May 3, 1938. W. HOLDSWORTH 2,116,201

GILL DRAWING FRAME

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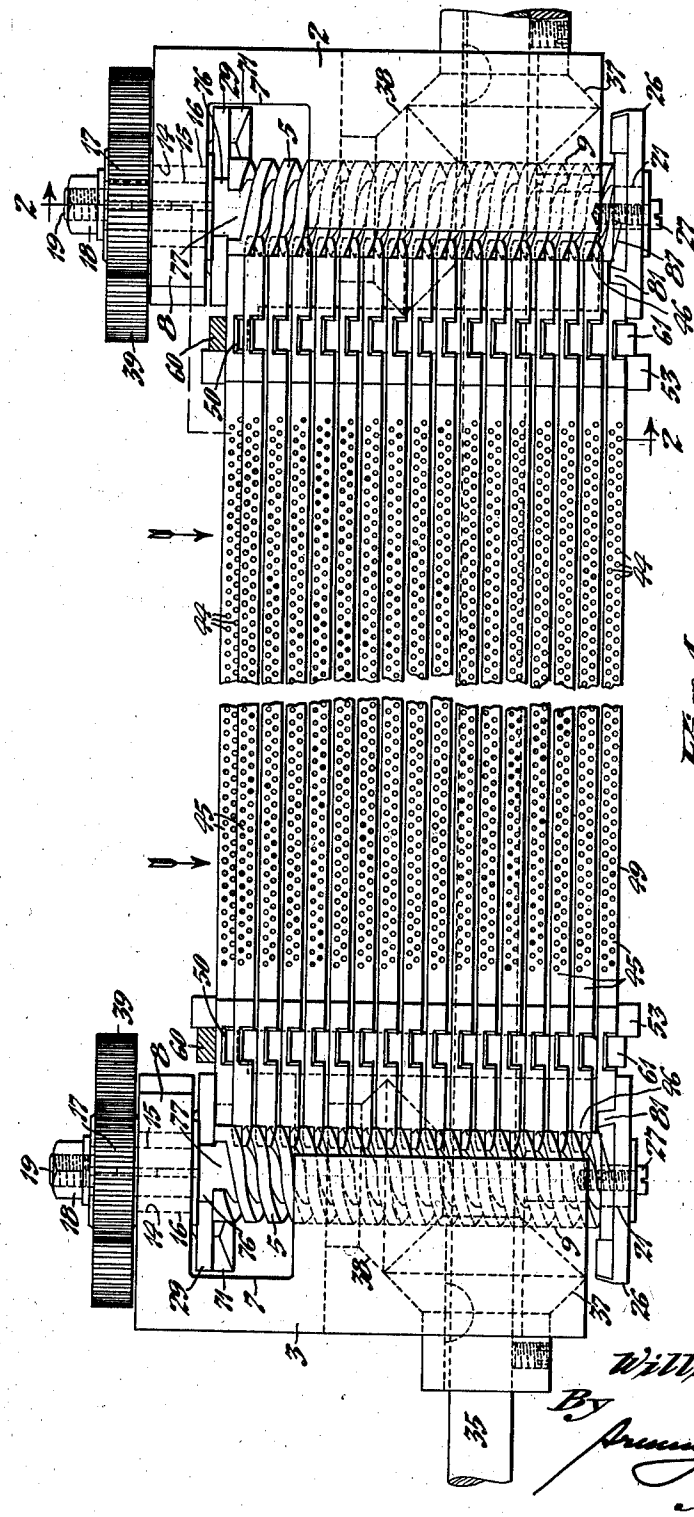


Fig. 1.

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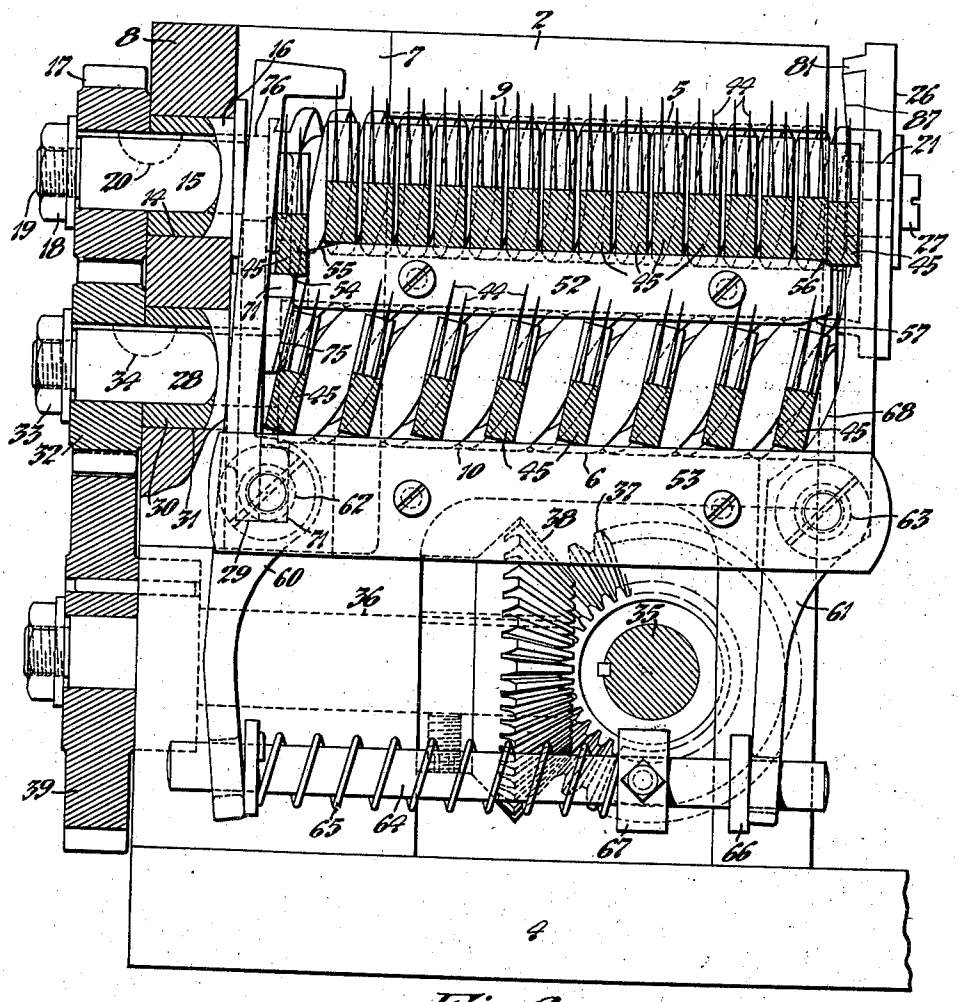


Fig. 2.

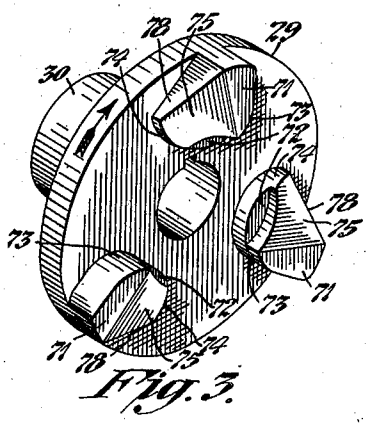


Fig. 3.

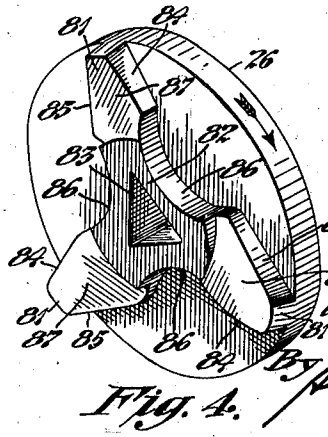


Fig. 4.

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GILL DRAWING FRAME

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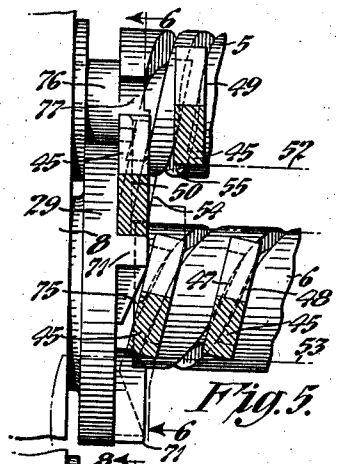


Fig. 5.

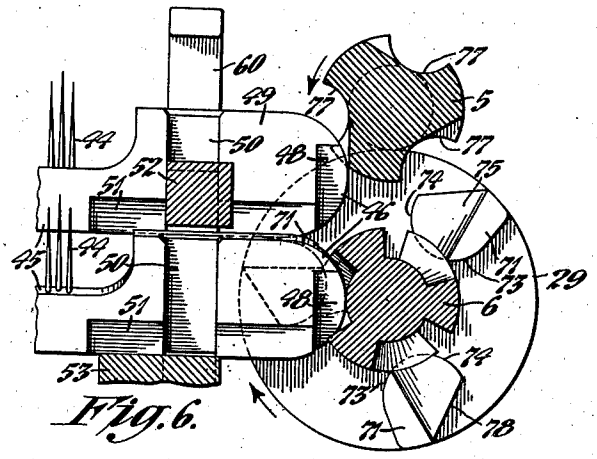


Fig. 6.

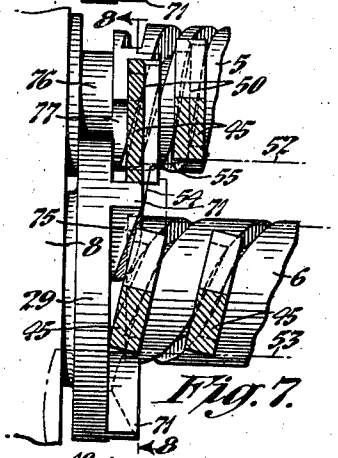


Fig. 7.

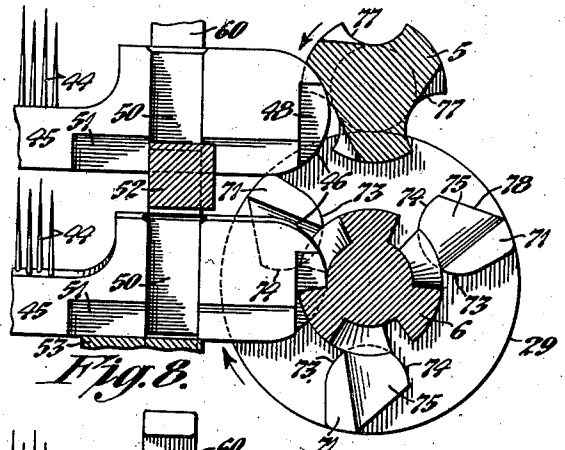


Fig. 8.

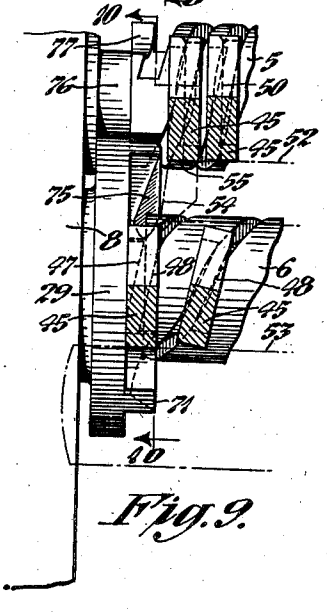


Fig. 9.

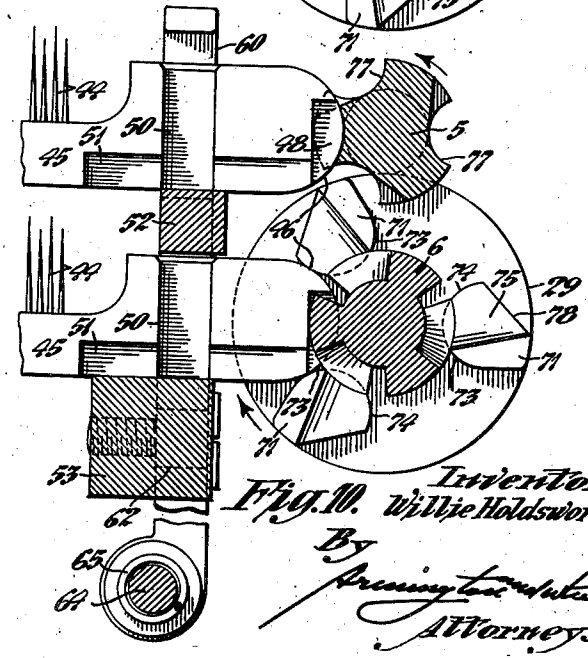


Fig. 10.

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GILL DRAWING FRAME

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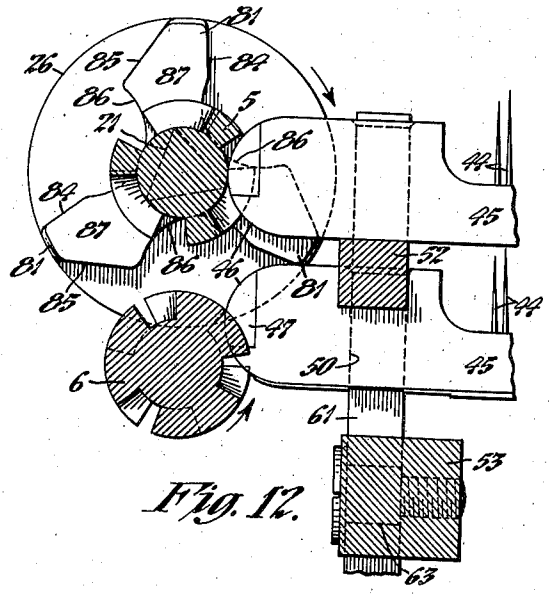


Fig. 12.

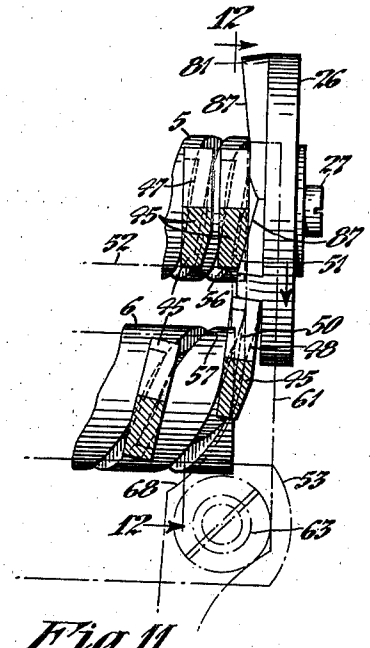


Fig. 11.

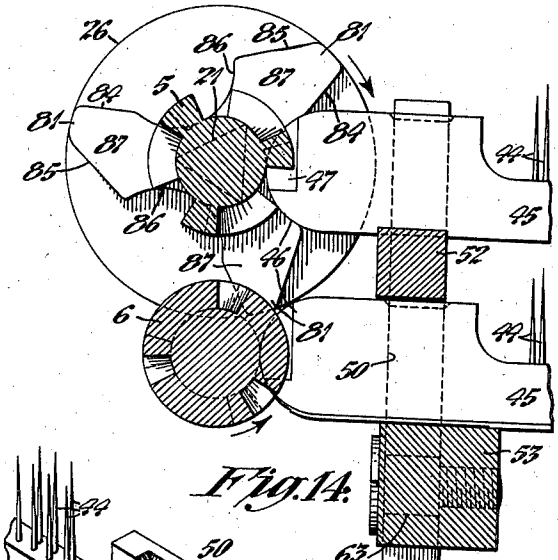


Fig. 14.

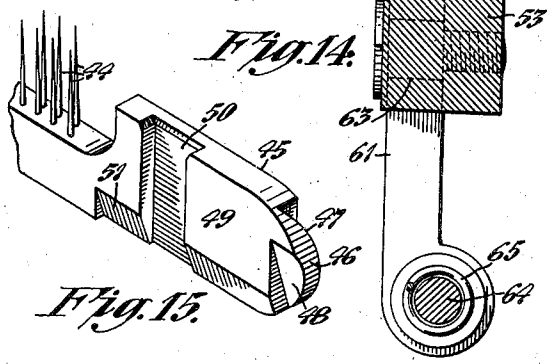


Fig. 15.

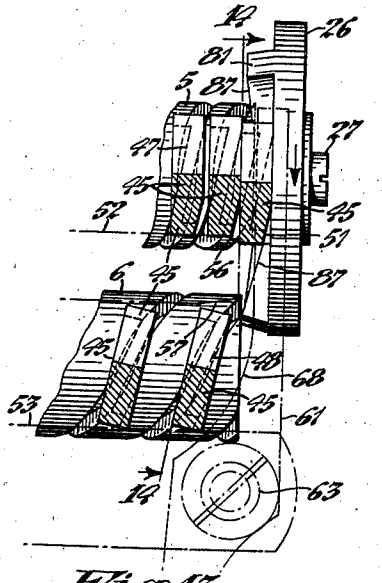


Fig. 13.

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UNITED STATES PATENT OFFICE

2,116,201

GILL DRAWING FRAME

Willie Holdsworth, Seekonk, Mass.

Application February 27, 1936, Serial No. 66,048

16 Claims. (Cl. 19—129)

This invention relates to gill-drawing frames or the like and consists of improvements in the means for traversing the gill-bars or fallers which act on the fibers passing through the drawing rolls of the machine.

The usual gill-drawing frame includes opposite pairs of top and bottom screws which engage the ends of the fallers to traverse the latter through their working and return strokes. At the end of their working stroke in the top screws the fallers are engaged by cams which carry them down into engagement with the threads of the bottom screws. At the end of the return stroke other cams engage the fallers to raise them into engagement with the top screws. During the transfer of the fallers at the end of the working and return strokes they change their direction of movement and heretofore the rate of transfer has limited the speed of traverse of the fallers.

One of the objects of the present invention is to increase the speed of traverse of the fallers through their working and return strokes without increasing the rotative speed of the gill-screws.

Another object of the invention is to provide in a machine of the type indicated means for transferring the fallers from one pair of gill-screws to the other pair at increased speed with means for embracing the ends of each faller to restrain it from undue movement at the beginning of its transfer.

Another object of the invention is to provide cams at the ends of the screws having radially-extending lobes for transferring the fallers, so constructed and arranged that the trailing and leading faces of adjacent cams form pockets for receiving and embracing the ends of the fallers as they are transferred from one pair of screws to the other pair.

Another object of the invention is to provide a machine of the type indicated adapted for smooth and efficient operation at high speed and for use over long periods of time without repair or replacement of its parts.

Further objects of the improvement are set forth in the following specification which describes a preferred form of construction of the invention, by way of example, as illustrated by the accompanying drawings. In the drawings:

Fig. 1 is a plan view of a portion of a gill-drawing frame incorporating the novel features of the present invention;

Fig. 2 is a part sectional view taken through the faller-bars on line 2—2 of Fig. 1 and showing the arrangement of the cooperating top and bottom gill-screws at one side of the machine and the transfer faller-cams at the opposite ends of the screws;

Fig. 3 is a detailed perspective view of one of the cam-disks which are mounted on the ends of the bottom screws for raising the faller-bars therefrom into engagement with the threads of the top screws;

Fig. 4 is a detailed perspective view of one of the cam-disks which are mounted on the ends of the top screws for transferring the fallers therefrom into engagement with the threads of the bottom screws;

Fig. 5 is a part sectional view taken through the faller-bars at one end of the screws and illustrating one of the faller-bars approaching the end of its return stroke in the bottom screws and the relative position of the gill-screws and faller-cam;

Fig. 6 is a transverse sectional view of the gill-screws taken on line 6—6 of Fig. 5 showing the position of the faller-bars in relation to the bottom cam at the time of transfer of a bar;

Fig. 7 is a view similar to Fig. 5 illustrating the relative position of the faller-bars and bottom cam at a time subsequent to that illustrated in Fig. 5;

Fig. 8 is a transverse sectional view taken on line 8—8 of Fig. 7 showing the same relative position of the parts;

Fig. 9 is a view similar to Fig. 5 illustrating one of the faller-bars at the end of its return stroke in position to be transferred to the top screws;

Fig. 10 is a transverse sectional view taken on line 10—10 of Fig. 9 showing the end of one of the faller-bars engaged between the leading and trailing faces of adjacent cam-lobes to restrain it from unwarranted movement at the beginning of the transfer;

Fig. 11 is a sectional view through the faller-bars at the forward end of the screws illustrating one of the fallers approaching the end of its forward or working stroke and another bar being transferred down into the bottom screw;

Fig. 12 is a transverse sectional view taken on line 12—12 of Fig. 11 and showing the same relationship of the parts;

Fig. 13 is a view similar to Fig. 11 illustrating one of the faller-bars at the end of its working stroke;

Fig. 14 is a longitudinal sectional view taken on line 14—14 of Fig. 13 showing the end of the same faller-bar engaged between the leading and trailing faces of adjacent cam-lobes to restrain it from

unwarranted movement at the beginning of its transfer; and

Fig. 15 is a detailed perspective view of one end of a faller-bar.

The present invention consists in general of a novel form of traverse-screw and faller-cam construction to provide for increased speed of operation of gill-drawing frames. The screws are constructed with triple instead of double threads for increasing the number of fallers traversed during each revolution of the screws and the cams cooperate with the ends of the screws to receive and transfer the fallers in a novel and improved manner. Adjacent lobes on the cams have leading and trailing faces forming pockets in which the ends of the fallers are held to restrain them from undue movement at the beginning of the transfer while their direction of motion is being changed. The novel and improved form and shape of the cam-lobes and the ends of the fallers provide the proper clearance for operation of the machine at a high rate of speed.

Referring to Figs. 1 and 2 of the drawings, a pair of pillow-blocks 2 and 3 for the gill-screws are supported in spaced relation on the main frame of the machine, indicated generally by the reference character 4. The pillow-block 2 mounts cooperating top and bottom gill-screws 5 and 6 while the opposite block 3 mounts a similar pair of top and bottom gill-screws of opposite hand. The pillow-blocks 2 and 3 are recessed at 7 to provide rearward end supports 8 in which the top and bottom screws are also journaled. Forwardly of the recesses 7 the pillow-blocks have semicircular grooves 9 and 10 for the screws which partially surround them and provide bearing seats.

As illustrated in Fig. 2, the top screw 5 has a reduced end portion 15 carrying a bearing sleeve 16 journaled in a bore 14 in the end support 8. A driving gear 17 is held on the reduced end 15 in abutting engagement with the end of the sleeve 16 by means of a nut 18 screwed onto a threaded stud 19 projecting from the end of the screw. The bearing sleeve 16 and gear 17 are rotatively connected with the screw 5 by means of a key 20. The opposite end of the top screw 5 overhangs the forward end of the pillow-block 2 and has a triangularly-shaped shank 21 for mounting a cam-disk 26, shown in detail in Fig. 4, which is secured thereto by a screw 27.

The bottom screw 6 has a reduced end 28 which mounts a cam-disk 29 shown in detail in Fig. 3. The cam-disk 29 is positioned in the recess 7 of the pillow-block 2 and has a hub 30 projecting rearwardly through a bearing 31 in the end support 8 to provide a journal for the screw 6. A gear 32 is mounted on the reduced end 28 of the bottom screw 6 with its teeth in mesh with the teeth of the gear 17 on the top screw 5. The gear 32 is held in abutting engagement with the end of the hub 30 by a nut 33 and the gear and hub are rotatively connected with the screw 6 by a key 34. The top and bottom screws 5 and 6 at the opposite side of the machine are mounted in the manner as explained above and carry driving gears and cam-disks of opposite hands which are indicated by the same reference characters.

The opposite pairs of top and bottom gill-screws 5 and 6 are rotated in synchronism by a drive-shaft 35 and lay shafts 36. The lay shafts 36 are journaled in lower bearings in the pillow-blocks 2 and 3 and connected to the drive-shaft 35 by beveled gears 37 and 38. The pairs of top and bottom screws 5 and 6 are driven through gears 39 which mesh with the gears 32 on the ends of the bottom screws.

In accordance with the present invention, each of the several gill-screws has three independent threads for receiving, traversing and discharging three of the gill-bars or fallers 45 during one complete revolution. The top screws 5 have relatively fine threads to maintain a maximum number of fallers 45 in closely adjacent parallel relationship during their traverse through a working stroke, while the bottom screws 6 have coarser threads to traverse the fallers through their return stroke in spaced relationship and at a faster rate. The fallers 45 are of usual construction except for their ends 46 which have a semicircular contour with their opposite faces 47 and 48 beveled or inclined with respect to the vertical sides of the fallers, see Fig. 15. The ends 46 of the fallers 45 are adapted to be engaged by the threads of opposite top or bottom screws and the beveled faces 47 and 48 correspond to the pitch of the top screws 5 to hold the fallers in an upright position as they are traversed through their working stroke. The forward faces 49 of the fallers 45 have vertical slots 50 adjacent each end and at their lower edges they are beveled as at 51. Spaced along the upper edges of the fallers 45 are the conventional teeth or upright pins 44.

During the traverse of the fallers 45 through their working and return strokes they are supported on saddles 52 and 53 of conventional type bolted to the opposite pillow-blocks 2 and 3 below the top and bottom screws 5 and 6, respectively. The lower saddles 53 extend throughout the length of the bottom screws 6, while the upper saddles 52 terminate short of the ends of the top screws 5 to provide a space for the fallers 45 to be transferred across their ends. The rearward ends of the top saddles 52 are inclined forwardly at 54 and their upper faces at opposite ends are beveled slightly as indicated at 55 and 56 while their bottom faces are also bevelled at the forward end as indicated at 57, see Fig. 2.

Conductors 60 and 61 are pivotally mounted on the opposite recessed ends of each of the bottom saddles 53 for guiding the fallers 45 during their transfer from the top screws 5 to the bottom screws 6 and vice versa. As illustrated in Figs. 2 and 13, the conductors 60 and 61 are pivoted intermediate their ends on studs 62 and 63 having threaded ends screwed into the saddles 53. The depending portions of each pair of conductors 60 and 61 are yieldingly urged apart by a spring 65 on a rod 64. The rod 64 extends through the lower end of the depending portions of the conductors and has an abutment 66 engaging the conductor 61 while the spring 65 acts between an abutment 67 on the rod and the opposite conductor 60. The upwardly-projecting portions of the conductors 60 engage the rearward sides of the fallers 45 while the upwardly-projecting portions of the conductors 61 engage the slots 50 in their forward faces and are curved at 68 to properly position the fallers to be received by the bottom screws 6.

The cam-disks 29 at the rearward ends of the bottom screws 6 are of novel construction adapted to transfer the fallers 45 into engagement with the threads of the top screws 5 at an increased speed or rate of traverse resulting from the increased number of threads on the screws. Referring to Fig. 3, three radially-extending cam-lobes 71 of identical form project from the side of each disk 29 and the lobes are arranged in equiangular relationship for cooperation with the ends of the three threads on the screws. The

cam-lobes 71 have curved grooves 72 at their inner edges to form circular seats for the ends of the screws 6, and the opposite sides of the lobes are shaped to provide an arcuate leading face 73 for engaging the ends 46 of the fallers 45 and a curved trailing face 74. The outer face of each lobe 71 is beveled or inclined at 75 toward the trailing face 74 to provide a clearance for the ends 46 of the fallers 45 as they are moved toward the disk 29 to be engaged by the leading face 73 of the adjacent lobe.

As illustrated in Figs. 5 and 6, the top screws 5 are formed with annular grooves 76 between the ends of the threads and the bearing sleeves 16 to provide clearance for the disks 29. The threads on the screws 5 adjacent their ends are also cut away or recessed at 77 to provide clearance for the lobes 71 and each lobe is flatted or cut away at 78 between its leading face 73 and trailing face 74 adjacent the periphery of the cam-disk 29 to clear the projecting portions of the screw threads.

As illustrated in detail in Fig. 4, the cam-disks 26 mounted on the forward ends of the top screws 5 have three radially-extending lobes 81 projecting laterally in spaced equiangular relationship for cooperation with the ends of the three separate threads on the screws 5. The cam-lobes 81 on each disk 26 are joined together by an axially projecting hub 82 having a triangularly-shaped aperture 83 through which the shank 21 of the screw 5 extends. Each of the cam-lobes 81 has a leading face 84 and a trailing face 85, and between these faces on adjacent lobes the hub 82 has circular recesses 86 of a contour corresponding to the semicircular ends 46 of the fallers 45. The axially-projecting hubs 82 on the cam-disks 26 abut the ends of the screws 5 and the lateral faces of the cam-lobes 81 are beveled at 87 from the leading face 84 toward the trailing face 85 to form a continuation of the threads of the screw. The construction and arrangement of the parts of the machine having now been described in detail its mode of operation will next be explained.

In assembling the machine the opposite top screws 5 and bottom screws 6 are adjusted until the corresponding threads of opposite hand are in alinement and the bottom screws in proper relationship with respect to the top screws. A number of fallers 45 are assembled in the machine with their opposite ends 46 seated in the thread grooves of each set of top and bottom screws 5 and 6; the thread grooves on facing sides of the screws being entirely filled with a suitable number of fallers as illustrated in Figs. 1 and 2. The cam-disks 26 and 29 are so mounted on the reduced ends 21 and 28 of the screws 5 and 6, respectively, as to position the trailing edges of each of the cam-lobes 71 and 81 in substantial register with the ends of the threads. Power is transmitted through the laterally-extending driveshaft 35 and lay shafts 36 to drive the gears 39 at opposite sides of the machine in reverse directions. The spur-gears 39 drive the gears 32 to cause the bottom screws 6 to be rotated in synchronism but in opposite directions. The top screws 5 are rotated in timed relation with the bottom screws 6 through the intermeshing gears 32 and 17.

Due to the engagement of the end portions 46 of the fallers 45 with the threads on the top and bottom screws 5 and 6, the fallers in the upper row are traversed forwardly through their working stroke and the fallers of the bottom row are traversed rearwardly through a return stroke, with the fallers sliding on their respective saddles 52 and 53. During the traverse of the fallers 45 through their forward or working stroke they are held in an upright position due to the beveled faces 47 and 48 at their ends 46 which correspond to the inclined threads of the top screws 5, but during their return stroke the fallers assume an angular position due to the long lead of the threads on the bottom screws 6.

During the operation of the machine the fibers are fed therethrough in the direction indicated by the arrows in Fig. 1 by means of the usual drawing rolls, not herein shown. The fallers 45 in the upper row are traversed in the same direction but at a faster rate of speed to cause their teeth or pins 44 to act on the fibers. As each faller reaches the end of its forward or working stroke, sliding on the upper saddles 52, it is transferred from the top screws 5 to the bottom screws 6 during one third of a revolution of the screws; while at approximately the same time another faller is being transferred from the bottom screws 6 to the top screws 5 to replace the one which has completed its working stroke. As illustrated in Figs. 5 and 6, one of the fallers 45 is being raised by the cam-lobes 71 on the lower disks 29 while a succeeding faller is being traversed rearwardly toward the cam-disks. Due to the angular relation of the faller 45 and the beveled faces 75 on the cam-lobes 71 the faller is permitted to move rearwardly while the cam-lobes are moving upwardly. The faller 45 continues to move rearwardly and the lobes 71 on the opposite cam-disks 29 continue to move upwardly until the bottom rearward edge of the faller engages the forward faces of the cam-disks between adjacent lobes 71, as illustrated in Figs. 7 and 8. The ends of the threads on the bottom screws 6 then cooperate with the beveled faces 48 of the faller to rock the latter to an upright position as illustrated in Figs 9 and 10. The ends of the threads on the screws 6 and the adjacent cam-lobes 71 on the disks 29 are so related that the faller 45 is rocked to its upright position at the instant that the leading and trailing faces 73 and 74 on adjacent lobes of the cams are in register with the semicircular ends 46 of the faller. The semicircular ends 46 of the faller 45 then seat between the leading and trailing faces 73 and 74 of adjacent cam-lobes 71 on the opposite disks and against the faces of the cam-disks 29 between the lobes which latter form a pocket, thus preventing the faller from jumping as it is struck by the cam-lobes which lift it.

The rotation of the cam-disks 29 being continuous the leading faces 73 of the lobes 71 immediately start to raise the faller 45 to transfer it from the bottom screws 6 to the top screws 5. As the faller 45 moves upwardly the leading and trailing faces 73 and 74 of adjacent cam-lobes 71 roll about the semicircular ends 46 of the faller until the preceding lobe advances away therefrom. It will thus be observed that due to the restraining effect of the adjacent cam-lobes 71 no movement of the faller 45 is permitted except through its predetermined path at the beginning of the transfer while its direction of movement is being changed.

The faller is moved upwardly by the leading faces 73 on the cam-lobes 71 of the opposite disks 29 to engage its ends 46 with the ends of the threads on the top screws 5, as illustrated in Figs. 7 and 8. During the latter part of its transfer the faller has a combined upward and forward

movement due to its engagement with the thread grooves in the screws 5; the inclined ends 54 and beveled upper faces 55 of the saddles 52, see Fig. 2, permitting this combined movement. The faller 45 is then traversed through its working stroke by the threads of the top screws 5, it being understood that each faller is successively moved rearwardly, transferred by the cam-lobes 71 on the disks 29 into engagement with the threads of the top screws 5 and then traversed through its working stroke.

When the fallers 45 complete their forward working stroke they are transferred from the top screws to the bottom screws 6 in a manner somewhat similar to that described in connection with their transfer from the bottom screws to the top screws. As each faller 45 approaches the end of its working stroke, see Figs. 11 and 12, its forward vertical face 49 comes opposite the beveled lateral faces 87 of the cam-lobes 81 on the opposite disks 26 while the lobes are moving downwardly simultaneously with the movement of the faller forwardly. These bevels on the lateral faces of the cam-lobes provide a clearance to permit the leading cam-lobes to pass the beveled faces 51 at the ends of the fallers. Preferably, the threads at the forward ends of the top screws 5 are cut away to provide a greater clearance in the grooves so that the leading faller 45 is engaged by the next succeeding faller and pushed into engagement with the vertical faces of the cam-disks 26 between the leading and trailing faces 84 and 85 of adjacent cam-lobes 81 on the disks, as shown in Figs. 13 and 14. In this position the vertical slots 50 adjacent the ends of the faller 45 are engaged by the upwardly-extending arms of the conductors 61 and the ends 46 of the faller seat in the opposite alined circular recesses 86 in the sides of the hubs 82 of the cam-disks 26 between adjacent lobes 81 to restrain the faller from undue motion at the beginning of its transfer. The fallers 45 are permitted a slight downward movement at the time that their ends are moved into the recesses 86 in the cam-disks 26, this being provided for by the beveled upper faces 56 on the top saddles 52.

Due to the substantially radial disposition of the leading faces 84 of the cam-lobes 81 on the disks 26 the faller 45 is dropped or forced down rapidly but without any considerable shock, due to its end being pocketed in the recesses 86 on the cam-disks 26 during the initial impulse of the transfer. The curved portions 68 of the conductors 61 finally guide and position the ends 46 of the faller to be engaged by the threads on the bottom screws 6. As before stated, the bottom beveled edges 51 of the fallers 45 provide clearance for the beveled faces 87 of the cam-lobes 81, and they also provide a clearance for passing the upper portion of a preceding faller being transferred so that it may move downwardly while another faller is moving forwardly. Further, due to the beveled bottom faces 57 at the forward ends of the top saddles 52 the fallers 45 are freely movable to tilt them into engagement with the threads of the bottom screws 6. Three of the fallers 45 are dropped and pushed down during each complete revolution of the top screws 5 in timed relation to the transfer of three other fallers from the bottom screws 6, and the fallers are restrained from unwarranted movement at the beginning of the transfer while their direction of movement is being changed.

It will be observed that the present invention provides for operating the gill-drawing frame at greatly increased speed to increase its output without increasing the speed of rotation of the screws. Further, it will be observed that the novel and improved form of the cams at the ends of the screws provide for transferring the fallers at increased speed while restraining them from jumping, chattering or other unwarranted movement. Due to this improvement in the method of performing the transfer the fallers and other parts of the machine are saved from wear and damage, thus materially increasing their durability.

Further, it will be observed that the parts are of simple construction and adapted to function at increased speed without increasing the wear or otherwise affecting the proper operation of the machine.

While I have herein described a preferred form of construction of the machine, various modifications may be made in the structure and arrangement of its parts without departing from the spirit or scope of the present invention. Therefore, without limiting myself to the exact embodiment herein shown and described, I claim:

1. In a gill-drawing frame, the combination of cooperating gill-screws, means for rotating said screws, faller-bars adapted to be traversed in opposite directions by said screws, and means at the end of one screw for transferring the faller-bars into engagement with the threads of an opposite screw, said means having cooperating parts for embracing the end of each faller-bar and simultaneously engaging its top and bottom edges as it is advanced thereto to restrain it from undue movement during its transfer.

2. In a gill-drawing frame, the combination of cooperating gill-screws, means for rotating said screws, faller-bars adapted to be traversed in opposite directions by the screws, and rotating means at the end of one screw for transferring the faller-bars into engagement with the threads of an opposite screw, said means having pockets for receiving the end of each faller-bar and simultaneously engaging its top and bottom edges as it is transferred from one screw to the other to restrain it from undue movement or jumping.

3. In a gill-drawing frame, the combination of cooperating gill-screws, means for rotating said screws, faller-bars adapted to be traversed in opposite directions by the screws and having circular end portions for engaging the threads of the screws, and means at the end of one screw for transferring the faller-bars into engagement with the threads of an opposite screw, said means having substantially circular pockets for embracing the circular end of each faller-bar and simultaneously engaging its top and bottom edges to restrain it from undue movement during its transfer.

4. In a gill-drawing frame, the combination of a pair of cooperating gill-screws each having a plurality of continuous threads, means for rotating said screws, faller-bars adapted to be traversed in opposite directions by the screws, and a rotating member at the end of one screw for transferring the faller-bars into engagement with the threads of an opposite screw, said rotating member having a radially-disposed pocket at the terminus of each screw-thread for embracing the end of a faller-bar as it exits from the appropriate thread of the screw and simultaneously engaging its top and bottom edges to restrain the bar from undue movement during its transfer.

5. In a gill-drawing frame, the combination of cooperating gill-screws each having a plurality

of continuous threads, means for rotating said screws, faller-bars adapted to be traversed in opposite directions by the screws, and rotating means at the end of one screw having a radially-extending cam-lobe at the terminus of each thread for transferring the faller-bars into engagement with the threads of an opposite screw, each two adjacent cam-lobes having cooperating leading and trailing faces engaging the top and bottom edges of the end of a bar to hold it during the transfer and to thereby restrain it from undue movement at the beginning of the transfer.

6. In a gill-drawing frame, the combination with the faller-bars thereof, of a pair of cooperating gill-screws each having three independent continuous threads adapted to traverse the bars in opposite directions, means for rotating the gill-screws, each screw delivering three of the faller-bars at its end during one complete revolution of the screws, and a cam at the end of one screw having a lobe for each of the threads of the screw, said cam acting to transfer the faller-bars into engagement with the threads of the opposite screw and the opposite faces of adjacent cam-lobes simultaneously engaging the end of a bar and cooperating to restrain the latter from unwarranted movement during its transfer.

7. In a gill-drawing frame, the combination with the faller-bars thereof, of a top screw having triple threads for receiving the ends of the faller-bars to traverse them through their working stroke, a bottom screw having triple threads for returning the faller-bars in the opposite direction, and a cam on the end of the bottom screw having three radially-extending lobes constructed and arranged to form pockets therebetween for receiving the ends of the faller-bars as they are delivered thereto by the screw, the adjacent radially-extending lobes engaging the top and bottom edges of each faller-bar to restrain it during its transfer, and said cam acting to transfer the faller-bars from the bottom screw into engagement with the threads of the top screw with the ends of the faller-bars held in the pockets to restrain the bars from unwarranted movement during the transfer.

8. In a gill-drawing frame, the combination with the faller-bars thereof, of cooperating gill-screws for traversing the faller-bars in opposite directions, a disk at the end of one screw provided with radially-extending- cam-lobes projecting laterally from its face and adapted to engage one edge of the faller-bars to transfer them into engagement with the threads of an opposite screw, and means on the disk for simultaneously engaging the opposite edge of the faller-bar being transferred to restrain it from undue movement during its transfer.

9. In a gill-drawing frame, the combination with the faller-bars thereof, of a top screw having triple threads for engaging the ends of the faller-bars to traverse them through a working stroke, a bottom screw having triple threads for traversing the faller-bars in the opposite direction, means for rotating the screws, a cam-disk at the end of the top screw having radially-extending lobes with the opposite faces of adjacent lobes adapted to simultaneously engage the end of each faller-bar on its top and bottom edges, and a cam-disk at the opposite end of the bottom screw having radially-extending lobes with the opposite faces of adjacent lobes simultaneously engaging the end of each faller-bar on its top and bottom edges, said cam-lobes acting to transfer the bars from one screw into engagement with the threads of the other screw and the opposite faces of the adjacent cam-lobes cooperating to restrain the bars from unwarranted movement during their transfer.

10. In a gill-drawing frame, the combination with the faller-bars thereof, of opposite pairs of top and bottom gill-screws each having a plurality of independent threads, a disk on each of the screws provided with radially-extending cam-lobes projecting laterally from the face thereof and spaced to provide openings therebetween, said disks being arranged in proper relation to the screw-threads to adapt them to receive the ends of the faller-bars advanced by the screws in the opening between the cam-lobes with the leading and trailing faces of adjacent lobes simultaneously engaging the top and bottom edges of each bar to transfer the bar into engagement with the threads of the opposite screw as the disks are rotated.

11. In a gill-drawing frame, the combination with the faller-bars thereof, of oppositely arranged pairs of top and bottom gill-screws each having three independent threads, a disk at one end of each of the screws provided with radially-extending cam-lobes projecting laterally from its face and adapted for transferring the faller-bars from one screw into engagement with the threads of an opposite screw, said cam-lobes having leading and trailing faces to constructed and arranged as to form pockets therebetween for receiving the ends of the faller-bars advanced by the screws, the leading and trailing faces of adjacent cam-lobes simultaneously engaging the top and bottom edges of each bar to restrain it from unwarranted movement during its transfer.

12. A cam for transferring fallers from the threads of one gill-screw to the threads of another screw comprising a disk having three cam-lobes arranged in equiangular relationship, each of said lobes having a leading face for engaging the ends of the fallers on one edge to transfer them from one screw to another screw and a trailing face for engaging the opposite edge of the next faller transferred to hold it against the leading face of the next adjacent lobe during the transfer.

13. A cam for transferring fallers from the threads of one gill-screw to the threads of another screw comprising a disk having three cam-lobes arranged in equiangular relationship, each of said lobes having a leading face for engaging the fallers on one edge to transfer them and a trailing face for engaging the opposite edge of the next faller being transferred to hold it against the leading face of the next adjacent lobe at the beginning of the transfer, the inner faces of said lobes being inclined from the leading to the trailing faces.

14. A cam for transferring fallers having circular ends from the bottom gill-screws into engagement with the threads of the top screws comprising a disk having three lobes arranged in equiangular relationship, each of said lobes having a curved leading face for engaging the fallers on one edge to transfer them and a curved trailing face for engaging the opposite edge of another faller being transferred to hold it against the leading face of the next adjacent lobe at the beginning of the transfer, said curved faces permitting rotation of the cam-disk with respect to the rounded ends of the fallers.

15. A cam for transferring fallers having circular ends from the top gill-screws into engagement with the threads of the bottom screws com-

prising a disk having three radially-extending lobes arranged in equiangular relationship, each of said lobes having a leading face for engaging a faller to transfer it and a trailing face for engaging another faller to hold it against the leading face of the next adjacent lobe at the beginning of the transfer, and a hub connecting the cam-lobes and having arcuate recesses forming a continuation of the leading and trailing faces of adjacent lobes, said arcuate recesses permitting rotation of the disk with respect to the circular end of the faller.

16. In a gill-drawing frame, the combination of a pair of cooperating gill-screws, means for rotating said screws, faller-bars adapted to be traversed in opposite directions by the screws, a cam at the end of one screw for transferring the faller-bars into engagement with the threads of an opposite screw, and means on said cam-carrying screw for simultaneously engaging the edge of each faller-bar opposite the edge engaged by the cam and cooperating with said cam to embrace the end of the faller-bar, said cam and cooperating means acting to restrain the faller-bars from undue movement during their transfer.

WILLIE HOLDSWORTH.