(No Model.) 2 Sheets—Sheet 1.

C. E. BARNES & A. C. WINN.

CORD BRAIDING MACHINE.

No. 290,624. Patented Dec. 18, 1883.

Fig. 3.

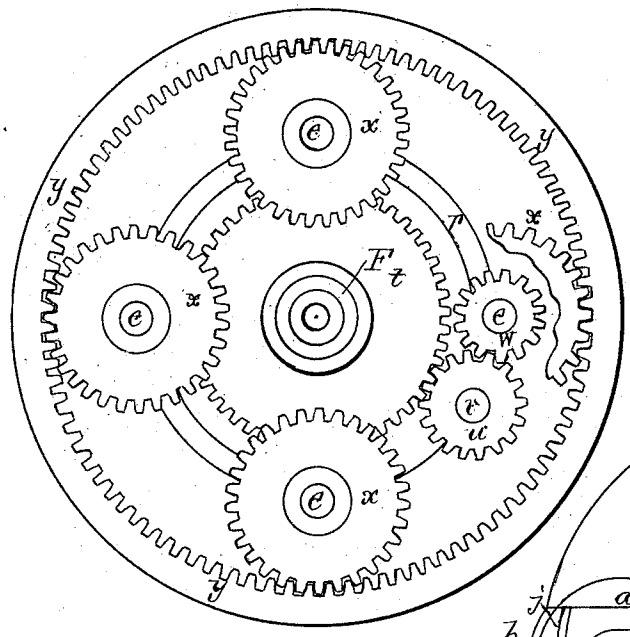


Fig. 1.

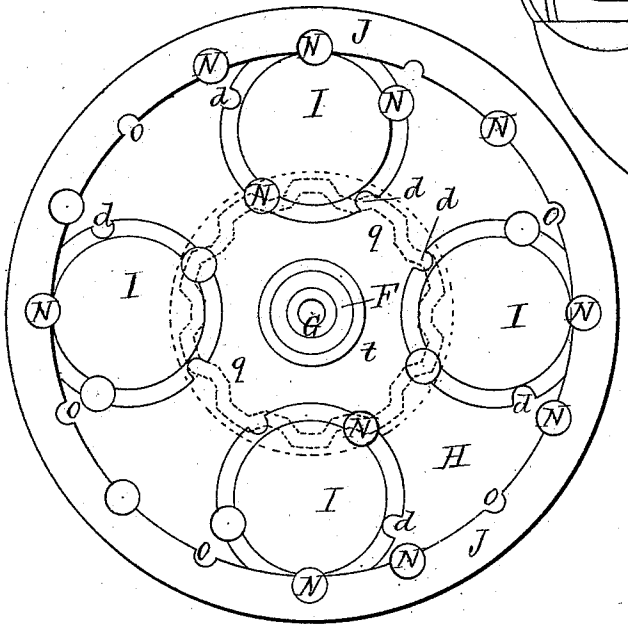


Fig. 5.

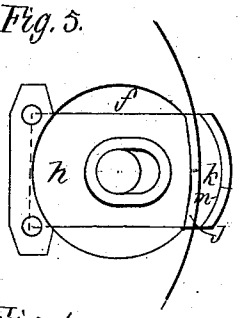


Fig. 4.

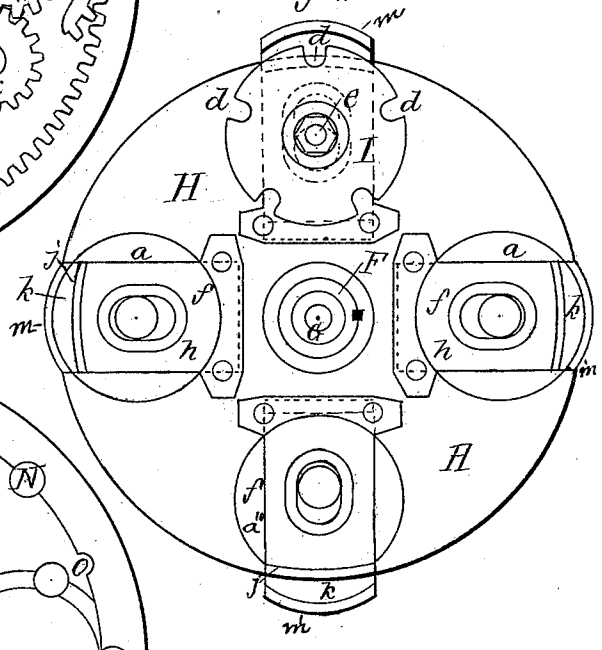


Fig. 6.



Witnesses.
H. E. Lodge.
Geo. Heyward

Inventors.
C. E. Barnes and A. C. Winn.
F. Curtis, Atty.

N. PETERS, Photo-Lithographer, Washington, D. C.

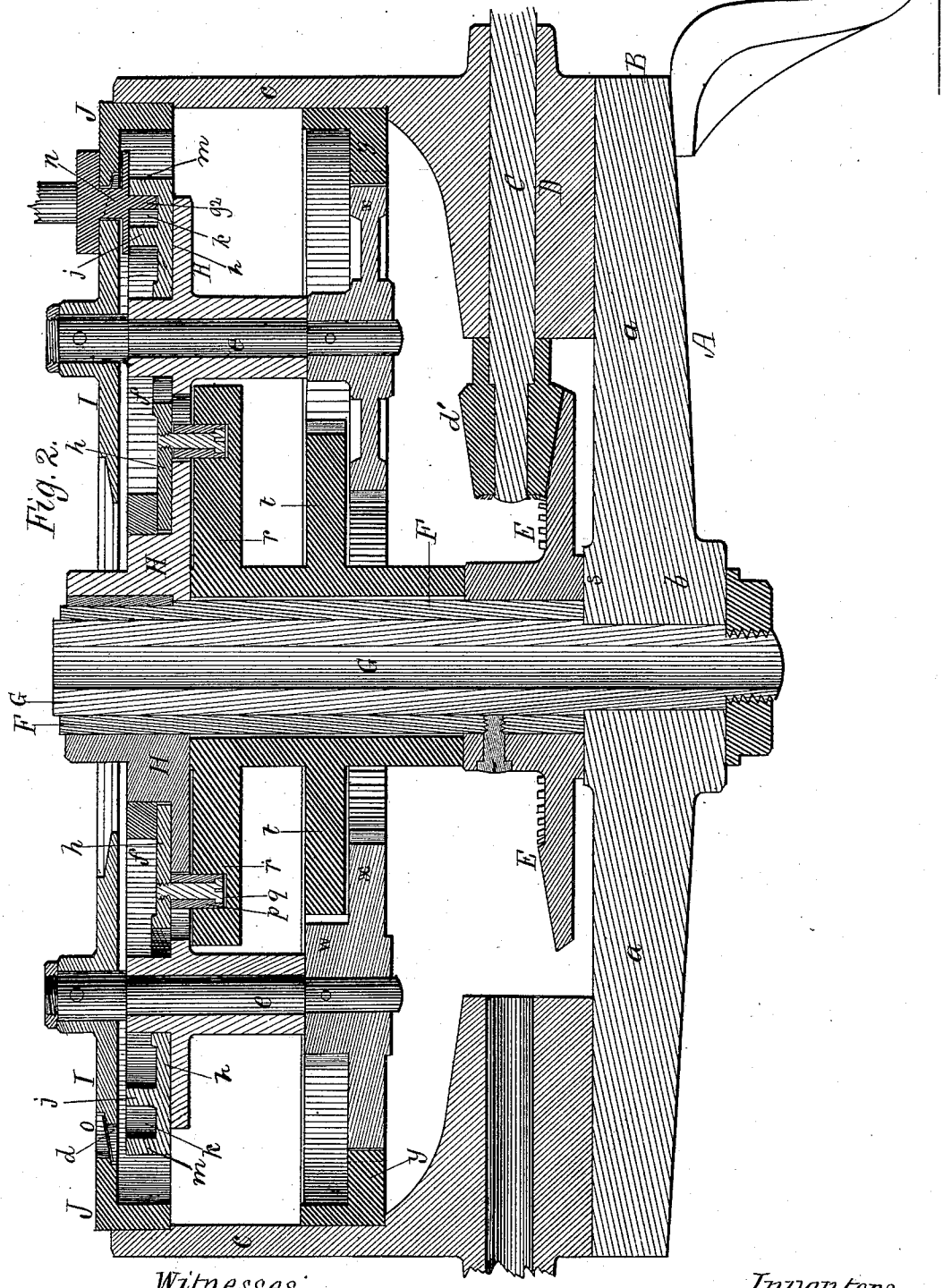
(No Model.) 2 Sheets—Sheet 2.

C. E. BARNES & A. C. WINN.

CORD BRAIDING MACHINE.

No. 290,624. Patented Dec. 18, 1883.

Fig. 2.



Witnesses.
H. E. Lodge.
Geo. Hamford

Inventors.
C. E. Barnes and A. C. Winn.
F. Curtis, Atty.

N. PETERS. Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

CHARLES E. BARNES, OF MELROSE, AND AMMI C. WINN, OF SOMERVILLE, MASSACHUSETTS; SAID BARNES ASSIGNOR TO JAMES H. WINN, OF WINCHESTER, MASSACHUSETTS.

CORD-BRAIDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 290,624, dated December 18, 1883.

Application filed December 12, 1881. (No model.)

To all whom it may concern:

Be it known that we, CHARLES E. BARNES and AMMI C. WINN, citizens of the United States, residing at Melrose and Somerville, respectively, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Cord-Braiding Machines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to a class of machines for manufacturing cords and ropes by a method embodying practically a combined braiding and twisting process such as is shown and described in Letters Patent of the United States issued on the 29th day of June, 1858, and in those issued on the 17th day of July, 1866, to James A. Bazin, in which a series of circular peripherally-notched traveler-carriers, rotating individually upon independent shafts carried by a revolving platform, move collectively with such platform, and are operated by a stationary ring-gear acting upon spur-gears secured to the said carrier-shafts, the combined motions of the rotary platform and the carriers, in connection with the ring-gear, being such that the threads from the spool-frames or travelers are carried successively about two others, so that each of the two threads thus inclosed or entwined shall in turn entwine two others. This inclosing and entwining of the threads is effected by extending the threads from side to side of the cord or rope across the same, practically centrally thereof—that is, across a chord subtending an arc of one hundred and twenty degrees, thus building up a cord or rope by crossing the threads composed of threads from several individual travelers, from outside to outside, diagonally across a thread previously laid, the center threads continually shifting, and the whole being partially twisted together, as clearly shown and described in said Letters Patent issued to Bazin on the 17th day of July, 1866, No. 56,485.

The Bazin machine, as above patented, was designed mainly to produce what is known in the arts as a "solid" cord—that is, a cord having no filling or core; but, as the specification states, it was capable of producing a "hollow" cord, so called—that is, a cord composed of a tube built up about a central strand or core.

With nine travelers and three carriers, as shown and explained in the Bazin machine, a practically solid cord is produced, in which the threads appear three times in the circumference of the cord during each complete revolution of the travelers. By operating the travelers so as to cause the threads thus to appear, the threads are so concatenated as to extend from one side of the cord, across the same, upon a chord subtending an arc of one hundred and twenty degrees, as before stated, the central portion of the cord at such crossing being composed of threads from several travelers twisted or entwined together, the threads nearest the center continually shifting, and each thread thus crossing from outside to outside, passing diagonally across a thread previously laid.

Among cord-manufactures the capacity of a machine is determined by the number of "stitches" per minute it will lay, by stitches being meant the laying of a thread over those previously deposited.

Our machine, as herein described, is designed to manufacture hollow cords, as distinguished from solid—that is, to build up about a central strand or core a tube, the inner portion of which is twisted or entwined, while the circumference is braided, the object of our invention being to increase the production of a machine of given size, and to produce a cord which, while being hollow, shall compensate for this by being of shorter twist or coil than those in which the threads appear but three times in the circumference of the cord at any given point, as in our cord the threads thus appear more than three times for each complete revolution of a traveler. Heretofore in cord-making machines of this class the aggregrate number of notches in all the carriers has been equal to the number of

notches in the ring-plate or "receiver," which latter, when the machine is in operation, receives temporarily every third traveler or every second traveler, according to the kind of machine employed, and any uneven number of traveler-carriers has been employed, as it has been considered impossible to produce a "solid" cord, so called—that is, without a core or filling, as before explained—except by causing the threads to appear at least three times in the circumference of the cord at a given point, as before stated, it having been found heretofore by long-continued experiments that a solid cord cannot be produced by an even number of traveler-carriers.

The essential feature of our invention consists in such a construction of the machine, as hereinafter described and claimed, as enables us to employ and operate more travelers than there are notches in the notched ring-plate or receiver without increasing the size of the machine in other respects or requiring in any considerable degree more power to run it. By thus increasing the relative number of travelers, we are enabled to increase the product of the machine by laying more stitches per minute than has been possible heretofore. We are enabled to carry and operate more travelers than there are notches in the ring-plate or receiver by increasing the number of notches in the four carriers, and by arranging these carriers diametrically opposite each other upon the platform which supports them, and by so constructing and arranging certain other devices, in combination with the said carriers, that the latter will simultaneously receive and deliver two diametrically-opposite travelers. For example, in a machine proportionally no longer than has heretofore been used to carry fifteen travelers and containing fifteen notches in the ring-plate or receiver, and laying an average of about two thousand four hundred stitches per minute, we carry with a ring-plate or receiver of sixteen notches, eighteen travelers, while the traveler-carriers are four in number, with five peripheral notches each, the aggregate notches of the carriers numbering twenty, or two more than the entire number of travelers, and four more than the aggregate notches of the ring-plate or receiver.

As the circumference of the cam-grooved disk offers but little space for the zigzags, whereby the switch-plates are to be operated, it becomes desirable to have the cam-grooved disk rotate in the same direction as the platform, though more slowly, instead of rotating in the opposite direction. To effect this, we employ the following construction: The platform is secured to and rotated by a sleeve, which is loosely mounted upon a vertical post or stud (preferably hollow, for lightness) erected centrally on the base of the machine, said sleeve being provided at its lower end with a horizontal beveled gear, which meshes with a beveled pinion secured to the inner end of the driving-shaft of the machine. The series of traveler-carriers are rotated by an annular internal gear secured to the machine-frame below the rotary platform, the shaft of each carrier having affixed to it a spur-gear, which engages said annular gear. The zigzagedly-grooved disk is mounted loosely upon the sleeve before named, and is rotated about this sleeve in the same direction with slower motion. The lessening of the speed of motion of said grooved disk is caused by the agency of a pinion fixed to the shaft of one of the traveler-carriers, and engaging and driving an intermediate pinion pivoted to the under side of the rotary platform, this intermediate pinion in turn meshing into and rotating a spur-gear secured to the under side of the grooved disk, or, as shown in the accompanying drawings, constituting part of the hub of such disk. The rotary motion of said disk is caused by the platform before described, and the pinion above mentioned serves to retard it.

The drawings accompanying this specification represent, in Figure 1, a plan, and in Fig. 2 a vertical section, of the lower portion of a cord-making machine containing our improvements. Fig. 3 is an under side view of the grooved disk or head containing the zigzag groove for operating the carrier switch-plate and the gears for operating such head and switch-plates. Fig. 4 is a plan of the rotary platform, with one carrier in place thereon. Fig. 5 is a plan of one of the switch-plates, showing such plate in its outermost position. Fig. 6 is a view of the lower portion of one of the travelers.

In the above-named drawings, A represents the bed-plate or base of the machine, the same being composed of an open or barred frame containing an outer annular plate or ring, B, supported upon suitable feet, and spanned at intervals by arms radiating from a central hub, *b*, the said ring being supplied with vertical posts or standards *c c c c*, erected quartering upon it, such posts constituting supports to the horizontal annular notched ring-plate or receiver, and the internal ring-gear, which operates the carriers, both of which will be duly explained.

We have in the accompanying drawings omitted the devices located above the notched ring-plate or receiver to support and take away the cord as it is formed, and we have in Fig. 1 of such drawings omitted the travelers, and in Fig. 2 shown only the lower portion or base of one of them.

The driving-shaft of the machine, which, as shown in the drawings, is horizontal, is seen at C, mounted in the lower part of one of the standards *c*, before named, and has affixed to its inner end a beveled pinion, *d'*, which engages and drives a horizontal beveled gear, E, which is secured to the lower end of a vertical sleeve or tubular shaft, F, loosely inclosing and supported by a stationary upright stud, G, (which, as before stated, may be hollow to ob-

tain lightness,) erected upon the hub *b*, before named, the sleeve being free to rotate about such stud by and with the gear E.

To the upper end of the sleeve or shaft F we secure a horizontal circular platform or table, H, which constitutes a support to the traveler-carriers. These carriers are shown at I I I I as of the construction common to machines of this class in general. Each is composed of a flat circular disk or head, formed, as shown in the present instance, with five equidistant peripheral notches, *d d*, &c., to receive the necks *n* of the travelers. The carriers I are disposed equidistant upon the platform H, and each is secured centrally to the top of a vertical shaft, *e*, mounted in suitable bearings in said platform. Each shaft *e* is rotated by a spur-gear secured to its lower end, which engages a stationary internal gear, to be hereinafter explained. The annular notched ring-plate or receiver, before alluded to, is shown at J in the drawings as supported fixedly upon the tops of the standards *c* of the machine-frame, the inner edge or periphery of this ring-plate or receiver overlapping the margins of the carriers I, and having in such inner edge a series of notches, *o o*, &c., of a size and shape corresponding with the notches in said carriers, and being disposed the same distance asunder as the latter notches, in order to coincide with them at stated intervals of time and form circular openings to inclose the necks of travelers.

Below each carrier I we form in the platform H a circular cell, *f*, which is concentric with the axis of the shaft *e* of said carrier, and receives the lower end of each traveler.

In the bottom of each cell *f* we form a radial groove, in which we place a switch-plate, *h*, having two flanges *j* and *m* formed on its upper side at its outer end, leaving the channel *k* between them. This channel receives the bases of the travelers, the inner face of the outer wall (flange *m*) of this channel being a segment of a circle struck from the center of the cell *f*, and of a diameter corresponding to that of such cell, while the outer face of the inner wall (flange *j*) of said channel is an arc of a circle of equal diameter with the circumference of the platform H. The switch-plate *h* has a reciprocating motion in the groove radially of the platform H, and when standing at its extreme inmost position, as shown at *a* in Fig. 4 of the drawings, the inner face of its outer wall (flange *m*) coincides with and completes the annular wall of the cell *f*. When the switch-plate *h* is in its extreme outermost position, as shown at a^{10} in said Fig. 4 of the drawings, and also as shown in Fig. 5, the outer face of its inner wall (flange *j*) coincides with and forms a proportional part of the circumference of the platform H, the channel *k* in this instance being entirely outside of such circumference, and in the first instance inside of the cell *f*. The switch-plate *h* is operated to move outward with the approach of every alternate traveler, and present its channel *k* in a position to permit the base of the traveler to enter it, then move inward, and by means of the inner face of the outer wall (flange *m*) crowd such base into a position coinciding with the cell *f*, in order that the next approaching notch of the next succeeding carrier shall sweep the traveler out of the channel *k*, and compel such traveler to follow the platform H in its rotation. When the traveler referred to arrives at that point of the periphery of the last-named carrier which is nearest to the fifth notch from which said traveler was taken, as aforesaid, the sliding switch-plate *h* is utilized to transfer said traveler from the carrier to said fifth notch. To effect this, the disk *r* causes said switch-plate, after receiving the traveler, to recede and force said traveler into the said fifth notch of the ring-plate or receiver. At each circuit each traveler is deposited in the notch of the ring-plate or receiver immediately in the rear of that which received it at the last circuit. As each traveler leaves one end of channel *k*, another enters the other end of said channel.

The carriers I, as before stated, are four in number, and each has five notches, while the travelers are eighteen in number, and the receiver has sixteen notches. The carriers stand diametrically opposite each other, and are so arranged and operated with respect to the notches of the ring-plate or receiver and the plates *h* that two diametrically-opposite carriers are delivering simultaneously each a traveler to the ring-plate or receiver while the alternate carriers are each taking a traveler from such ring-plate or receiver. The relative positions of the carriers which permit of this dual taking and delivering of the travelers are shown in Fig. 4 of the accompanying drawings, one of the switch-plates *h* being therein shown in dotted lines. By this manner of disposing and operating the four carriers—that is, so that two diametrically-opposite ones shall be delivering each a traveler to the ring-plate or receiver simultaneously with the taking from such ring-plate or receiver of two other travelers by the alternate carriers—we are enabled to dispose of the two travelers in excess of the number of notches in the ring-plate or receiver, one extra traveler being contained in each pair of carriers, and as the cave of these travelers is continually shifted from one pair of carriers to the other, they never interfere with or create disturbance among the other travelers, and the ring-plate or receiver is enabled to accommodate more travelers than its notches number. For this reason we are enabled in a machine of given size to lay more stitches per minute than in machines heretofore in use.

By the employment of four traveler-carriers, and by causing these carriers to pick up and deliver diametrically-opposite travelers, as stated, the thread from each of the four carriers is carried about the threads from four other

carriers, and the various threads do not intersect at a point approximately near the center of the cord, as in the Bazin patent, but assume the form of a tube, and build up a cord of shorter coil than the Bazin machine—that is, a cord in which the threads appear more than three times in its circumference at any given point. By this means the cord produced is tubular or hollow in the center; and to fill up this bore we prefer to employ a center strand or core, about which the outer tube is built as the making of the cord progresses.

In some classes of cords the hollow one filled by a core is somewhat objectionable, but we compensate, or more than compensate, for this by the greater tensile strength, owing to the shorter twist or coil which is produced by causing the threads to appear at comparatively short intervals at the surface of the cord. Each switch-plate *h* has a pendent stud or anti-friction bowl, *p*, (see Fig. 2 of the drawings,) which enters a continuous zigzag cam-groove, *q*, formed in the upper face of a horizontal circular disk or head, *r*, loosely encompassing the sleeve F, before named, and resting upon the hub of the gear E. The steps of the cam-groove *q* are so calculated or arranged that with each coincidence of every other notch of a given carrier, I, with every other notch of the ring-plate or receiver, the switch-plate *h* effects a traverse in two directions—inward and outward—whereby the carriers are put in position to take from such receiver every traveler remaining in it, and to deposit the alternate travelers in such receiver.

Upon the lower part of the pendent hub of the horizontal circular disk or head *r* we form a spur-gear, *t*, which meshes with a pinion, *u*, pivoted to the lower part of a pendent stud, *v*, projecting from the under side of the rotary platform H, this pinion *u* meshing into a second pinion, *w*, secured to the shaft *e* of one of the carriers I. The pinion *w* last named is free from engagement with the gear *t*, and is secured to or forms the upper part of a larger gear, *x*, which is secured to one of the carrier-shafts *e*, and meshes with a horizontal annular or internal gear, *y*, situated below the notched ring-plate or receiver J, and secured in position upon the standards *c* of the machine-frame. As before stated, each carrier-shaft *e* has secured to it a gear, *x*, and the series of such gears *x* mesh into the annular gear *y;* hence, as the shaft *e* and gears *x* bodily revolve around the stud G by and with the platform H, the stationary internal gear, *y*, effects rotation of the said shafts *e* and their carriers with respect to the platform. If the shafts *e* rotated in fixed bearings, the pinion *u* would drive the grooved disk *r* in an opposite direction to the platform H; but as the shaft *e* and the said pinion *u* travel bodily with the platform at a much greater rate of speed than the disk, the said disk is rotated in the same direction as the platform at slower speed. This lower rate of speed of said disk results from the forward revolution of said carriers and their gear *x*, in combination with and opposition to the independent rotary motion of said carriers and gears *x*, due to the meshing of said gears with the stationary internal gear aforesaid, while gear *x* and carriers are revolving with said rotary platform.

In the operation of this machine the beveled pinion *d'* drives the beveled gear E, sleeve F, and carrier H, the gears *x* impel the shafts *e* and the traveler-carriers I, and one of such gears *x* impels the pinion *w*, while such pinion *w* impels the pinion *u*, and the latter pinion impels the grooved disk or head *r* through the gear *t* of the latter, the rapid rotations of the platform H being transmitted into sluggish motions of the disks, as before explained.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The combination, with the platform H, the stationary internal gear, *y*, the cam-grooved disk *r*, provided with a gear upon its hub, and means for rotating the platform H, of the shaft *e*, gears *x*, and pinions *u* and *w*, whereby the forward rotation of the platform causes a rotation of the cam-grooved disk in the same direction as the platform, but at a slower rate of speed, as specified.

2. The combination of a stationary internal gear and a stationary ring-plate or receiver, a platform, and means for rotating the latter with a series of four notched carriers arranged in pairs and carried by said platform, the number of notches in each carrier exceeding by one the number of the carriers themselves, and the number of notches in the ring-plate or receiver being divisible without remainder by the latter number, a series of travelers more numerous than the notches in the ring-plate or receiver, but less numerous than the aggregate of the notches in said carriers, said travelers being adapted to be shifted from the notches in said carriers to the notches in said ring-plate or receiver, and back again, a series of switch-plates whereby this shifting or transferring is effected, a disk or head which is provided with a zigzag cam-groove for operating said switch-plates in pairs, as described, and a series of gear-wheels carried by said rotary platform, whereby the stationary internal gear causes said carriers to rotate in a direction opposite to the direction of rotation of said platform, and also causes said disk or head to rotate in the same direction with said platform, but more slowly, substantially as set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

CHAS. E. BARNES.
AMMI C. WINN.

Witnesses:
F. CURTIS,
H. E. LODGE.