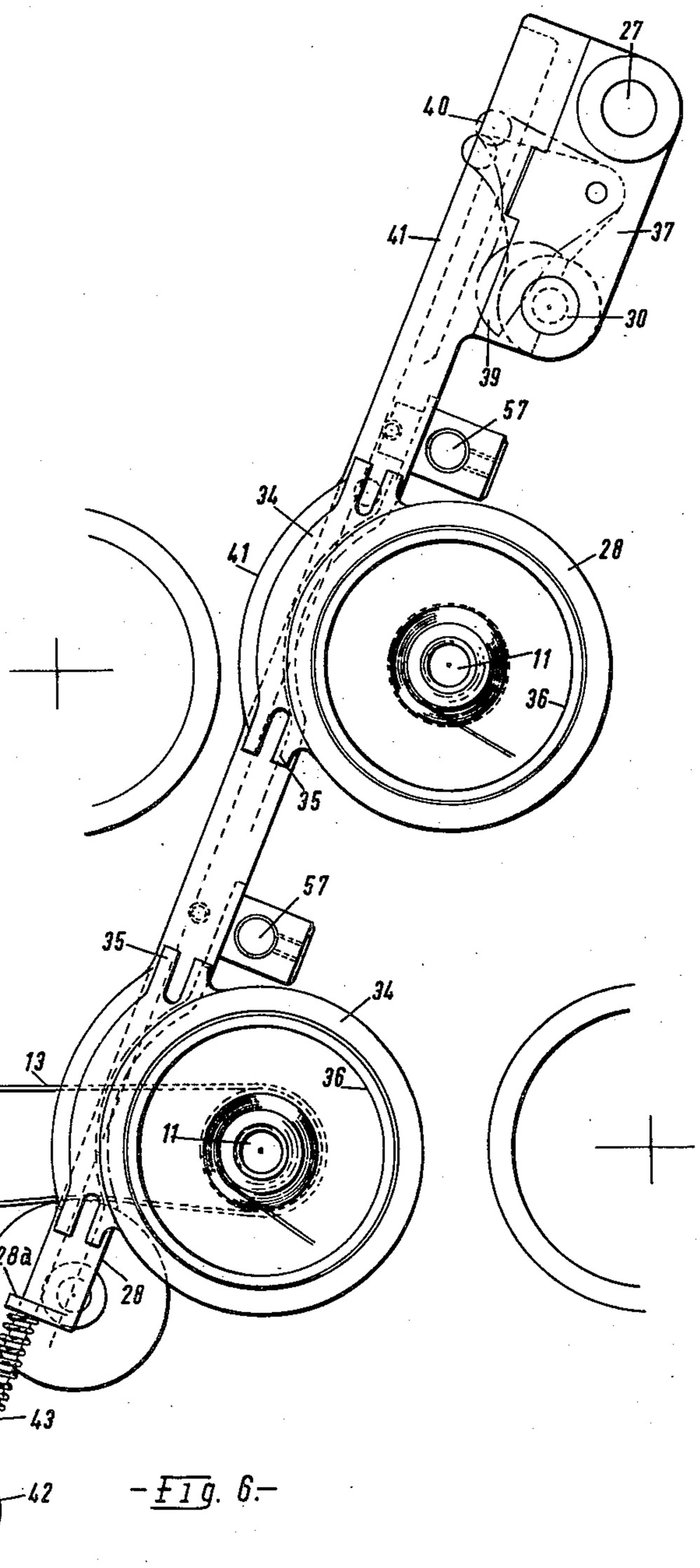

-Fig. 6.-

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Aug. 8, 1961 F. LEACH ET AL 2,995,002

DIRECT SPINNING OF CONDENSER YARN

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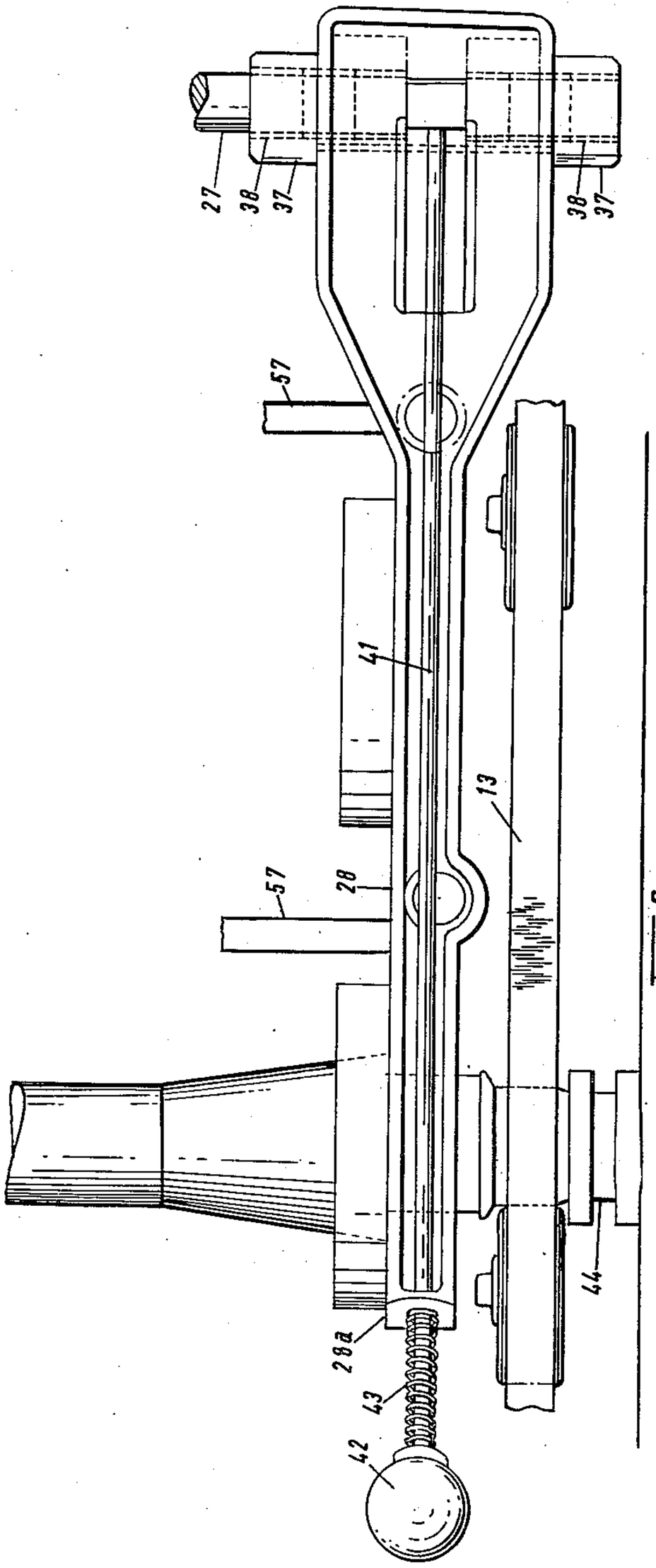

-Fig. 7.-

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Aug. 8, 1961 F. LEACH ET AL 2,995,002

DIRECT SPINNING OF CONDENSER YARN

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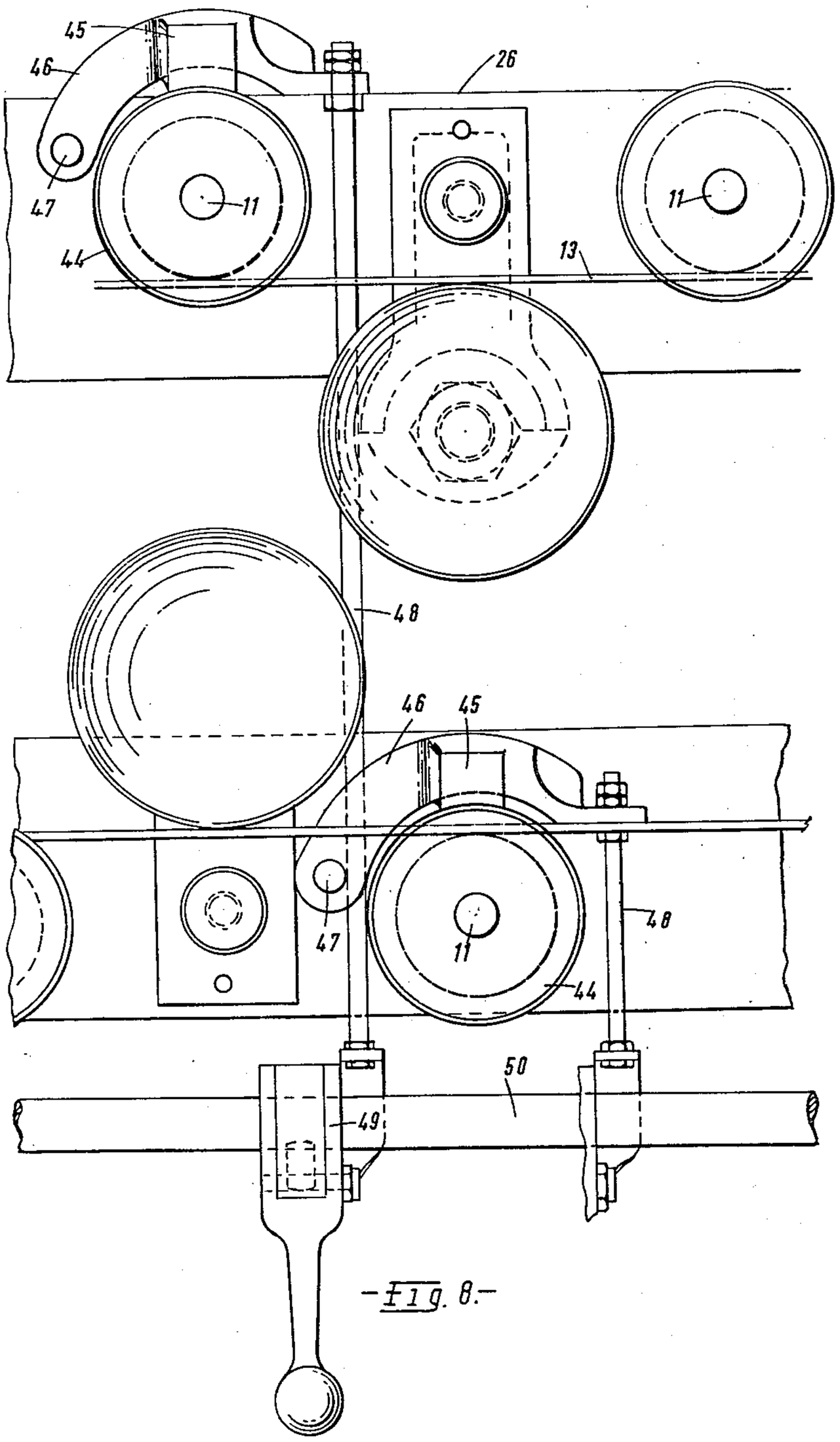

-Fig. 8.-

INVENTOR
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Aug. 8, 1961 F. LEACH ET AL 2,995,002

DIRECT SPINNING OF CONDENSER YARN

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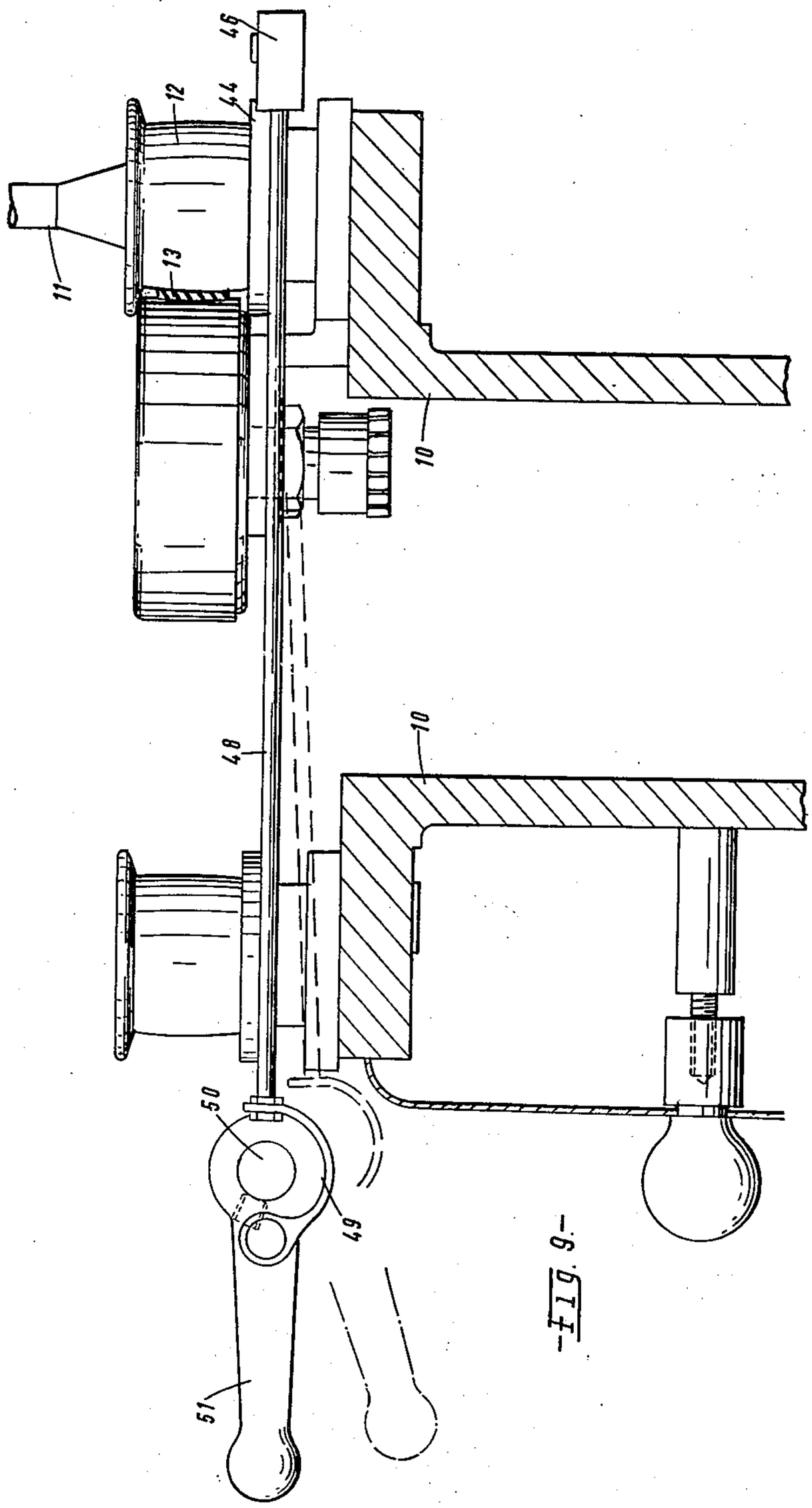

Fig. 9.

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DIRECT SPINNING OF CONDENSER YARN

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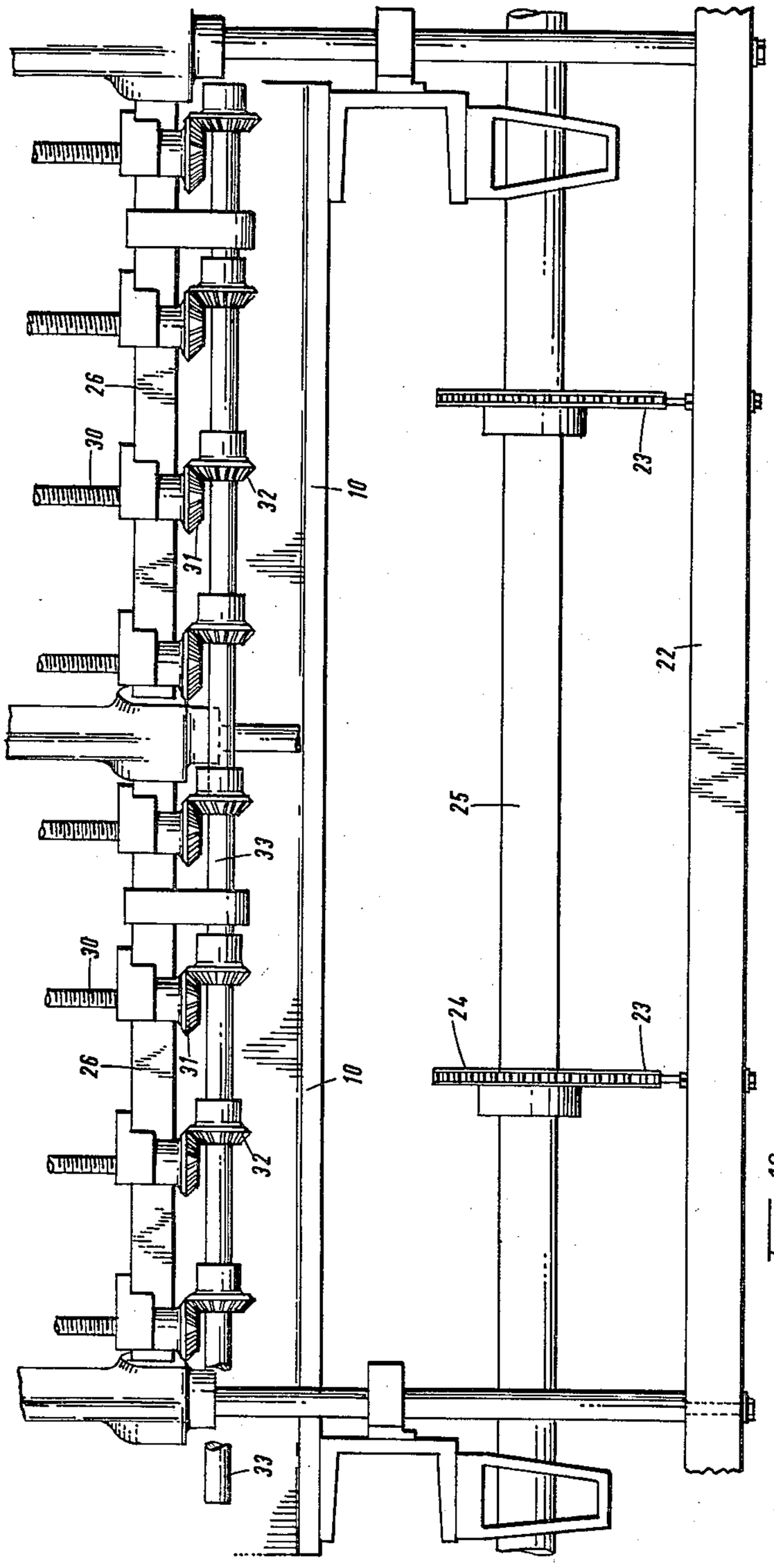

Fig. 10.

INVENTOR
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DIRECT SPINNING OF CONDENSER YARN

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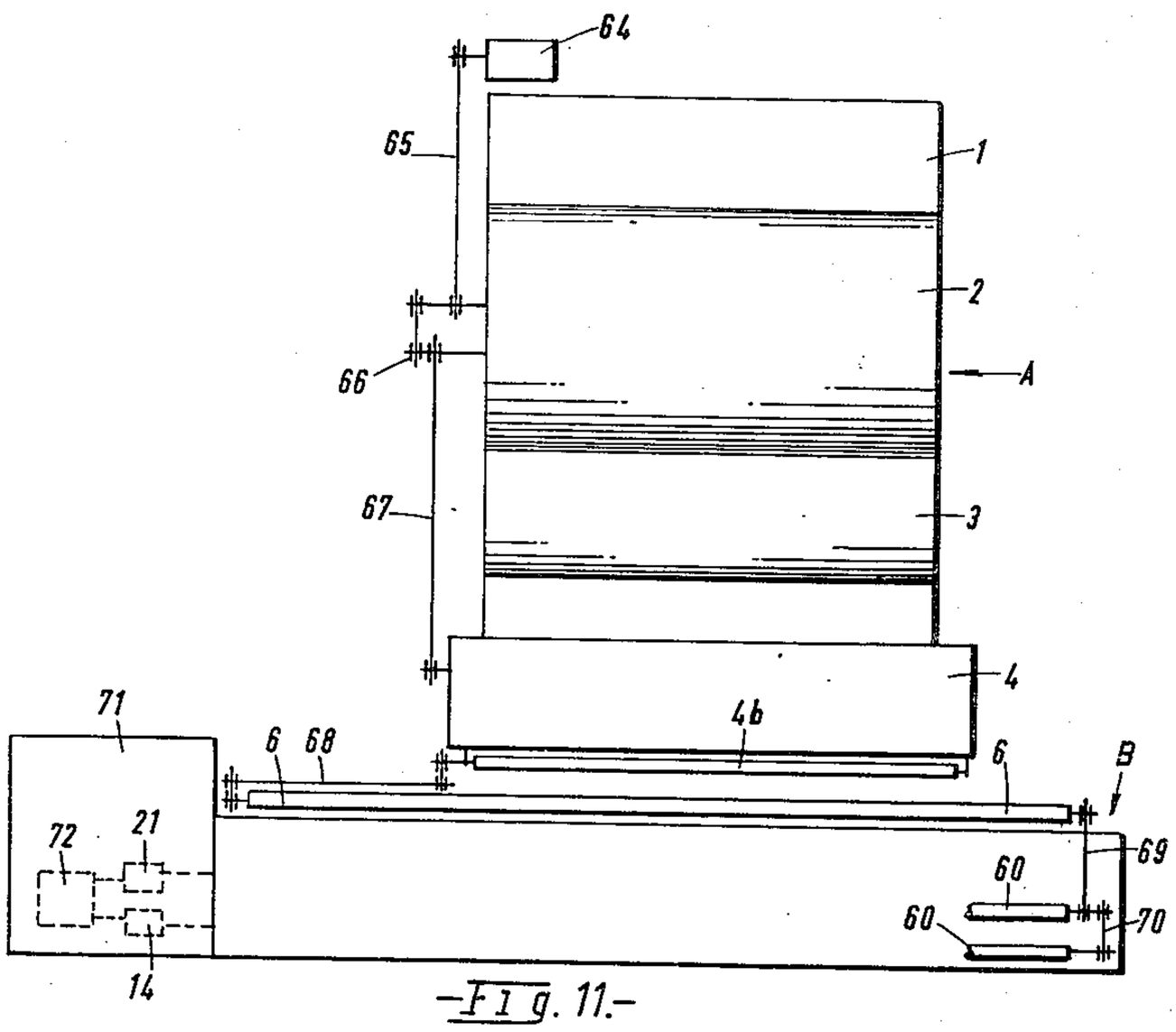

Fig. 11.

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United States Patent Office

2,995,002

Patented Aug. 8, 1961

2,995,002

DIRECT SPINNING OF CONDENSER YARN

Frank Leach and Harry Shenton, Rochdale, England, assignors to Permo Spinning Limited, Rochdale, England, a British company

Filed Mar. 3, 1959, Ser. No. 796,937
Claims priority, application Great Britain Mar. 5, 1958
9 Claims. (Cl. 57—52)

This invention relates to the production of textile yarns. An important application of the invention is to the spinning of condenser yarn.

Hitherto, it has not been possible to feed a spinning machine directly and continuously from a carding unit because the spinning frame has had to be stopped periodically while all its full yarn packages are being doffed and replaced by empty ones, whereas the card can go on producing continuously. Accordingly, in the case of condenser yarns for example, it has hitherto been customary for the material leaving the rubbing leathers of a condenser card to be wound on bobbins and transferred to a ring spinning machine on such bobbins, or in some cases to be transferred to a drawing unit on such bobbins and afterwards be taken to the spinning unit on other bobbins.

This invention has for its main object therefore, to provide means whereby yarn may be spun on a machine fed directly by a carding engine, without requiring stoppages of the machine for the doffing of full bobbins. This results not only in a great saving of time and labor, but also ensures an improved, more consistent output of yarn.

The present invention provides a process and apparatus for the continuous production of spun yarn from condenser yarns by feeding the condenser yarns from the condensers to ring spinning heads in a continuous flow, and timing the filling of the packages at the respective spinning heads so that they fill in a predetermined sequence and can be doffed in the same sequence without interruption of the working of the machine.

The invention is intended primarily for the production of yarn packages of cop form having a "chase" build. It is however applicable also to the production of yarn packages having a parallel build. In the former case, the invention includes the feature that each spinning head (or each of a plurality of small groups of spinning heads to be doffed at the same time) has its ring (or group of rings) independently releasable from the chase motion and capable of being returned independently to the starting position. Thereby, instead of all the spindles of a ring frame having a common ring rail and having all the packages formed to the same extent at any instant, any individual package (or said small group of packages) may be commenced at any time, without stopping the machine, and likewise can be doffed when full without the stopping of the machine.

For this purpose, apparatus according to the invention may provide a chase movement common to all the rings of a ring-spinning machine and operating between fixed limits (which may be variable), a driving member for a build-up motion at each said spindle (or group of spindles) and releasable clutch means between said driving member and the respective ring (or group of rings) whereby any ring (or group of rings) may be caused to partake or not partake of said chase movement, selectively, at any position in the build-up of the package.

In the alternative arrangement, where the yarn package has a parallel build-up, e.g. on flanged bobbins, the ring rail may be continuous as in a normal ring frame, the various spindles will be fed with condenser yarn continuously from the carding engine and the commencement of spinning at the respective spindles (or small groups of spindles) will be timed sequentially so that doffing may be effected in the same sequence without the stopping

of the machine. If desired, however, even with a parallel build-up motion, the continuous ring rail may be replaced by independently-adjustable units as described above, each carrying one or a group of rings and each adapted for selective engagement with and disengagement from the traverse mechanism.

In dependence on the type of yarn to be spun, for example whether fine or coarse, the apparatus may include one or more drafting units between the condensers and the said spinning heads.

As the width of a condenser card delivering a given number of condenser yarns is much less than the normal width of a ring frame having that number of spindles, various means may be adopted for reducing the width of the ring frame without impeding the doffing of the spindles individually. For example, the spindles may be in two or more rows, with those in each row staggered relatively to each adjacent row; and/or the spindles may be in tiers; and/or the spinning machine may be of a back to back type having a row or rows of spindles at each side; and/or a single carding engine may feed two or more spinning units arranged one in front of another with a gangway between them, the yarns for a spinning unit more remote from the carding engine being passed, for example, over the top of the intervening unit or units.

The carding and spinning devices may be incorporated in a single composite machine or, what will probably be more usual, existing carding engines will be associated with one or more spinning machines made to operate according to the invention. In either case, all the operating parts may be driven from a common source, or some of them may have independent driving sources. In the said more probable arrangement it is preferred that those parts of the spinning unit which advance the yarn towards the spindles will be driven from or in synchronism with the carding unit, while the spindles themselves, the chase movement and the buildup motion will be driven from a separate source or sources.

Since, during the time of doffing and donning a spindle, the yarn for that spindle is still being fed from the carding unit, it is necessary to take care of the excess yarn. This is best done by feeding the yarn end into a pneumatic suction system while doffing and donning is effected, the yarn entering such system being collected and, if suitable, returned to the carding unit.

The present invention is particularly useful for the spinning of yarns into the large packages now becoming popular, especially for the softer grades of yarn. In this connection, the invention may include the further feature that the lappets which guide the yarn to the travellers on the rings are vertically adjustable between a normal lower position and a temporary higher position and are adapted to partake of the traverse movement of the ring during the later stages of building up the cop, so as to ensure a minimum distance between lappet and traveller in the later stages of cop-building without having too great a maximum distance between those parts in the first stages of cop building.

The invention will now be described with reference to the accompanying drawings, wherein:

FIG. 1 is a diagrammatic side view of a complete machine for the continuous production of spun yarns, including a carding unit and a spinning unit;

FIG. 2 is a perspective view of a part of the rear of the spinning unit of the machine, adjacent the delivery end of the carding unit;

FIG. 3 is a perspective view of a part of the front of the spinning unit;

FIG. 4 is an enlarged perspective view taken from the front of the spinning unit to show the arrangement of adjustable lappets;

FIG. 5 is an end elevation of the spinning unit;

FIG. 6 is a plan to a larger scale of one of the releasable ring carriers equivalent to sections of a ring rail;

FIG. 7 is a side elevation of the ring carrier shown in FIG. 6;

FIG. 8 is a diagrammatic plan of a braking mechanism for the spindles;

FIG. 9 is a side elevation of such braking mechanism;

FIG. 10 is a front elevation of the means for driving the traverse mechanism;

FIG. 11 is a diagrammatic lay-out of the drive to the various parts of the machine.

Referring to FIG. 1, the combined machine for continuous yarn production comprises a carding unit denoted generally as A, and a spinning unit denoted generally as B. The carding unit shown has an intake at 1, a cylinder at 2 and a doffing mechanism at 3. There is also a condenser unit 4 of known kind with two sets of condenser rubbers 4a and a final delivery roller 4b. This delivers condenser yarns 5 which are then fed over the common guide roller 6 to the spinning unit B where they are led to the respective spinning spindles as is more fully explained below. The spindles in unit B are arranged in two rows, those in the rear row being staggered with respect to those in the front row, the total number of spindles being equal to the number of condenser yarns coming from the condenser 4 of the carding unit A. FIG. 1 also shows an auxiliary yarn supply 7 for use in piecing up when doffing, as described below.

Referring more particularly to FIGS. 2 and 3 and 5, the spinning unit B comprises end frames 8 adjustably carried on feet 9, from which frames the said guide roller 6 is mounted in suitable bearing brackets (not shown). Said end frames 8 carry between them a longitudinal structure or bolster 10 on which are mounted spindle bearings for two rows of spindles 11, these spindles being fitted with the usual driving pulleys 12 for engagement by a snake band or belt 13 in known manner. All the spindles rotate in the same direction and at the same speed, the snake band 13 receiving its drive from a variable speed gear 14 shown in FIG. 11 and referred to in more detail below.

Also carried between the said end frames 8 are longitudinal bars 15 on which are bearings 16 for vertically slidable rods 17, which are in upper and lower parts and are adapted to be raised and lowered through said bearings 16. The raising and lowering movement is effected by poker bars 18 (FIG. 2) under the control of bell cranks 19, which in turn are oscillated by a connecting rod 20 from the usual cam shaft (not shown) which in turn is driven from the variable speed gear 21 (FIG. 11), the several bell cranks 19 being coupled together by a coupling rod 19a for simultaneous movements. The poker bars 18 therefore impart a "chase" movement to the said rods 17, and the actual drive for this movement may be of any known kind. The said rods 17, and the cop-building structure carried by them (described below) are counter-weighted by balance weights 22 held on the ends of chains 23 which pass over the chain sprockets 24 on a shaft 25.

Between the upper and lower portions of the said vertical rods 17 is a rectangular frame structure comprising longitudinal members 26 connected together by vertical spacers 27, said spacers 27 also constituting vertical guides for the rear end of ring-carrying arms 28. Said arms 28 are counter-balanced by weights 29, see for example FIG. 1.

Also extending between the members 26 are vertical screws 30, one for each ring-carrying arm 28, on the lower end of each of which screws is a bevel wheel 31, see FIG. 10 meshing with a complemental bevel wheel 32 on a horizontal shaft 33 extending across the machine. This shaft 33 will be driven by a chain drive on a toggle linkage (not shown) the toggle linkage straightening and flexing as the shaft 33 rises and falls during the chase movements. The chain sprockets will be co-axial with the pivot points of the said linkage and the shaft 33 will therefore have a continuous rotation despite its rising and falling movements. The screws 30 may be enclosed in a resilient bellows type cover 30a, one of which is shown in FIGS. 3 and 4. This serves to exclude dust and fly from the screw threads.

The up and down movement of said frame takes place continuously between fixed limits, which limits are variable for example by varying the connections between the said connecting rod 20 and the bell crank levers 19 or by making variations in the drive to the connecting rod. This up and down movement constitutes a "chase" movement as known in ring spinning frames.

Referring now more particularly to FIGS. 6 and 7, each ring-carrying arm 28 carries in a removable manner two annular ring holders 34. These ring holders have connecting lugs 35 by which they are secured to the arm 28 and each such holder carries a ring 36, provided with a traveller (not shown) and lubricating means therefor in known manner. Each ring 36 lies around and concentric with a spindle 11. In the particular case shown, each arm 28 carries two rings 36, one for a spindle in a front row and the other for a spindle in a rear row. In other cases, there could be only one ring or more than two rings on each arm, as may be convenient.

At its rear end, each said arm 28 is formed or provided with a bearing system 37 having bushes 38 to slide on the said spacers 27 and on the screws 30. Pivotally mounted in each such bearing system 37 is a half-nut 39 adapted by its pivoting movements to enter into and be withdrawn from engagement with the screw 30. This half-nut 39 is pivotally connected at 40 to a push rod 41 which lies alongside the arm 28 and the front end of which has an operating knob 42 between which and the front end 28a of the arm 28 is a compression spring 43. This spring normally moves the rod 41 forwardly so as to pivot the half-nut 39 in a direction (anti-clockwise in FIG. 6) to engage the screw 30, in which position it causes the arm 28, and all that is carried thereby to move upwardly under the driving influence of the rotating screw 30. At the same time however, since the arm 28 when coupled to the screw 30 becomes a part of the rising and falling frame it partakes of the above-mentioned chase movement as well as having a rising movement within the frame.

By pushing the knob 42 inwardly, against the resistance of spring 43, the half-nut 39 can be disengaged from its screw 30, thereby leaving the arm 28, and all that it carries, free to be lowered (and raised) on its guides independently of the chase movements of the frame, and independently of all the other arms 28.

Referring now to FIGS. 8 and 9, each spindle 11 carries a brake disc 44, to be engaged by a brake pad 45 on a shoe 46 which is pivoted at 47 to the adjacent angle member 26 of the said frame. Each shoe 46 has a pull rod 48, the forward end of which is connected to a crank disc or eccentric toggle member 49 freely mounted on a shaft 50 running along the front of the machine. Said member 49, has an operating knob 51 to facilitate its being rotated. When the knob 51 is in the lowered position as shown in broken lines in FIG. 9, the rod 48 is pushed backwards and thereby disengages the brake pad 45 from the brake disc 44 whereas, when the knob 51 is pulled upwardly to the position shown in full lines, said rod 48 is moved forwards and causes the brake pad 45 to engage its brake disc 44. This braking mechanism is quite optional and, although tending to shorten the doffing and donning interval, is not essential to the invention.

Behind each spindle 11 is a vertical guide rod 52 of square section (see FIG. 4), which is fixedly held in the said frame and has a fixed shoulder or collar 53 near its upper end. Slidable on said rod 52, above said collar 53, is a carrier 54 for a hinged lappet 55 having a pigtail guide 56 at its forward end. The normal position of said lappet is its lowermost position where its carrier

54 rests on the collar 53 but, in the later stages of building up the cop, the carrier 54 is engaged by an upward extension 57 on the ring-carrying arm 28 (FIGS. 6 and 7) so that, thereafter, further rising movements of the arm 28 cause the lappet 55 to rise with it. There is therefore a guaranteed minimum distance between the cop and the lappet during the later period of cop building without, during the earlier period of cop building, having too great a distance between the cop and the lappet.

Extending across the front of the machine is a pneumatic tube 58 subjected interiorly to a slight vacuum and, at spaced intervals, inlet holes 59 for a purpose described below.

Referring now to FIGS. 2 and 5, there are provided at the top of the machine pairs of drafting rollers 60 and 61, one pair for each spindle, the lower rollers 60 of each pair being driven whilst the upper rollers are held against the lower rollers removably by resilient means indicated at 62 in FIG. 5. There are two sets of such pairs of rollers, one for the spindles 11 in the front row and the other for the spindles in the back row. The condenser yarns 5 after passing over the guide roller 6 pass over respective guide bars or rollers 63 and then through the pairs of drafting rollers 60, 61 and from thence to the pigtail guides 56 and on to the travellers on the rings 36.

In the preferred arrangements, the guide roller 6 of the spinning unit and the drafting rollers 60 are driven from the carding unit so as always to be in correct synchronism with the rate of the delivery of yarn at the condenser rubbers 4.

This is illustrated diagrammatically in FIG. 11, where the carding engine is driven from the motor 64 by chain 65 and, by countershaft 66 and chain 67 a drive is taken to the condenser unit 4. From the delivery roller 4^b of the condenser unit is a drive through lay shaft 68 to the roller 6 of the spinning unit and, at the other end of that roller are drive 69 and 70 to the two sets of bottom rollers 60. At one end of the spinning unit is a drive box 71 containing the electric motor 72 which, through the variable gear drives 14 and 21 mentioned above drives the spindles and the cop-building mechanism.

In use, the machine operates continuously, the carding unit supplying a continuous flow of condenser yarns from the condenser rubber 4^a, and delivery roller 4^b, and the spinning unit consuming this supply without requiring periodic interruption. In the particular machine illustrated, the carding engine is adjusted to give the desired weight of yarn at the condensers 4 so as to make the introduction of drafting systems in the spinning unit unnecessary. In other machines one or more drafting systems may be included between the condenser unit 4 and the said rollers 60, 61, preferably as an integral part of the spinning unit B.

On first starting up the machine, the spinning at the various spindles 11 is commenced not at the same time, as in a normal ring frame, but in a sequence, pair by pair, usually from one end of the machine to the other. At each spindle, the ring carrying arm 28 is in its lowest position when spinning begins. This means that after the machine has been running for a while, the ring carrying arms 28 are at progressively lower levels along the machine since they commenced their rising movement from the initial position at successively later time instants. Similarly, the completion of cop building on the various spindles takes place in the same sequence and, accordingly, when the pair of cops at the highest arm 28 are ready for doffing, the respective ring carrying arm 28 may be disengaged from its lifting screw 30 and lowered to its initial position, thereby making space available for those full cops to be doffed and empty cops donned. Before actually doffing a spindle, the operator brings the spindle to rest by means of the brake mechanisms 51—45, and also breaks the yarn between the corresponding drafting rollers 60 and 61 and the pigtail guide 56. The

yarn end, still coming from the drafting rollers is passed into the nearest hole 59 of the pneumatic tube 58 so that, during the doffing period, the yarn which continues to be fed from the carding unit passes into the pneumatic tube and is collected at a suitable receiver, in known manner, and eventually fed back to the carding unit. After the donning of the empty cop, the operator winds on to it a short length of "bunch" of yarn from the auxiliary 7 (FIG. 1), then again brakes the spindle 11, severs the yarn between the said bunch and the auxiliary supply, severs the yarn entering the pneumatic tube 58 and then pieces together the yarn end of the bunch on the cop carried by the spindle 11 and the yarn end coming from the drafting rollers. The spindle 11 is then released for spinning to commence.

It is apparent therefore, that an operator may set the various spindles spinning at such time intervals that cops are completed at the same intervals, say first at one end of the machine and then progressively along the machine, and the intervals need be of only sufficient duration to give the operator time to doff the full cops and replace them by empty ones. As a result, the machine runs continuously without simultaneous interruption of all the spindles and without requiring any change in the output of the carding unit.

In those modifications of the invention where a parallel build-up is effected at the spindles 11 as distinct from the cop build-up with a chase motion, the arms 28 will be replaced by the normal continuous ring rail to which a simple up and down movement will be imparted in known manner, either at a constant stroke or at a varying stroke as is known in the art. Doffing and donning would take place spindle by spindle, each spindle being doffed while the ring rail is in the lower region of its traverse.

Other means for the gradual raising of the ring holders 28 in said frame may be adapted in the place of the screw and nut mechanisms described. For example, there may be for each ring holder 28, an endless chain passing over upper and lower sprockets in the frame with means operated similarly to the rod 41 for clutching and declutching one of said sprockets to and from a driving source, such as the shaft 33; or with means for connecting and disconnecting the ring holder to and from the chain. Either of these arrangements would allow the ring holders to be moved to the lowermost position selectively. In another alternative, a notched bar and ratchet mechanism is used, the bar, or a slide thereon, being raised notch-by-notch to raise the ring holder, and being held by a retaining pawl in such a way that withdrawal of the pawl allows the ring holder to slide freely down the bar to be brought again to its lowest position.

In another arrangement, instead of the push rod 41, a pull rod is provided for pivoting the half-nut 39 into and out of engagement with the screw 30, and a lever for operating that rod is pivoted at the front end of the arm 28 in such a way that the operator may grasp both the arm and the lever to squeeze them together against spring pressure to release the half-nut from the screw 30, the lever returning to its initial position when released, to re-engage the half-nut into the screw.

The selective doffing of individual spindles or of small groups of spindles, in a succession or series, without having to stop the machine, may be carried out in a reverse way to that described, namely by having the ring holders normally stationary and by the spindles themselves rising and falling through the rings and building up the cop, each spindle being selectively engageable with and disengageable from the lifting mechanism so that, at the time of doffing, the spindle may be brought to a lowermost position. In such an arrangement, a normal, continuous ring rail could be used or, if desired, the ring rail could be in end to end sections, each temporarily displaceable to give more room for the don-

ning and doffing movements. In another example, the ring holders (or spindles) could participate in a chase motion only and the spindles (or ring holders) have the building up motion only, but in all cases so that the rings and spindles may be brought to their starting position selectively for doffing individually or in groups without stopping the machine.

What we claim is:

1. In a machine for the continuous production of spun yarn from condenser yarns and incorporating traverse and chase mechanisms comprising in combination, a carding unit and condensers for delivering condenser yarns, a ring spinning unit for receiving the condenser yarns from said carding unit and winding them in successive conical layers by a chase motion, said ring spinning unit including a ring carrying rail being divided into a plurality of sections, each of the sections carrying at least one ring, each of the sections being individually disconnectible at a higher position from the traverse and chase mechanisms and being returnable to a lowermost initial position for recoupling to the traverse and chase mechanisms.

2. In the machine as set forth in claim 1 having a chase motion common to all of the rings of said ring spinning rail and operating between fixed limits, including a driving member for imparting a build-up motion to the spindles and releasable clutch means between said driving member and the respective ring section whereby any ring section may be selectively caused to partake of the chase motion at any position in the build-up of the package with the ring sections and spindles being selectively brought to their starting positions for individual doffing.

3. In the machine as set forth in claim 2 wherein said driving member is a constantly rotating screw, and said clutch means is a half-nut on a member carrying the ring section, with means for pivoting said half-nut into and out of engagement with said screw.

4. In the machine as set forth in claim 3, including lappets for guiding the yarn to the travellers on the rings, the lappets being vertically adjustable between a normal lower position and a higher position and adapted to partake of the traverse movement of the ring during the later stages of building up the package.

5. In a machine for the continuous production of spun yarn from condenser yarns and incorporating traverse and chase mechanisms comprising, a carding unit and condensers for delivering condenser yarns, a ring spinning unit for receiving the condenser yarns from said carding unit and winding them in successive conical layers by a chase motion, said ring spinning unit including a plurality of spinning heads, each of the spinning heads of said ring spinning unit having a ring for a spindle independently releasable from the chase motion and returnable independently to the starting position, said ring spinning unit including a frame extending across the machine and to which a constant chase motion is imparted, said frame including a plurality of vertical guides, a ring-holding arm on each said vertical guide, a constantly rotating lifting screw for each said arm, and a retractable half-nut on said arm for engagement with and disengagement from said lifting screw.

6. In a machine for the continuous production of spun yarn from condenser yarns and incorporating traverse and chase mechanisms comprising, a carding unit and condensers for delivering condenser yarns, a ring spinning unit for receiving the condenser yarns from said carding unit and winding them in successive conical layers by a chase motion, said ring spinning unit including a plurality of spinning heads, each of the spinning heads of said ring spinning unit having a ring for a spindle independently releasable from the chase motion and returnable independently to the starting position, and one or more drafting systems between the condensers of the carding unit and the spinning heads of said ring spinning unit.

7. In a machine for the continuous production of spun yarn from condenser yarns and incorporating traverse and chase mechansims comprising, a carding unit and condensers for delivering condenser yarns, a ring spinning unit for receiving the condenser yarns from said carding unit and winding them in successive conical layers by a chase motion, said ring spinning unit including a plurality of spinning heads, each of the spinning heads of said ring spinning unit having a ring for a spindle independently releasable from the chase motion and returnable independently to the starting position, the means within said ring spinning unit for advancing the yarn towards the spindles being driven from and in synchronism with said carding unit while the spindles and the build up motion are driven from a separate source.

8. In a machine for the continuous production of spun yarn from condenser yarns and incorporating traverse and chase mechanisms comprising, a carding unit and condensers for delivering condenser yarns, a ring spinning unit for receiving the condenser yarns from said carding unit and winding them in successive conical layers by a chase motion, said ring spinning unit including a plurality of spinning heads, each of the spinning heads of said ring spinning unit having a ring for a spindle independently releasable from the chase motion and returnable independently to the starting position, and a pneumatic suction system for taking away the yarn fed from the condensers during the periods of doffing and donning of the spindles.

9. In a machine for the continuous production of spun yarn from condenser yarns comprising in combination, a carding unit for delivering condenser yarns, a ring spinning unit for receiving the condenser yarns from said carding unit and winding them in successive conical layers by a chase motion, said ring spinning unit including a small group of spinning heads to be doffed simultaneously, the group of spinning heads having a group of rings for groups of spindles independently releasable from the chase motion and capable of being returned independently to the starting position.

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