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PATENTED JULY 4, 1905.

M. J. SHAUGHNESSY.
STITCH TRANSFERRING MECHANISM FOR KNITTING MACHINES.

APPLICATION FILED MAY 26, 1904.

3 SHEETS—SHEET 1.

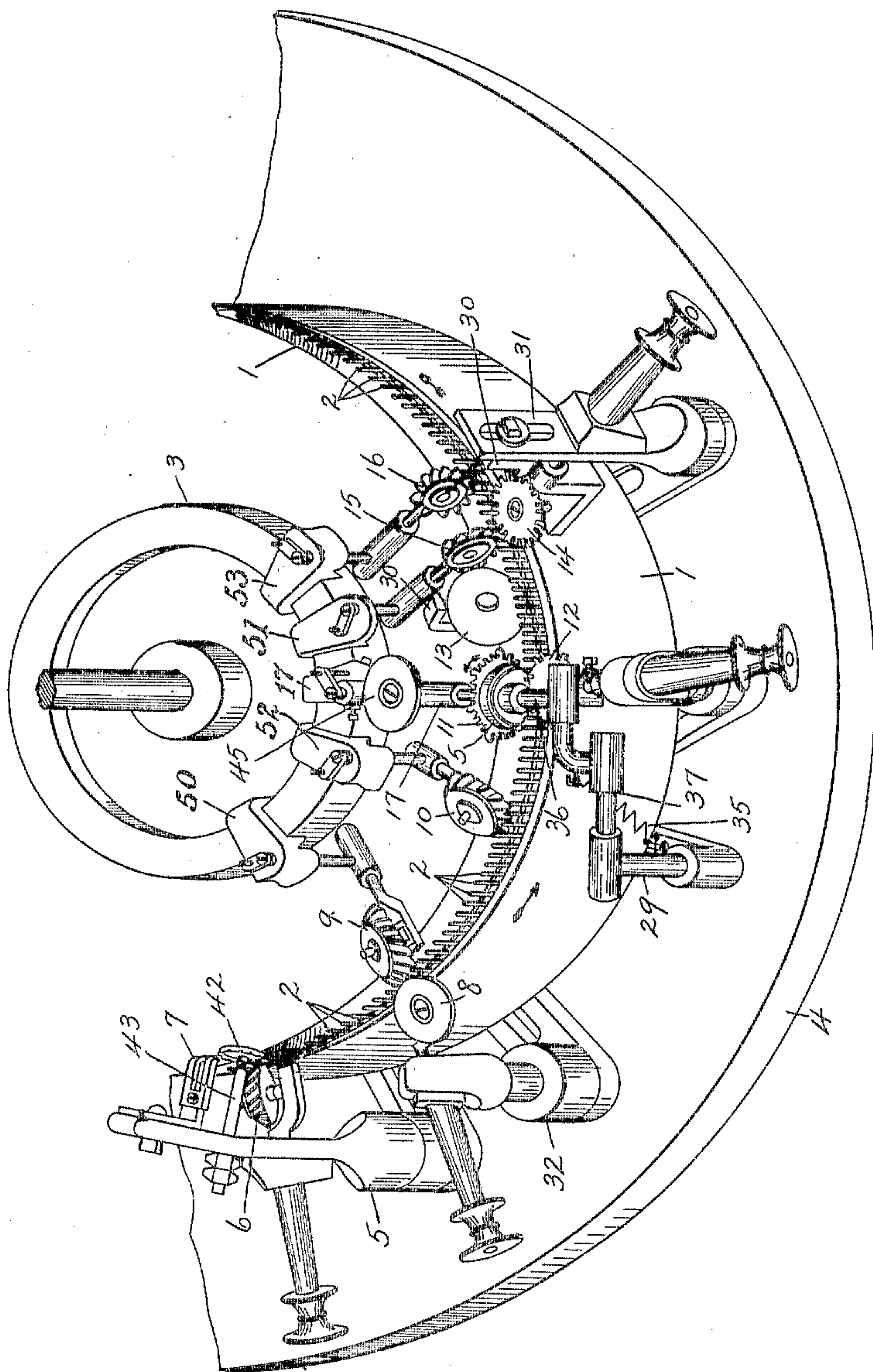


FIG. 1

WITNESSES

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3 SHEETS—SHEET 2.

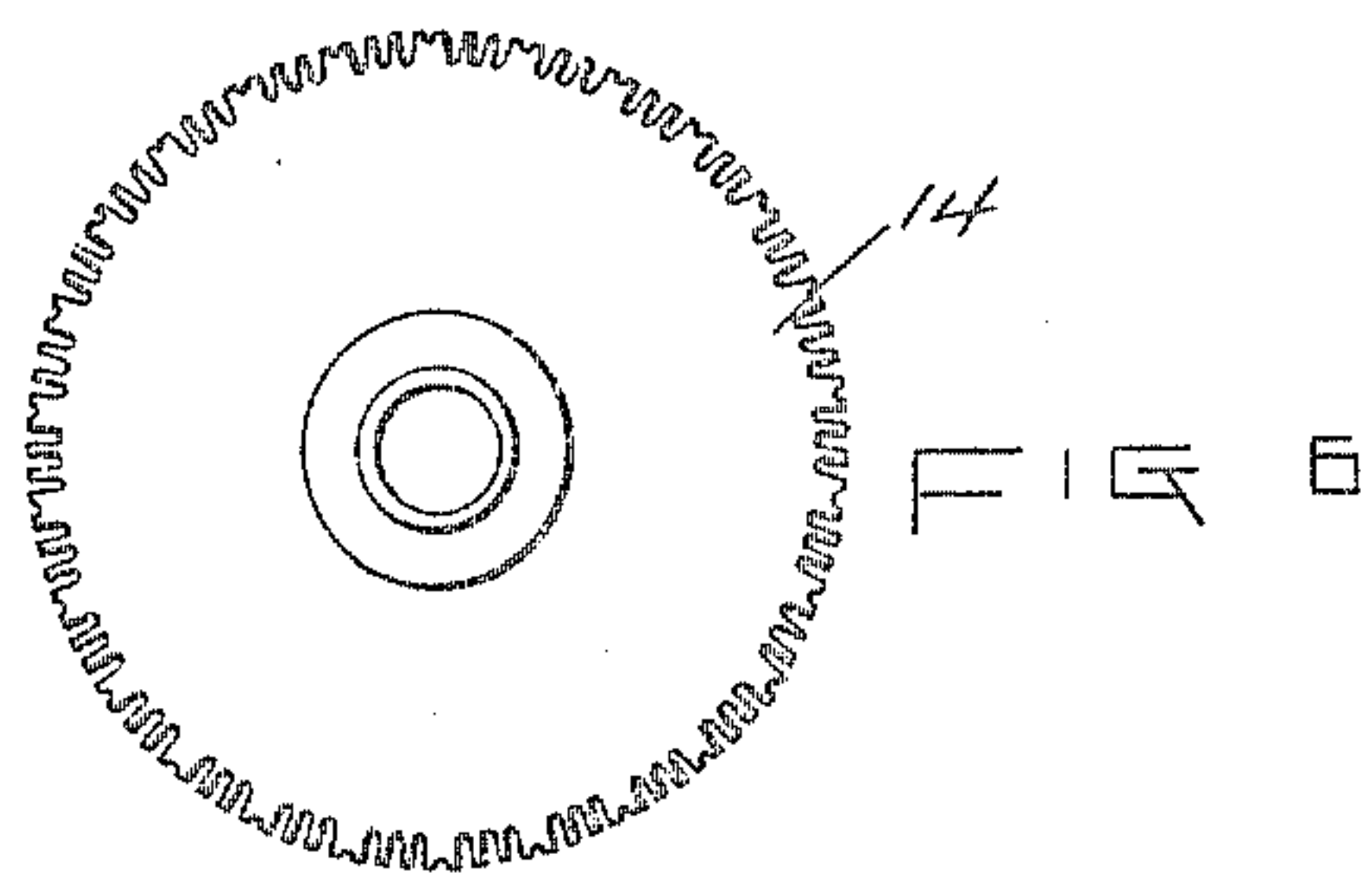


FIG 6

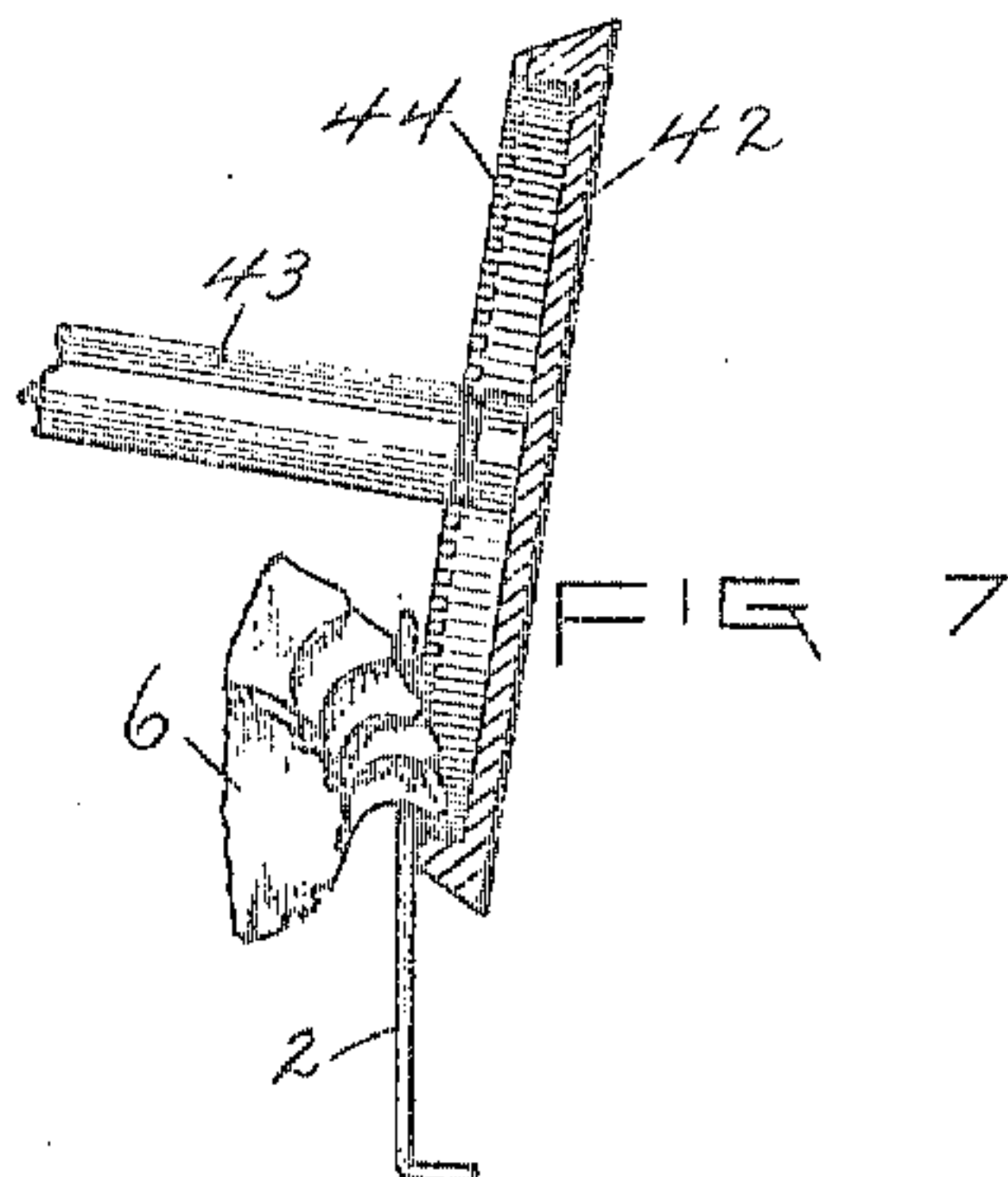


FIG 7

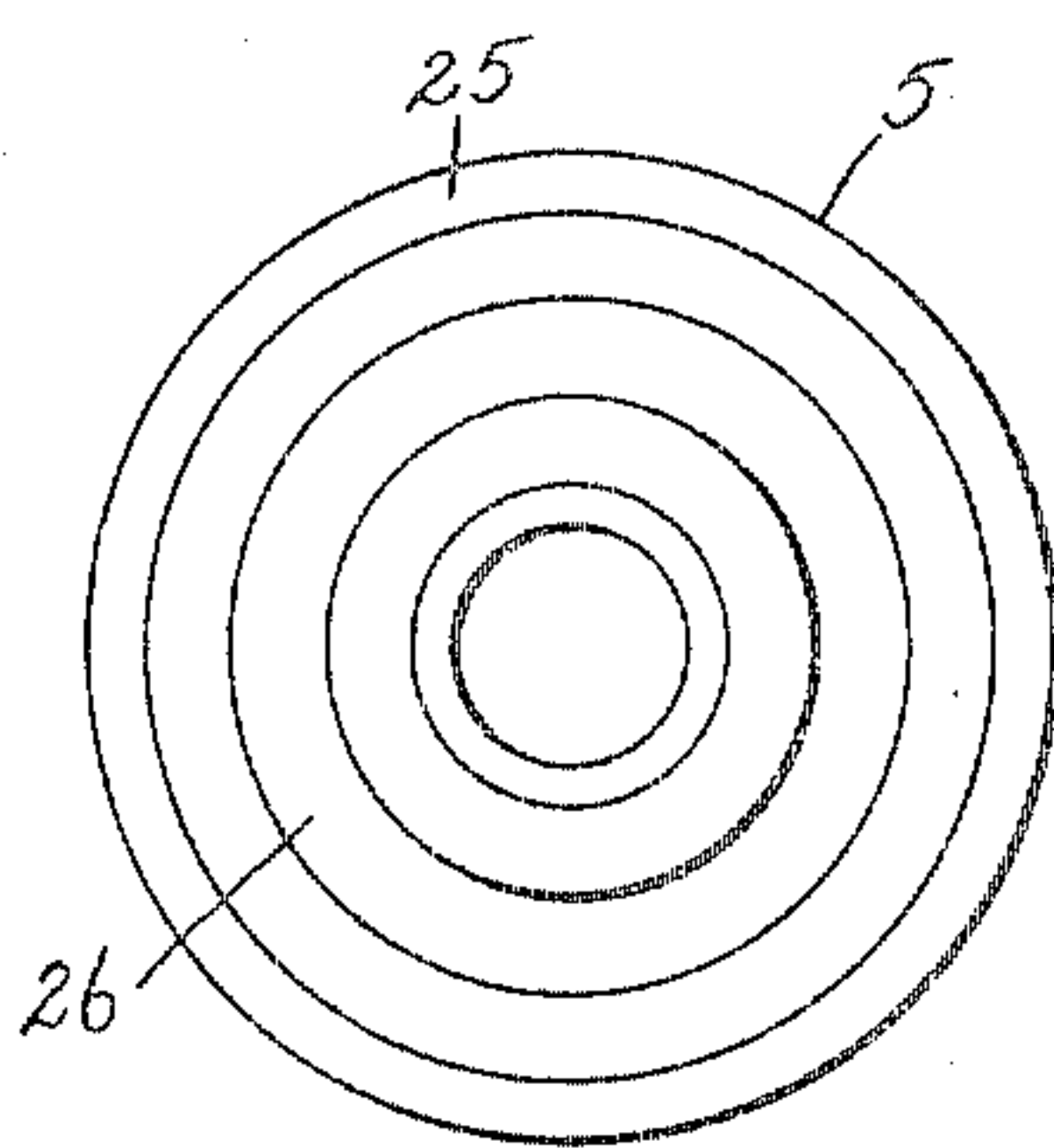


FIG 4

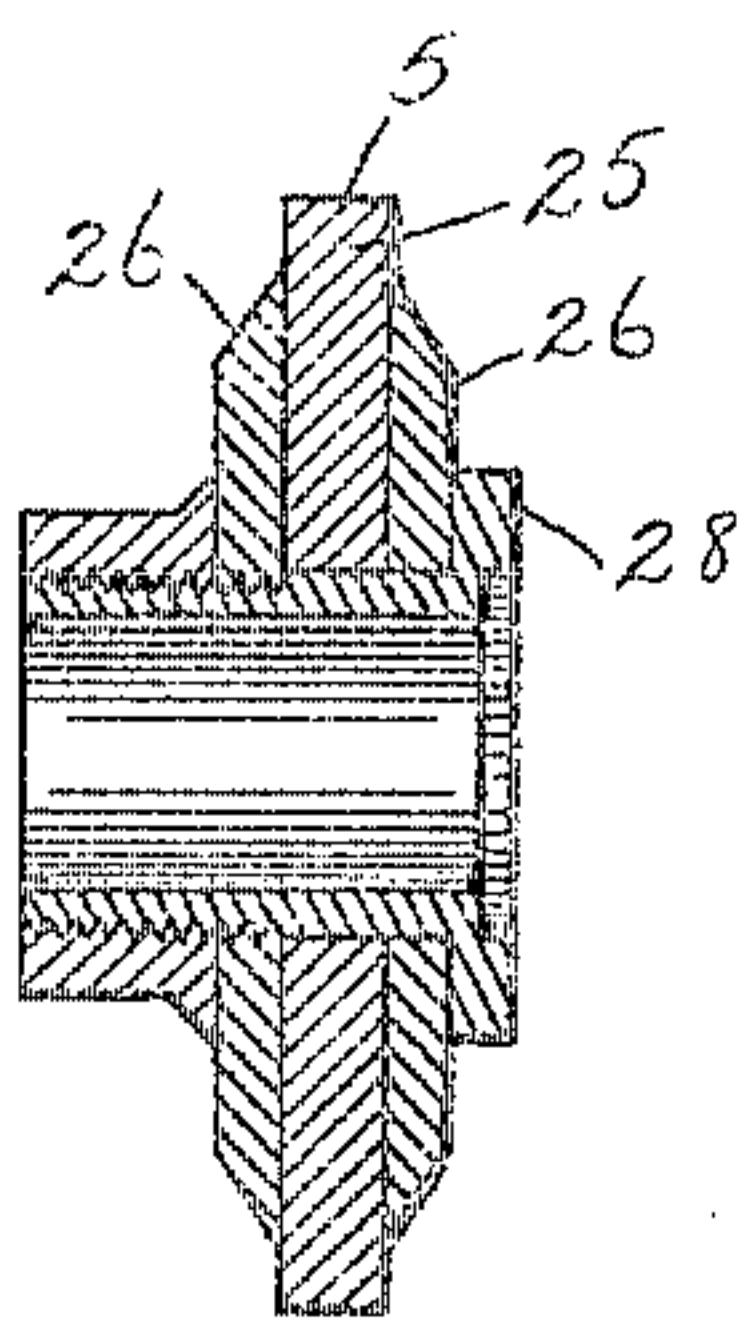


FIG 5

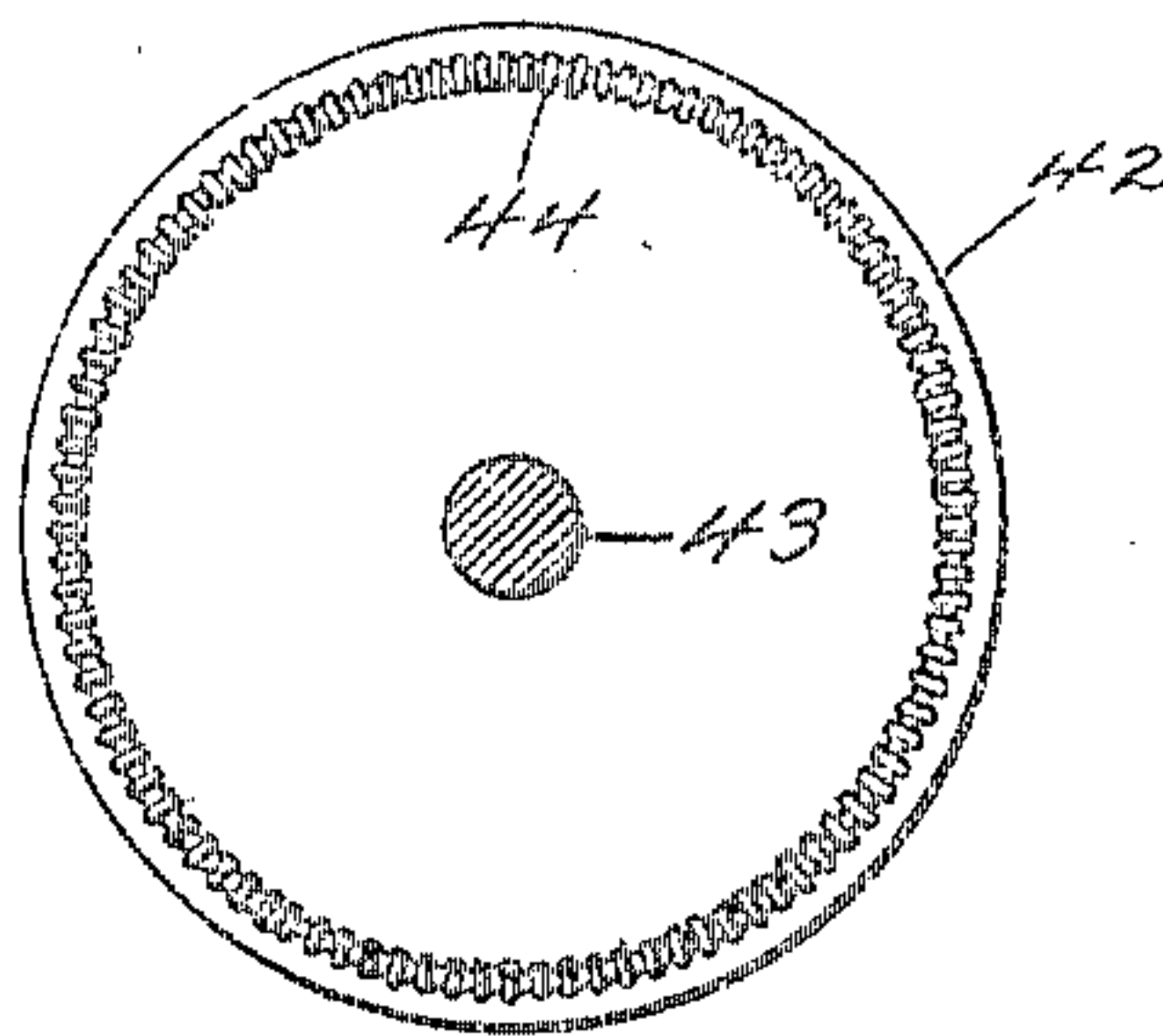


FIG 8

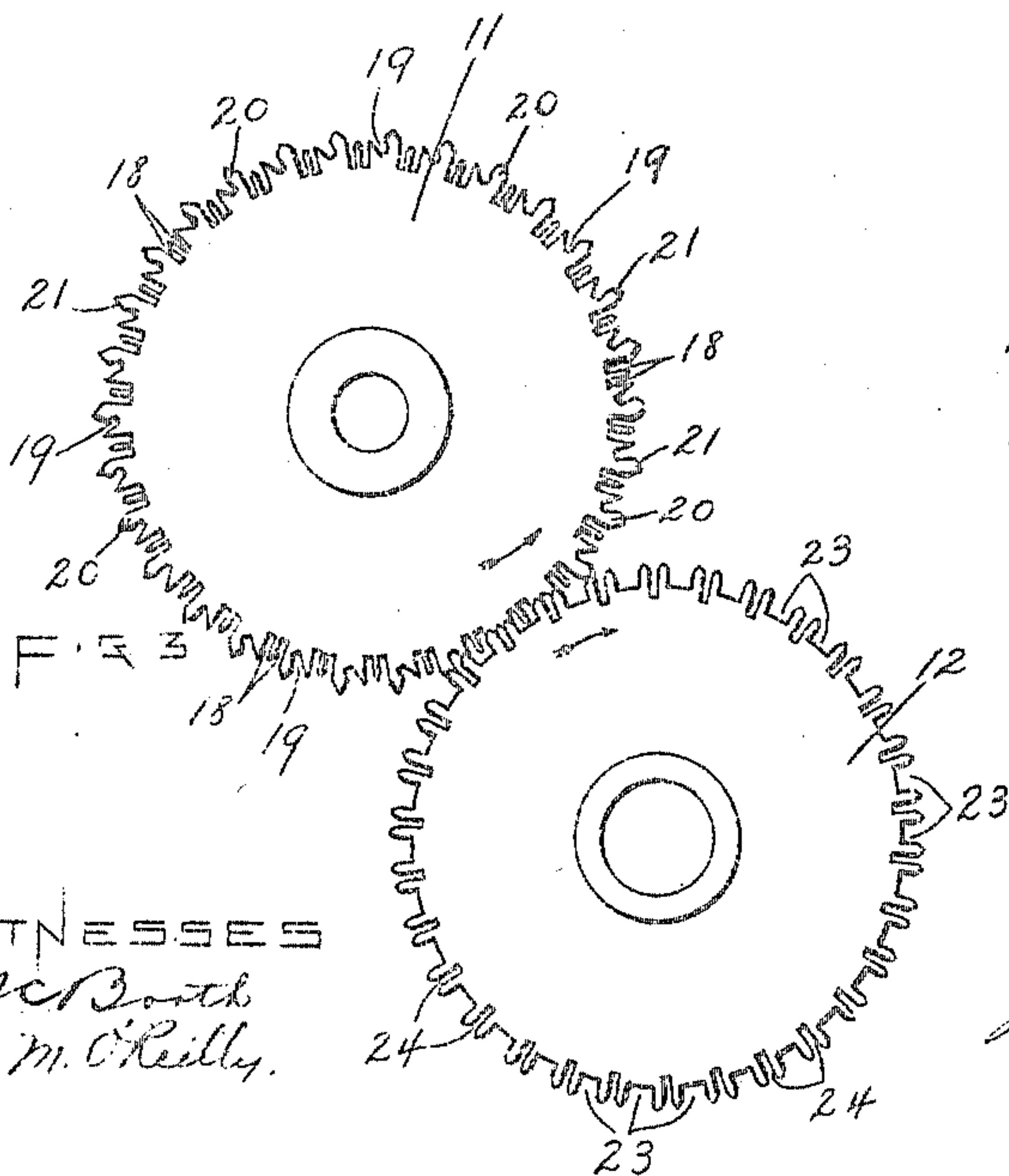


FIG 3

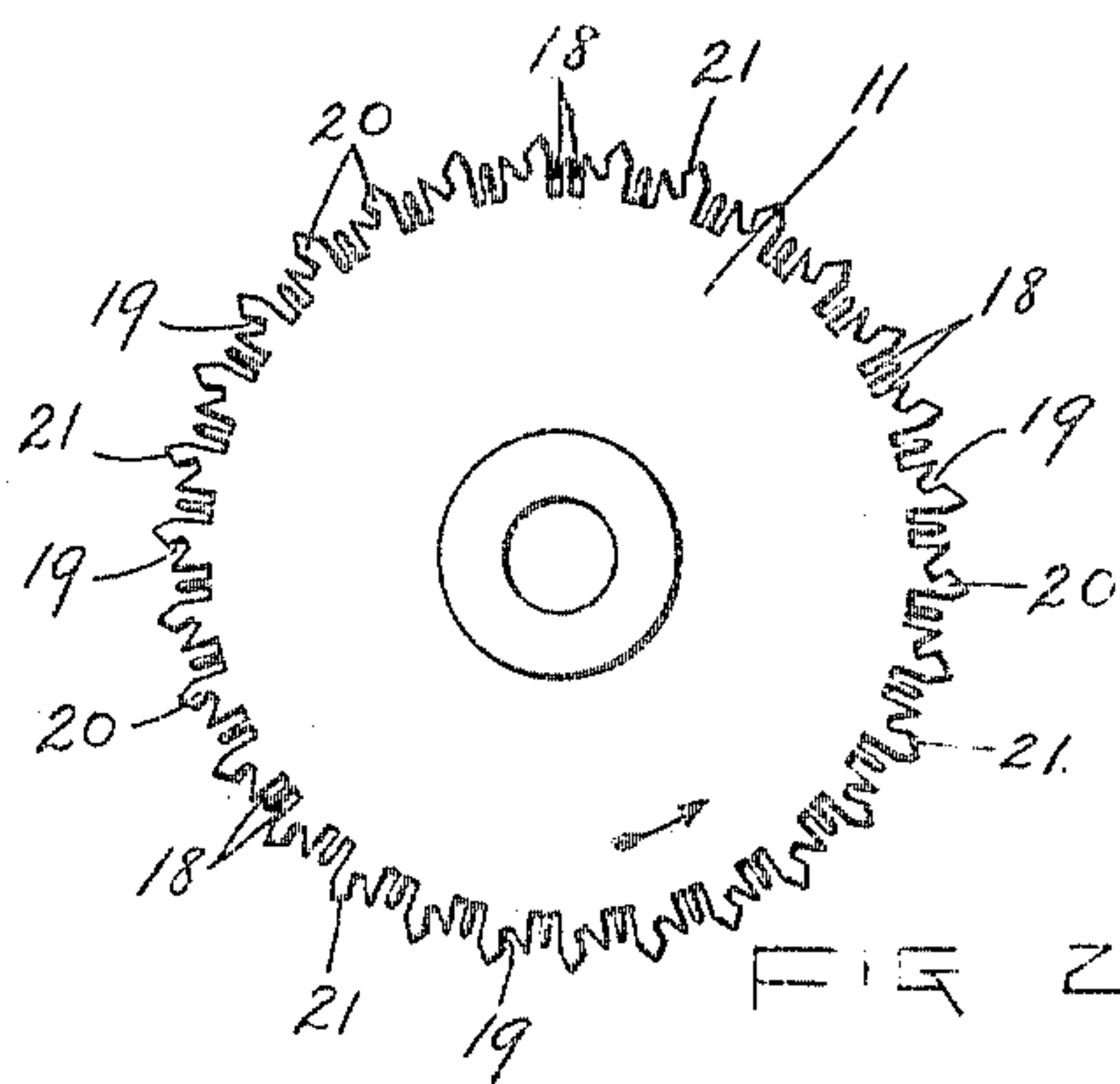


FIG 2

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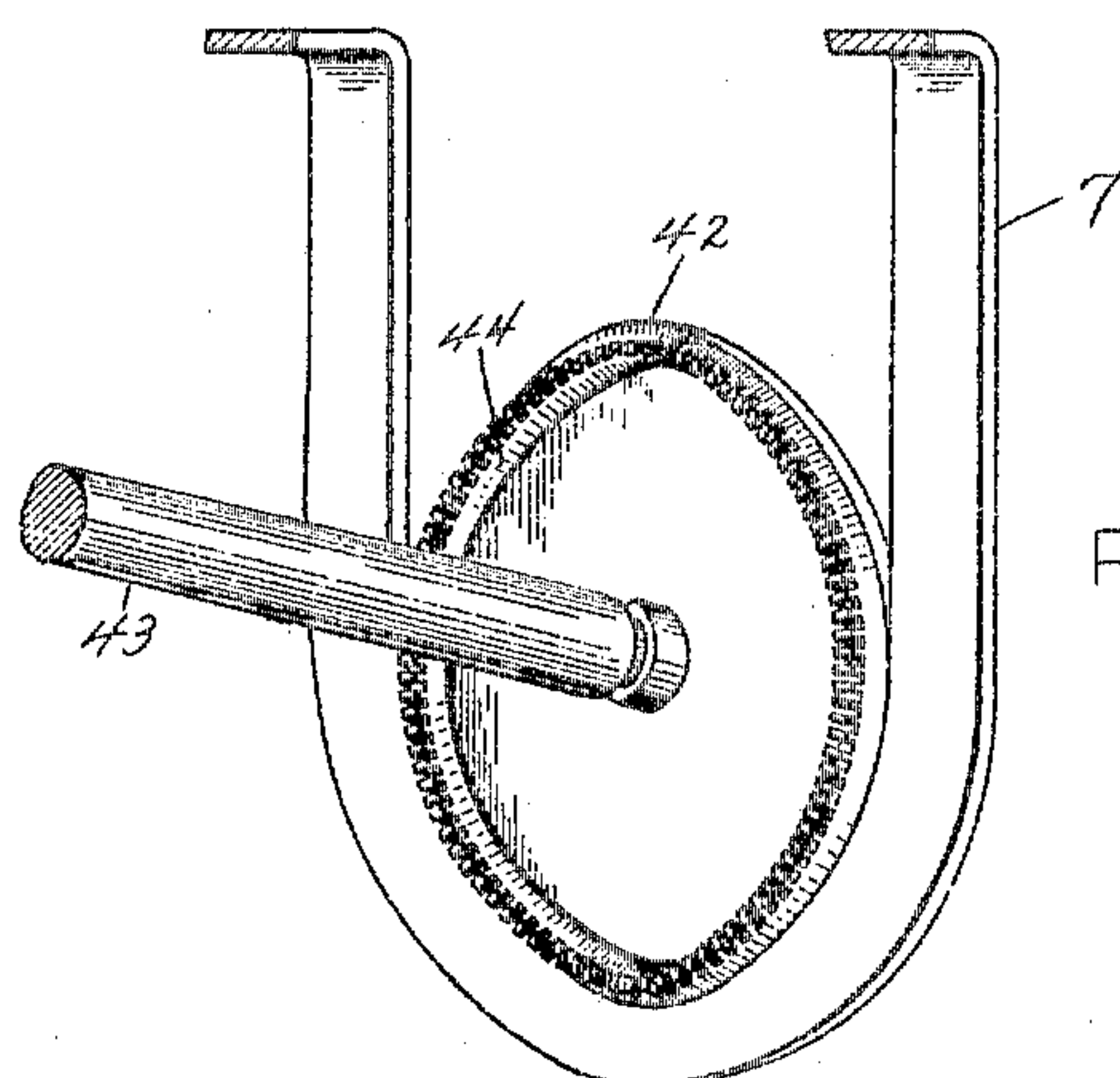
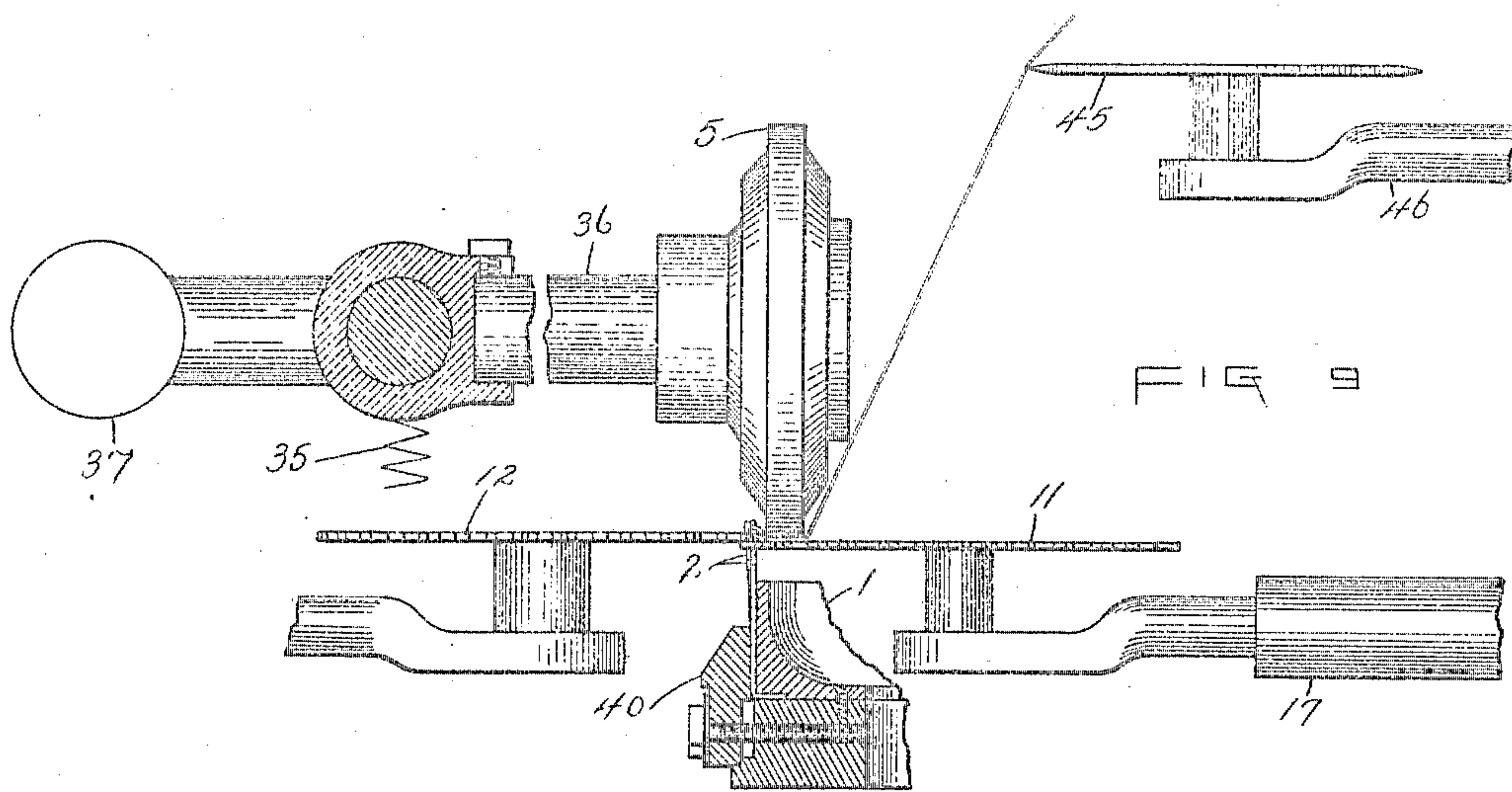
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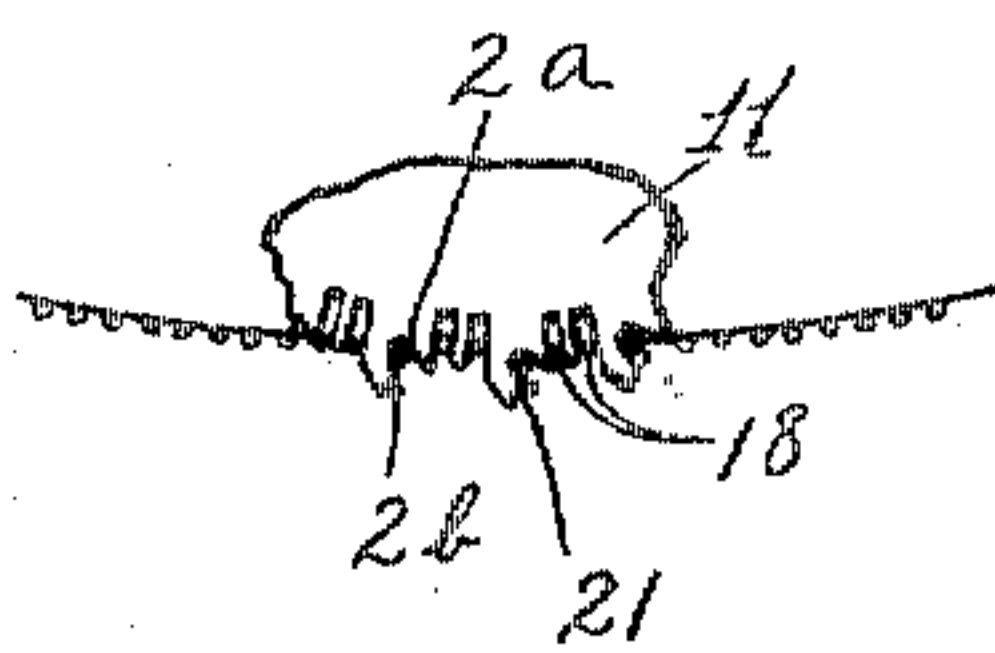
3 SHEETS—SHEET 3.



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WITNESSES

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UNITED STATES PATENT OFFICE.

MARTIN J. SHAUGHNESSY, OF AMSTERDAM, NEW YORK.

STITCH-TRANSFERRING MECHANISM FOR KNITTING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 793,913, dated July 4, 1905.

Application filed May 26, 1904. Serial No. 209,857.

To all whom it may concern:

Be it known that I, MARTIN J. SHAUGHNESSY, a citizen of the United States, residing at Amsterdam, county of Montgomery, and State of New York, have invented certain new and useful Improvements in Stitch-Transferring Mechanism for Knitting-Machines, of which the following is a specification.

The invention relates to such improvements; and it consists of the novel construction and combination of parts hereinafter described and subsequently claimed.

Reference may be had to the accompanying drawings, and the reference characters marked thereon, which form a part of this specification. Similar characters refer to similar parts in the several figures therein.

Figure 1 of the drawings is a view in perspective of a portion of a circular-knitting machine, showing my improved stitch-transferring mechanism applied thereto. Fig. 2 is a plan view of the gathering-wheel detached. Fig. 3 is a plan view of the gathering and alining wheels detached from the machine and placed in the positions which they occupy relatively to each other in use. Fig. 4 is a face view of a cloth-depressor wheel for landing the transferred stitch upon the needle to which it is transferred. Fig. 5 is a central section of the same, taken on a plane coincident with the axis thereof. Fig. 6 is a plan view of the cut-presser employed for closing the beards of the needles from which stitches are to be transferred. Fig. 7 is a central cross-section of a wheel for supporting the needles in opposition to the stitch-wheel, the relative positions of the stitch-wheel and needles being also shown. Fig. 8 is a face view of said needle-supporting wheel. Fig. 9 is a view in side elevation of the gathering-wheel, alining-wheel, cloth-depressor wheel operating in connection therewith, and web-tension wheel in the relative positions they occupy in use, the needle-cylinder being shown in cross-section. Fig. 10 is a view in perspective of the needle-supporting wheel shown in Figs. 7 and 8 and the cloth-depressing cam or shoe within which said wheel is supported in use. Fig. 11 is a plan view of a portion of the gathering-wheel, showing

the positions relatively thereto of the needles in the needle-cylinder.

It is known in the art that a pattern fabric can be produced upon a knitting-machine by transferring certain of the loops or stitches from one needle to another as the knitting operation proceeds. This is accomplished by transferring a loop or stitch from one needle to an adjacent needle, leaving both stitches or loops upon the latter needle to be treated as a single stitch in the subsequent steps of the knitting operation and leaving the needle from which the stitch was transferred without a stitch until supplied with yarn from the next feed. The resultant fabric has at intervals two-thread or double loops or stitches and adjacent thereto small holes left by the transferred stitches. By proper arrangement or combination of ordinary knitting-wheels operating in connection with certain feeds and suitably-constructed stitch-transferring devices operating in connection with certain other feeds it is possible to locate the double stitches and holes at predetermined points in the fabric, and thereby to produce a variety of ornamental patterns.

My invention relates principally to means for transferring stitches from one needle to another in knitting fabric of the nature indicated; and the principal object of my invention is to facilitate the knitting of pattern fabrics on circular-knitting machines by means of transferred stitches.

Other objects of the invention will appear in connection with the following description.

My invention is applicable to various styles of spring-needle knitting-machines, and in its preferred form, as shown in the drawings, it is especially adapted for use in connection with spring-needle circular-knitting machines, and particularly that style of circular-knitting machine in which the needles are mounted in what is known in the art as a "trick-cylinder"—that is, a cylinder provided with grooves within which the needles are respectively located and clamped instead of being mounted in leads.

In carrying out my invention I employ one or more feeds in connection with ordinary knitting-wheels and operating in the usual

manner, which ordinary feed or feeds are not shown in the drawings, as their manner of operation is well understood, only one feed being shown which operates in connection with
5 the stitch-transferring mechanism.

In Fig. 1 of the drawings considerable latitude has been taken in the disposition of the various attachments which embody my invention, and they are shown somewhat diagram-
10 matically for clearness of illustration. Referring to said figure, 1 is the cylinder, which may be any well-known type of cylinder adapted for spring-needles, a plurality of needles 2 being shown mounted on the cylinder. Located within the cylinder is the usual inner
15 circle or support 3, and beneath the cylinder is the outer circle 4, also known as the "feed-circle" or "stand-bed." The feed-stand 5, erected from the stand-bed 4, supports the stitch-
20 sinker wheel 6, which operates in the usual manner to feed yarn to the needles as the cylinder is rotated. For reasons which will be presently explained I employ a shoe or cam
7 in place of the usual cloth-wheel or push-down wheel in connection with the stitch-
25 sinker wheel 6, which shoe, however, performs the usual function of the cloth-wheel in depressing the edge of the cloth below the beards of the needles while the new stitches
30 are being fed to the needles. After passing the stitch-wheel 6 the needles and stitches are next subjected to the action of an ordinary plain presser 8 and landing-wheel 9, which operate in the usual manner, the presser to
35 close the beards of the needles and the landing-wheel to force the older stitches upwardly toward the ends of the needles outside of the beards thereof preparatory to said older
40 stitches being forced entirely off the needles by means of the cast-off or knocking-over wheel 10. After the older stitches have thus been cast off there are left upon the needles only the stitches formed by the stitch-wheel
45 6. To secure the transfer from one needle to another of one of said remaining stitches, I provide what I term a "gathering-wheel" 11, the function of which is to bring into close proximity with each other the needles from
50 which and to which the stitch is to be transferred; an alining-wheel 12, the function of which is to bring the two gathered needles into line with each other approximately radially to the needle-cylinder, so that the
55 stitch in the outer of the two gathered needles will lie directly over the end of the inner of said gathered needles; a cloth-depressor wheel 5, the function of which is to force the edge of the fabric downwardly and
60 with it the loop or stitch on said outer needle, which is to be transferred, downwardly over the end of said inner needle, causing said loop to embrace or inclose both said needles and
65 to hold the cloth and loops or stitches so depressed until they are brought within the influence of the ordinary push-down or cloth-

wheel 13, which serves the usual purpose of forcing the cloth and stitches down below the beards of the needles; a cut-presser 14, cut to close the beards of only the needles
70 from which the stitches are to be transferred; a landing-wheel 15, operating in connection with said cut-presser to locate the stitch to be transferred outside of and upon the beard of
75 the needle from which it is to be transferred, and a cast-off or knocking-over wheel 16, which casts off from the needles upon which they were originally formed the stitches which
80 have been so landed outside the beards thereof, thereby completing the transfer of the stitches, leaving the needles from which
85 stitches have been transferred free of yarn, while the needles to which stitches have been transferred are provided with double loops or stitches which in the subsequent operation
90 of knitting are treated the same as single stitches. Referring more particularly to the mechanism for causing the loop which is to be transferred to embrace or inclose both the needle
95 upon which it was originally formed and the needle to which it is to be transferred, the gathering-wheel 11 is in the form of a bur-wheel rotatively mounted in approximately
horizontal position upon the bracket 17, fixed upon the inner circle, said wheel being located
100 within the needle-cylinder in position to mesh with the needles thereon and to engage the backs or inner vertical surfaces of the needles as distinguished from the front or beards
thereof.

The gathering-wheel, which is shown de-
100 tached in Fig. 2, is provided in its periphery with radial slots or notches 18, adapted to receive the needles other than those to and from which stitches are transferred, and certain
105 other slots or notches 19, which extend obliquely inwardly and rearwardly, (referring to the direction of rotation of the wheel as indicated by arrows.) Adjacent to each in-
110 clined slot 19, and in rear thereof, is a tooth 20, projecting prominently from the general periphery of the wheel, which tooth is provided on its forward side with a needle-en-
115 gaging surface 21, inclined inwardly and forwardly toward said slot and intersecting the rear wall of said slot at a slightly-obtuse angle. As the needle-cylinder and gathering-wheel
120 rotate together, the needles other than those to and from which stitches are to be transferred mesh freely with the notched portions 18 of the periphery of the gathering-wheel, while a needle 2^a, to which a stitch is to be
125 transferred, will freely enter the outer end of an inclined notch 19. The next rearwardly-located needle 2^b, however, will be engaged by the inclined surface 21 at a point considerably in rear of a line projected from the
130 center of the needle-cylinder through the center of the gathering-wheel and at such an angle as to force the engaged needle 2^b outwardly out of line with the neighboring

needles in the cylinder. This is accomplished by springing the needle which is made of resilient material. As the movement of the cylinder and wheel is continued and the needle 5 2^b approaches a point in line with the centers of the cylinder and gathering-wheel, the angle at which the surface 21 engages said needle will be so changed that the elasticity of the sprung needle will cause it to slide over the inclined surface 21 into the notch 19 on the outer side of the needle 2^a, which had previously entered said notch.

The notch 19 is of a width less than the diameters of two needles, so that the last needle to enter the slot 19 bears against the outer side of the previously-entered needle. The needle from which and the needle to which the stitch is to be transferred are thus brought into close proximity or contact with each other. By the action of the inclined front wall of the slot 19 and the inclined tooth-surface 21 the assembling or gathering together of said two needles is accomplished by a bending movement of each needle toward the other, so that both are displaced somewhat from their original position. To make more certain a proper alinement of said two needles, so that the loop or stitch on the needle 2^b can be made to embrace or inclose also the needle 2^a, the alining-wheel 12 is provided in the form of a bur-wheel comprising a thin disk, which overlaps slightly the edge of the gathering-wheel in close proximity to the upper surface thereof and is provided in its periphery with a series of notches 23, adapted to receive the needles other than those to and from which stitches are transferred, and with another series of slightly-deeper notches 24, adapted each to receive two gathered needles 2^a and 2^b. The deeper notches 24 are of a width approximately equal to the diameter of a single needle, and the alining-wheel is so arranged and its notches 24 are so located that said two needles when seated in a notch 24 are exactly in line with each other approximately radially to the needle-cylinder and in such position that the loop or stitch in the outer needle is directly over the end of the inner needle. The alining-wheel is rotatively mounted upon a vibratory arm 36, pivoted at 37 upon a stand or bracket 29, erected from the bed 4.

The alining-wheel meshes with and is rotated by the needles on the needle-cylinder, and its notches are so arranged that when the parts are operated, as described, the deeper notches 24 will at the proper time be in position to receive the gathered needles—that is, the needles in the inclined notches 19 in the gathering-wheel—while the notches 23 will be in position to receive, respectively, the needles intervening between two neighboring groups of gathered needles. While the loop or stitch in the outer needle is thus caused by proper alinement of the needles to lie directly over the end of the inner needle, the fabric

is engaged by the cloth-depressor wheel 5, and thereby depressed so as to force said loop or stitch down over and inclosing said inner needle, in which position said stitch incloses both the needle to which and the needle from which it is to be transferred.

The cloth-depressor wheel is rotatively mounted upon a vibratory arm 36, pivoted at 37 upon a stand or bracket 29, erected from the bed 4. The cloth-depressor wheel 5, which occupies a vertical position, is yieldingly forced down, by means of the spring 35, against the upper side of the gathering-wheel or the interposed fabric and is rotated by frictional contact therewith. The peripheral portion of the cloth-depressor wheel 5 is preferably formed of leather, as by interposing a disk 25 of leather between two washers 26, clamped together by a flanged screw-bushing 27 and nut 28, as shown in Fig. 5; but said wheel may be made of other desired material. The cloth-wheel 13 is rotatively mounted upon an arm 30, projecting from the stand or bracket 31, erected from the bed 4, upon which stand is also rotatively mounted the cut-presser 14. The arm 30 is shown partly broken away for convenience of illustration. The landing-wheel 9 is rotatively mounted upon the bracket 50, the landing-wheel 15 upon the bracket 52, the cast-off wheel 16 upon the bracket 53, said brackets being secured in fixed position upon the inner circle 3, and the plain presser 8 is rotatively mounted upon a stand or bracket 32, erected from the bed 4, all in the usual manner. Provision can be made in the various wheel-supports for securing desired adjustments in the usual manner.

It will be understood that when the fabric is depressed by the cloth-wheel 13 the stitch to be transferred will be forced down below the beard of the needle from which it is to be transferred, and also down over the beard of the needle to which it is to be transferred to a position below the same in company with the stitch originally on said latter needle. When said stitches are again forced upwardly by the landing-wheel 15, the stitch to be transferred will be caused to pass up outside of and over the beard of the needle from which it is to be transferred, due to the closing of said beard by the cut-presser 14, and will be subsequently cast off from said needle by the cast-off wheel 16, while said stitch will pass up under the beard of the needle to which it is to be transferred in company with the stitch originally formed thereon, so as to not be cast off, due to the fact that the cut-presser 14 is adapted to receive said last-mentioned needle without closing the beard thereof.

The pattern to be knitted is determined by the relative number of plain feeds employed in connection with the transfer-feed, by the relative number and arrangement of the radial slots and the inclined slots with the teeth adjacent thereto in the gathering-wheel, the

alining-wheel having the proper number and relative arrangement of deep and shallow notches to correspond therewith, and by the number of needles in the cylinder relatively to the notches in the gathering-wheel. As
5 shown in the drawings, the stitch will be transferred from every fourth needle.

By locating the gathering-wheel within the needle-cylinder and causing it to operate upon
10 the inner side of the needles I am able to utilize the tension of the web of fabric to reinforce and support the needles which are sprung outwardly out of alinement with the other needles in the cylinder and to assist the
15 elasticity of said disalined needles to restore the alinement of the same when relieved from outward pressure. By locating the gathering-wheel within the cylinder I am also able to secure a greater interval for operation upon
20 the needles than could be secured by a gathering-wheel on the outer side of the cylinder, due to the fact that the internal location of the wheel permits it to mesh with the cylinder throughout a greater number of degrees
25 of its periphery. By making the teeth or projections which are located between the teeth 20 of less length or projection from the center of the wheel than said teeth 20 I am able to accommodate my improved gathering-wheel to the interior of a cylinder of comparatively small diameter, using needles of fine gage. The internal location of the gathering-wheel is particularly advantageous when employed with a trick-cylinder, as with such
30 a cylinder I am able to reduce the height of the needle-clamping plates, leaving the needles unsupported on the outer side to a considerably greater depth than on the inner side.

As shown in Fig. 9, the needle-clamping
40 plate 40 terminates at its upper end a considerable distance below the upper edge of the cylinder, which supports the shanks of the needles on the inner side, said construction permitting the needles to be sprung outwardly with greater facility and less danger
45 of breaking or permanently bending the needles than if the needle-plate extended to the full height of the cylinder, while at the same time the support afforded to the needles to
50 resist the inward pull of the web of fabric and inward pressure of the exteriorly-located knitting devices is not materially lessened.

I have shown as integral structures certain of the bur-wheels employed in carrying out
55 my invention; but it will be understood that they can be made in any known manner of making bur-wheels for knitting-machines.

It is desirable to have some or all of the stitches of the course in which is the stitch to
60 be transferred somewhat longer than the stitches in other courses, and the stitch-wheel 6 may be adjusted to accomplish this result in the usual manner. By so doing, however, an additional strain may be exerted upon the
65 needles by the stitch-wheel and yarn, and I

have therefore provided a needle-supporting wheel 42, rotatively mounted upon the arm 43, projecting from the feed-stand 5, which arm projects just above the upper ends of the needles and supports the wheel with its lower
70 portion in close proximity to the inner sides or backs of the needles opposite the stitch-wheel. This needle-supporting wheel has a recessed outer face inclosed by an edge flange 44, which is notched to mesh with the needles,
75 the supporting-arm 43 being inwardly and downwardly inclined, so as to cause only the bottom edge of the wheel 42 to engage the needles, such point of engagement being below the beards of the needles a sufficient distance to not interfere with the operation of
80 the stitch-wheel, the blades of which are free to pass between the needles into the recess in the outer face of the needle-supporting wheel. The needles are thus supported to resist the
85 inward thrust of the stitch-wheel and yarn, insuring uniformity in the length of the stitches. By employing a shoe or cam 7 in place of the usual cloth-wheel I am able to make said shoe or cam of hollow or skeleton
90 form to receive therewithin said needle-supporting wheel 42, as shown.

In order to secure uniform tension upon the fabric at the point where the transfer of stitches is accomplished, I provide a tension-wheel 45, rotatively mounted upon an arm 46,
95 projecting from the bracket 17, upon which is mounted the gathering-wheel, said tension-wheel being adapted to engage and force outwardly to the desired degree the web of fabric just above the transferring mechanism. The tension-wheel is rotated by engagement with said web.

It is characteristic of certain features of my invention that the locating of the two needles
105 in proper position for the transfer of a stitch from one to another is accomplished principally by bending or displacing the needle from which the stitch is to be transferred, which bending movement is in opposition to
110 the pull or tension of the fabric, causing the loop or stitch which is to be transferred to be drawn out more or less beyond the other loops and directly over the end of the needle to which said stitch is to be transferred, and that
115 while so drawn out and located said stitch is forced down by a depressing device over the end of the needle to which it is to be transferred and is thereby landed securely thereupon. To accomplish this displacement by
120 means of an outward and sidewise movement of the needle from which the stitch is to be transferred, it will be readily seen that the loop to be transferred is not drawn radially from the fabric, but diagonally or obliquely,
125 so that it is not sufficient that the displaced needle should be brought into exact radial line with the needle to receive the transferred stitch; but it is necessary that the displaced needle should be moved sufficiently past said
130

needles in the cylinder. This is accomplished by springing the needle which is made of resilient material. As the movement of the cylinder and wheel is continued and the needle 5 2^b approaches a point in line with the centers of the cylinder and gathering-wheel, the angle at which the surface 21 engages said needle will be so changed that the elasticity of the sprung needle will cause it to slide over the 10 inclined surface 21 into the notch 19 on the outer side of the needle 2^a, which had previously entered said notch.

The notch 19 is of a width less than the diameters of two needles, so that the last needle 15 to enter the slot 19 bears against the outer side of the previously-entered needle. The needle from which and the needle to which the stitch is to be transferred are thus brought into close proximity or contact with each 20 other. By the action of the inclined front wall of the slot 19 and the inclined tooth-surface 21 the assembling or gathering together of said two needles is accomplished by a bending movement of each needle toward the other, 25 so that both are displaced somewhat from their original position. To make more certain a proper alinement of said two needles, so that the loop or stitch on the needle 2^b can be made to embrace or inclose also the needle 30 2^a, the alining-wheel 12 is provided in the form of a bur-wheel comprising a thin disk, which overlaps slightly the edge of the gathering-wheel in close proximity to the upper surface thereof and is provided in its periphery 35 with a series of notches 23, adapted to receive the needles other than those to and from which stitches are transferred, and with another series of slightly-deeper notches 24, adapted each to receive two gathered needles 2^a and 2^b. 40 The deeper notches 24 are of a width approximately equal to the diameter of a single needle, and the alining-wheel is so arranged and its notches 24 are so located that said two needles when seated in a notch 24 are exactly 45 in line with each other approximately radially to the needle-cylinder and in such position that the loop or stitch in the outer needle is directly over the end of the inner needle. The alining-wheel is rotatively mounted upon 50 a vibratory arm 36, pivoted at 37 upon a stand or bracket 29, erected from the bed 4.

The alining-wheel meshes with and is rotated by the needles on the needle-cylinder, and its notches are so arranged that when the 55 parts are operated, as described, the deeper notches 24 will at the proper time be in position to receive the gathered needles—that is, the needles in the inclined notches 19 in the gathering-wheel—while the notches 23 will be 60 in position to receive, respectively, the needles intervening between two neighboring groups of gathered needles. While the loop or stitch in the outer needle is thus caused by proper alinement of the needles to lie directly 65 over the end of the inner needle, the fabric

is engaged by the cloth-depressor wheel 5, and thereby depressed so as to force said loop or stitch down over and inclosing said inner needle, in which position said stitch incloses both 70 the needle to which and the needle from which it is to be transferred.

The cloth-depressor wheel is rotatively mounted upon a vibratory arm 36, pivoted at 37 upon a stand or bracket 29, erected from the bed 4. The cloth-depressor wheel 5, 75 which occupies a vertical position, is yieldingly forced down, by means of the spring 35, against the upper side of the gathering-wheel or the interposed fabric and is rotated by frictional contact therewith. The peripheral portion of the cloth-depressor wheel 5 is preferably 80 formed of leather, as by interposing a disk 25 of leather between two washers 26, clamped together by a flanged screw-bushing 27 and nut 28, as shown in Fig. 5; but said wheel 85 may be made of other desired material. The cloth-wheel 13 is rotatively mounted upon an arm 30, projecting from the stand or bracket 31, erected from the bed 4, upon which stand 90 is also rotatively mounted the cut-presser 14. The arm 30 is shown partly broken away for convenience of illustration. The landing-wheel 9 is rotatively mounted upon the bracket 50, the landing-wheel 15 upon the bracket 52, the cast-off wheel 16 upon the 95 bracket 53, said brackets being secured in fixed position upon the inner circle 3, and the plain presser 8 is rotatively mounted upon a stand or bracket 32, erected from the bed 4, all in the usual manner. Provision can be 100 made in the various wheel-supports for securing desired adjustments in the usual manner.

It will be understood that when the fabric is depressed by the cloth-wheel 13 the stitch 105 to be transferred will be forced down below the beard of the needle from which it is to be transferred, and also down over the beard of the needle to which it is to be transferred to a position below the same in company with 110 the stitch originally on said latter needle. When said stitches are again forced upwardly by the landing-wheel 15, the stitch to be transferred will be caused to pass up outside of and over the beard of the needle from which 115 it is to be transferred, due to the closing of said beard by the cut-presser 14, and will be subsequently cast off from said needle by the cast-off wheel 16, while said stitch will pass up under the beard of the needle to which it 120 is to be transferred in company with the stitch originally formed thereon, so as to not be cast off, due to the fact that the cut-presser 14 is adapted to receive said last-mentioned needle without closing the beard thereof.

The pattern to be knitted is determined by 125 the relative number of plain feeds employed in connection with the transfer-feed, by the relative number and arrangement of the radial slots and the inclined slots with the teeth adjacent thereto in the gathering-wheel, the 130

alining-wheel having the proper number and relative arrangement of deep and shallow notches to correspond therewith, and by the number of needles in the cylinder relatively to the notches in the gathering-wheel. As
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10 the inner side of the needles I am able to utilize the tension of the web of fabric to reinforce and support the needles which are sprung outwardly out of alinement with the other needles in the cylinder and to assist the
15 elasticity of said disalined needles to restore the alinement of the same when relieved from outward pressure. By locating the gathering-wheel within the cylinder I am also able to secure a greater interval for operation upon
20 the needles than could be secured by a gathering-wheel on the outer side of the cylinder, due to the fact that the internal location of the wheel permits it to mesh with the cylinder throughout a greater number of degrees
25 of its periphery. By making the teeth or projections which are located between the teeth 20 of less length or projection from the center of the wheel than said teeth 20 I am able to accommodate my improved gathering-wheel to the interior of a cylinder of comparatively small diameter, using needles of fine gage. The internal location of the gathering-wheel is particularly advantageous when employed with a trick-cylinder, as with such
30 a cylinder I am able to reduce the height of the needle-clamping plates, leaving the needles unsupported on the outer side to a considerably greater depth than on the inner side.

As shown in Fig. 9, the needle-clamping
40 plate 40 terminates at its upper end a considerable distance below the upper edge of the cylinder, which supports the shanks of the needles on the inner side, said construction permitting the needles to be sprung outwardly with greater facility and less danger
45 of breaking or permanently bending the needles than if the needle-plate extended to the full height of the cylinder, while at the same time the support afforded to the needles to resist the inward pull of the web of fabric and inward pressure of the exteriorly-located
50 knitting devices is not materially lessened.

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80 the stitch-wheel, the blades of which are free to pass between the needles into the recess in the outer face of the needle-supporting wheel. The needles are thus supported to resist the
85 inward thrust of the stitch-wheel and yarn, insuring uniformity in the length of the stitches. By employing a shoe or cam 7 in place of the usual cloth-wheel I am able to make said shoe or cam of hollow or skeleton
90 form to receive therewithin said needle-supporting wheel 42, as shown.

In order to secure uniform tension upon the fabric at the point where the transfer of stitches is accomplished, I provide a tension-wheel 45, rotatively mounted upon an arm 46,
95 projecting from the bracket 17, upon which is mounted the gathering-wheel, said tension-wheel being adapted to engage and force outwardly to the desired degree the web of fabric just above the transferring mechanism. The tension-wheel is rotated by engagement with said web.

It is characteristic of certain features of my invention that the locating of the two needles
105 in proper position for the transfer of a stitch from one to another is accomplished principally by bending or displacing the needle from which the stitch is to be transferred, which bending movement is in opposition to
110 the pull or tension of the fabric, causing the loop or stitch which is to be transferred to be drawn out more or less beyond the other loops and directly over the end of the needle to which said stitch is to be transferred, and that
115 while so drawn out and located said stitch is forced down by a depressing device over the end of the needle to which it is to be transferred and is thereby landed securely thereupon. To accomplish this displacement by
120 means of an outward and sidewise movement of the needle from which the stitch is to be transferred, it will be readily seen that the loop to be transferred is not drawn radially from the fabric, but diagonally or obliquely,
125 so that it is not sufficient that the displaced needle should be brought into exact radial line with the needle to receive the transferred stitch; but it is necessary that the displaced needle should be moved sufficiently past said
130

radial line to bring the two needles referred to into line with the loop-aperture in order to locate said loop fully over and upon the needle which is to receive it. It will thus be seen that while the gathered needles are alined approximately radially to the cylinder they are not exactly so, but are in a line extending somewhat obliquely rearwardly of the axis of the cylinder with reference to the direction in which the cylinder is rotated. This oblique alining of the needles is shown in Fig. 11 and is accomplished by reason of the inclination of the slots 19 in the gathering-wheel, which slots are of a width adapted to receive a single needle, but of a depth adapted to receive two needles.

The deeper notches in the alining-wheel while radial to said wheel are made to correspond with the proper oblique arrangement of the gathered needles by locating said alining-wheel slightly in advance of a line passing through the centers of the cylinder and gathering-wheel, the relative positions being substantially shown in Figs. 1 and 3.

For certain purposes of the invention the alining-wheel may be omitted.

What I claim as new, and desire to secure by Letters Patent, is—

1. In stitch-transferring mechanism for knitting-machines, the combination with the needles; of means engageable with the backs of said needles adapted to displace against the pull of the fabric the needle from which a stitch is to be transferred to a position in front of the needle to which said stitch is to be transferred; means for forcing said stitch inwardly over the end of the needle to which the same is to be transferred; and means for freeing said stitch from the needle from which the same is to be transferred.

2. In stitch-transferring mechanism for cylinder knitting-machines, the combination with a needle-cylinder; and spring-needles mounted thereon; of a gathering-wheel located within the cylinder in mesh with, and engageable with the backs of, the needles thereon adapted to bring into close relationship with each other the needle from which, and the needle to which, a stitch is to be transferred; and means for freeing said stitch from the former needle and locating it upon the latter needle.

3. In stitch-transferring mechanism for cylinder knitting-machines, the combination with a needle-cylinder; and spring-needles mounted thereon; of a gathering-wheel located within the cylinder in mesh with, and engageable with the backs of, the needles thereon, and adapted to displace against the pull of the fabric the needle from which a stitch is to be transferred to a position in front of the needle to which said stitch is to be transferred; means for forcing said stitch inwardly over the end of the needle to which the same is to be transferred; and means for freeing

said stitch from the needle from which the same is to be transferred.

4. In stitch-transferring mechanism for knitting-machines, the combination with a needle-cylinder; and spring-needles thereon; of a gathering-wheel rotatively mounted within the cylinder in mesh with said needles and adapted to bring into close relationship with each other the needle from which and the needle to which a stitch is to be transferred; a cloth-depressor adapted to land said stitch over the end of, and upon, the needle to which it is to be transferred; and means for freeing said stitch from the needle from which it is to be transferred.

5. In stitch-transferring mechanism for knitting-machines, the combination with a trick-needle-cylinder body; trick-needles mounted upon the periphery of said cylinder-body; and needle-clamping plates of less height than the cylinder-body; of means engageable with the backs of said needles for bringing into close relation with each other the needle from which and the needle to which a stitch is to be transferred; and means for freeing said stitch from the former needle and locating it upon the latter needle.

6. In stitch-transferring mechanism for knitting-machines, the combination with a trick-needle-cylinder body, trick-needles mounted upon the periphery of said cylinder-body; and needle-clamping plates of less height than the cylinder-body; of a gathering-wheel rotatively mounted within the cylinder in mesh with said needles and engageable therewith to bring into close relation with each other the needle from which and the needle to which a stitch is to be transferred; and means for freeing said stitch from the former needle and locating it upon the latter needle.

7. In stitch-transferring mechanism for knitting-machines, the combination with a needle-cylinder; and spring-needles mounted thereon; of a needle-gathering wheel rotatively mounted within the cylinder engageable with the backs of the needles; a needle-alining wheel rotatively mounted exteriorly of the cylinder engageable with two gathered needles to aline the same approximately radially to the cylinder; means for forcing downwardly over the end of the inner of said two needles while so alined the loop or stitch on the outer needle; and means for subsequently casting off said stitch from said outer needle.

8. In stitch-transferring mechanism for knitting-machines, the combination with a needle-cylinder; and spring-needles mounted thereon; of a needle-gathering wheel rotatively mounted within the cylinder engageable with the backs of the needles; a needle-alining wheel rotatively mounted exteriorly of the cylinder engageable with two gathered needles to aline the same approximately radially to the cylinder; and a cloth-depressor

wheel having its periphery engageable with the top surface of the gathering-wheel or interposed fabric in rear of the needles, and adapted to land upon the inner of two gathered and alined needles the stitch to be transferred thereto originally formed on the outer of said two needles.

9. In stitch-transferring mechanism for knitting-machines, the combination with a needle-cylinder; and spring-needles mounted thereon; of a needle-gathering wheel rotatively mounted within the cylinder engageable with the backs of the needles; a needle-alining wheel rotatively mounted exteriorly of the cylinder engageable with two gathered needles to aline the same approximately radially to the cylinder; a cloth-depressor wheel having its periphery engageable with the top surface of the gathering-wheel or interposed fabric in rear of the needles, and adapted to land upon the inner of two gathered and alined needles the stitch to be transferred thereto originally formed on the outer of said two needles; and means for freeing said stitch from said outer needle.

10. In a machine of the class described, the combination with the needle-cylinder; needles; stitch-wheel; and means for depressing the fabric opposite said stitch-wheel; of a needle-supporting wheel rotatively supported in inclined position in rear of the needles opposite the stitch-wheel, having a face-flange notched to receive the needles and engageable therewith at the bottom of said wheel.

11. In a machine of the class described, the combination with the needle-cylinder; needles; stitch-wheel; and a skeleton cam or shoe in rear of the needles opposite the stitch-wheel for depressing the fabric; of a needle-supporting wheel rotatively supported within said skeleton cam or shoe in rear of the needles opposite the stitch-wheel.

12. In a stitch-transferring mechanism for circular-knitting machines, a gathering-wheel provided in its periphery with radial slots to receive needles other than those from and to which stitches are to be transferred and with inclined slots to receive each in gathered position a needle from which and a needle to which a stitch is to be transferred and having adjacent to and in rear of each inclined slot a projecting tooth presenting on its front side an inclined needle-engaging surface leading to said inclined slot in combination with an alining-wheel adapted to operate upon the gathered needles.

13. In a knitting-machine, the combination with the cylinder and needles and stitch-transferring mechanism; of a web-distending wheel located within the web approximately in vertical line with said stitch-transferring mechanism.

14. In stitch-transferring mechanism for knitting-machines, the combination with the needles; of a gathering-wheel engageable with

the backs of the needles and provided with oblique peripheral slots of a width adapted to receive only a single needle, and of a depth adapted to receive a plurality of needles.

15. In stitch-transferring mechanism for knitting-machines, a gathering-wheel provided in its periphery with inclined slots each of a width adapted to receive only a single needle and of a depth adapted to receive a plurality of needles, and having adjacent to, and in rear of, each inclined slot a projecting tooth presenting on its front side an inclined needle-engaging surface leading to said inclined slot.

16. In stitch-transferring mechanism for knitting-machines, a gathering-wheel provided in its periphery with radial needle-receiving slots, and also with inclined needle-receiving slots each of a width adapted to receive a single needle only and of a depth adapted to receive a plurality of needles, and having adjacent to and in rear of each inclined slot a projecting tooth presenting on its front side an inclined needle-engaging surface leading to said inclined slot.

17. In stitch-transferring mechanism for cylinder knitting-machines, the combination with a needle-cylinder and needles thereon; of a gathering-wheel rotatively mounted within the cylinder engageable with the backs of the cylinder-needles and provided in its periphery with inclined needle-gathering slots each of a width adapted to receive a single needle only and of a depth adapted to receive a plurality of needles.

18. In stitch-transferring mechanism for cylinder knitting-machines, the combination with the needle-cylinder; and needles mounted thereon; of a gathering-wheel rotatively mounted within the cylinder engageable with the backs of the cylinder-needles, said gathering-wheel being provided in its periphery with inclined slots each of a width adapted to receive a single needle only, and of a depth adapted to receive a plurality of needles, and having adjacent to and in rear of each inclined slot a projecting tooth presenting on its front side an inclined needle-engaging surface leading to said inclined slot.

19. In stitch-transferring mechanism for cylinder knitting-machines, the combination with the needle-cylinder; and needles mounted thereon; of a gathering-wheel rotatively mounted within the cylinder engageable with the backs of the cylinder-needles therein, and provided in its periphery with rearwardly-inclined slots, and having adjacent to and in rear of each inclined slot a projecting tooth presenting on its front side an inclined needle-engaging surface leading to said inclined slot; and a cloth-depressor adapted to force the stitch to be transferred downwardly over the end of the needle to which the same is to be transferred.

20. In stitch-transferring mechanism for

cylinder knitting-machines, the combination with the needle-cylinder; and needles mounted thereon; of a gathering-wheel rotatively mounted within the cylinder in mesh with the
5 cylinder-needles and provided in its periphery with radial slots and inclined needle-gathering slots, and having adjacent to and in rear of each inclined slot a tooth projecting beyond the radially-slotted periphery of the

hub, and presenting on its front side an inclined needle-engaging surface leading to said inclined slot.

In testimony whereof I have hereunto set my hand this 18th day of May, 1904.

MARTIN J. SHAUGHNESSY.

Witnesses:

H. H. W. CONATT,

ELLEN M. CROWE.