Sept. 6, 1966 B. SCHUBERT 3,270,601

APPARATUS FOR MANIPULATING ROD-LIKE MATERIAL

Original Filed Nov. 14, 1963 7 Sheets-Sheet 1

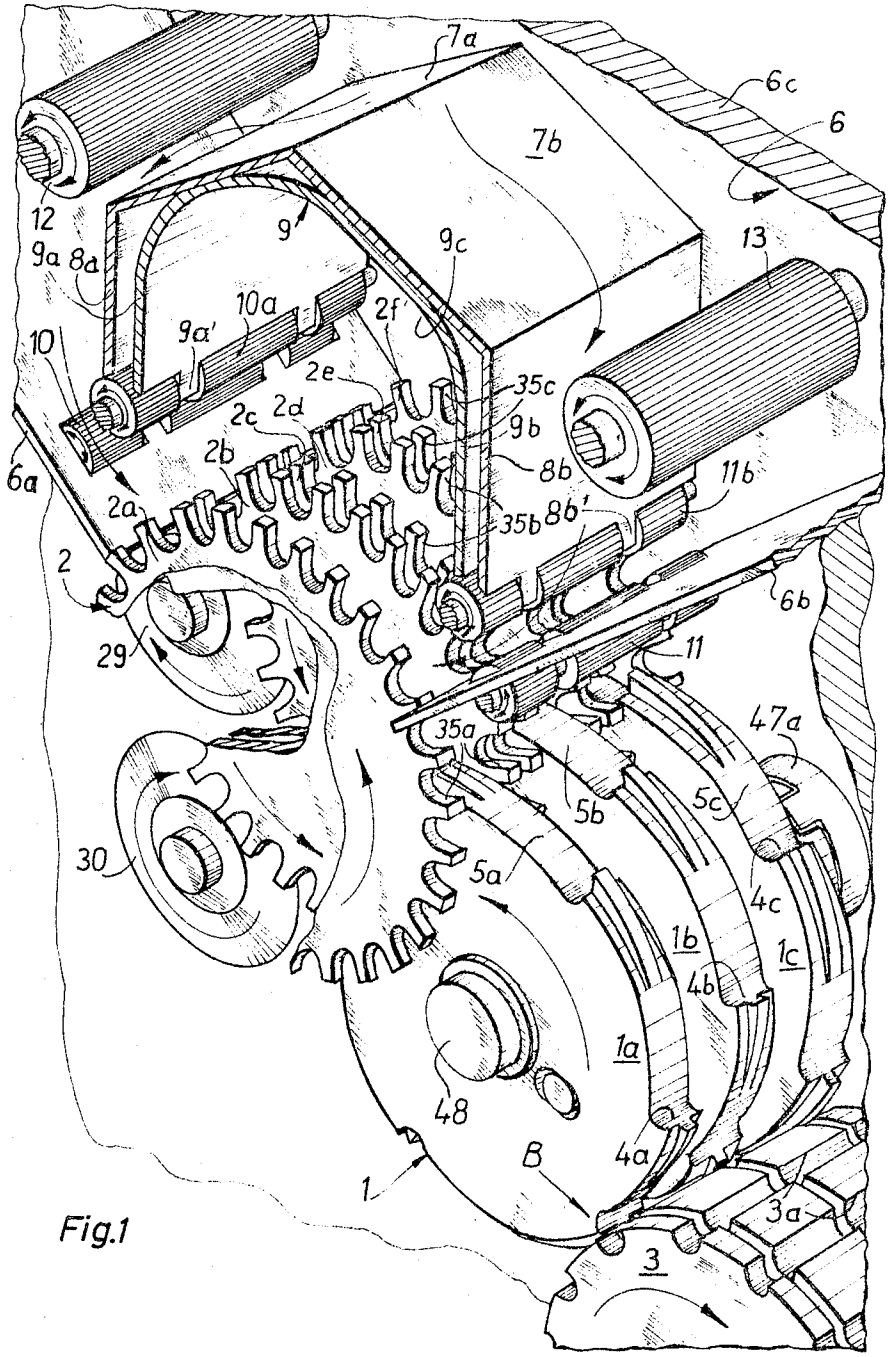


Fig.1

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APPARATUS FOR MANIPULATING ROD-LIKE MATERIAL

Original Filed Nov. 14, 1963 7 Sheets-Sheet 2

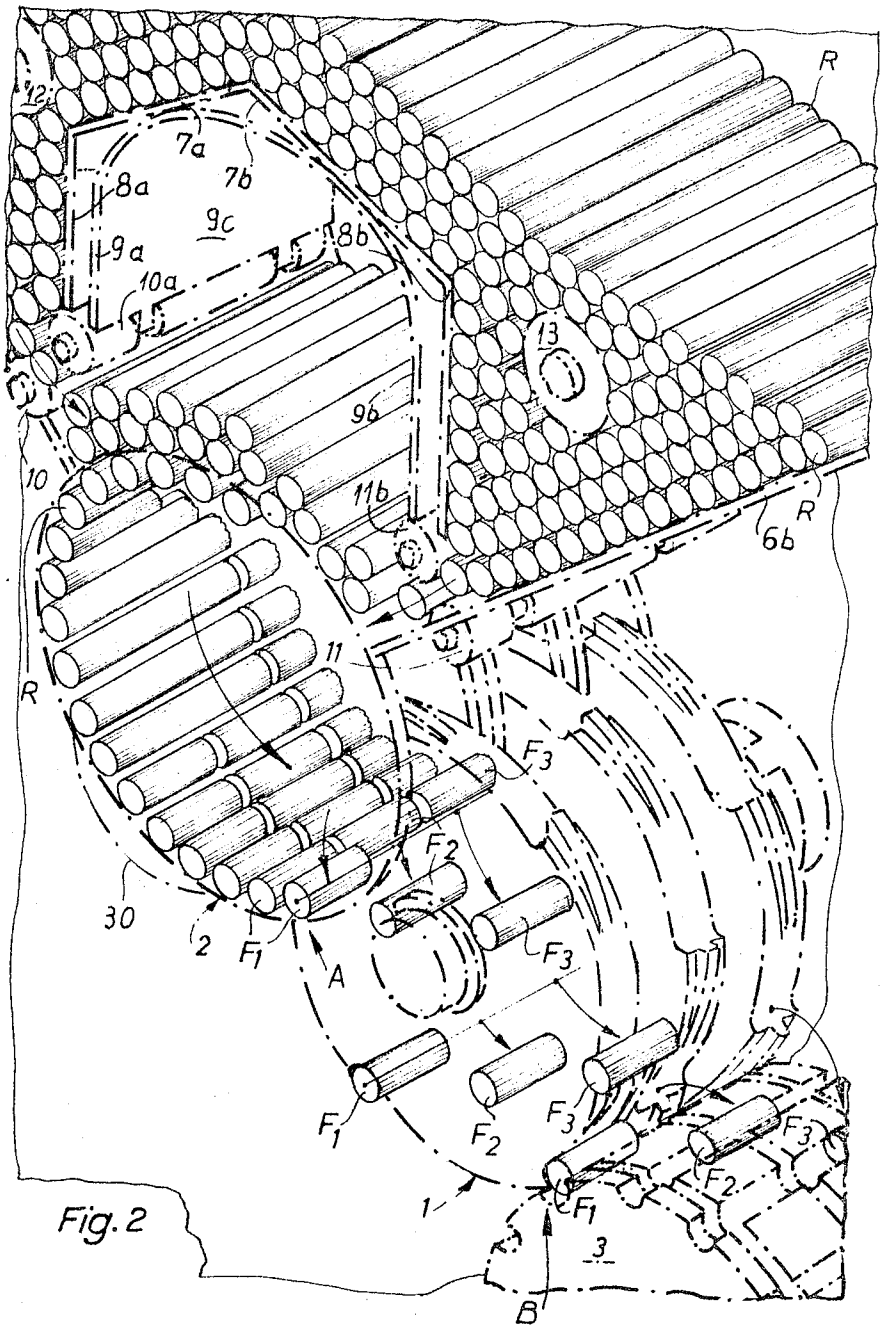


Fig. 2

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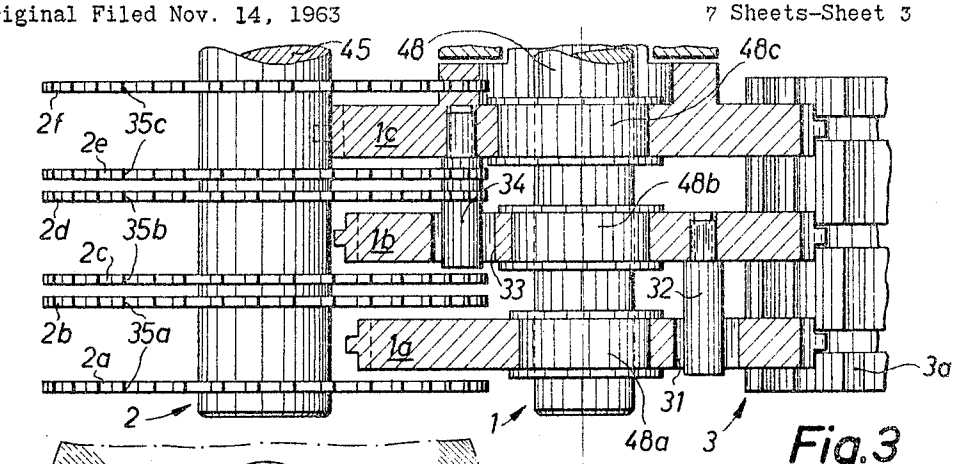


Fig.3

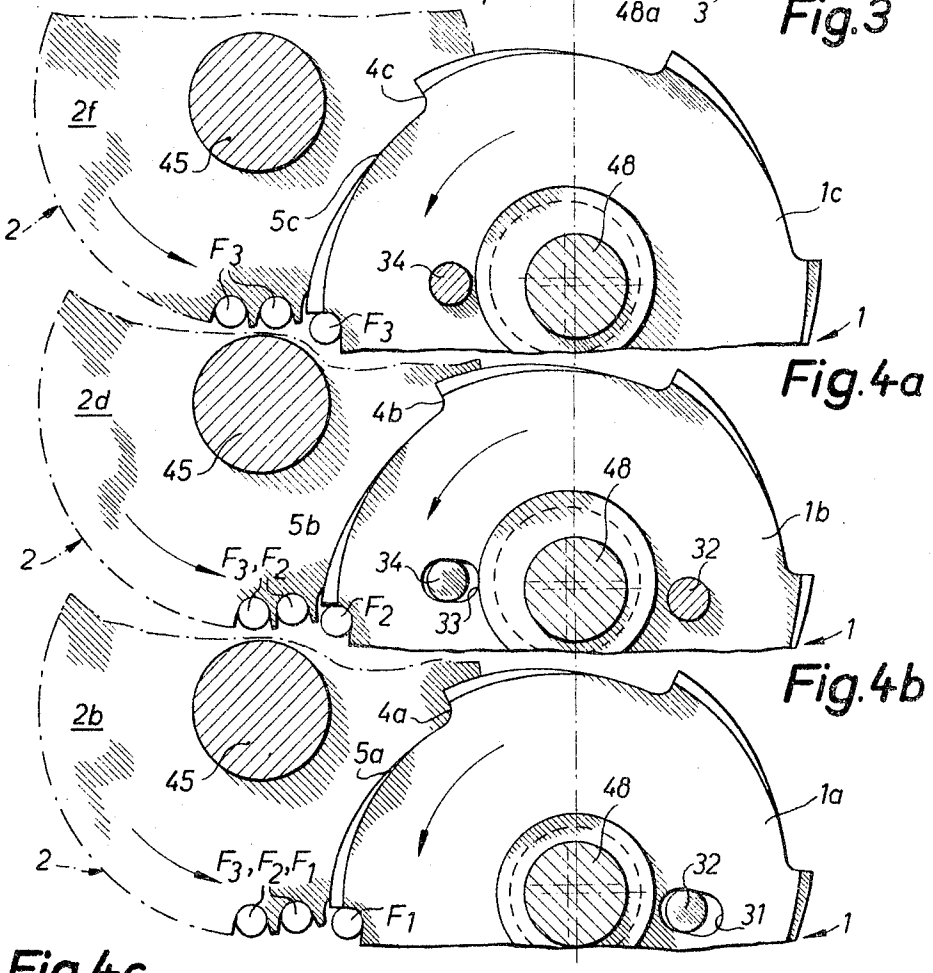


Fig.4a

Fig.4b

Fig.4c

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APPARATUS FOR MANIPULATING ROD-LIKE MATERIAL

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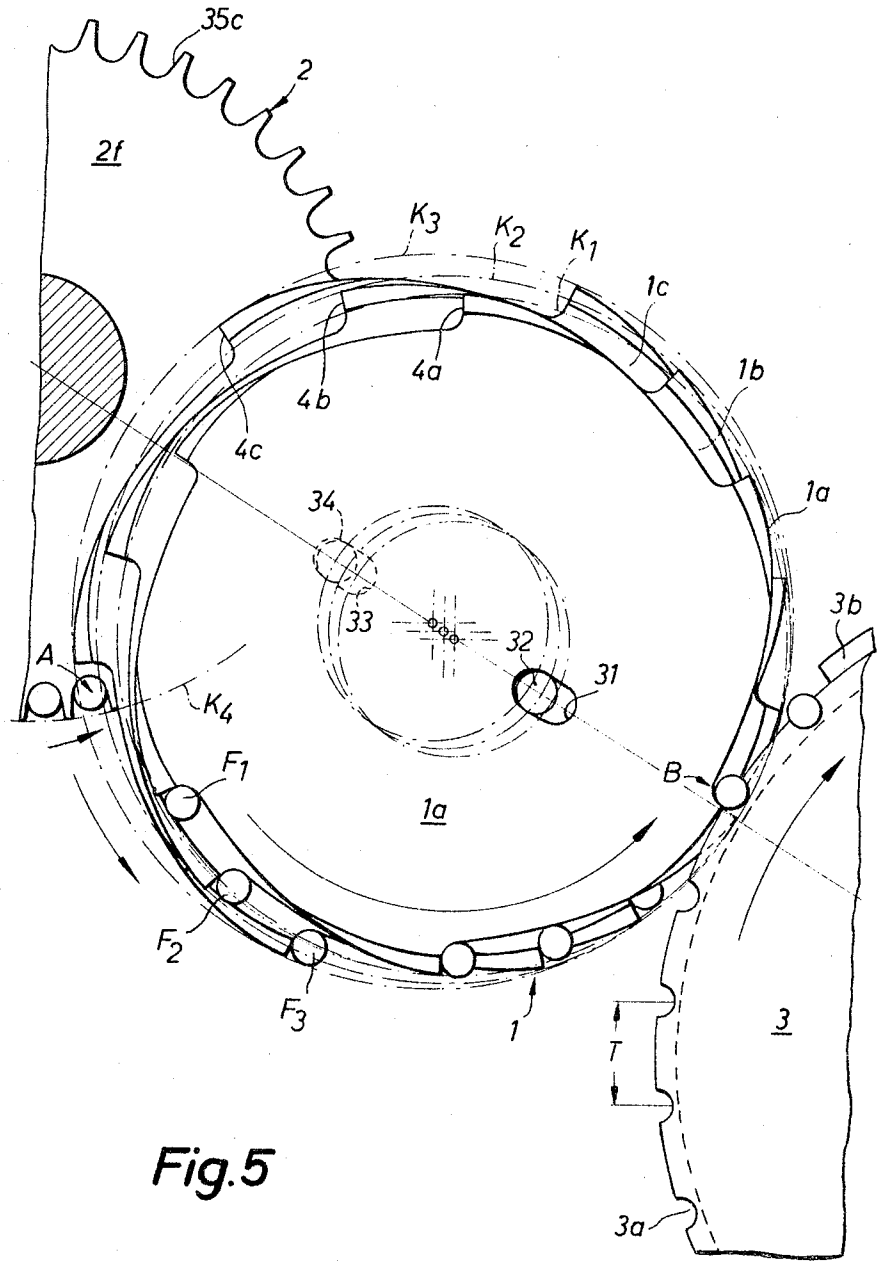


Fig.5

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APPARATUS FOR MANIPULATING ROD-LIKE MATERIAL

Original Filed Nov. 14, 1963 7 Sheets-Sheet 5

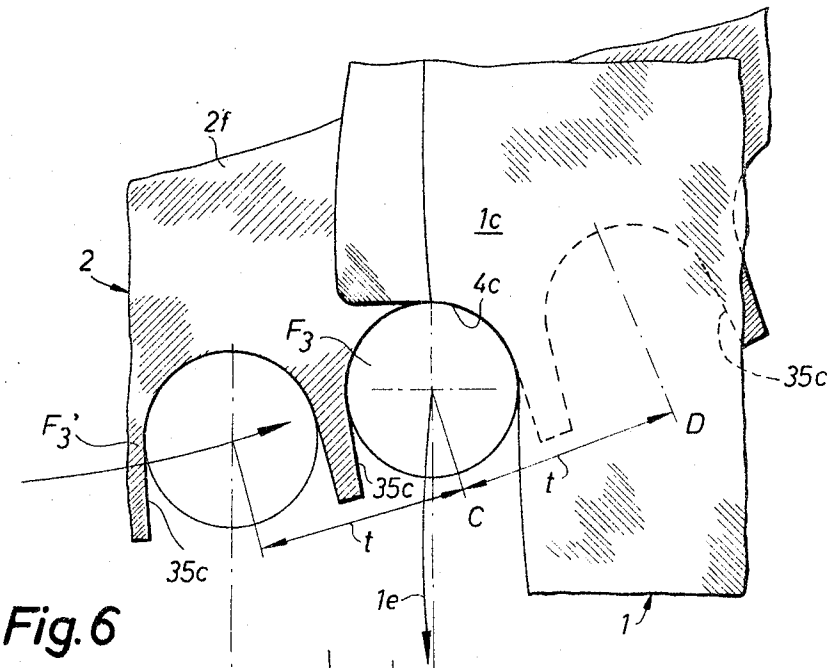


Fig. 6

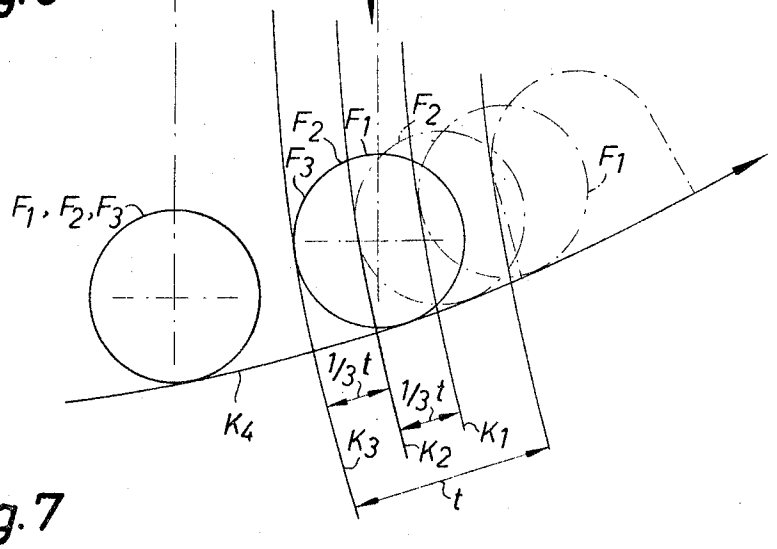


Fig. 7

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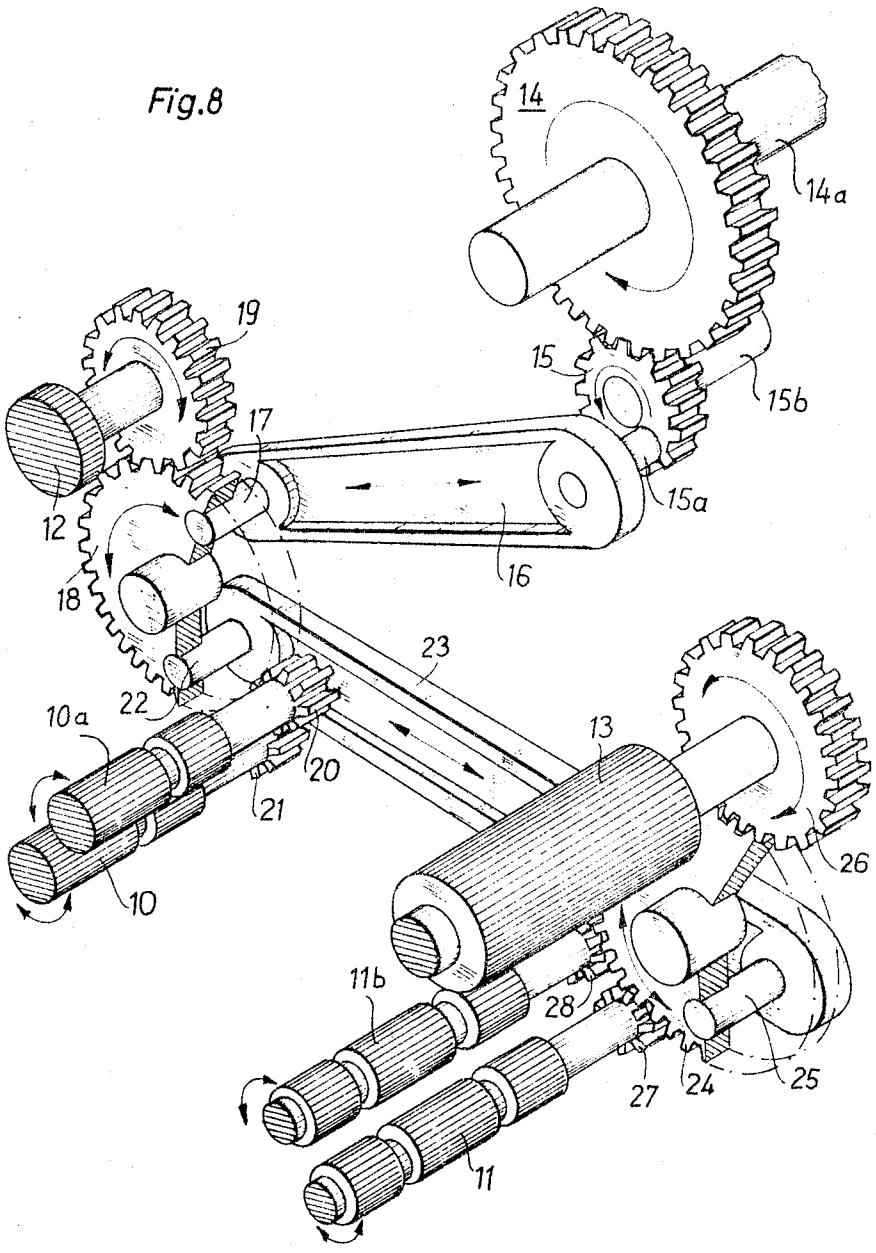
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APPARATUS FOR MANIPULATING ROD-LIKE MATERIAL

Original Filed Nov. 14, 1963 7 Sheets-Sheet 6

Fig.8



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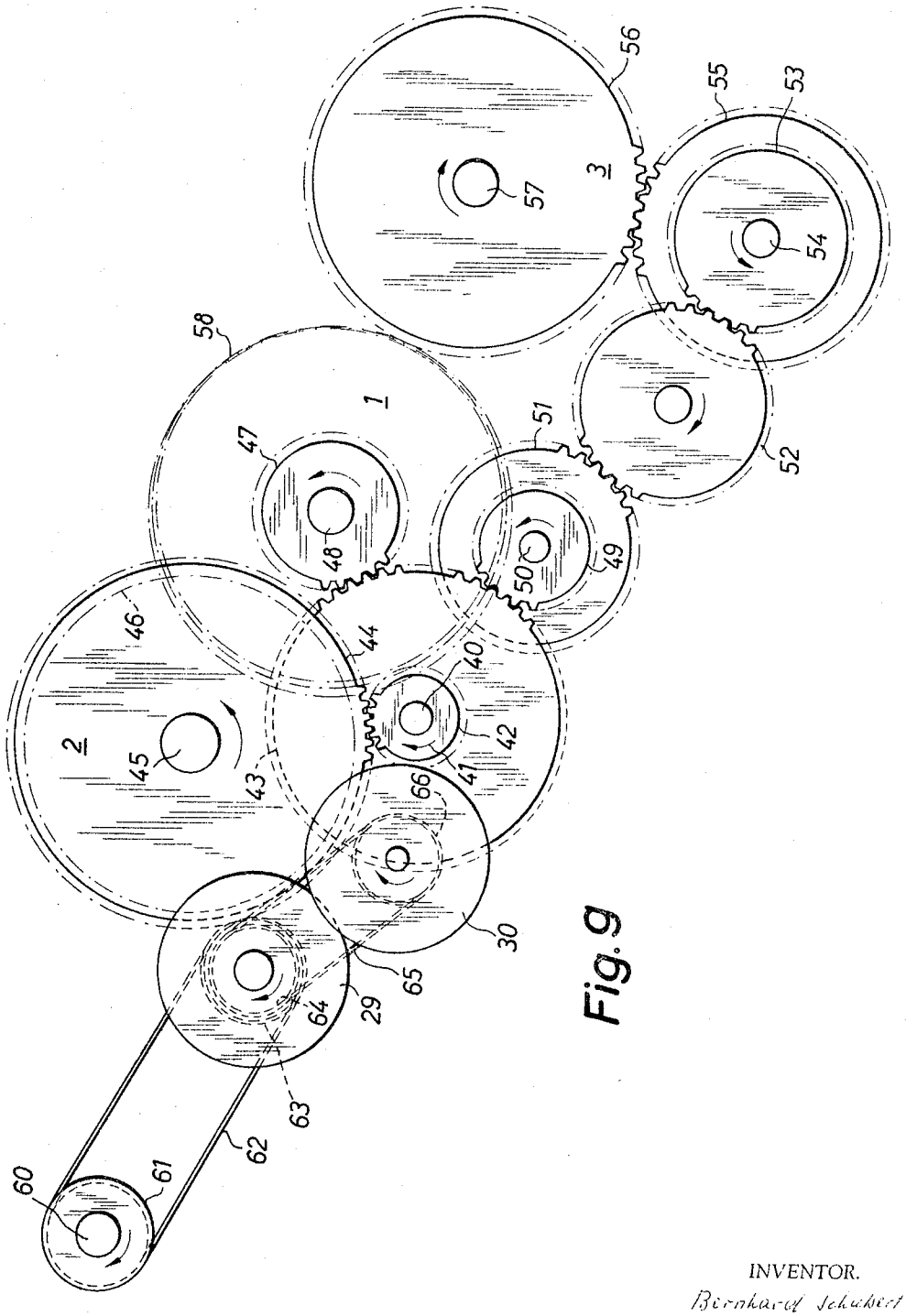


Fig. 9

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APPARATUS FOR MANIPULATING ROD-LIKE MATERIAL

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Original application Nov. 14, 1963, Ser. No. 323,694. Divided and this application Oct. 6, 1965, Ser. No. 493,319

Claims priority, application Germany, Nov. 17, 1962, H 47,424

11 Claims. (Cl. 83—102)

This is a division of my copending U.S. application Serial No. 323,694, filed November 14, 1963.

The present invention relates to an apparatus for manipulating filter rods, cigarette rods and similar rod shaped articles. More particularly, the invention relates to an apparatus for conveying and staggering in a novel way rod-like articles which are obtained by serving or subdividing rods of multiple unit length into two or more axially aligned sections and which are thereupon arranged in a single row wherein the articles form a single file.

In modern filter cigarette machines, mouthpiece sections of double unit length are inserted between pairs of axially aligned cigarette rods, and such assemblies of cigarette rods and mouthpiece sections are thereupon provided with wrappers of adhesive-coated tape which surround the mouthpiece section and the adjacent portions of both cigarette rods so that each assembly forms a filter cigarette of double unit length. The assemblies are then severed across the wrapper to obtain two filter cigarettes of ultimate length. Mouthpiece sections of double unit length are obtained by severing or subdividing filter rods of multiple unit length and by thereupon shuffling the thus obtained axially aligned sections in order to form a single file which may be fed to a so-called assembly drum of the filter cigarette machine on which the mouthpiece sections are assembled with pairs of cigarette rods.

It is an important object of the present invention to provide an apparatus for shuffling sections of filter rods or other types of rod-like articles in such a way that the rods may be severed or subdivided and the resulting sections shuffled and arranged in a single file while travelling at a speed which is sufficient to insure that the apparatus may be incorporated in or assembled with a modern high-speed filter cigarette machine.

Another object of the invention is to provide a novel apparatus for transferring rod-like sections from rows wherein the sections are axially aligned with each other into consecutive pockets of a receiving conveyor which may be used to deliver such sections to the assembly drum of a filter cigarette machine.

An additional object of the invention is to provide a novel apparatus which is sufficiently compact to fit into presently used filter cigarette machines.

A further object of the invention is to provide a novel magazine and a novel transfer conveyor which may be utilized in an apparatus of the just outlined characteristics.

Still another object of the instant invention is to provide an apparatus wherein severing or subdivision of rods of multiple unit length into two or more sections and subsequent transfer of such sections into the pockets of a receiving drum may take place in a fully automatic way and without any supervision on the part of the operator.

With the above objects in view, one feature of my invention resides in the provsion of an apparatus for staggering an array of rod-like sections wherein the sections are initially arranged in a plurality of rows of equidistant sections so that each section of one row is in

substantial axial alignment with one section of each other row. The apparatus comprises means moving an array of equidistant parallel rods in a direction at right angles to their axes, means for simultaneously severing or subdividing each rod into a plurality of sections whereby the array of rods is transformed into an array of sections wherein each section of one row is axially aligned with one section of each row, means for moving the array of sections in a first path at right angles to their axes, means for consecutively transferring the foremost axially aligned sections of each row seriatim into a plurality of separate paths at such intervals that all foremost axially aligned sections are transferred before a rod moves through a distance which is equal to the distance between two consecutive rods whereby the sections are transversely staggered with reference to each other, means for moving the thus staggered sections at right angles to their axes at a higher speed and through different distances so that the sections remain in transversely staggered relation, and means for thereupon shifting the sections axially with reference to each other to form a single row in which all sections are arranged in a single file.

For example, if the rods are filter rods of multiple unit length, they may be severed into sections of double unit length and, once such sections form a single file, they may be introduced between consecutive pairs of cigarette rods to form filter cigarettes of double unit length. After a wrapper of adhesive-coated material is applied around the sections and around the adjacent end portions of the respective cigarette rods, the resulting product is severed or subdivided into two halves by forming a cut across the filter sections to obtain two filter cigarettes of ultimate length.

In one of its simplest forms, the apparatus of my invention preferably comprises a feed conveyor whose pockets or similar holding means receive filter rods from a magazine and which moves such rods substantially or exactly at right angles to their axes and past one or more cutting devices which automatically sever or subdivide each rod into two or more axially aligned sections of requisite length, a receiving conveyor which is spaced from the feed conveyor and which is provided with equidistant pockets or similar holding means each arranged to receive a single section, and a special transfer conveyor which is disposed between the two previously mentioned conveyors and which includes a plurality of transfer elements each serving to transfer one section of any given rod from the feed conveyor to the receiving conveyor. The elements of the transfer conveyor have portions of different length which extend from a first transfer station at which the transfer conveyor receives seriatim the foremost axially aligned sections from the feed conveyor and a second transfer station at which the transfer conveyor delivers transversely staggered sections to the receiving conveyor. The apparatus further comprises drive means arranged to move the transfer conveyor and the receiving conveyor at identical speeds but in different directions and to move the feed conveyor at a lower speed so that the pockets or similar holding means provided on the elements of the transfer conveyor receive sections of a given rod seriatim while moving along the first transfer station and at such short intervals that all sections of a given rod are transferred before a rod or a group of axially aligned sections covers with the feed conveyor a distance which equals the distance between two consecutive rods.

The sections of a given rod are caused to move with respect to each other and become staggered at the time they are being transferred seriatim at the first transfer station, and to a small extent while they travel between the two transfer stations. While moving with a given conveyor, the sections travel at identical speed and each

conveyor moves the sections at right angles to their axes, i.e., sideways.

My apparatus differentiates from certain known apparatus in that the transfer of any given group of axially aligned sections from the pockets of the feed conveyor into the pockets of the transfer elements does not take place simultaneously but at timely spaced intervals so that the first section of a given rod is transferred onto the respective element of the transfer conveyor while the remaining section or sections of the same rod will continue to advance with the feed conveyor for a period of time which is necessary to move the nearest empty pocket of the respective transfer element into registry with the second section of the same rod, and so on until all of the sections are on the transfer conveyor. Such transfer of two or more axially aligned sections is completed within a period of time which is needed by a rod to cover on the feed conveyor the distance between two consecutive rods. In conventional apparatus, the transfer conveyor comprises a series of coaxial disks which are driven at different speeds, or a series of eccentric disks whose pockets are aligned at two spaced transfer stations. The drive mechanism for such disks is quite complicated and, furthermore, even minimal inaccuracies in mounting of the disks will result in destruction or mutilation of sections as well as in many other inconveniences.

In accordance with the present invention, all elements of the transfer conveyor may be driven at the same speed and their pockets need not be aligned at either of the two transfer stations. If the transfer elements assume the form of disks, all that is necessary is to use disks of different diameters and to mount them in such a way that the disks are substantially tangential to the receiving conveyor at the second transfer station and that portions of the disks overlap the feed conveyor at the first transfer station. At this time, I prefer to utilize a feed conveyor which resembles a drum with equidistant axially parallel peripheral pockets, and the receiving conveyor preferably also resembles a drum with equidistant axially parallel peripheral pockets. The feed drum may be assembled of a plurality of pair-wise arranged coaxial wheels defining between themselves spaces into which portions of the transfer disks extend so that the pitch circles of pockets on the transfer disks intersect the pitch circle of pockets on the feed conveyor at such points at which the disks remove foremost axially aligned sections from the pockets of the feed conveyor.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved apparatus itself, however, both as to its construction and the mode of operating the same, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of a specific embodiment with reference to the accompanying drawings, in which:

FIG. 1 is a persepctive view of the three conveyors, of two rotary cutters, and of a magazine for filter rods, with certain parts broken away;

FIG. 2 is a similar perspective view wherein the parts shown in FIG. 1 are indicated by phantom lines and wherein the manner in which the filter rods and the sections of severed filter rods move through the apparatus is shown by full lines;

FIG. 3 is an end view of the feed conveyor and an axial section through the disks of the transfer conveyor;

FIG. 4*a* is a fragmentary front elevational view of the transfer station between the feed conveyor and one disk of the transfer conveyor;

FIG. 4*b* is a similar front elevational view of the transfer station between the feed conveyor and another disk of the transfer conveyor;

FIG. 4*c* is a similar front elevational view of the transfer station between the feed conveyor and a third disk of the transfer conveyor;

FIG. 5 is an enlarged front elevational view of the transfer conveyor in a position its disks assume just prior to transfer of a section from the feed conveyor into the pocket of a disk;

FIG. 6 is a greatly enlarged fragmentary front elevational view of the feed conveyor and transfer conveyor at the first transfer station, showing a section in a position it assumes when it is simultaneously received in the pockets of both conveyors;

FIG. 7 is a schematic diagram showing the manner in which axially aligned sections obtained by severing a multiple-length filter rod are transferred seriatim into the pockets of the transfer conveyor;

FIG. 8 is a perspective view of the drive mechanism serving to rotate a series of agitating rollers which regulate the discharge of filter rods from the magazine, certain portions of the mechanism being broken away; and

FIG. 9 is a schematic front elevational view of the drive mechanism for the conveyors and the cutters.

Referring to FIGS. 1 and 2, there is shown an apparatus which is utilized for transforming an array consisting of rows of equidistant axially aligned filter rod sections of double unit length into a single row of transversely staggered sections. This row of transversely staggered sections is thereupon condensed to form a single file of sections which may be delivered to an assembly drum where each section enters the space between a pair of axially aligned cigarette rods to form with the cigarette rods a filter cigarette of double unit length.

The apparatus comprises a magazine **6** which feeds filter rods R of sextuple unit length to a feed conveyor **2**, and this feed conveyor cooperates with a pair of angularly and axially spaced rotary cutters **29**, **30** which sever or subdivide the rods R into sections F_1, F_2, F_3 of double unit length. The conveyor **2** thereupon moves such sections in a circular path to a first transfer station A at which the foremost axially aligned sections F_1, F_2, F_3 are received seriatim by a transfer conveyor **1** in such a way that the axially aligned sections of each consecutive rod are staggered transversely and thereupon move in separate paths and through different distances to a second transfer station B at which they are deposited in peripheral holding means or pockets *3a* provided on a receiving conveyor **3** which serves to move the sections in a further circular path at identical speeds so that the transverse spacing between the sections remains unchanged. The conveyor **3** allows the sections to be moved axially with respect to each other so that the sections form a single file which is ready to be delivered to an assembly drum, not shown.

The transfer conveyor **1** comprises three transfer elements here shown as disks *1a*, *1b*, *1c* which are respectively provided with equisdistant peripheral holding means in the form of pockets *4a*, *4b*, *4c*. The angular distance between the centers of pockets *4a*, *4b* or *4c* is 3T wherein T is the angular distance between the centers of pockets *3a* on the receiving conveyor **3**. The reference numerals *5a*, *5b*, *5c* indicate arcuate guide faces provided on the peripheries of the disks *1a*, *1b*, *1c* and leading inwardly to the respective pockets *4a*, *4b*, *4c*.

The feed conveyor **2** comprises six coaxial gear-shaped wheels *2a*, *2b*, *2c*, *2d*, *2e*, *2f* which are disposed in pairs including a first pair *2a*, *2b*, a second pair *2c*, *2d* and a third pair *2e*, *2f*. The distance between the wheels *2a*, *2b* is such that a portion of the disk *1a* extends into the space therebetween. A larger portion of the disk *1b* extends into the space between the wheels *2c*, *2d*, and a still larger portion of the disk *1c* extends into the space between the wheels *2e*, *2f*. The cutter **29** extends into the gap between the wheels *2d*, *2e* and the cutter **30** extends into the gap between the wheels *2b*, *2c* so that a filter rod R of sextuple unit length which is received in aligned holding means or pockets of the wheels *2a–2e* is automatically severed or subdivided to yield three sections F_1, F_2, F_3 of double unit length as the rod advances past the cutters **29**, **30**. The aligned pockets of the first pair of wheels *2a*, *2b* are identified by numerals *35a* and

these pockets accommodate the left-hand sections F_1 of the rods R which are severed by the cutter **30**. The aligned pockets **35***b* of the second pair of wheels **2***c*, **2***d* receive the median sections F_2 which are severed by the cutter **29**, and the aligned pockets **35***c* of the wheels **2***e*, **2***f* receive the right-hand sections F_3 which are severed by the cutter **29**. The distance between the centers of two adjacent pockets **35***a*, **35***b* or **35***c* exceeds only slightly the diameter of a filter rod R so that a feed conveyor of comparatively small diameter may carry a large number of rods.

The magazine **6** comprises a pair of converging outer side walls **6***a*, **6***b*, a rear wall **6***c* and an internal structure including two roof-shaped top walls **7***a*, **7***b* two vertical inner side walls **8***a*, **8***b* and an arcuate housing **9** having side walls **9***a*, **9***b*. The side walls **6***a*, **8***a* and **6***b*, **8***b* form two chutes having open lower ends which discharge two streams of filter rods R by gravity feed toward the periphery of the feed conveyor **2**. Two horizontal agitating rollers **12**, **13** extend into the respective chutes and serve to prevent bridging of filter rods which descend by gravity toward the feed conveyor **2**. The rollers **12**, **13** rotate back and forth and are driven by a mechanism which is shown in FIG. 8. Two agitating rollers **10**, **10***a* are disposed at a level below the roller **12** at the open lower end of the left-hand chute, and each thereof comprises a series of coaxial rolls with the rolls of the roller **10** extending into cutouts provided in the outer side wall **6***a*. The rolls of the roller **10***a* are located below the lower ends of the walls **8***a*, **9***a*, and these walls have downwardly extending projections (only the projections **9***a*′ are shown in FIG. 1) which extend into the spaces between the rolls of the roller **10***a*. The rollers **10**, **10***a* are rotated back and forth by the mechanism which is shown in FIG. 8 and serve to deliver rods R individually into the pockets **35***a*–**35***c* or into a rod-receiving compartment **9***c* defined by the housing **9**.

A second pair of agitating rollers **11**, **11***b* is disposed below the roller **13** and the rolls of the roller **11** are recessed in cutouts provided in the outer side wall **6***b*. The roller **11***b* is located below the walls **8***b*, **9***b* and these walls have projections (only the projections **8***b*′ are shown in FIG. 1) which extend into the spaces between the axially aligned rolls of the roller **11***b*. The rollers **11**, **11***b* rotate back and forth and perform the same function as the rollers **10**, **10***a*.

The mechanism which drives the rollers **10**, **10***a*, **11**, **11***b*, **12** and **13** is illustrated in FIG. 8. It comprises a driver gear **14** whose shaft **14***a* is rotated by the main drive shaft **40** of the apparatus (to be described in connection with FIG. 9) and which meshes with a pinion **15** mounted on a shaft **15***b* and carrying an eccentric pin **15***a*. The pin **15***a* is connected with a push rod **16** which carries a pin **17** eccentrically secured to a gear **18** which in turn meshes with pinions **19**, **20** and **21** respectively mounted on the shafts of the rollers **12**, **10***a* and **10**. The gear **18** carries a second eccentric pin **22** which is connected with one end of a second push rod **23**, and the other end of this second push rod carries a pin **25** which is eccentrically secured to a gear **24**. The gear **24** meshes with pinions **26**, **27**, **28** which are respectively mounted on the shafts of the rollers **13**, **11**, **11***b*. The shaft **14***a* of the driver gear **14** rotates in a clockwise direction so that the pinion **15** will be driven in a counterclockwise direction and the wheels **18**, **24** will rotate back and forth to transmit similar rotary movements to the rollers whereby the rollers agitate the supply of filter rods in the magazine **6** and advance two single streams of such rods into the pockets **35***a*–**35***c* of the feed drum **2** as well as into the compartment **9***c*.

Referring to FIG. 3, the disk **1***a* is provided with an elongated radially extending slot **31** which receives a portion of a coupling bolt **32**, and this bolt has a threaded portion which is screwed into the disk **1***b*. A similar radially extending slot **33** in the disk **1***b* receives a portion of a second coupling bolt **34** which is screwed into the disk **1***c*. Such connection between the disks **1***a*–**1***c* is necessary in order to insure that the disks may move with respect to each other at the time they rotate about a common shaft **48** in such a way that their axes are parallel but eccentric with reference to each other. The slots **31**, **34** are provided at such distance from the axis of the feed drum **2** that the coupling bolts **32**, **34** remain spaced from the teeth of the wheels **2***a*–**2***f*. The shaft **48** is stationary and is provided with eccentric collars **48***a*, **48***b*, **48***c* which are coaxial with and support the disks **1***a*, **1***b*, **1***c*.

FIG. 3 also shows that the extent to which a portion of the disk **1***c* projects into the space between the wheels **2***e*, **2***f* is greater than the extent to which a portion of the disk **1***b* extends into the space between the wheels **2***c*, **2***d*, and a portion of the disk **1***a* extends even less into the space between the wheels **2***a*, **2***b*.

FIGS. 4*a* to 4*c* show that the bottom portion of each pocket **3***a*, **4***b*, **4***c* is bounded by an arcuate surface which extends along an angle of about 90 degrees, i.e., such arcuate surfaces are provided between radial surfaces (which extend outwardly toward the tips of the teeth on the disks **1***a*–**1***c*) and the aforementioned guide faces **5***a*, **5***b*, **5***c*. The conveyors **1** and **2** are driven in the same direction, namely, counterclockwise as viewed in FIGS. 1, 2, 4*a*–4*c*, 6 and 9.

Referring to FIG. 5, the lines K_1, K_2 and K_3 respectively indicate the addendum circles or crown circles of the disks **1***a*, **1***b*, **1***c* and it will be noted that these circles intersect the crown circle K_4 of the conveyor **2** as well as the pitch circle of the pockets **3***a*. The pitch circles of the pockets **4***a*–**4***c* also intersect the pitch circles of the pockets **35***a*–**35***c* but are tangential to the pitch circle of the pockets **3***a*. The pitch circles pass through the axes of the sections F_1, F_2, F_3 in the pockets of the respective conveyors. Thus, the diameter of the pitch circle of the pockets **3***a* corresponds to the maximum diameter of the receiving conveyor **3** because the pockets **3***a* are of semicircular outline so that one-half of each filter rod section will extend into the respective pocket on the conveyor **3**. The crown circle of the conveyor **2** is the circle touching the tips of teeth between the pockets **35***a*–**35***c*.

The angular position of the disks **1***a*–**1***c* with reference to each other is such that the pockets **4***c* are staggered with respect to the pockets **4***b* and that the pockets **4***b* are staggered with respect to the pockets **4***a* through a distance T. Thus, and as clearly shown in FIGS. 2 and 5, a section F_3 which forms part of the foremost filter rod R is transferred prior to the section F_2 of the same rod, and the section F_2 is transferred prior to the section F_1 of the same rod.

In accordance with the present invention, all three sections F_1, F_2, F_3 of the foremost filter rod R are transferred within a distance which does not exceed the angular distance *t* between the centers of two adjacent pockets **35***a*, **35***b* or **35***c*. This distance *t* is shown in FIG. 6 which illustrates (in broken lines) a first pocket **35***c* in the wheel **2***f*, a second pocket **35***c* which still accommodates a section F_3 but which is in exact registry with a pocket **4***c* of the disk **1***c*, and a third pocket **35***c* which accommodates a section F_3'. The center C of the section F_3 shown in FIG. 6 begins to travel along the line indicated by an arrow **1***e* which is a portion of the pitch circle of the pockets **4***c*. The line D passes through the center of the rightmost pocket **35***c* in FIG. 6, and it will be noted that the distance *t* is the distance between the centers of two adjacent pockets **35***c*. Before the central pocket **35***c* of FIG. 6 reaches the position occupied by the rightmost pocket **35***c*, the disks **1***a*–**1***c* have moved three foremost axially aligned sections F_1, F_2, F_3 from axially aligned pockets **35***a*, **35***b*, **35***c* of the feed conveyor **2**. This is shown in FIG. 7 which indicates that the filter rod sections F_1, F_2 continue to travel with the

conveyor 2 through a distance $t/3$ after the disk 1c has removed the corresponding section F_3 and before the disk 1b removes the section F_2, and that the section F_1 then continues to move with the conveyor 2 through a distance $t/3$ after the disk 1b has removed the section F_2 of the same filter rod. In other words, the sequence in which the sections of the foremost filter rod R are transferred seriatim at the station A is as follows: The section F_3 is transferred in the first step whereby the sections F_1, F_2 remain in the respective pockets 35a, 35b to cover a distance $t/3$ whereupon the section F_2 is removed but the section F_1 continues to move through another distance $t/3$ so that removal of all three axially aligned sections takes place within a distance t corresponding to the distance between the centers of two adjacent pockets 35a, 35b or 35c which is the distance between a pair of consecutive filter rods R on the feed conveyor 2. Consequently, the transfer of axially aligned filter rod sections into the pockets 4a, 4b, 4c takes place at the same rate at which such groups of axially aligned sections advance toward the transfer station A so that all pockets 35a–35c advancing beyond the transfer station A are empty and may receive unsevered filter rods R which descend between the rollers 11, 11b, from the compartment 9c, or between the rollers 10, 10a. The improved process for transferring groups of axially aligned sections F_1, F_2, F_3 may be described in another way by stating that the points at which the crown circles K_3, K_2, K_1 intersect the crown circle K_4 of the conveyor 2 are angularly spaced by distances $t/3$ wherein the distance t corresponds to the distance between a pair of adjacent pockets 35a, 35b or 35c, i.e., to the distance between two consecutive filter rods or between two consecutive groups of axially aligned sections on the conveyor 2.

The manner in which the disks 1a–1c receive the sections F_1, F_2, F_3 is best shown in FIGS. 4a to 4c. FIG. 4a illustrates one pocket 4c of the disk 1c in a position in which this pocket registers with the foremost filled pocket 35c of the wheel 2f. FIG. 4b illustrates one of the pockets 4b in exact registry with the foremost filled pocket 35b of the wheel 2d, and FIG. 4c illustrates one of the pockets 4a in exact registry with the foremost filled pocket 35a of the wheel 2b. The wheels 2a, 2c and 2e are omitted in FIGS. 4a–4c for the sake of clarity because, if they were shown, the wheels 2a, 2c and 2e would respectively overlap portions of the disks 1a, 1b and 1c. The transfer of axially aligned sections F_3, F_2, F_1 (in this order) takes place in rapid sequence which means that the disks 1a–1c must rotate much faster than the wheels 2a–2f. This will be described in connection with FIG. 9. The peripheral speeds of the conveyors 1, 3 are the same and these conveyors rotate in opposite directions, see the arrows in FIGS. 1, 5 and 9.

The diameter of the crown circle K_2 is greater than the diameter of the crown circle K_1 but less than the diameter of the crown circle K_3. Thus, the distance covered by a section F_2 between the transfer stations A, B is less than the distance covered by a section F_3 but more than the distance covered by a section F_1.

During their travel in circular paths defined by the conveyors 2, 1 and 3, the rods R and the sections R_1, F_2, F_3 always move at right angles to their axes and, at the time they are accommodated in the pockets 3a, the transverse spacing between consecutive sections F_1, F_2, F_3, F_1, F_2, F_3 . . . is sufficient to allow for axial shifting of such transversely staggered sections so that the sections form a single file.

The means for shifting the sections axially comprises a pair of inclined cams 3b (only one shown in FIG. 5) which move the sections F_1, F_3 inwardly until the sections F_1, F_3 form a single file with the sections F_2.

It goes without saying that certain portions of the conveyors 1–3 are surrounded by suitable shields (omitted for the sake of clarity) which serve to retain the rods R and the sections F_1–F_3 in the respective pockets. It is also possible to replace such shields by suction ducts provided in the conveyors and serving to hold the rods or the filter sections by suction which is effective along certain portions of the paths for the rods R and sections F_1–F_3.

Referring to FIG. 9, there are shown the drive mechanisms for the conveyors 1–3 and cutters 29, 30. A main drive shaft 40 carries two driver gears 42, 43 which rotate in a clockwise direction (arrow 41). The gear 42 meshes with a gear 44 which in turn drives the shaft 45 of the feed conveyor 2. The circle 46 shown in FIG. 9 is the pitch circle of the pockets 35a–35c.

The gear 43 drives a gear 47 which is mounted on the shaft 48 of the transfer conveyor 1. The shaft 48 is stationary and the gear 47 drives the disk 1c through a clutch 47a shown in FIG. 1. The disk 1c drives the disk 1b through the coupling bolt 34 and the disk 1b drives the disk 1a through the coupling bolt 32.

The gear 47 also meshes with a gear 49 mounted on an intermediate shaft 50 which carries a gear 51 meshing with a gear 52 which in turn meshes with a gear 53 on a shaft 54. The shaft 54 carries a gear 55 which meshes with a gear 56 on the shaft 57 of the receiving conveyor 3. If desired, the gear train 49, 51, 52, 53, 55 may be replaced by a gear 58 (shown in phantom lines) mounted on the shaft 48 and meshing with the gear 56 on the shaft 57 of the conveyor 3.

In the illustrated embodiment, the wheels 2a–2f of the feed conveyor 2 are provided with 48 pockets 35a, 35b, 35c. The conveyor 3 has 16 pockets 3a, and each of the disks 1a–1c has six pockets. The transmission ratio between the conveyors 1 and 2 is 8:1.

The main drive shaft 40 rotates the driver shaft 14a of FIG. 8 through a chain or belt drive, not shown. All shafts are mounted in a suitable frame a portion of which constitutes the rear wall 6c of the magazine 6. The shaft 40 is driven by a suitable electric motor through a variable-speed transmission, not shown.

The cutters 29, 30 are driven by a main shaft 60 which carries a pulley 61 for a belt 62. The belt 62 is trained around a pulley 63 which drives the cutter 29. The pulley 63 is coaxially secured to a pulley 64 which drives a belt 65 trained around a pulley 66. This pulley 66 rotates the cutter 30. The shaft 60 may be driven by a separate electric motor, not shown.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of my contribution to the art and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is:

1. An apparatus for staggering an array of rod-like sections wherein the sections are disposed in rows and wherein each section of one row is in substantial axial alignment with one section of each other row, comprising a feed conveyor having a plurality of equidistant holding means each arranged to receive a plurality of axially aligned sections; a receiving conveyor having a plurality of equidistant holding means each arranged to receive a single section; drive means for moving said conveyors at different speeds and in directions substantially at right angles to the axes of said sections; a transfer conveyor disposed between said first mentioned conveyors and comprising a plurality of transfer elements, one for each section in a holding means of said feed conveyor and each comprising a plurality of holding means, the holding means of said transfer elements being staggered with reference to each other and said transfer elements having portions of different length extending from a first trans-

fer station at which the holding means of said transfer elements receive seriatim the foremost axially aligned sections from consecutive holding means of said feed conveyor to a second transfer station at which the holding means of said receiving conveyor receive sections seriatim from the holding means of said transfer elements; and drive means for moving said transfer elements substantially at right angles to the axes of said sections at such a speed that all axially aligned sections are transferred from a holding means of said feed conveyor into the holding means of said transfer elements while a section moves with said feed conveyor through a distance which is less than the distance between the centers of two consecutive holding means on said feed conveyor.

2. An apparatus as set forth in claim 1, wherein the distance between the centers of holding means on each of said transfer elements approximates the distance between the centers of holding means on said receiving conveyor multiplied by the number of said transfer elements.

3. An apparatus as set forth in claim 1, wherein said transfer elements are disks which are adjacent to each other and rotate about parallel axes, and further comprising coupling means connecting each pair of adjacent disks to each other, said coupling means comprising a bolt connected to one of each pair of disks and a substantially radial slot provided in the other disk of the respective pair and receiving a portion of said bolt.

4. An appaartus as set forth in claim 1, wherein said feed conveyor comprises a plurality of coaxial wheels and wherein the holding means of said feed conveyor are axially parallel pockets provided in the peripheries of said disks, each pocket of one disk being axially aligned with one pocket of each other disk.

5. An apparatus as set forth in claim 1, further comprising a magazine arranged to deliver rods of multiple unit length into consecutive holding means of said feed conveyor, and cutter means cooperating with said feed conveyor to subdivide consecutive rods into a plurality of axially aligned sections whereby the sections obtained upon subdivision of a rod form a group of axially aligned sections which are moved by said feed conveyor toward said first transfer station.

6. An apparatus as set forth in claim 5, wherein said magazine comprises a pair of chutes each arranged to deliver by gravity feed a stream of rods to said feed conveyor, and housing means defining a rod-receiving comparament communicating with and located between said chutes and having an open side adjacent to a portion of said feed conveyor so that any holding means of said feed conveyor which fails to receive rods from said chutes may receive a rod from said compartment.

7. An appaartus for staggering an array of rod-like sections wherein the sections are disposed in rows and wherein each section of one row is axially aligned with one section of each other row, comprising a feed conveyor including a drum having a plurality of equidistant axially parallel peripheral pockets each arranged to receive a plurality of axially aligned sections; a receiving conveyor including a drum having a plurality of equidistant axially parallel peripheral pockets each arranged to receive a single section; drive means for rotating said conveyors at different speeds and in different directions; a transfer conveyor disposed between said first mentioned conveyors and comprising a plurality of eccentrically mounted disks, one for each row of sections and each comprising a plurality of equidistant axially parallel peripheral pockets each arranged to receive a single section of the respective row, the pockets of said disks being staggered circumferentially with reference to each other and said disks having portions of different length extending from a first transfer station at which the pockets of said disks receive seriatim the foremost axially aligned sections from consecutive pockets of said feed conveyor to a second transfer station at which the pockets of said receiving conveyor receive sections seriatim from the pockets of said disks; and drive means for rotating said disks at such a speed that all axially aligned sections are transferred from a pocket of said feed conveyor into the pockets of the respective disks while a section rotates on the feed conveyor through a distance which is less than the distance between the centers of two consecutive pockets on said feed conveyor.

8. An apparatus for staggering an array of rod-like sections obtained by severing rods of multiple unit length so that the sections are disposed in a plurality of rows whereby each section of one row is axially aligned with one section of each other row, comprising a rotary feed conveyor including a plurality of pairwise arranged coaxial wheels having equidistant peripheral pockets, each pocket of one wheel being axially aligned with one pocket of each other wheel; a rotary receiving conveyor having a plurality of equidistant axially parallel peripheral pockets; a rotary transfer conveyor comprising a plurality of eccentric disks having different diameters, each of said disks having a portion extending between a pair of said wheels and each being substantially tangential to said receiving conveyor, said disks having axially parallel peripheral pockets angularly spaced from each other through distances equaling the distance between a pair of pockets on said receiving conveyor multiplied by the number of disks and the pockets of said disks being staggered circumferentially with reference to each other through distances equal to the distance between a pair of consecutive pockets on said receiving conveyor; a magazine adjacent to said feed conveyor and arranged to deliver rods of multiple unit length into consecutive pockets of said wheels at a point ahead of said portions of said disks, as seen in the direction in which said feed conveyor rotates; rotary cutter means adjacent to said feed conveyor and arranged to subdivide each rod into a plurality of sections whose number equals the number of said pairwise arranged wheels whereby each pair of wheels supports and advances a section of a given rod toward said portion of the respective disk; and drive means for rotating said conveyors about parallel axes and at such a speed that axially aligned sections are transferred seriatim from consecutive pockets of said feed conveyor into the pockets of the respective disks while a section moves with said feed conveyor through a distance which is less than the distance between two consecutive rods whereby the sections are transversely staggered with reference to each other and the thus staggered sections are thereupon transferred seriatim into consecutive pockets of said receiving conveyor.

9. As a novel article of manufacture, a transfer conveyor for rod-like articles comprising a pair of rotary disks having fixed parallel axes; coupling means comprising a bolt secured to one of said disks and a substantially radially extending slot provided in the other disk and receiving a portion of said bolt; drive means for rotating one of said disks whereby the other disk rotates with said one disk; and peripheral holding means provided on said disks.

10. A transfer conveyor as set forth in claim 9, wherein said holding means are equidistant axially parallel pockets and wherein the pockets of one disk are staggered circumferentially with reference to the pockets of the other disk.

11. A transfer conveyor as set forth in claim 9, further comprising a stationary shaft having collars each coaxial with and surrounded by one of said disks so that the axis of each collar coincides with the axis of the respective disk.

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