Sept. 15, 1942. L. M. COTCHETT 2,295,935

SPINNING, TWISTING, AND SIMILAR TEXTILE MACHINE

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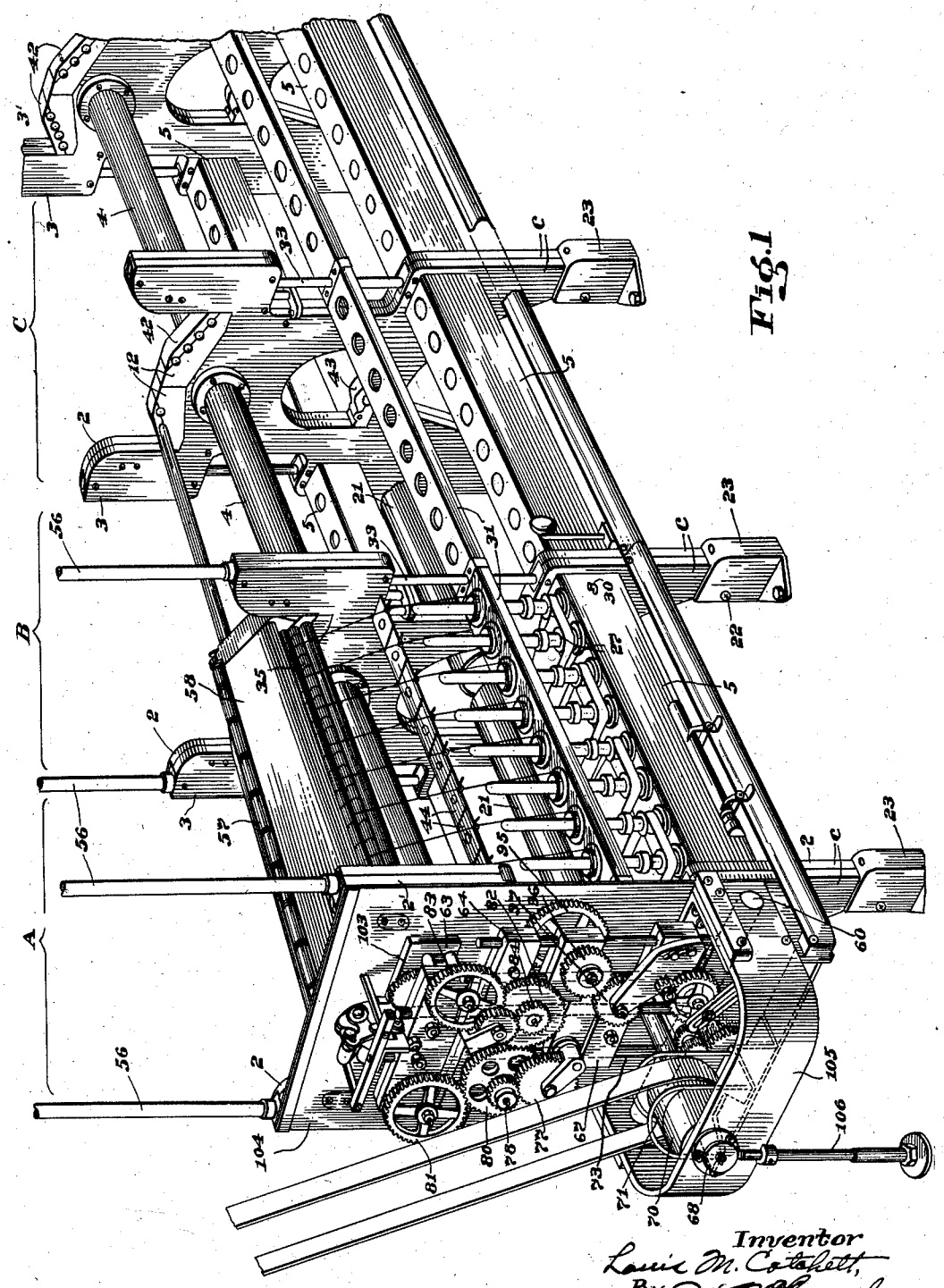

Fig. 1

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SPINNING, TWISTING, AND SIMILAR TEXTILE MACHINE

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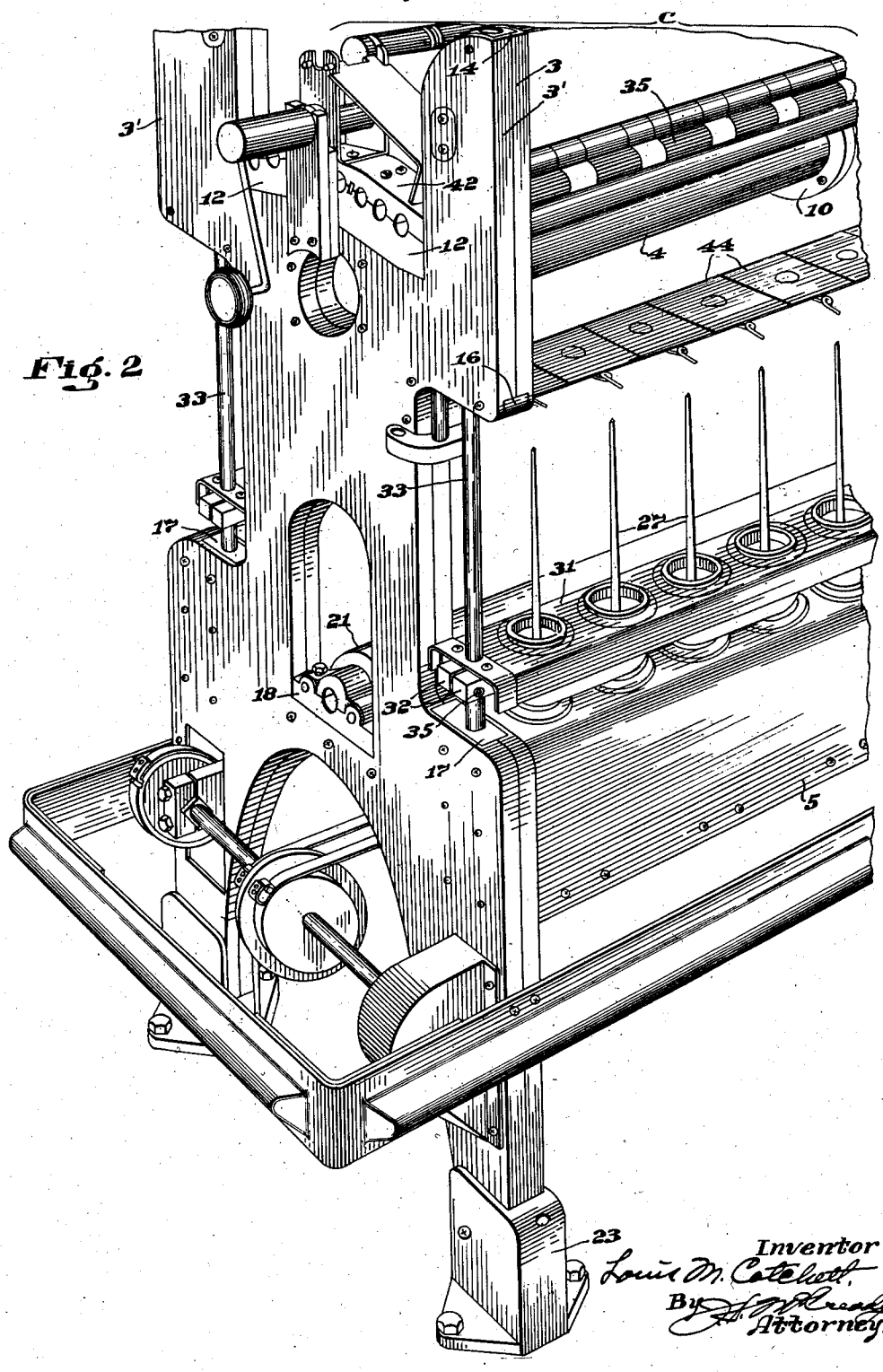
Fig. 2



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SPINNING, TWISTING, AND SIMILAR TEXTILE MACHINE

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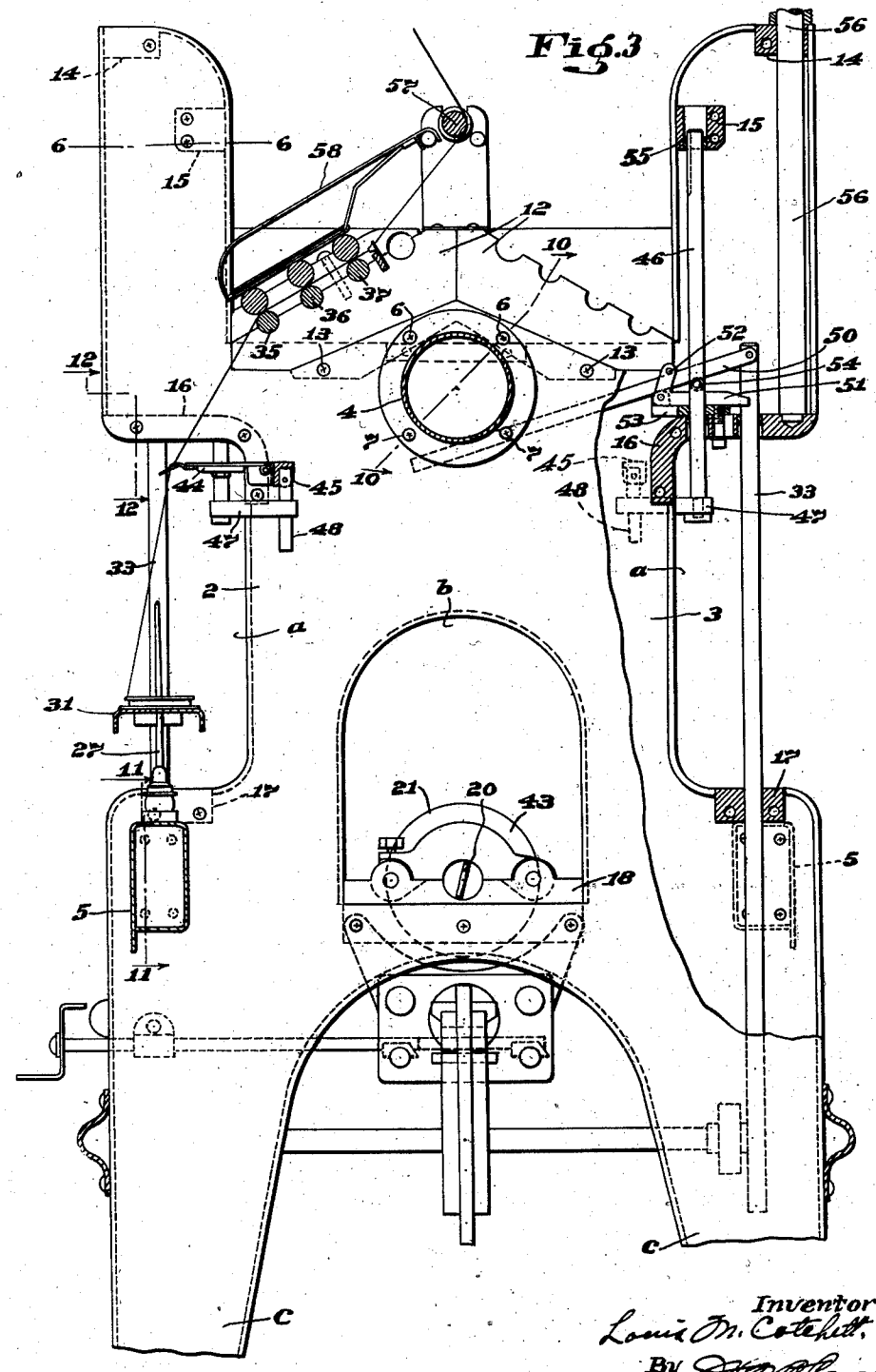
Fig. 3



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SPINNING, TWISTING, AND SIMILAR TEXTILE MACHINE

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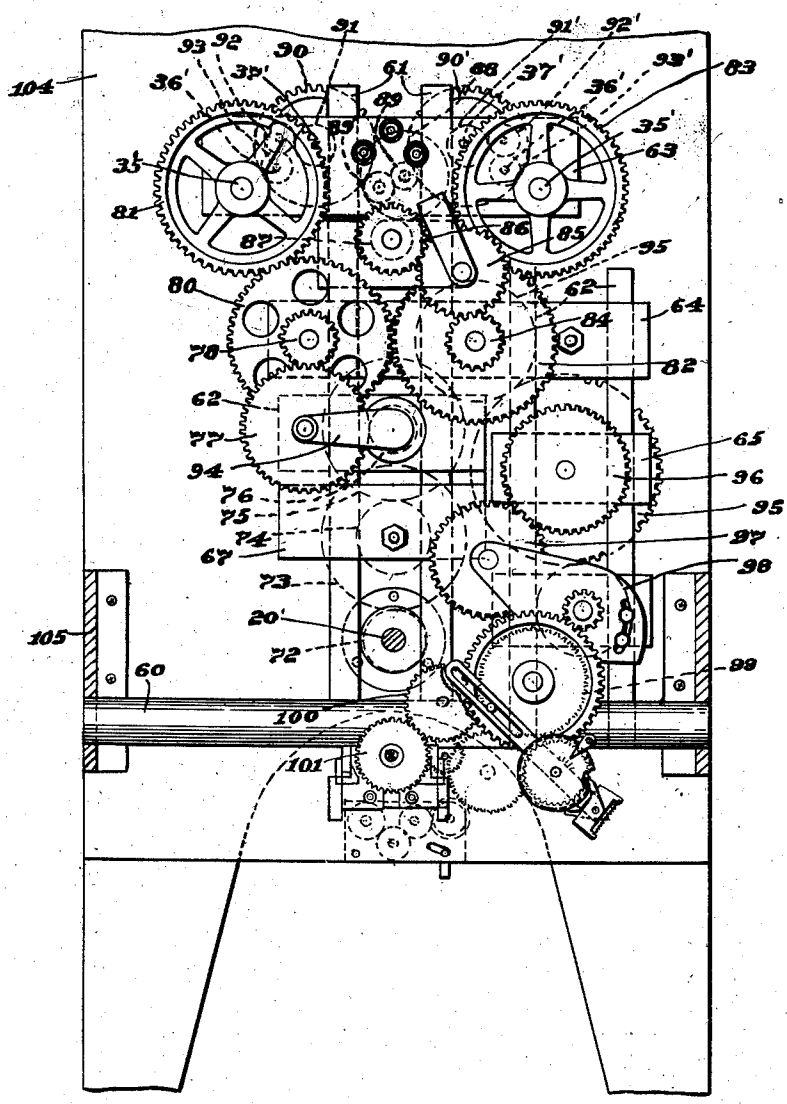
Fig. 4



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SPINNING, TWISTING, AND SIMILAR TEXTILE MACHINE

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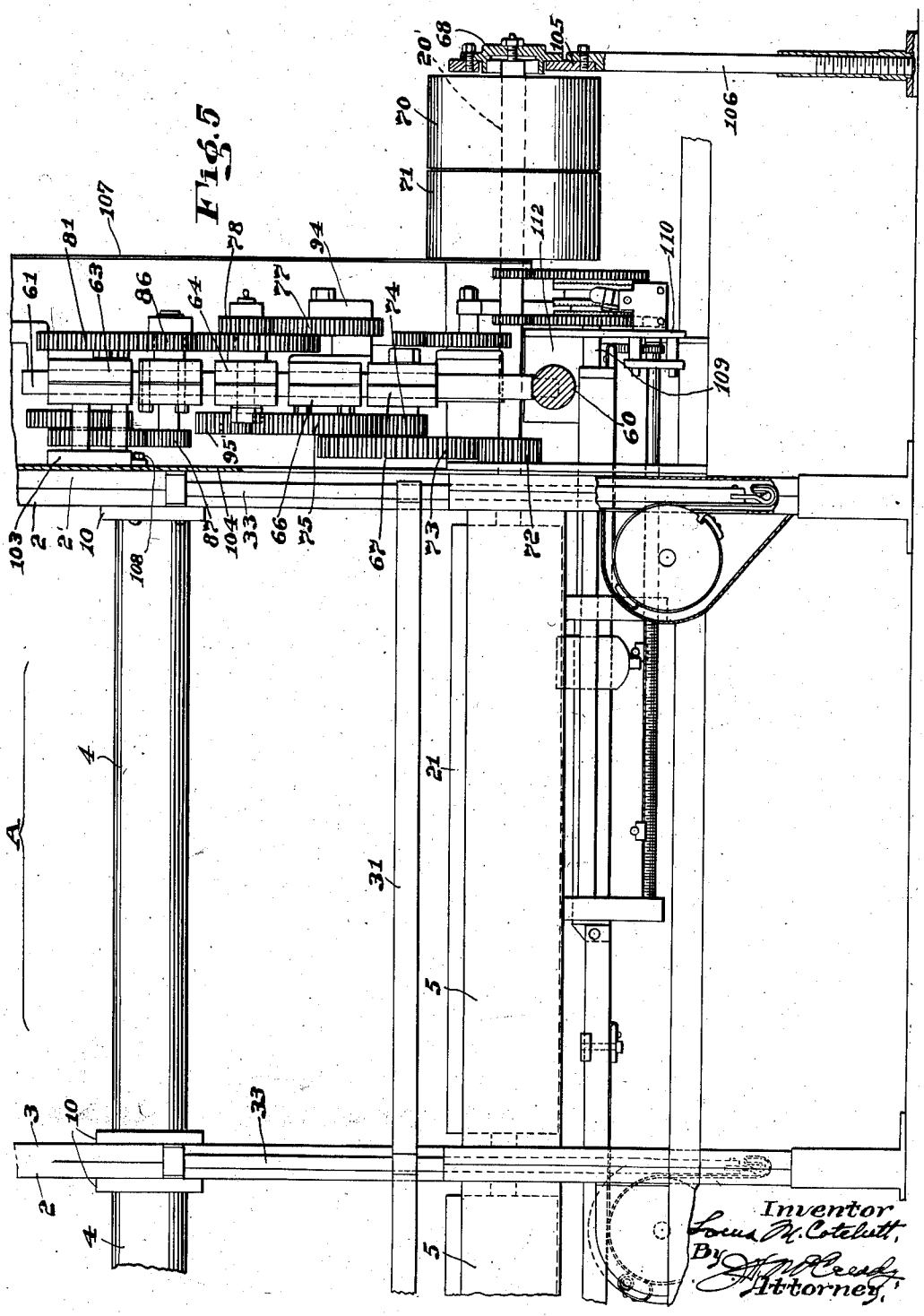
Fig. 5



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SPINNING, TWISTING, AND SIMILAR TEXTILE MACHINE

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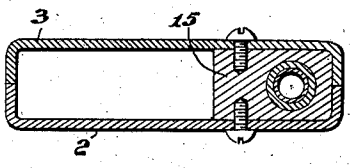
Fig. 6



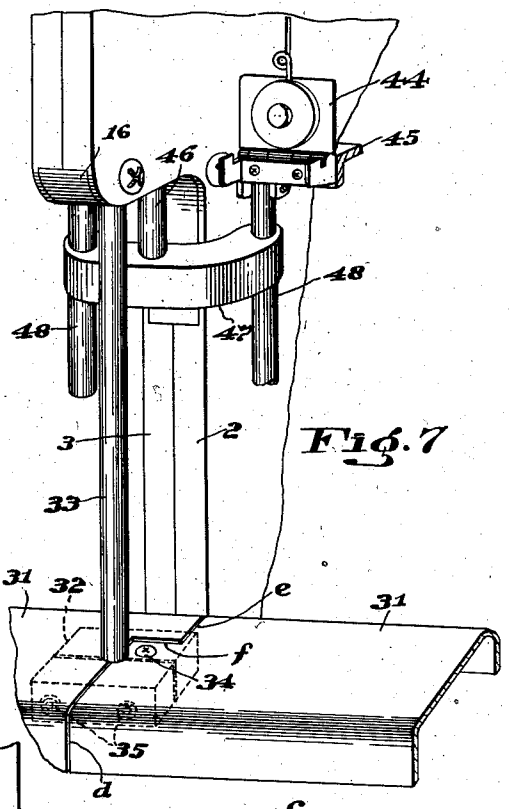


Fig. 7

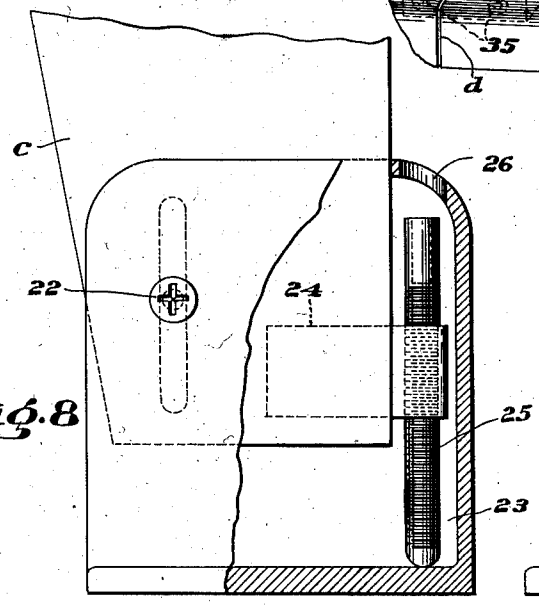


Fig. 8

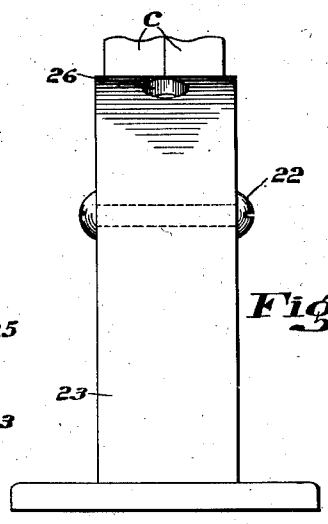


Fig. 9

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SPINNING, TWISTING, AND SIMILAR TEXTILE MACHINE

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Fig. 12

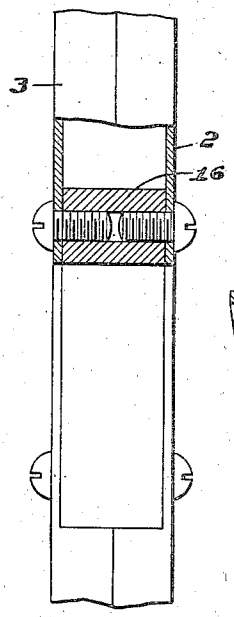


Fig. 10

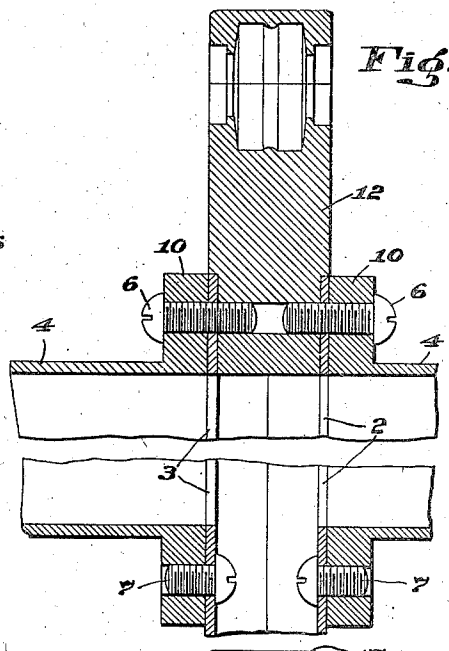


Fig. 13

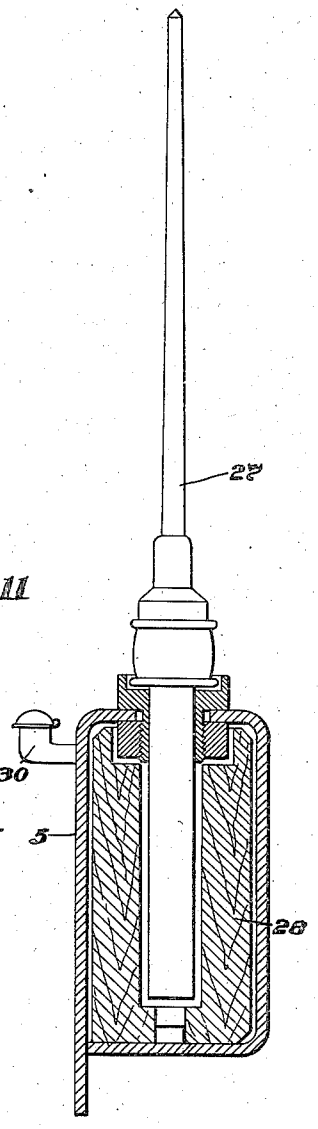
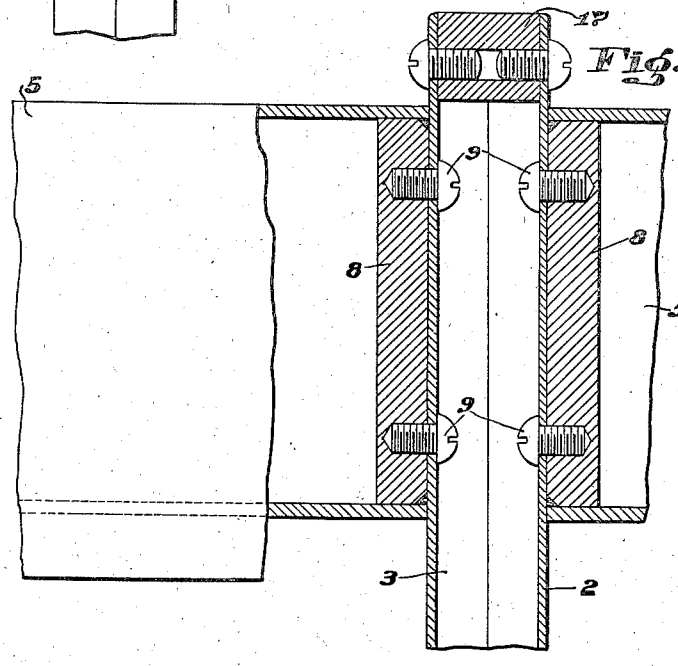


Fig. 11



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SPINNING, TWISTING, AND SIMILAR TEXTILE MACHINE

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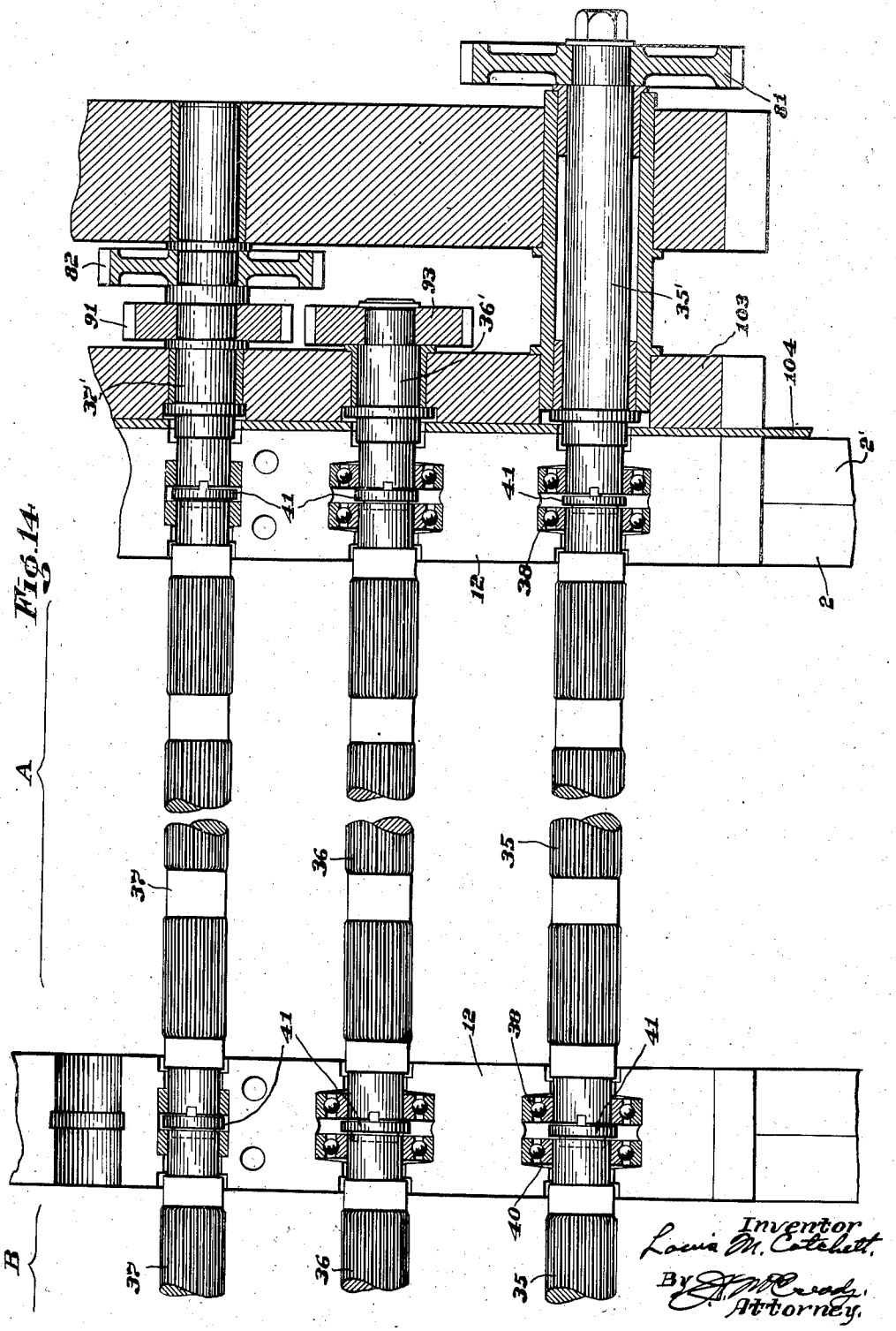

Fig. 14.

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SPINNING, TWISTING, AND SIMILAR TEXTILE MACHINE

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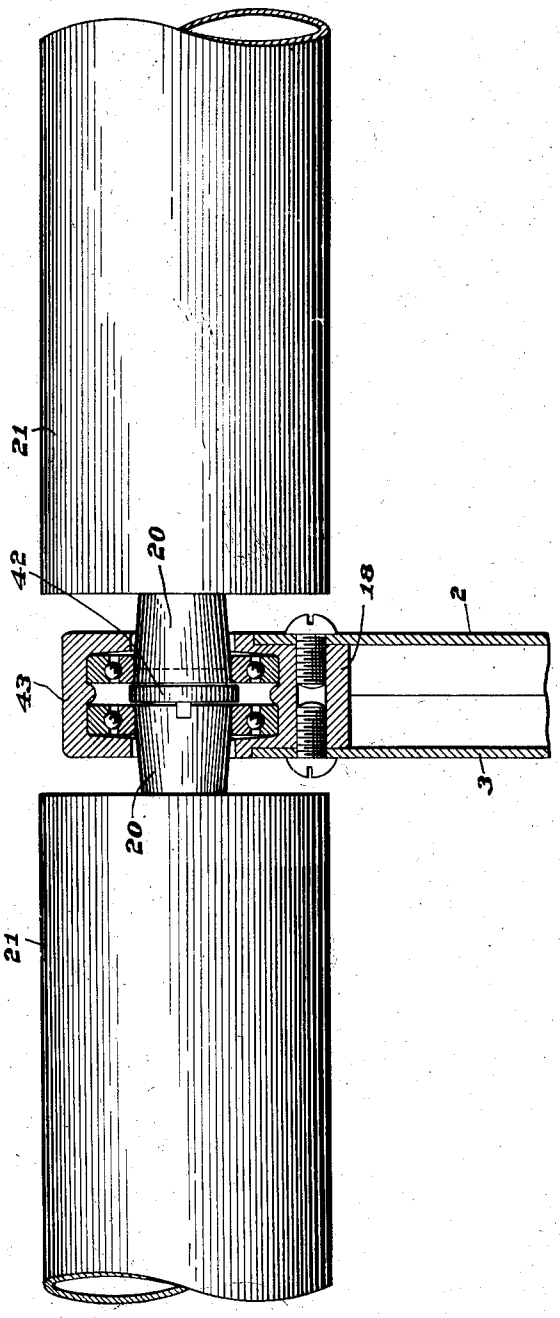

Fig. 15

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Patented Sept. 15, 1942 2,295,935

UNITED STATES PATENT OFFICE

2,295,935

SPINNING, TWISTING, AND SIMILAR TEXTILE MACHINES

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Application April 30, 1940, Serial No. 332,465

42 Claims. (Cl. 57—1)

This invention relates to spinning, twisting and roving frames and other textile machines adapted to be built in sectional form, all of which will be hereinafter referred to generically as "spinning frames."

In manufacturing these machines according to the methods heretofore used commercially, various parts of the frame structure, usually consisting chiefly of castings, are produced, machined and assembled. The spindles and drawing rolls later are installed, together with the builder motion, the head-end mechanism and the other accessories and details, the various parts are adjusted, and the frame is operated for a sufficient length of time to develop and cure any mechanical defects. Thereafter the machine is disassembled and shipped to the mill which has purchased it. There the machine is again assembled and adjusted for commercial operation. This erecting and adjusting operation is performed carefully to the end that, when the machine is left, it shall be in as perfect running condition as possible.

After any such machine has been in operation for a year or thereabouts, it is practically always found that difficulties of one kind or another begin to make their appearance. For example, there may be an increase in the number of "ends down" in the course of a day's run, the quality of the yarn may begin to decline, mechanical failures may appear, and an increase in power consumption nearly always occurs. This is practically always the history of a spinning frame after it has been in operation for a considerable length of time.

A searching investigation for the reasons involved in such developments shows that misalignment of the bearings which support the long lines of rolls or shafting is the most important cause. These machines are relatively long, frames of from fifty to sixty feet in length being common. They necessarily are supported on the mill floor, and as time goes on, parts of the floor on which the machine rests undergo unequal changes in level. These changes are transmitted to the frame and create a misalignment of the bearings in which the drawing rolls or the cylinder shaft run, thus causing the rolls or shaft to chafe and wear, and disturbing the correct relationship of the various spinning instrumentalities to each other, with such results as those above mentioned.

The obvious remedy is to take the machine out of production and level it up thoroughly. In the meantime, however, the various machine parts have become worn to different degrees and in various ways because they have been run in a misaligned condition. Consequently, they must be repaired or replaced in order to restore the machine again to its proper running condition.

These considerations have long been recognized, and it is customary in most mills to shut down spinning frames at stated intervals for overhauling and realignment.

A further condition in this branch of the textile industry with which the present invention is concerned, is the fact that it has been the practice from time out of mind to manufacture spinning frames solely to order. In other words, the machines are custom made. While in some measure this practice has been due to the natural tendency to cater to the ideas of the customers, far more important reasons have been the nature of these machine structures and the necessity for accommodating the great number of gauges,—i. e., the distance between the center lines of spindles.

Serious objections to this practice, however, are that it greatly increases the expense of manufacture and it makes anything approaching prompt delivery impossible, especially in view of the very extensive use of cast iron throughout the machine.

The present invention deals especially with the foregoing conditions, and with the problem of overcoming them. It aims to devise a spinning frame which will accommodate the misalignments caused by the unpredictable and inevitable changes in floor level, to do away with most of the cast iron formerly used in machines of this character, and particularly to devise a construction which lends itself to standardization so that the parts can be carried in stock and a resultant flexibility in manufacture, production and delivery can be realized.

Referring now to the drawings which illustrate a typical embodiment of the invention,

Figure 1 is a perspective view of a portion of a spinning frame constructed in accordance with this invention, the machine being partially dismantled;

Fig. 2 is a perspective view of the opposite end of the frame from that shown in Fig. 1;

Fig. 3 is a vertical, transverse, sectional view of the frame with many of the spinning instrumentalities omitted, some of the parts broken away and others shown in section;

Fig. 4 is a front elevation showing chiefly the gearing at the head end of the machine;

Fig. 5 is a side elevation, with some parts in

section, of the head end and portions of the first section of the frame;

Fig. 6 is a horizontal, sectional view approximately on the line 6—6, Fig. 3;

Fig. 7 is a perspective view showing the relationship between one of the lifter rods, the ring rail, and a portion of the thread board;

Figs. 8 and 9 are side and edge views, respectively, of a foot which rests on the floor and supports parts of adjoining frame sections;

Figs. 10, 11 and 12 are sectional views approximately on the lines 10—10, 11—11 and 12—12, respectively, Fig. 3;

Fig. 13 is a vertical, sectional view through the spindle rail;

Fig. 14 is a horizontal, sectional view on the plane of the lower drawing rolls at one side of the machine frame and illustrates the manner in which these rolls are connected with each other and with the gears at the head end; and

Fig. 15 is a side view, partly in section, showing the manner in which the cylinder is supported.

Preliminary to a detailed description of the various parts of the machine, it may be pointed out that in order to deal with the problems of misalignment and standardization above referred to, this invention proposes to make a spinning frame in relatively short standard sections, connected together end to end in such a manner that they can accommodate themselves individually to variations in floor level. Each section is a substantially complete spinning unit. A head end mechanism common to all the sections is provided to operate them. It consists of a unit independent of said sections and it drives the first section directly but each subsequent section is driven from a preceding section. The rolls and the cylinder shaft for each section are so supported that they can align themselves in their own bearings regardless of the fact that corresponding rolls or shafts of adjoining sections, and which they drive or which are driven by them, may be out of alignment with them. In other words, the rolls and shafts of each individual unit are held continuously in correct relationship to their bearings and to the other spinning elements with which they cooperate, but the joints connecting corresponding rolls and shafts of adjoining sections accommodate misalignment while still maintaining undisturbed the driving relationship between said parts.

For purposes of explanation a spinning frame composed of three sections only has been illustrated in Fiv. 1, but since all of the sections are substantially identical in construction, any number of them may be assembled to form a single machine having the desired number of spindles. In Fig. 1 these sections are indicated, respectively, at A, B and C, and parts of the last mentioned section are shown in Fig. 2. From these figures and Fig. 3 it will be seen that each section includes a frame comprising two end plates 2 and 3 of unique form. While each of these plates is exactly like the other, the plates at the head and foot of each section are designated by different numerals for convenience of description. Each of these end plates consists of a large piece of metal plate punched or died out to the desired shape and dimensions and provided around practically its entire margin with an edge flange of the nature illustrated in Fig. 6. The machine shown is of the usual duplex type. That is, it includes two rows of spindles, one on each side. Each is associated with its own set of drawing rolls and both sets of spindles are operated from a central driving cylinder. Accordingly, the plates 2 and 3 are made with recesses *a*, Fig. 3, at opposite sides thereof to receive the spindles and the ring rails. The plates also have apertures *b* to take the shaft for the driving cylinder and legs *c* equipped with feet adapted to rest on the floor.

Considering an individual section, it will be observed that its two end plates 2 and 3 are secured rigidly together by a tube 4 and by the two spindle rails 5—5. Each of these parts is made of relatively large dimensions and of such construction that it is well adapted to function as a truss. The tube is provided at opposite ends with flanged heads which are secured to the end plates by two upper screws 6—6 and two lower screws 7—7. The spindle rails are of hollow metal construction, as best shown in Fig. 11 and 13, and are equipped at each end with a plate or plug 8 completely filling the cross-sectional dimensions of the rail and welded to it around its entire edge. Screws 9 passing through the plates 8 secure the opposite ends of each rail to the end plates 2 and 3 of its individual section, as indicated in Fig. 11. Thus these parts 4 and 5 for each section secure the end plates for that section together with the necessary degree of rigidity to hold the bearings for the shafts and the various spinning instrumentalities in the proper cooperative relationship to each other at all times.

In assembling an individual section the end plates and their connecting members 4 and 5 are set up and secured rigidly together, as just described, and such other parts may be added as desired. At any convenient point after the assembly of these frame pieces the number of sections required for the entire machine may then be secured together end to end, as shown in Fig. 1. This fastening of the sections to each other is accomplished partly by the way in which the upper edge of the flanged heads 10—10 of the tube or pipe 4 are secured by the two screws 6—6 to the end plates 2 and 3, both these screws passing through the end plates and being threaded into the roll stands 12—12, as shown in Figs. 3 and 10. Additional screws 13—13, Fig. 3, also secure adjacent portions of these plates to the roll stands. Neither the anchorage of the spindle rails to the plates nor of the screws 7—7 to the heads 10—10 secures adjoining plates to each other, as will be evident from an inspection of Figs. 10 and 11. At several other points, however, bearing blocks are secured between the plates by screws which pass through the respective plates and are threaded into the blocks so that the plates are secured together at these locations. Such bearings are shown at 14, 15, 16 and 17, Fig. 3, and the fastening of the bearing pieces 15, 16 and 17 is shown more clearly in Figs. 6, 12 and 11, respectively. It should be observed that the edges of the flanges of adjoining end plates 2 and 3 abut against each other, as shown for example in Fig. 6, and the dimensions of the parts are made such that there is room between the two plates for bearing pieces of substantial thickness.

An additional connection of the plates to each other is made at the bearing 18 for the shaft 20 of the driving cylinder 21, Figs. 3 and 15. Also, the legs *c*—*c* of adjoining end plates are secured together at their lower ends by a bolt 22, Figs. 8 and 9, one of the legs being slotted to provide for relative vertical adjustment of these parts. Both these legs fit loosely into a foot 23, adapted to rest

on the floor, and a block 24, Fig. 8, is welded to one of them and has a screw 25 threaded vertically through it, the upper end of this screw being provided with a socket for the reception of a key or wrench by means of which it may be rotated to change the adjustment of the legs relatively to the floor. A hole 26 in the foot 23 affords access to the screw.

These methods of fastening the plates together and of securing the rails 5—5 and tube 4 to the plates of their respective sections, plus the spacing of these different forms of anchorage, are useful in providing that flexibility of connection of one section to another which is important in enabling the frame, as a whole, to accommodate itself to departures of successive portions of the floor on which it rests from a common horizontal plane.

For example, assume that the floor settles in such a manner as to cause the end plates connecting the sections A and B to sag by a distance of, say, an eighth of an inch with reference to corresponding plates at the head end of the frame. It will be evident by referring to Fig. 5 that as this settling of the end plates occurs, there will be a tendency for the upper edges of the flanges 10 of the tubes 4 to tip toward each other, while their lower edges will tend to swing apart. The upper edges are firmly secured to the roll stands 12—12, Figs. 3 and 10, by the screws 6—6 so that they cannot move but their lower edges are secured to the end plates merely by the screws 7—7. These plates are not fastened together for a considerable distance away from the screws 7—7. They are made of such stock that while they are stable in their own planes they are flexible transversely. Consequently, they can flex under the forces so applied to them. Similarly, at the points 17—17, Figs. 3 and 11, the end plates are firmly secured together, but below these points and at the sides of them, the plates are free from each other. The ring rails 5—5 act here in much the same manner as does the tube 4, and the plates spring slightly under the strain to which they are subjected. The entire transverse springing movement of the portions of the end plates so affected is not great, probably a few thousandths of an inch, but it is sufficient for the purposes of this invention.

Under conditions such as those just described a different action occurs at the end plate 2, Fig. 5, at the right-hand end section A. Here the upper edges of the flange 10 and of the ring rails 5—5 tend to tip outwardly, but they cannot move appreciably because of the fact that they are securely anchored at these points. However, their lower edges can tip inward somewhat by buckling or springing those parts of the end plate to which they are fastened and which are not rigidly secured to the next section.

Thus this construction provides a limited degree of flexibility in the structural members of the sections enabling them to make those movements necessary to adjust themselves to variations in floor level but without disturbing their operative relationship to each other. The thicknesses and kinds of metal of which the end plates should be made to accomplish this result will readily suggest themselves to engineers. However, plates made of soft steel an eighth of an inch to three-sixteenths of an inch in thickness have proved satisfactory.

At the opposite ends of a series of these sections or units, what might be termed "terminal end plates" exactly like those shown at 2 and 3, are secured to the latter to complete the frame structure and to provide for the installation of the lifter rods, bearing blocks, and the like, necessary at these points. In Fig. 1 the terminal plate at the head end of the machine is shown at 2' and that at the opposite end at 3'. These plates are secured to their abutting end plates in the same manner as those above referred to.

Considering again an individual section, each spindle rail 5 supports a series of spindles, preferably arranged in pairs, as shown in section A, Fig. 1, so that they may be driven by tapes in the usual manner. While this construction lends itself to the manufacture of a wide variety of gauges and affords a rate and economy of production substantially greater than the prior arrangements, it is contemplated that for general purposes a standard section will be produced in which the distance between the centers of the first and last spindle may be say thirty inches. Such a dimension will accommodate three common gauges, namely, three inches, three and three-quarter inches and five inches. These may be regarded as fine, medium and coarse gauges. The numbers of spindles in each spindle rail will be ten, eight and six, respectively, for these different gauges. This will satisfy most users. However, the matter of making sections of different lengths for other gauges may be readily accomplished merely by changing the length of the sections.

The spindle rail 5 will accommodate any of the common types of spindles. A typical form is shown in Fig. 13 at 27. This rail construction, however, lends itself readily to the automatic lubrication of the spindles, the bolster of each spindle projecting into an oil well or reservoir common to all the spindles. Because of the size of this well, replenishment of the oil supply need be made at only very infrequent intervals. In fact, it may be desirable to reduce the oil capacity of the well by partially filling it with blocks of wood or other suitable material as shown in Fig. 13 at 28. Oil may be introduced through a filler 30 and may be drained off through a drain hole normally closed by a plug (not shown). The spindles are driven by tapes or bands running over the "driving cylinder" 21 in any usual or convenient manner.

Cooperating with each set of spindles is a ring rail 31. Referring to Figs. 1 and 7, it will be observed that this rail is made in sections meeting approximately at the junction of adjoining frame sections. Opposed ends of the rail sections, however, are cut on transverse lines *d* and *e*, Fig. 7, offset longitudinally of the rail, and these two offset cuts are connected by a lengthwise cut *f*, so that the two adjoining ends overlap lengthwise of the frame while lying in the same plane. Both these end portions rest on a block 32 which is split to embrace a lifter rod 33. The two sections of the block are secured together by screws 35 and are clamped by them firmly to the lifter rod. One end of a rail section is secured to the block by a screw 34 but the opposite end is free and simply rests on the block. Also the cuts *d* and *e* provide a sufficient degree of clearance to prevent the rail sections from jamming as they rise and fall, in the event that the misalignment of adjoining frame sections is such as to produce this effect were it not for the presence of the clearance.

A lifter rod 33 is mounted between each pair of abutting end plates of adjoining sections. Each

rod extends vertically across the space *a*, Fig. 3, in the end plates and it is guided both above and below the ring rail in the bearings **16** and **17**. Thus it is better supported mechanically with reference to its load than in the usual spinning frames. It may be operated by any convenient form of builder motion.

Each bank of spindles must be equipped with a set of rolls for feeding the fibrous strands to it and, if desired, drawing or attenuating these strands. Such feeding and drawing mechanisms may be similar to those heretofore used with machines of this type, but the present invention provides a novel arrangement for supporting and driving them. Each machine section is equipped with two sets of rolls, one for each bank of spindles, and the lower rolls are supported solely by the roll stands **12—12** at opposite ends of the section, no intermediate stands being provided for them. Referring to Figs. 3 and 14, it will be seen that the set of lower rolls includes front, middle and rear rolls **35**, **36** and **37**, respectively. The rolls for section A are driven directly from gearing at the head end but the rolls for each of the subsequent sections are driven from corresponding rolls of a preceding section. Considering first the front roll **35** of section A, Fig. 14, it will be seen that opposite ends of this roll are mounted in ball bearings **38—38**. The adjacent end of the roll **35** for section B is similarly supported in a ball bearing **40**. The opposed end faces of these two roll sections are grooved or slotted diametrally but at right angles to each other to receive the correspondingly disposed tangs or ribs of an intermediate disk-like key **41**. Consequently, this key transmits torque from one roll to the other. Such a coupling structure is known as an Oldham joint. It will be evident that if the sections A and B should become so changed in position as to throw these two roll sections **35** out of alignment with each other, such misalignment would be accommodated by a joint of the character just described because the key **41** can slide radially with reference to each roll while remaining in torque transmitting relation to both. The ball bearings **38—38** are so designed that they will align themselves with any reasonable change in position of the axis of the roll section **35** which they support. And such changes occur due to movements of the floor, as above described. These ball bearings also serve to hold the roll axially positioned in its frame section.

The same construction is used between the opposed ends of corresponding roll sections throughout the machine. As above stated, the frame for each section is inherently rigid so that while such variations in floor level as those above referred to may throw a section out of a level position, the shafts and rolls in that section will still remain in their normal relationship to each other and to their ring rails and spindle rails. Thus the cooperative relationship of the elements of an individual sectional unit of the machine will not be disturbed by such a change in floor level. Also, by providing flexible joints for transmitting torque from each rotary roll or shaft of one section to the corresponding element of the next, the functions of the machine as a whole will not be impaired by such movements of the floor and any chafing of the rolls in their bearings due to these conditions will be effectually avoided.

While the rear roll **37**, Fig. 14, is not mounted in ball bearings, since it revolves at a very low speed, it is given sufficient freedom in its bearings so that it is self-aligning or, if desired, the bearings may be made of some common or suitable self-aligning type. The bearings for the joints connecting the roll sections may be packed with grease or lubricated in any convenient manner. Preferably each roll stand is equipped with a cover **42**, Figs. 1 and 2, held in place by one or more screws.

A similar arrangement is provided for connecting the shaft or shaft sections supporting the tape driving cylinder **21** as shown in Fig. 15. Ball bearings at opposite ends of each cylinder length support its shaft sections for self-alignment. Also, the opposed adjacent faces of the shaft ends at each bearing **18** are grooved at right angles to each other to receive a rotary key **42** having diametral ribs or tangs extending from opposite sides thereof and fitting into said grooves, so that this joint connects the two shaft portions together in torque transmitting relationship and such relationship is not disturbed by any reasonable degree of angular misalignment of the sections. A cap or cover **43** is provided for the bearing.

The customary lappets **44**, Figs. 1, 2, 3 and 7, are utilized to guide the strands from the delivery rolls to the travellers on the rings associated with the spindles, and these lappets are supported on a thread board **45** which may consist simply of a length of angle iron, as shown in Figs. 3 and 7. A very limited traversing movement of this thread board is desirable and a novel arrangement is provided for producing this movement from the motion of the lifter rods **33**. Referring to the right-hand side of Fig. 3, it will be seen that a vertical rod **46** is guided through the bearing blocks **15** and **16** for axial movement. A U-shaped yoke **47**, best shown in Fig. 7, is secured to the lower end of the rod and is curved around the adjacent edge of the end plates **2** and **3**. At opposite sides of this end plate assembly the yoke carries two vertical rods **48—48** and the thread board **45** for any individual section is secured to and is supported on the upper ends of two of these rods located at opposite ends of the section. The traversing movement of the thread board is produced by means of an inclined bar **50**, Fig. 3, pivoted to the upper end of the lifter rod **33** and extending backwardly and downwardly, this bar being located in the space between two end plates. It passes through a slot in a bell crank lever **51** and under a roll **52** carried by said lever, the lever being fulcrumed on a stationary frame piece **53**. As the lifter rod **33** rises, it carries the right-hand end, Fig. 3, of the bar **50** up with it, and in so doing slowly tips the bell crank lever **51** in a counterclockwise direction. The forward arm of this lever lies under and engages a roll **54**, carried by the rod **46**, so that as the lever is slowly tipped it acts on this roll to lift the rod **46** and thus gradually raises the thread board **45**. The same action, of course, takes place at each of the lifter rods so that all the thread boards rise in unison. They are lowered slowly as the lifter rods descend. A key **55**, Fig. 3, lying in a keyway in the rod **46** prevents this rod from turning around its own axis during its traversing movement.

The creel or stand which supports the packages of sliver, roving, or other material to be fed to the spinning instrumentalities is mounted on upright rods or bars **56**, Fig. 1, and each of these bars is supported as shown at the right-

hand side of Fig. 3. That is, the lower end of the rod there illustrated rests in a socket formed in the bearing plate 16 while a higher portion of it passes through and is steadied in the bearing block 14. Preferably the strands to be operated upon are led from the supply packages supported in the creel down around a grooved guide rod 57, Figs. 1 and 3, and are thence guided to the drawing rolls. The latter are covered by inclined plates 58 which shed lint and fly and prevent it from accumulating on the rolls.

As above indicated, the head end mechanism or driving mechanisms for the various operating instrumentalities is a separate unit and is so associated with the spinning sections that it can readily be disconnected from them for repairs or for any other reason, and may be replaced by a new one, if desired. In spinning frames as heretofore constructed, the gearing has been mounted on a large cast iron plate at the head end of the frame, and the bearings for the various rolls and shafts at this end of the frame have been mounted directly on this casting. Consequently, one of the reasons for some of the misalignment troubles experienced with these constructions, has been the fact that this large casting warps and undergoes changes in shape due to its internal stresses. In performing the initial manufacturing operations, care is taken to bore the holes, ream the bushings, and adjust the bearings with great accuracy, but the subsequent warping and distortion of the casting on which they are mounted results, after only a very brief interval of time, in so changing their positions that this accuracy of alignment is lost. And such warping continues for a long time due to the gradual release of strains inherent in the castings.

With a view to overcoming these difficulties in construction of the head end unit, a supporting frame for the gearing is provided comprising a main horizontal bar 60, Figs. 1, 4, and 5, in which the lower ends of two pairs of upright parallel rods or posts 61 and 62 are mounted. Located on one or more of these pairs of posts at suitable intervals are several heavy split brackets, each bracket consisting of two steel plates or bars machined to receive the posts 61 or 62, or both, on which it is mounted, the brackets being adjustably clamped to the posts by any suitable number of bolts. In the particular construction shown the bars and posts are of circular section and may consist simply of standard steel shapes readily obtainable in the open market.

These parts may be easily machined and assembled in such a relationship that all the brackets will be accurately positioned, and because they are produced by fabricating operations which leaves the metal in a stable condition, a frame so made will be free from distortion due to inherent internal strains. The plates of which the bracket is composed may be bolted together and then drilled and reamed to receive the posts, the meeting faces of the plates being spaced sufficiently to give the desired clearance for clamping. Several such brackets are shown in Fig. 4 at 63, 64, 65, 66, and 67.

Mounted partly in this supporting structure and partly in a bearing 68, Figs. 1 and 5, is a shaft 20' in alignment with the shaft sections 20 which support the driving "cylinder" 21 and it carries fast and loose pulleys 70 and 71, respectively, by means of which it may be driven. All of the gearing at the head end of the machine is driven either directly or indirectly through this shaft.

Referring again to Fig. 4, the main train of gearing comprises a pinion 72 fast on the shaft 20'. It meshes with a gear 73 having a pinion 74 revolving therewith and driving a gear 75. Revolving with the latter is a pinion 76 driving a gear 77 which operates through a pinion 78 to drive a gear 80. This gear meshes with another gear 81 fast on the extension 35' of the lefthand lower roll shaft 35, Fig. 14. Another gear 82, like the gear 80 and located beside it and meshing therewith, drives the gear 83 on the extension 35' of the front roll at the opposite side of the frame. From the pinion 84, revolving with the gear 82, motion is transmitted to the rear drawing roll 37 through gears 85, 86, 87, 88, 89, 89', and 90, the last mentioned gear being fast on the shaft 37'. Through intermediate gears 91 and 92 this train also drives a gear 93 on the extension 36' of the middle roll 36. The lower drawing rolls at the opposite side of the frame are similarly driven from the gear 88 through gears 89—90', 91', 92', and 93'. Gear 84 is a draft change gear, the gear or pinion 85 being mounted to accommodate such change.

The twist put into the work depends upon the ratio between the speeds of the front drawing roll 35 and the cylinder 21, and this ratio may be varied by changing the gear 78, commonly referred to as the "twist change gear," its cooperating gear 77 being mounted on a swinging arm 94 so that it can be adjusted to accommodate gears 78 of different diameters.

In order to change the rate at which the yarn will be wound on the bobbin or spool, commonly called the "lay," and which depends on the ratio between the speed of the lower drawing roll 35 and the traversing speed at which the ring rail is driven by the builder motion, the gear 82 drives the builder mechanism through a gear 95, a change gear 96, another gear 97 cooperating therewith and, in the present machine, additional gears 89, 90', 100, and 101 which transmit motion from the change gear 96 to the builder motion. The point at which motion is taken off this train of gears from the gear 97 will depend upon the nature or design of the builder motion, and since this motion may take a great variety of forms, no specific builder construction is here described.

In some places it is necessary to secure additional plates or brackets to the bracket shown, as for example, that illustrated at 103 in Figs. 1 and 5, in order to afford support for certain of the gears at the back of the main part of the frame, or to provide for the attachment of the head end unit to the section A. Also, a plate 104 is secured to the frame at the back of the entire mechanism and is fastened to the end plate 2', Figs. 1 and 5, in essentially the same manner that the end plates 2 and 3 are fastened to each other. A U-shaped support 105, Fig. 1, which carries the bearing 68 and the bar 60, has its opposite ends bolted to the adjacent end plates of section A and is supported partly by them and partly by the pedestal 106. The head end unit is held in place partly by this support 105 and partly, also, by two bolts which pass through the plates 2, 2' and 104, Fig. 5, and are threaded into the flange 10 of the tube 4 in the screw threaded holes normally occupied by the screws 6—6. One of these bolts is shown in Fig. 5 at 108, and it passes through a portion of the bracket 103 projecting

from the lower edge of the main body of said bracket and reduced in thickness.

The head end unit may be removed by taking out the bolts 108 and those which fasten the support 105 to the right-hand end, Fig. 5, of section A. In this particular design it is necessary to remove the gearing which drives the builder motion. Most of this gearing is held in place by a screw threaded into the right-hand end of the shaft 109, Fig. 5. After removing this gearing the supporting plate 110 for the other parts of this mechanism that must be removed can be disconnected from the block or bracket 112 on which it is mounted. This bracket, in turn, is clamped to the bar 60 in the same manner that such brackets as those shown at 63 and 64 are fastened to the upright bars 61. In other designs this removal of the builder motion gears may not be necessary. After removal of this unit it may be repaired and returned again to its operative position, or it may be replaced by a new one, and neither such removal or replacement of the head end mechanism disturbs any of the parts of the spinning sections.

While such removal and replacement is permitted primarily by the fact that the mechanism is made as an independent unit, it is also facilitated by the further fact that the shaft 20' which drives the cylinder shaft 20, and the shafts 35', 36' and 37' which drive the lower drawing rolls, are all connected to their respective rolls or shafts in the spinning unit A, Fig. 14, by disk keys 41, as shown in the latter figure. Thus these shaft sections in the head end will slide freely out of their bearings during removal of the driving mechanism and can be re-inserted again, when desired, and connected up to their respective rolls or shafts by means of the elements 41. These joints are housed in a bearing bracket 12 supported by the end plates 2 and 2' exactly as corresponding joints are mounted in other parts of the frame, and they accommodate any misalignment of corresponding shaft elements of the head mechanism and those in section A. In this connection it may be pointed out that no distinction should be made between the terms "shafts" and "rolls" so far as their cooperation with the flexible joints is concerned, these words being used merely in accordance with the customary terminology in the trade.

A removable casing, partly shown at 107 in Fig. 5, cooperates with the back plate 104 to enclose the gearing in the head end mechanism.

From the foregoing it will be evident to those skilled in this art that the invention provides a machine which represents a radically new solution for the problems dealt with in spinning, twisting and roving frames. Cast iron, with its objectionable features, has been substantially eliminated. The construction of the machine in standard sectional units permits manufacture by more economical methods, for which prior constructions were not adapted. The invention also enables a manufacturer to carry the various parts or assemblies of parts of the machine in stock so that deliveries can be made far more promptly than has been possible heretofore. This fact permits a more uniform and stable manufacturing program to be followed. Shipping expenses also are reduced, and there is not the same need for assembling a machine completely and running it for a considerable period of time before it can be shipped. The ability of these machines to operate normally, efficiently and undisturbed by any change in floor level which may reasonably be expected is an advantage very important to the mill using them because it avoids factors which have heretofore hampered mill production and have adversely affected quality of the product.

While I have herein shown and described a preferred embodiment of my invention, it will be evident that the invention may be embodied in other forms without departing from the spirit or scope thereof.

Having thus described my invention, what I desire to claim as new is:

1. A spinning frame comprising a series of substantially identical sections, each section being a substantially complete spinning unit with its own frame adapted to rest on the floor and with rotary shafts individual to it, means connecting the frames of said sections together end to end to hold them in a definite cooperative relationship to each other, said means and said frames being constructed and arranged to permit relative movement of adjoining frames to enable each of them to accommodate itself to the requirements of the floor on which it rests while supporting the shafts of its own section in substantially fixed operative relationship to the spinning elements with which it cooperates substantially undisturbed by such relative movement.

2. A spinning frame comprising a series of substantially identical sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame rigidly supporting said instrumentalities; means securing the frames of said sections together end to end, and means flexibly connecting the shafts of adjoining sections so as to drive those of one section from the corresponding shafts of the next section.

3. A spinning frame comprising a series of substantially identical sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame supporting said instrumentalities; bearings at the junctions of said sections supporting the ends of the shafts of adjoining sections; means securing the frames of said sections together end to end, and means flexibly connecting the shafts of adjoining sections so as to drive those of one section from the corresponding shafts of the next section.

4. A spinning frame comprising a series of substantially identical sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame supporting said instrumentalities; the frame for each section including structural members supporting the elements of its respective spinning mechanism in a definite and cooperative relationship notwithstanding misalignment of an adjacent section with reference thereto and also including end plates having a limited degree of transverse flexibility, and means securing said end plates of adjoining sections together and thereby connecting said sections end to end.

5. A spinning frame comprising a series of substantially identical sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame and of such rigidity as to support the instrumentalities mounted therein in a fixed cooperative relationship to each other, means connecting the frames of adjoining sections together end to end but permitting limited relative movement between them to enable

the respective frames to accommodate themselves to variations in the level of the floor on which the spinning frame is supported, and mechanism common to all of said sections for driving the spinning instrumentalities of all the sections in unison.

6. A spinning frame comprising a series of substantially identical sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame supporting said instrumentalities; each of said frames including end plates having a limited degree of transverse flexibility and structural members fastened securely to said end plates and connecting them together, and means connecting said sections together end to end, said means including fastenings securing portions of said plates rigidly to each other at points spaced from the points of fastening of said structural members to the end plates, whereby said sections are afforded a limited degree of movement relatively to each other due to the flexibility of the end plates.

7. A spinning frame comprising a series of substantially identical sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame supporting said instrumentalities; bearings at opposite ends of each section supporting said shafts, the shafts of the respective sections terminating at their respective bearings, and coupling means flexibly and releasably connecting the opposed ends of each pair of corresponding shafts at said bearings.

8. A spinning frame comprising a series of substantially identical sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame supporting said instrumentalities; and means securing the frames of said sections together end to end, said instrumentalities including a ring rail, and lifter rods located at the junctions of adjoining sections and supporting said ring rails.

9. A spinning frame comprising a series of sections located end to end; each section having its own set of spinning instrumentalities, including spindles, a driving cylinder, and tapes driven by said cylinder for driving the spindles, each section also including a frame supporting said instrumentalities, means securing the frames of the sections together end to end in cooperative relationship with each other, and means connecting the cylinders of adjacent sections end to end to drive one from another, the last mentioned means having sufficient flexibility to accommodate axial misalignment of adjacent cylinders.

10. A sectional unit for a spinning frame, comprising a set of spinning instrumentalities and means operatively supporting said instrumentalities and including two upright end plates and parallel horizontal structural members secured to and connecting said end plates together and cooperating with them to form a rigid frame, said instrumentalities including horizontal shafts, bearings mounted on said opposite end plates and supporting said shafts, the shafts terminating at said bearings but being equipped with joint elements adapted to cooperate with similar elements of corresponding shafts of another section of like nature to drive shafts of one section from corresponding shafts of an adjoining section.

11. A sectional unit for a spinning frame, comprising a set of spinning instrumentalities including spindles, a ring rail cooperating with them and a rigid frame supporting said instrumentalities in a fixed relationship to each other, said frame including two transversely disposed upright plates at opposite ends of the frame and horizontal structural members fastened to said plates and connecting them together, lifter rods at opposite ends of said unit supporting said ring rail, and bearings mounted on said end plates and guiding said lifter rods.

12. A sectional unit for a spinning frame as defined in preceding claim 10, in which bearings are mounted on said end plates both above and below the ring rail to guide said lifter rods.

13. A sectional unit for a spinning frame comprising a set of spinning instrumentalities including spindles, a ring rail cooperating with them and a rigid frame supporting said instrumentalities in a fixed relationship to each other, said frame including two transversely disposed upright plates at opposite ends of the frame, spindle rails at opposite sides of said frame for supporting the spindles, said rails being rigidly secured to said end plates, and one or more rigid horizontal structural members above the level of said rails, secured to said end plates, and cooperating with said rails to give rigidity to said frame.

14. A spinning frame comprising a series of sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame supporting said instrumentalities; each of said frames including two transversely disposed plates at opposite ends thereof and structural members connecting said plates and securing them rigidly together, the edges of said end plates being flanged and the flanges of each extending toward the next adjacent section, and means securing the end plates of adjoining sections together with the flanges of the plates abutted one against another and the main portions of the plates being spaced apart.

15. In a spinning frame, the combination with spinning instrumentalities and a frame operatively supporting them, of a head end mechanism for driving said instrumentalities, said mechanism including its own individual frame in which elements of the mechanism are supported in cooperative relationship to each other and being organized as a unit independent of the spinning frame, means releasably securing said unit to said spinning frame in cooperative relationship thereto, and joints releasably connecting shafts of said spinning frame with their respective driving elements in said mechanism.

16. In a spinning frame, the combination with spinning instrumentalities including rotary shafts and a frame supporting said instrumentalities, of a head end mechanism for driving said instrumentalities, said mechanism including elements for driving the respective shafts of said spinning frame and being organized as a unit independent of the spinning frame, means releasably securing said unit to said spinning frame in cooperative relationship thereto, and joints releasably connecting the shafts of said spinning frame with their respective driving elements in said mechanism, said joints being capable of accommodating misalignment of said elements with said shafts.

17. A head end section for a spinning frame comprising a main power transmitting element, gearing driven thereby and adapted to drive vari-

ous shafts of a spinning frame, and a frame structure individual to said section and supporting said element and said gearing in cooperative relationship to each other, said section including parts adapting it for attachment to and removal from a spinning frame as a complete and independent unit.

18. A spinning frame comprising a series of substantially identical sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame supporting said instrumentalities; means securing the frames of said sections together, end to end, a head end section for driving all of said spinning sections, said head end section including a frame individual to itself and means securing said head end section releasably to the end of said series of sections and in cooperative relationship thereto.

19. A spinning frame comprising a series of substantially identical sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame supporting said instrumentalities; bearings at opposite ends of each section supporting said shafts, the shafts of the respective sections terminating at their respective bearings, joints releasably connecting the opposed ends of corresponding shafts of adjoining sections to drive like shafts of one section from those of another, and means securing the frames of adjoining sections together end to end.

20. A spinning frame comprising a series of sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame supporting the instrumentalities mounted therein in a fixed cooperative relationship to each other, means connecting the frames of adjoining sections together end to end but permitting limited relative movement between them to enable the respective frames to accommodate themselves to variations in the level of the floor on which the spinning frame is supported, and flexible joints connecting the ends of the shafts of one section to corresponding shafts of the next adjoining section to drive the shafts of one section from those of another, said joints being adapted to accommodate misalignment of the shafts which they connect.

21. A spinning frame comprising a series of sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame supporting the instrumentalities mounted therein in a fixed cooperative relationship to each other, means connecting the frames of adjoining sections together end to end but permitting limited relative movement between them to enable the respective frames to accommodate themselves to variations in the level of the floor on which the spinning frame is supported, and flexible joints connecting the ends of the shafts of one section to corresponding shafts of the next adjoining section to drive the shafts of one section from those of another, said joints including radially slidable members serving to transmit torque from one shaft to the other.

22. A spinning frame comprising a series of sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame supporting the instrumentalities mounted therein in a fixed cooperative relationship to each other, means connecting the frames of adjoining sections together end to end but permitting limited relative movement between them to enable the respective frames to accommodate themselves to variations in the level of the floor on which the spinning frame is supported, bearings at the opposite ends of each section supporting the shafts for that section, and flexible joints connecting the opposed ends of each pair of corresponding shafts at said bearings, said joints including radially slidable members serving to transmit torque from one shaft to the other.

23. A spinning frame comprising a series of sections located end to end; each section having its own set of spinning instrumentalities including rotary shafts individual thereto and a frame supporting said instrumentalities; each of said frames including two transversely disposed upright plates at opposite ends thereof and horizontal structural members connecting said plates and securing them rigidly together, the edges of said plates being flanged and the flanges of each extending toward and abutting against the end plate of an adjoining section, said plates being flexible transversely but stable in their own planes, and means connecting said end plates of adjoining sections together at points spaced substantially from their points of connection to their individual horizontal structural members.

24. A spinning frame comprising a series of sections located end to end; each section having its own set of spinning instrumentalities including rotary shafts individual thereto and a frame supporting said instrumentalities; each of said frames including two transversely disposed upright plates at opposite ends thereof and structural members connecting said plates and securing them rigidly together, and means securing said end plates of adjoining sections together but spaced apart, certain of the operating instrumentalities for said sections being located between the end plates of adjoining sections.

25. A spinning frame comprising a series of sections located end to end; each section having its own set of spinning instrumentalities including rotary shafts individual thereto and a frame supporting said instrumentalities; each of said frames including two transversely disposed upright plates at opposite ends thereof and structural members connecting said plates and securing them rigidly together, the edges of said plates being flanged and the flanges of each extending toward and abutting against the end plate of an adjoining section, said plates being flexible transversely but stable in their own planes, and means connecting said end plates of adjoining sections together, including bearings having parts located between the plates, certain of said operating instrumentalities being supported in said bearings and enclosed between the end plates of adjoining sections.

26. A spinning frame comprising a series of sections, each section being a substantially complete spinning unit and including a set of spindles and a ring rail cooperating with them, means securing said sections together end to end in cooperative relationship to each other, lifter rods supporting said ring rail, a thread board positioned above said ring rail, and connections between said lifter rods and said thread board for causing the traversing movement of the rods to give the thread board a similar traversing movement but of reduced rate and amplitude.

27. A spinning frame comprising a series of sections, each section being a substantially complete spinning unit and including a set of spindles

and a spindle rail in which they are mounted, said spindle rail accommodating an extreme spindle spacing which is a multiple of a plurality of common spindle spacings or gauges, and means securing said sections together end to end in cooperative relation to each other.

28. A spinning frame comprising a series of sections, each section being a substantially complete spinning unit and including its own set of spinning instrumentalities and a frame supporting them, each of said frames including two upright plates at opposite ends thereof and structural members connecting said plates and securing them together, said plates having legs, means for securing two corresponding legs of the abutting end plates of adjoining sections together, a foot in which said pair of said legs is mounted, said foot being adapted to rest on the floor, and a vertically disposed screw cooperating with one leg of said pair and with the foot supporting them for adjusting the relationship of said legs to said foot.

29. A spinning frame comprising spinning instrumentalities including rotary shafts individual thereto and a frame supporting said instrumentalities, a head and mechanism for driving said shafts comprising a frame structure including a plurality of upright posts and brackets mounted on said posts and supported by them, gearing mounted on said brackets, said mechanism being constructed and organized as an independent unit, means releasably securing said unit to said spinning frame, and means for releasably connecting certain of said gears to the said shafts in said spinning frame.

20. A head end section for a spinning frame comprising gearing adapted to drive various shafts of a spinning frame, and a frame structure supporting said gearing, including a plurality of upright posts and plates mounted on said posts and forming brackets supporting various elements of the gearing, said posts holding said plates in aligned relationship to each other.

31. A spinning frame comprising a series of sections, each section being a substantially complete spinning unit and including its own set of spinning instrumentalities and a frame supporting them, each of said frames including two transversely disposed upright plates at opposite ends thereof and longitudinal structural members connecting said plates and securing them together, additional members resting on the floor and supporting said end plates, and means adjustably connecting said frames with said additional members and operable to adjust the corners of said frames independently of each other.

32. A spinning frame comprising a series of sections, each section being a substantially complete spinning unit with its own frame adapted to rest on the floor and with rotary shafts individual to it, means releasably connecting the frames of said sections together end to end to hold them in a definite cooperative relationship to each other, said means and said frames being constructed and arranged to permit relative movement of adjoining frames to enable each of them to accommodate itself to the requirements of the floor on which it rests, Oldham joints connecting together the shafts of adjoining sections so as to drive those of one section from the corresponding shafts of the next section, and mechanism at one end of said series of sections for driving the shafts of all of said sections in unison.

33. A spinning frame comprising a series of sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame supporting said instrumentalities; the frame for each section being adapted to rest on the floor and including structural members supporting the elements of its respective spinning mechanism in a definite and cooperative relationship notwithstanding misalignment of an adjacent section with reference thereto and also including transversely disposed end plates having a limited degree of transverse flexibility, means securing said end plates of adjoining sections together in abutting relationship and thereby connecting said sections end to end, whereby said sections are permitted a limited degree of movement one relatively to another to enable them to accommodate themselves individually to the requirements of the floor on which the machine rests, and flexible couplings releasably connecting together the shafts of adjoining sections so as to drive those of one section from the corresponding shafts of the next section.

34. A spinning frame comprising a series of essentially identical sections located end to end; each section having its own set of spinning instrumentalities, including rotary shafts individual thereto and a frame supporting said instrumentalities; the frame for each section having parts adapted to rest on the floor at opposite ends of the section and including structural members supporting the elements of its respective spinning mechanism in a definite and cooperative relationship notwithstanding misalignment of an adjacent section with reference thereto and also including end members having a limited degree of transverse flexibility, and means securing said end members of adjoining sections together and thereby connecting said sections end to end.

35. A spinning frame comprising a series of essentially identical sections located end to end; each section having its own set of spinning instrumentalities, including spindles and driving mechanisms for said spindles; each section also including a frame supporting said instrumentalities, said spindles, and the driving mechanism for them; means securing the frames of said sections together end to end in cooperative relationship to each other, and means connecting the spindle driving mechanisms of adjacent sections to drive one from another.

36. A spinning frame comprising a series of essentially identical sections located end to end; each section having its own set of spinning instrumentalities, including spindles, driving mechanism for said spindles and rotary shafts individual to said sections; each section also including a frame supporting said instrumentalities, spindles, driving mechanism and shafts; means securing the frames of said sections together end to end in cooperative relationship to each other, and means connecting the shafts and driving mechanisms of adjacent sections to drive one from another including joints connecting the adjacent ends of the shafts of adjoining sections, and bearings at the junctions of said frames supporting said connecting means.

37. A sectional unit for a spinning frame, comprising a set of spinning instrumentalities and means operatively supporting said instrumentalities and including two upright end members and parallel horizontal members secured to and connecting said end members together and cooperating with them to form a rigid frame, said end members being flexible transversely but stable in vertical planes.

38. A spinning frame comprising a series of essentially identical sections, each section being a substantially complete spinning unit and including spinning instrumentalities and rotary shafts individual thereto and a frame supporting said instrumentalities and said shafts, said frame including transversely disposed end members, means securing the frames of said sections together with said transversely disposed members of one section in abutting relationship to those of an adjoining section, means connecting similar shafts of adjoining sections, and mechanism at one end of said series of sections for driving the shafts of all of said sections in unison.

39. A spinning frame comprising a series of substantially identical sections located end to end, each section having its own set of spinning instrumentalities and a rigid frame supporting said instrumentalities in fixed cooperative relationship to each other, and means securing the frames of said sections together end to end in a continuous series.

40. A spinning frame comprising a series of substantially identical sections located end to end, each section having its own set of spinning instrumentalities and a rigid frame supporting said instrumentalities in fixed cooperative relationship to each other, said frame having upright transversely disposed end members, and means securing said end members of adjoining sections together in abutting relationship to each other.

41. A sectional unit for a spinning frame comprising a set of spinning instrumentalities including spindles, and a frame supporting said instrumentalities and comprising longitudinal frame members supporting said spindles, transversely disposed upright members at opposite ends of the frame to which said longitudinal frame members are secured, said end members extending upwardly above said horizontal members and supporting certain of said instrumentalities located in a higher plane than said spindles.

42. A spinning frame according to preceding claim 39, in which said means and said frame are so related as to provide limited flexibility in the connections permitting one section to move out of line with an adjoining section without disturbing the cooperative relationship between the elements of the individual sections.

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