

Dec. 23, 1941.

E. B. HELM

2,267,402

APPARATUS FOR MANIPULATING THREAD OR THE LIKE

Filed Dec. 12, 1940

4 Sheets-Sheet 1

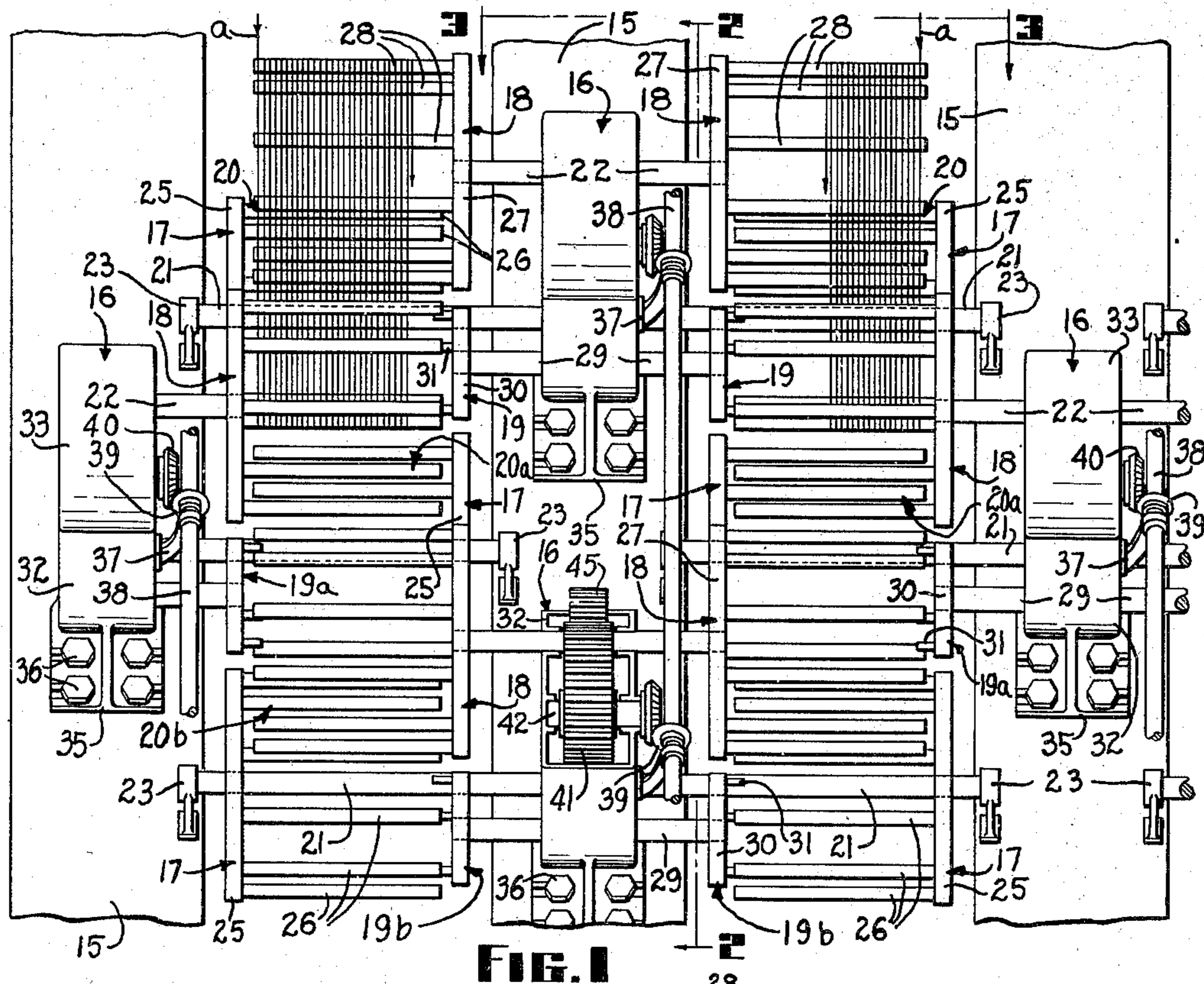


FIG. 1

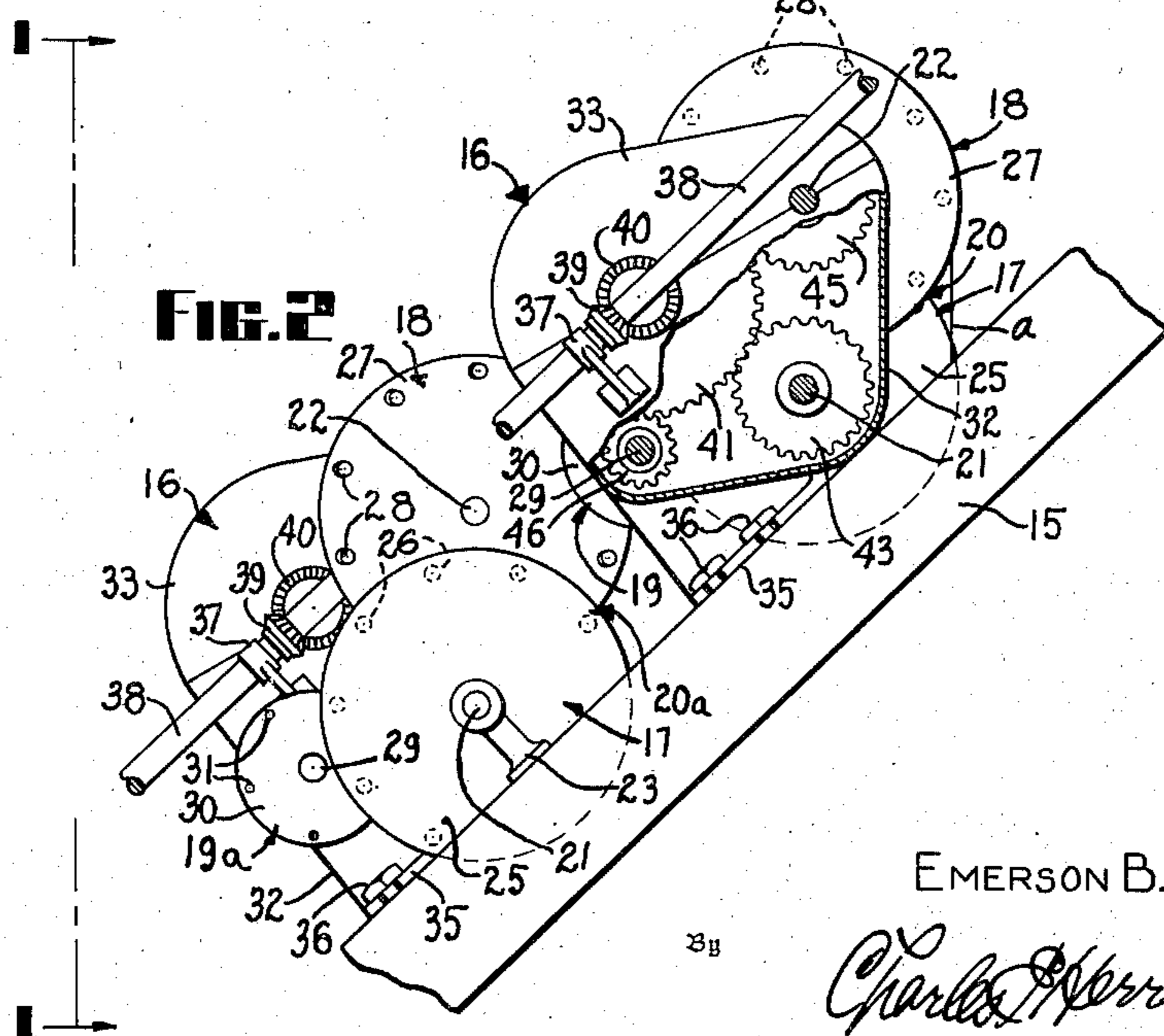


FIG. 2

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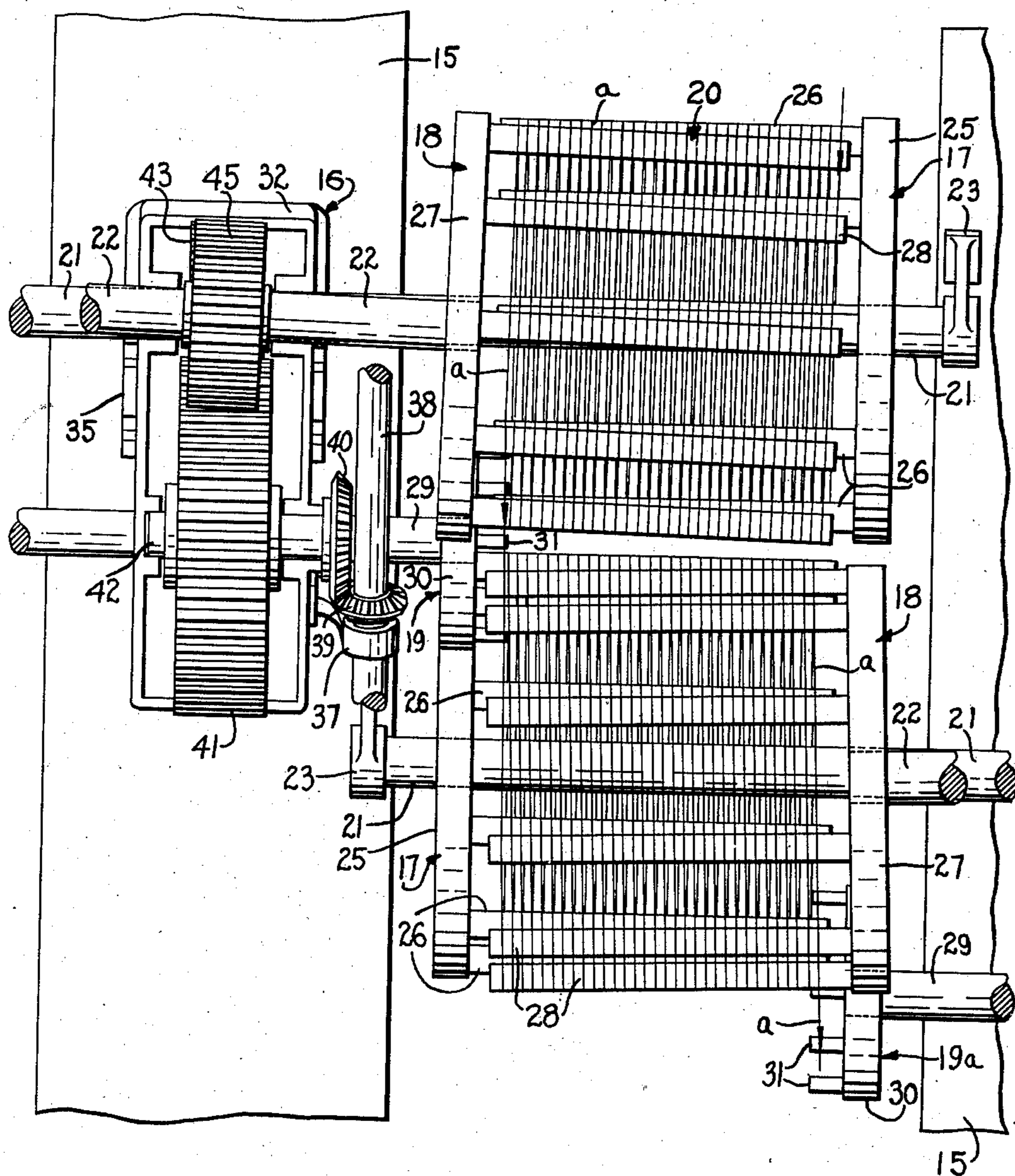
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FIG. 3



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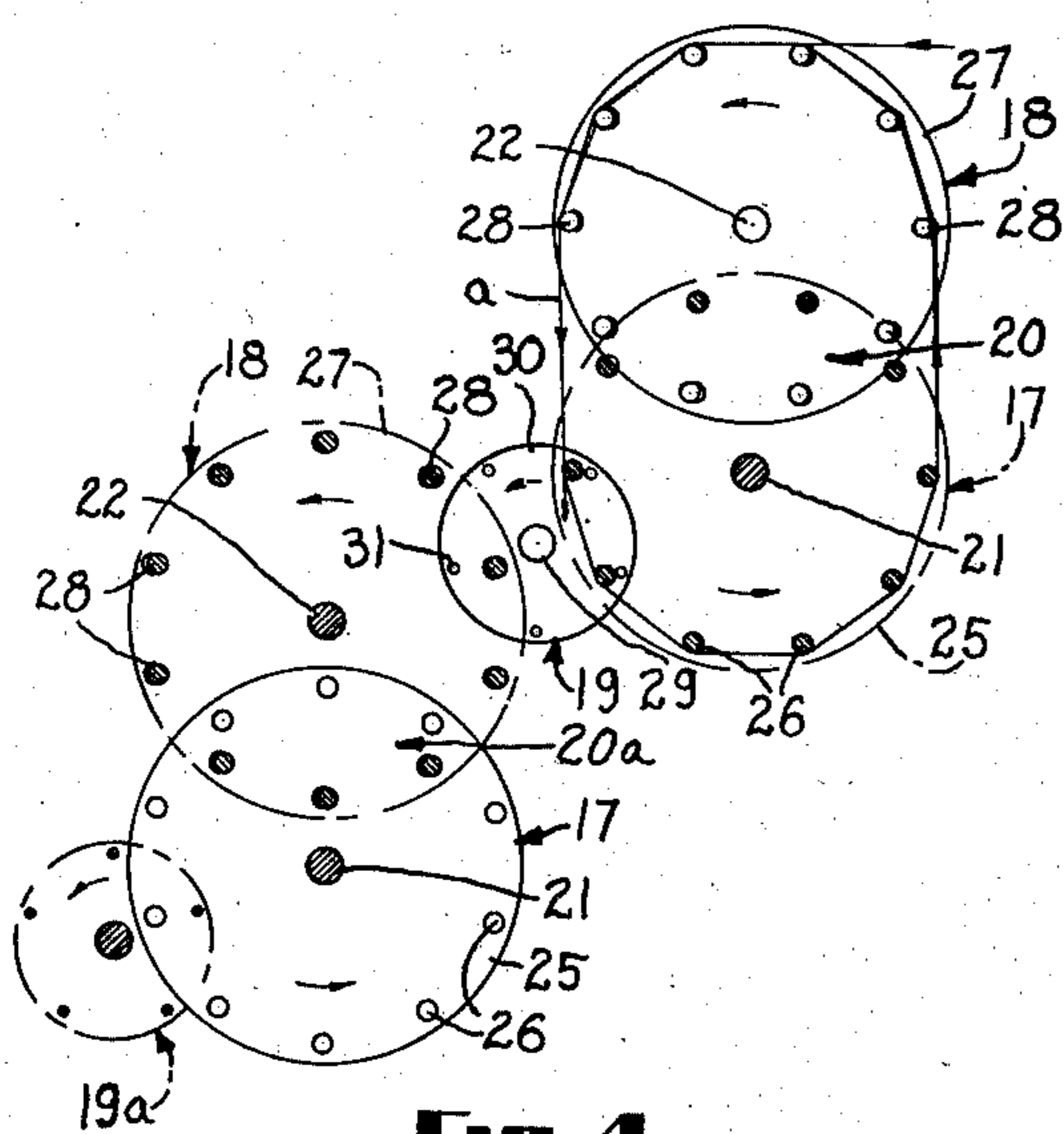


FIG. 4

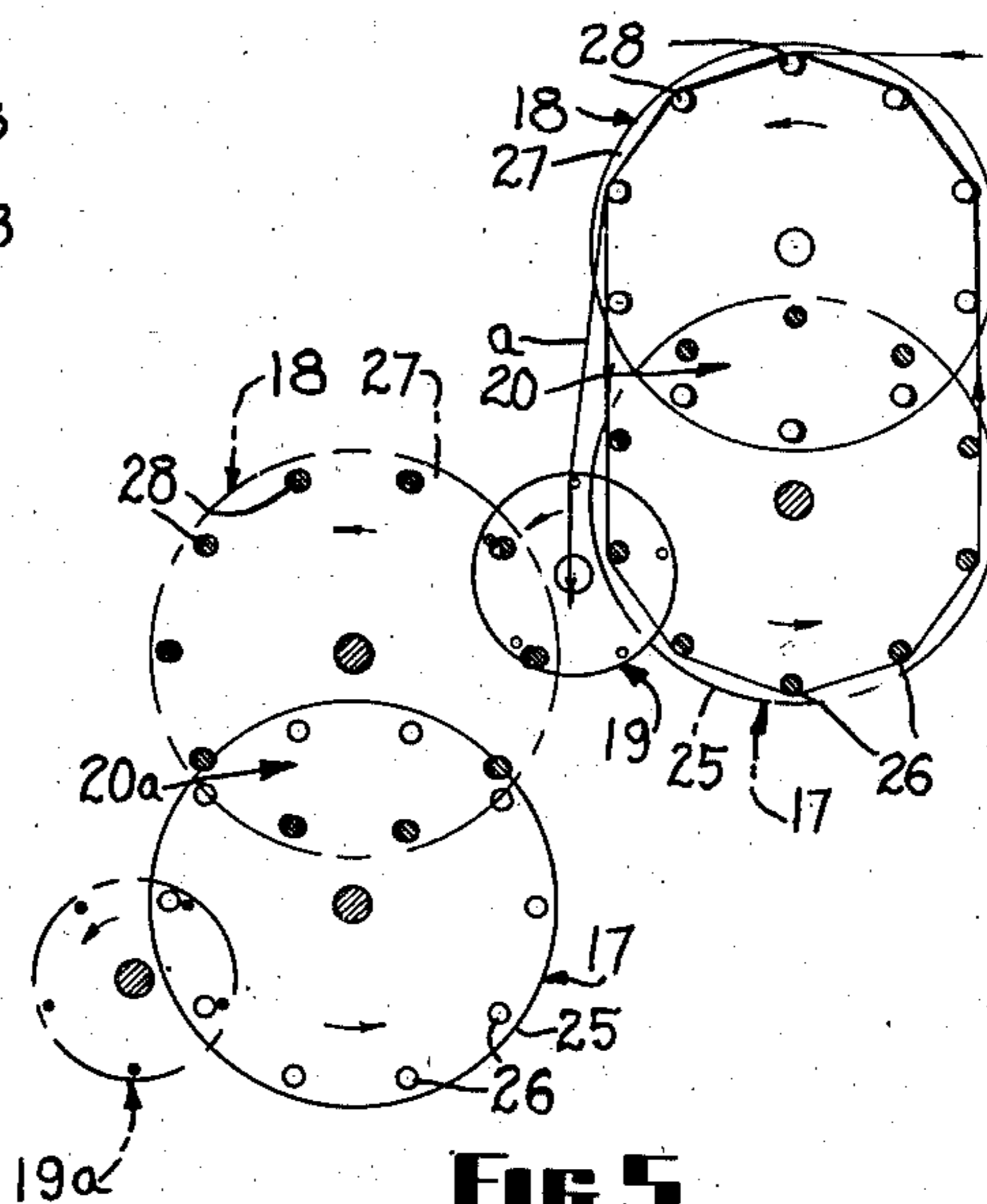


FIG. 5

FIG. 6

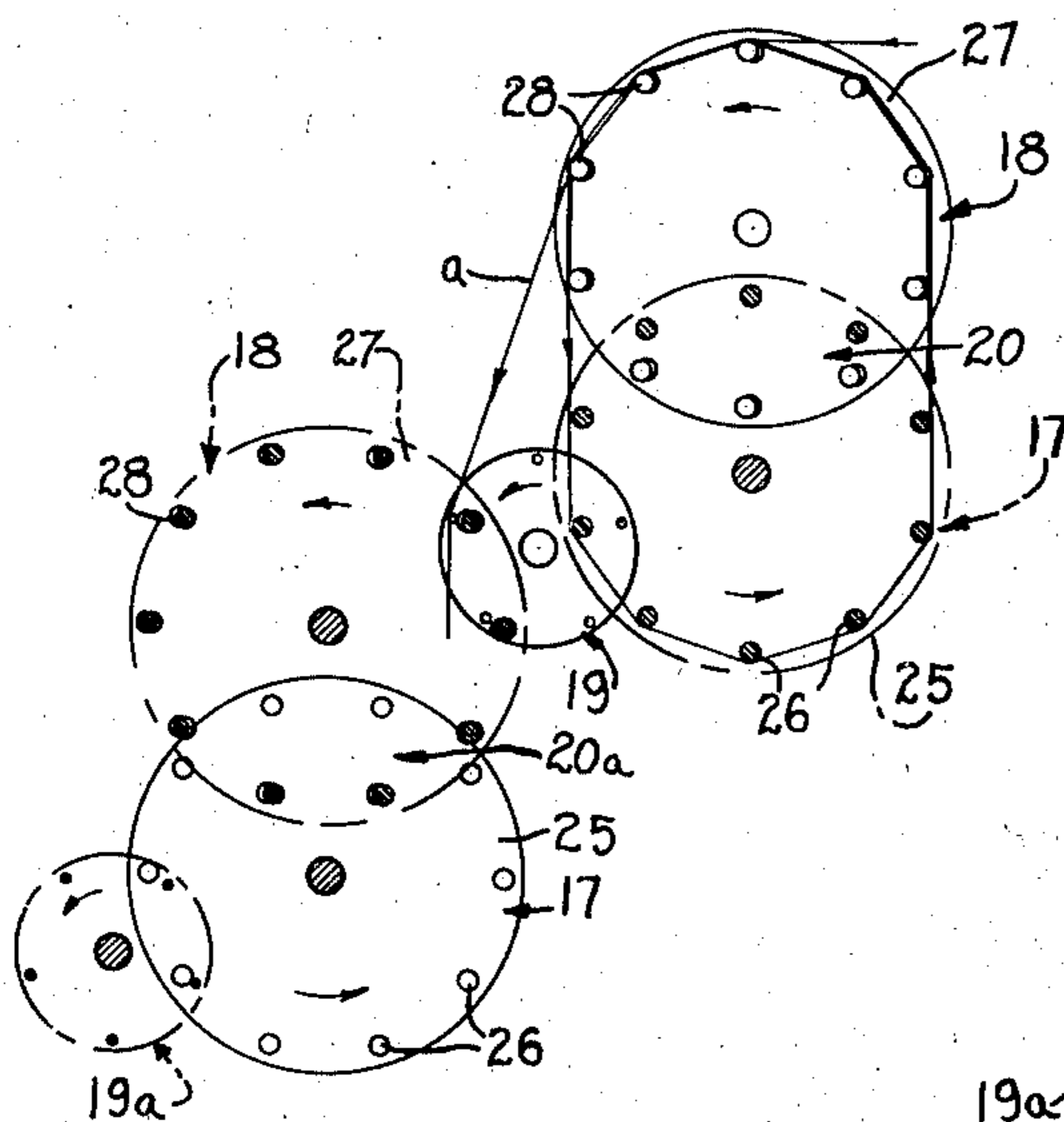
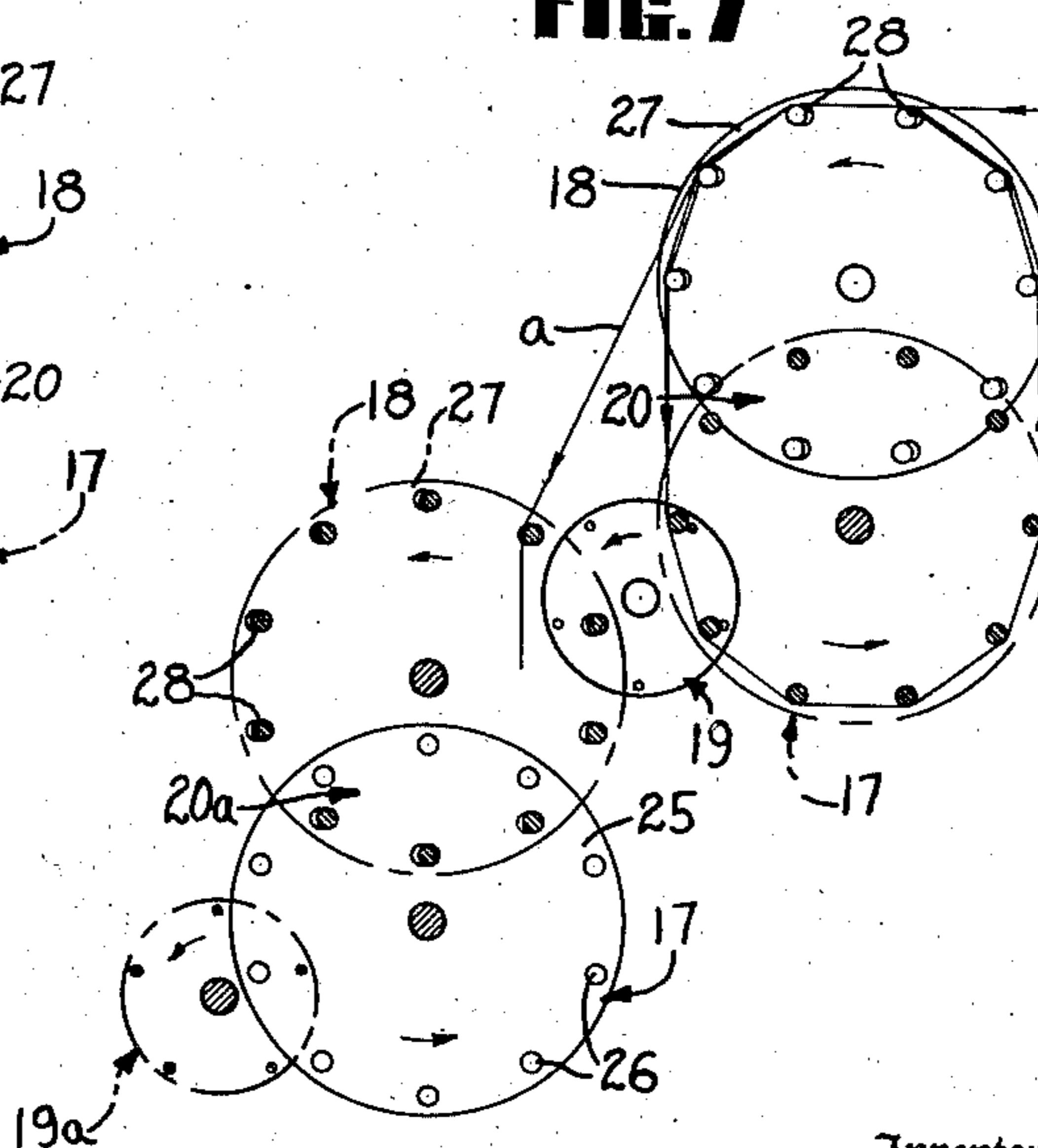


FIG. 7



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APPARATUS FOR MANIPULATING THREAD OR THE LIKE

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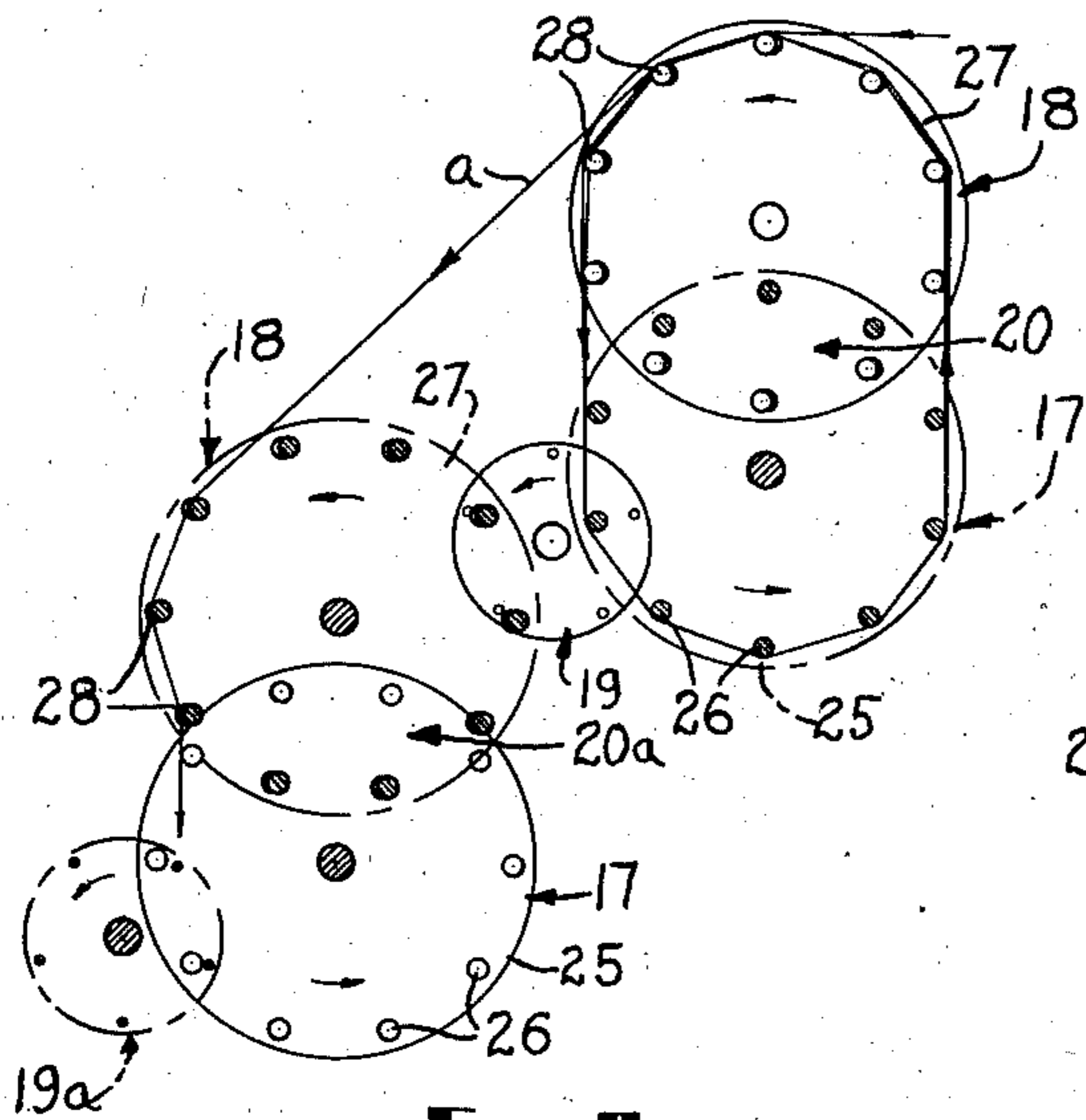


FIG. 8

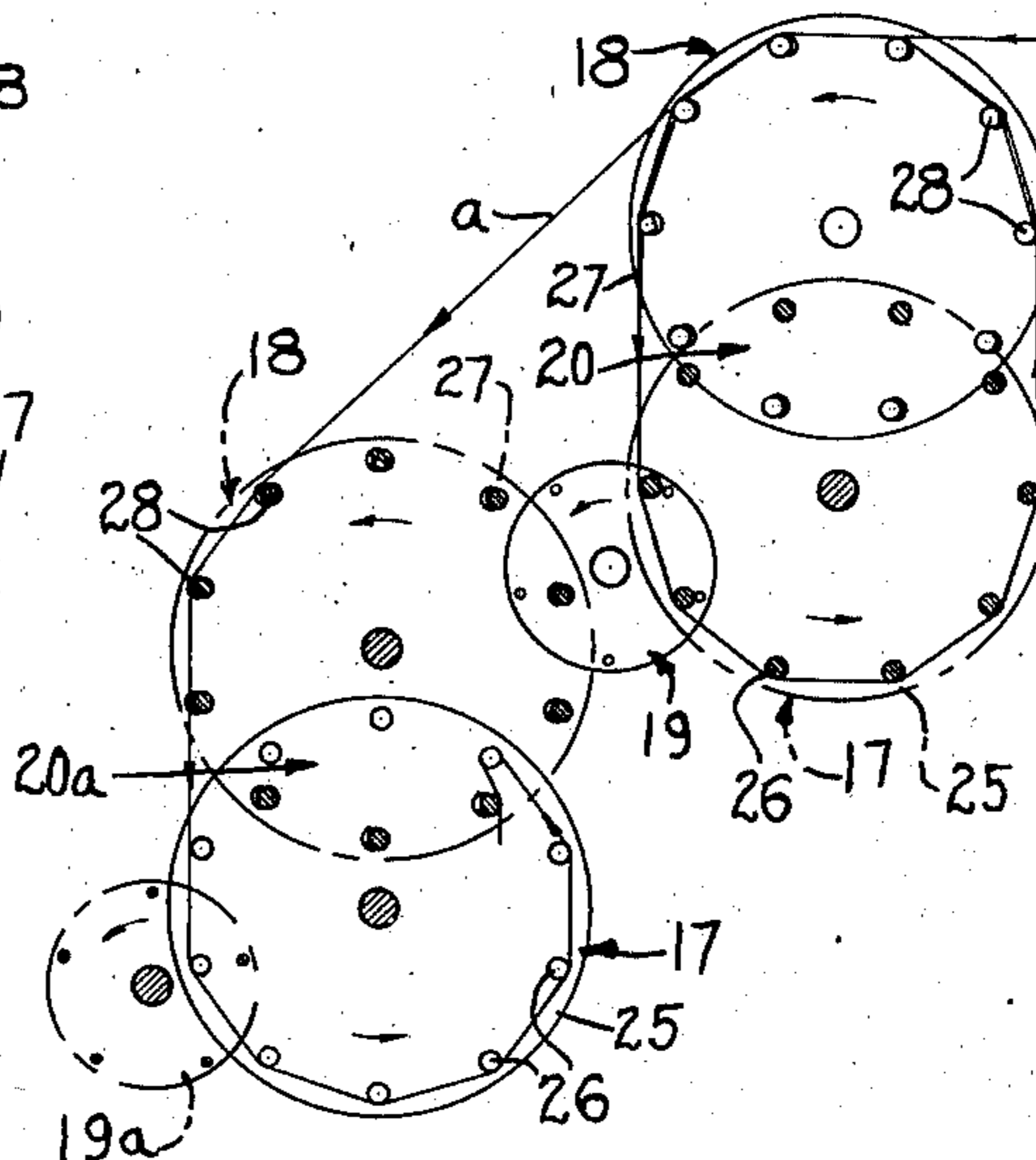


FIG. 9

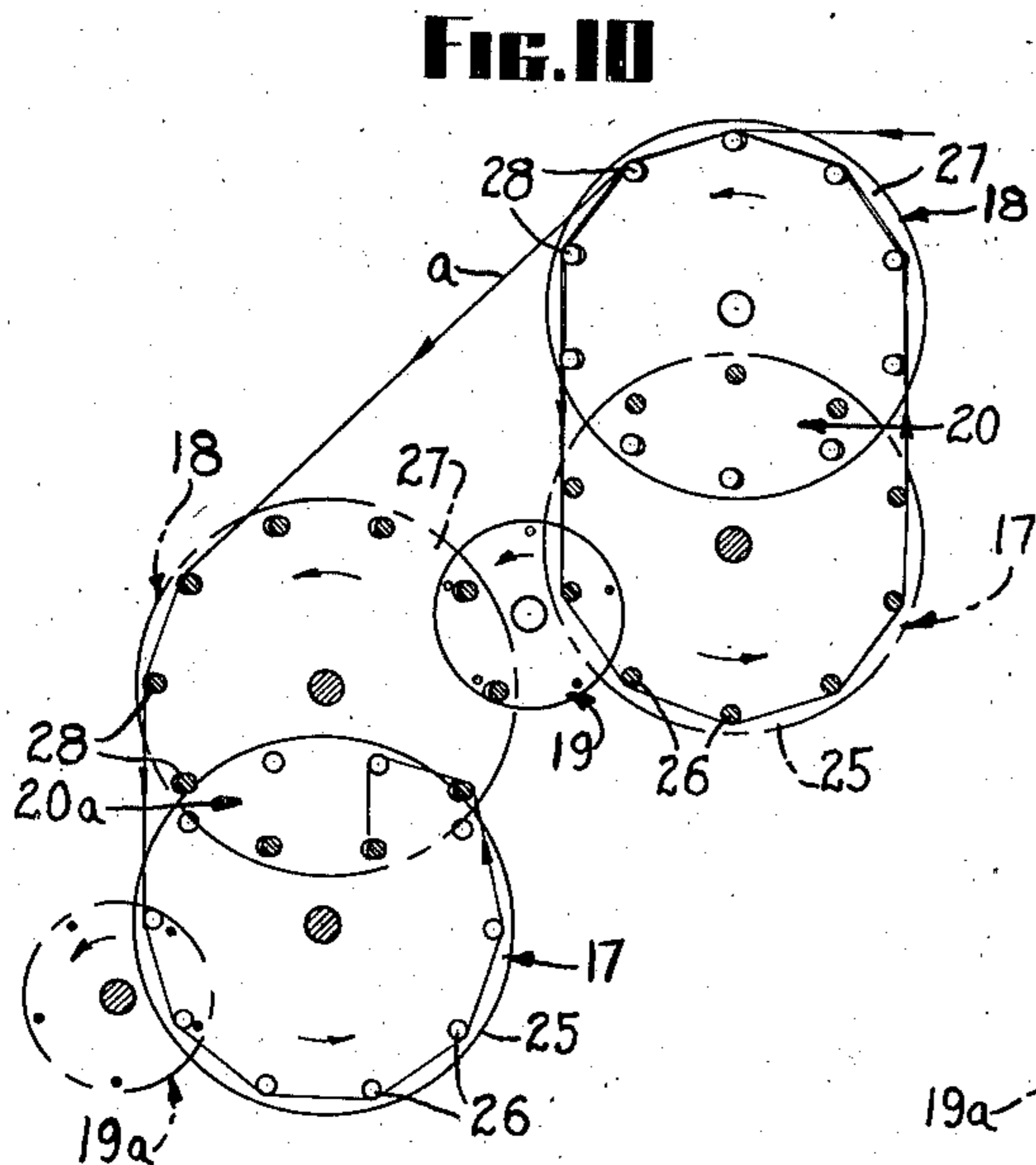


FIG. 10

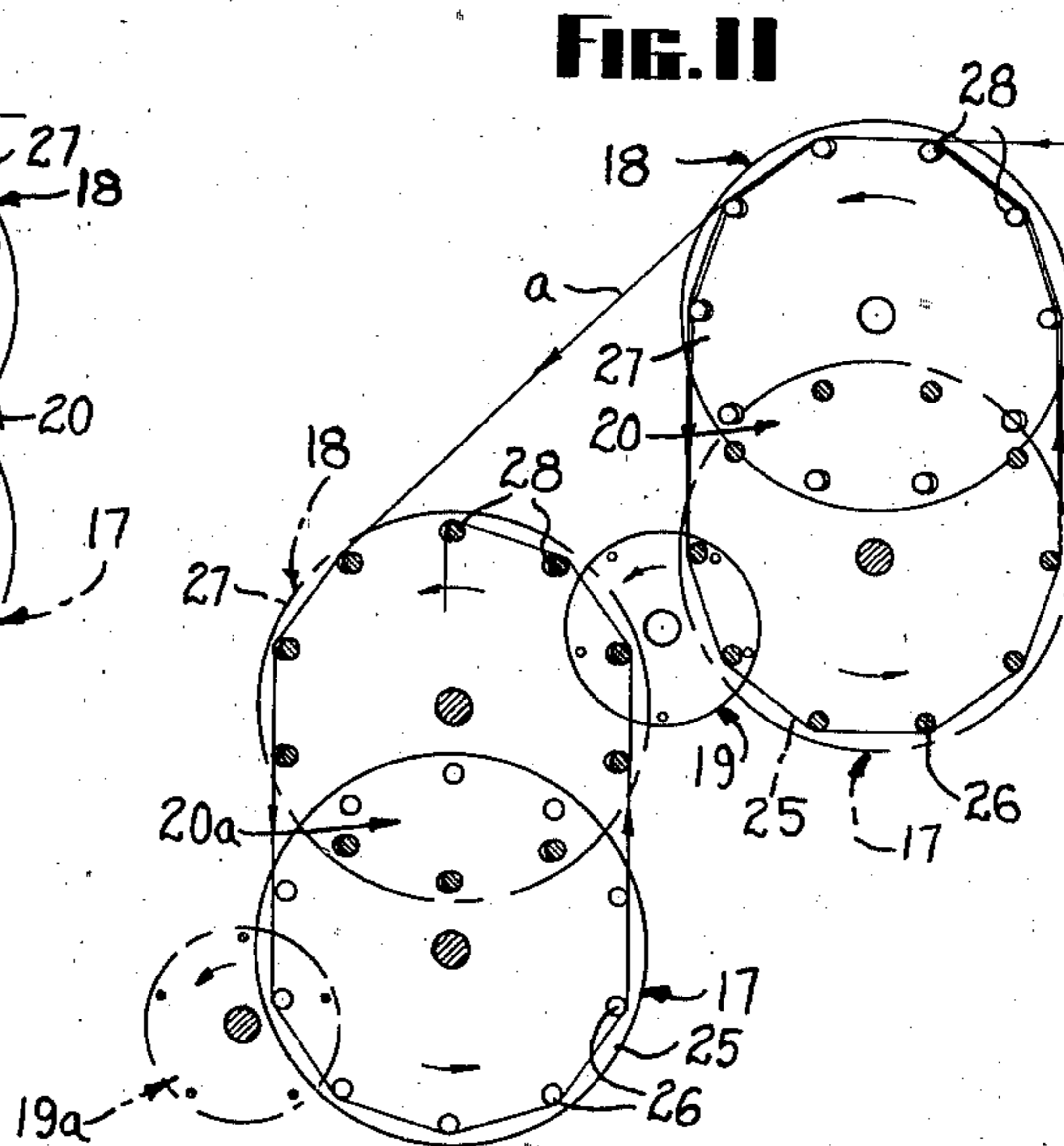


FIG. 11

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2,267,402

APPARATUS FOR MANIPULATING THREAD
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Application December 12, 1940, Serial No. 369,860

14 Claims. (Cl. 242—53)

This invention relates to a novel apparatus for the manipulation of thread or the like by means of a thread-advancing thread store device provided with an automatic transfer mechanism.

The apparatus of the invention finds application in the handling of continuous lengths of material such as threads, tapes, bands, ropes, wire and the like, which will be hereinafter referred to simply as "thread". It may be employed to particular advantage in the manufacture of artificial silk thread by any of the well known processes; e. g., the viscose, cuprammonium, nitrocellulose and cellulose acetate processes. For convenience, the invention will be described in connection with the manufacture of multiple filament viscose artificial silk thread according to the so-called continuous process.

In machines for the production of multiple filament viscose artificial silk thread, it has been found desirable to employ thread-advancing thread store devices on which it is possible to subject the thread to processing. It is advantageous to arrange such thread-advancing thread store devices in sequence in such manner that the thread may pass from one device to another in the course of the various operations. The advantages of an arrangement of this kind are greatly enhanced if means are employed for effecting automatic transfer of the thread from one thread-advancing thread store device to the next.

A thread-advancing thread store device may be defined as a thread-advancing device to which a thread may be applied with the result that, upon rotation of the device, the thread is advanced in a direction parallel to the axis of the device as a whole in a large number of helical or generally helical turns. One type of thread-advancing thread store device which is particularly well adapted to use in continuous processing apparatus is the thread-advancing reel of the present invention. A transfer device may be defined as a device which operates to remove the thread after it has traversed the length of a first thread-advancing thread store device in order to start it on a succeeding thread-advancing thread store device.

Both the thread-advancing reel and the transfer means of the present invention are efficient in operation, yet so simple in construction as to permit a high degree of flexibility in the structural design of the apparatus in which they are employed. The arrangement of thread-advancing reels in sequence in the manner em-

ployed in continuous processing apparatus is restricted, if at all, only to the extent that the transfer device interdigitates with one of the cage members of each of the two thread-advancing reels from one to the other of which the thread is to be transferred. Thus once a thread has been started on a first thread-advancing reel of a given series, it can pass successively from one to another until it has traversed all of the thread-advancing reels going to make up the series.

In the accompanying drawings, Figure 1 is a front elevation of a portion of an apparatus employing a number of thread-advancing reels with which are associated transfer means of the kind to which the invention relates. Figure 2 is a partial sectional elevation, with parts omitted, of the apparatus of Figure 1 as seen from line 2—2. Figure 3 represents a plan with parts removed showing two thread-advancing reels with their associated transfer means as seen from line 3—3 of Figure 1. Figures 4 to 11, inclusive, illustrate somewhat diagrammatically the steps by which a leading end of thread is transferred in accordance with the invention from one to another of a series of thread-advancing reels.

The assembled machine shown in Figures 1 and 2 represents but one of a number of possible arrangements of thread-advancing reels. The apparatus embodies thread-advancing reels 20, 20a and 20b arranged in series, together with transfer devices 19, 19a and 19b. The frame structure comprises a plurality of inclined members 15 extending upward in parallel relation to each other, said members 15 supporting one or more gear boxes 16. Each gear box 16 supports and drives a single thread-advancing reel 20 and its associated transfer device 19, or in some cases a plurality of reels and transfer devices.

As shown in Figure 3, each thread-advancing reel 20 includes two cage members 17 and 18, which, broadly speaking, cooperate after the fashion of the two reel members employed in the reel of Knebusch Patent No. 2,210,914. Cage member 17 is known as the concentric member by virtue of the fact that it is mounted for rotation concentrically with shaft 21, which is supported at both ends in perpendicular relation to the side wall of gear box 16. Cage member 18, which is referred to as the eccentric member, is unilaterally mounted on shaft 22, which is inclined with respect to the side wall of gear box 16.

The axis of shaft 22 of eccentric member 18 lies in a plane substantially parallel to a plane

containing the axis of shaft 21 of concentric member 17, but due to the inclination of its mounting in gear box 16, shaft 22 is inclined with respect to shaft 21. According to the invention, the planes of the axes of shafts 21 and 22 are offset laterally from each other by a distance greater than the length of the radius of either of said cage members but preferably less than the combined length of the radii of both of said cage members.

Concentric member 17 comprises a disc-like supporting member 25 disposed concentrically of shaft 21 carrying a plurality of axially extending, rigidly mounted bar members 26. Eccentric member 18 likewise includes a disc-like supporting member 27 to which are rigidly secured axially extending bar members 28. By reason of the disposition of the axes of the cage members 17 and 18 in the relationship hereinbefore described, the bar members 26 of concentric member 17 intermesh to a certain extent, but not completely with the bar members 28 of eccentric member 18.

Due to the fact that supporting member 25 of concentric member 17 is disposed at some distance from gear box 16, which serves to drive shaft 21, it is desirable to provide a bearing bracket 23 in which is carried the other end of said shaft.

Transfer devices 19, 19a, 19b, etc., one of which is disposed as shown in Figure 1 between each two reels, are substantially similar in construction to the cage members of reel 20. Each transfer device 19 comprises a drive shaft 29 supported and driven by gear box 16, a disc-like supporting member 30, and a plurality of rigidly mounted fingers 31 preferably equal in number to half that of the bar members in either of the cage members forming reel 20. Fingers 31 of transfer device 19 are preferably considerably shorter than the bar members of either cage member. As indicated in Figures 1 and 2, fingers 31 interdigitate with one of the cage members of each of the two reels 20 and 20a between which the transfer device is disposed.

Thus each transfer device cooperates with the adjacent cage members of the immediately preceding and subsequent reels to transfer the thread, regardless of whether such cage member be the concentric or eccentric member of the reel.

Gear box 16 comprises a housing 32 with a removable cover 33 which serves to enclose gearing adapted to support and drive the individual cage members 17 and 18 and transfer device 19 of each unit. Forming part of housing 32 is a bracket 35 which, together with bolts 36, constitutes the means for mounting gear boxes 16 upon inclined frame members 15 in the manner indicated in Figure 2. To the outer wall of housing 32 is secured a bearing bracket 37 for supporting an inclined drive shaft 38 which serves to provide motive power for a plurality of gear boxes 16 arranged along frame member 15. Bevel gear 39 mounted on drive shaft 38 meshes with a similar bevel gear 40 which is disposed outside housing 32 of gear box 16 and operates to drive a stub shaft 42 extending into said gear box and carrying spur gear 41.

Meshing with spur gear 41 are spur gear 43, mounted upon shaft 21 for concentric member 17, and spur gear 45, mounted on shaft 22 for eccentric member 18. Spur gear 46 upon shaft 29, which serves to drive transfer device 19, likewise meshes with gear 41. It is preferable that the

ratio of the gearing in each gear box 16 be such that transfer device 19 operates at a greater peripheral speed than the reel members with which it interdigitates. The gears are in any event so provided that the several reel members and transfer devices may be synchronized to insure against any possibility of clashing or interference between their respective bar members and fingers.

Any suitable arrangement of gearing other than that shown in the illustrated embodiment of the invention may be employed; however, in order that a uniform driving relation may be maintained in each reel unit, it is desirable that each individual reel and at least one of the transfer devices therewith associated be driven from the same train of gears. In any event, suitable driving means such, for example, as a drive shaft extending longitudinally of the apparatus and connected to a motor or other source of power (not shown) may be employed to operate a plurality of shafts 38 simultaneously. In such case, each shaft 38 operates a plurality of gear boxes 16 in each of which, except those at the extreme left- and righthand ends of the apparatus, are supported and driven two reel units, one in each of two adjacent series of reels.

An arrangement of reels such as that illustrated is readily adaptable to a variety of operations of the kind customarily employed in the handling of continuous lengths of thread. By virtue of the fact that the axes of cage members 17 and 18 are offset laterally and disposed in inclined relation to each other, a thread applied to the periphery of the reel will automatically advance in a plurality of spaced turns along the periphery thereof in an axial direction. When a number of such reels are arranged in series, transfer devices 19 will operate to transfer the thread from one to another of the reels in the series without manual intervention.

With the arrangement of reels contemplated by the illustrated embodiment of the invention, the thread is advanced more or less in zig-zag fashion on each series of reels. The thread on the series of reels at the right in Figure 1, for example, advances toward the left on reel 20. After being transferred to reel 20a by transfer device 19, the thread changes direction and advances axially along the reel periphery toward the right. The cycle is repeated when the thread is transferred by transfer device 19a to reel 20b and those succeeding reels comprising the series.

This follows from the fact that where two reels in adjacent series are supported and driven from the same gear box 16, the inclination between the reel members of one reel is necessarily opposite to that existing between the reel members of the adjacent reel.

As hereinbefore stated, the offset and inclined relation existing between the axes of cage members 17 and 18 accounts for the advance of the thread in an axial direction along the periphery of reel 20. Members 17 and 18 are positively rotated at the same angular speed by gear box 16 in the manner previously described. During such rotation, the offset relationship of the axes of said members causes each turn of thread wound about the reel periphery to be supported intermittently by the bar members of one cage member and the bar members of the other. Simultaneously, the inclined relationship of the cage members causes the thread turns to assume a definite spacing therebetween and to advance in

substantially helical turns in a direction generally parallel to the axes of said cage members.

Where only a single thread-advancing reel is associated with a transfer device, the thread will advance upon rotation of the reel in the manner just described in a direction parallel to the axis of the reel as a whole to the point at which the intermeshing fingers of the transfer device project into the periphery of the reel. Upon reaching this zone, the fingers of the transfer device will positively remove the thread from engagement with the bar members of the reel. From the transfer device, the thread may be directed to other apparatus for performing additional processing operations; for example, to means for effecting a reduction of the thread to fibers of staple length, or to twisting, doubling or packaging equipment.

In apparatus using a plurality of thread-advancing reels, the material will travel axially along one reel until engaged by the transfer device, which will carry the thread end bodily over to the reel member of the succeeding reel with which it intermeshes. After the leading end of the thread is once picked up by the bar members of the succeeding reel and said reel is fully threaded up, the thread will thereafter pass directly from reel to reel independently of the transfer device. The transfer device will continue to rotate uninterruptedly and will again operate to engage the thread if for any reason the continuity of travel of the thread is broken so as to produce a new leading end.

Referring now to the diagrams representing Figures 4 to 11, inclusive, Figure 4 indicates that a thread *a* has been wound upon and is being advanced axially along reel 20 and as yet has not reached the zone of reel member 17 into which fingers 31 of transfer device 19 project. Figure 5 represents that stage in the manipulation of the thread *a* at which one of the fingers 31 of transfer device 19 has picked up the leading end of thread *a* and is directing the same toward bar members 28 of member 18 of reel 20a. In Figure 6, thread *a* is about to be picked up by one of the bar members 28 of member 18 of reel 20a and in Figure 7 the transfer from finger 31 of transfer device 19 to said bar member has been accomplished.

Figure 8 indicates the manner in which the leading end of thread *a* now supported solely by bar members 28 of member 18 of reel 20a is transferred to bars 26 of member 17 of said reel. Figure 9 shows the thread as being supported now upon the bar members 26 of cage member 17 just prior to its being picked up by the remaining bar members 28 of member 18, while Figure 10 shows the manner in which the transfer is negotiated. Figure 11 shows reel 20a as being completely threaded up after which the thread will advance in a generally axial direction therealong until it contacts the fingers of transfer device 19a whereupon the process hereinbefore outlined is repeated.

It will thus be apparent that, barring inadvertent breakage of the thread, the series of reels and transfer devices will continue, once the leading end of the thread or the like has been applied to the uppermost reel of the series, to deliver a continuous length of said material from the lowermost reel.

Obviously, the apparatus of Figures 2 and 3 of the drawings may be employed in any process in which a plurality of successive processing operations is to be performed upon a continuous

length of material. In the interests of clarity, all auxiliary equipment necessary to perform such processing operations has been omitted in the illustrated embodiment of the invention.

Suitable piping and troughs may, however, easily be installed upon the machine and supported from the inclined frame members 15 so as to facilitate the application of appropriate treating liquids to the material as it traverses the reels. Housings of various types surrounding the reels may also be provided where treatment with gaseous media is contemplated.

As hereinbefore indicated, many modifications in arrangement and adaptation of the thread-advancing reels and their associated transfer devices may be made without departing from the spirit of the invention. For example, instead of being arranged in an inclined plane as shown in Figure 2, the reel units may, if desired, be disposed in stacked relation or side by side in the same horizontal plane: this follows from the fact that transfer of the thread does not depend upon gravitational force but occurs positively regardless of the direction of travel of the thread from one reel to the next.

It is intended that the patent shall cover, by suitable expression in the appended claims, the features of patentable novelty which reside in the invention.

What is claimed is:

1. A thread-advancing thread store device comprising two rotatable, generally cylindrical cage members which are so mounted that a portion of the periphery of one of said cage members intersects that of the other cage member, the axes of said cage members being inclined with respect to each other and lying in parallel planes which are spaced apart by a distance greater than the length of the radius of either cage member.

2. A thread-advancing thread store device comprising two rigid generally cylindrical cage members which are mounted for rotation in the same direction in such manner that at least a portion of the periphery of one of said cage members intersects that of the other cage member, the axes of said cage members being inclined with respect to each other and disposed in parallel planes spaced apart by a distance greater than the length of the radius of either cage member.

3. A thread-advancing thread store device comprising two rigid generally cylindrical cage members the peripheries of which are defined by a plurality of spaced, axially extending bar members, said cage members being mounted for rotation in the same direction in such manner that a portion of the bar members of one cage member intermesh with those of the other cage member and that the axes of said cage members are inclined with respect to each other and disposed in parallel planes spaced apart by a distance greater than the length of the radius of either cage member.

4. A thread-advancing thread store device comprising two rotatably mounted intermeshing sets of longitudinally extending bar members each of which sets is formed as a rigid unit of substantially circular cross section, the axes of said sets lying in parallel planes but inclined with respect to each other and disposed in each case outside the periphery of the other set.

5. A thread-advancing thread store device comprising two rotatably mounted intermeshing sets of longitudinally extending bar mem-

bers each of which sets is formed as a rigid unit of substantially cylindrical form, the axes of said sets being arranged in different parallel planes and in inclined relation with respect to each other but in each case being disposed outside the periphery of the other set.

6. A thread-advancing thread store device comprising two rigid generally cylindrical sets of spaced axially extending bar members which are rotatably mounted in such manner that at least a portion of the bars of one set intermesh with those of the other, the axes of said sets being in inclined relation to each other but lying in parallel planes which are displaced from each other so that in each case the axis of one of said sets of bar members is disposed outside the periphery of the other set.

7. A thread-advancing thread store device comprising two intermeshing sets of rigid, axially extending bar members mounted for rotation in the same direction about axes which are disposed in inclined relation with respect to each other, and in parallel planes spaced apart by a distance greater than the length of the radius of either member.

8. A thread-advancing thread store device comprising two intermeshing sets of rigid, axially extending bar members mounted for rotation about axes which are disposed in parallel and inclined relation with respect to each other and so arranged that the axis of each of said sets lies outside the periphery of the other.

9. A thread-advancing thread store device comprising two cage members each of which is made up of a plurality of rigidly supported, axially extending bar members forming the generally cylindrical periphery of each cage member, said cage members being mounted for rotation about axes which are arranged in inclined relation with respect to each other and lie in parallel planes spaced apart by a distance greater than the length of the radius of either cage member but less than the combined length of the radii of both cage members so that the peripheries of said cage members intersect.

10. A thread-advancing thread store device comprising two rotatable sets of rigidly mounted, axially extending bar members so disposed that a plurality of said bar members in a portion of the periphery of the first set intermesh with the bar members in a portion of the periphery of the second set and so mounted that the axis of each of said sets lies outside the periphery of the other set, said axes being arranged in parallel planes and in inclined relation with respect to each other.

11. Apparatus for manipulating thread or the like comprising, in combination, a series of thread-advancing thread store devices each of which includes two rotatably mounted sets of axially extending bar members arranged at spaced intervals upon a supporting member, said bar members in a portion of the periphery of the first set intermeshing with the bar members in a portion of the periphery of the second set, the axis of each set lying outside the periphery of the other, said axes being in inclined relation in

parallel planes, and alternately disposed with respect to each of said successively arranged thread-advancing thread store devices in the series, transfer devices provided with a plurality of bar members defining its periphery which intermeshes with a portion of the periphery of one set of bar members of each of said thread-advancing thread store devices.

12. Apparatus for manipulating thread or the like comprising, in combination, a plurality of thread-advancing thread store devices arranged in series each of which includes two sets of rigidly supported, axially extending bar members rotatably mounted in such manner that a portion of the periphery of the first set intermeshes with a portion of the periphery of the second set, the axes of each of said sets being inclined with respect to each other and lying in parallel planes spaced apart by a distance greater than the length of the radius of either set of bar members, and alternately disposed between each of said successively arranged thread-advancing thread store devices in said series, a transfer device which has a plurality of relatively shorter bar members intermeshing with a portion of the periphery of the second set of bar members of one of said thread-advancing thread store devices and a portion of the periphery of the first set of bar members of the next succeeding thread-advancing thread store device in the series.

13. Apparatus for manipulating thread or the like comprising, in combination, a thread-advancing thread store device which includes two rotatable sets of axially extending bar members so mounted that the bar members in a portion of the periphery of the first set intermesh with the bar members forming the periphery of the second set, the axes of said sets being disposed in inclined relation with respect to each other in parallel planes but in each case lying outside the periphery of the other set, and a transfer device provided with a plurality of bar members defining its periphery which intermeshes with a portion of the periphery of one set of bar members of said thread-advancing thread store device.

14. Apparatus for manipulating thread or the like comprising, in combination, a thread-advancing thread store device including two rigid, generally cylindrical cage members the periphery of each of which is defined by a plurality of spaced axially extending bar members, said cage members being mounted for rotation in the same direction about axes which are inclined with respect to each other but lie in parallel planes spaced apart by a distance greater than the length of the radius of either cage member in such fashion that the bar members in a portion of the periphery of one cage member intermesh with those of the other cage member, and a transfer device provided with a plurality of bar members defining its periphery which intermeshes with a portion of the periphery of one of the cage members of said thread-advancing thread store device.

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