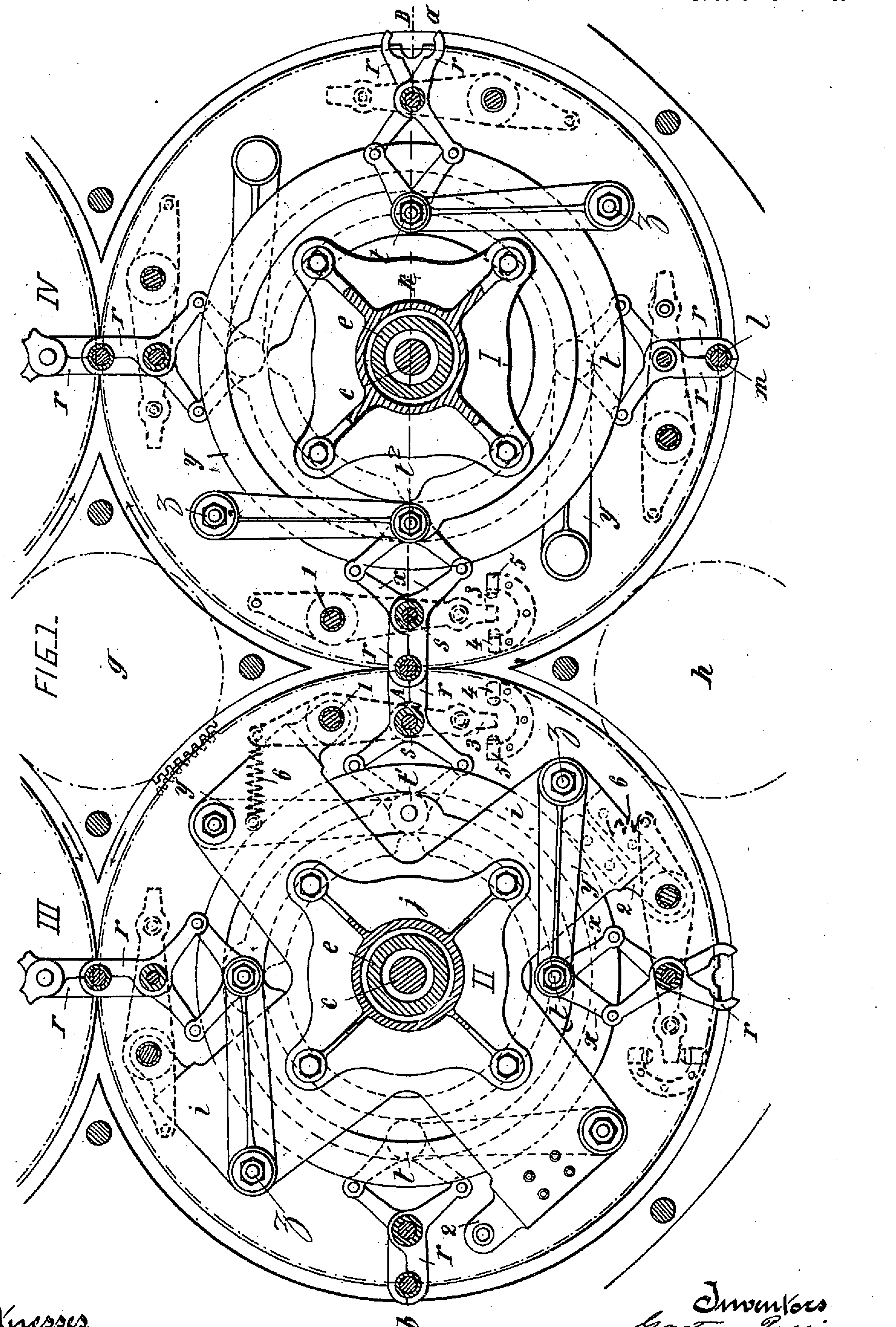
No. 659,693. Patented Oct. 16, 1900.

G. POSSIEN & F. V. MAQUAIRE.

ROTARY TRANSPORTING DEVICE.

(Application filed Aug. 2, 1899.)

(No Model.) 5 Sheets—Sheet 1.



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(No Model.) 5 Sheets—Sheet 2.

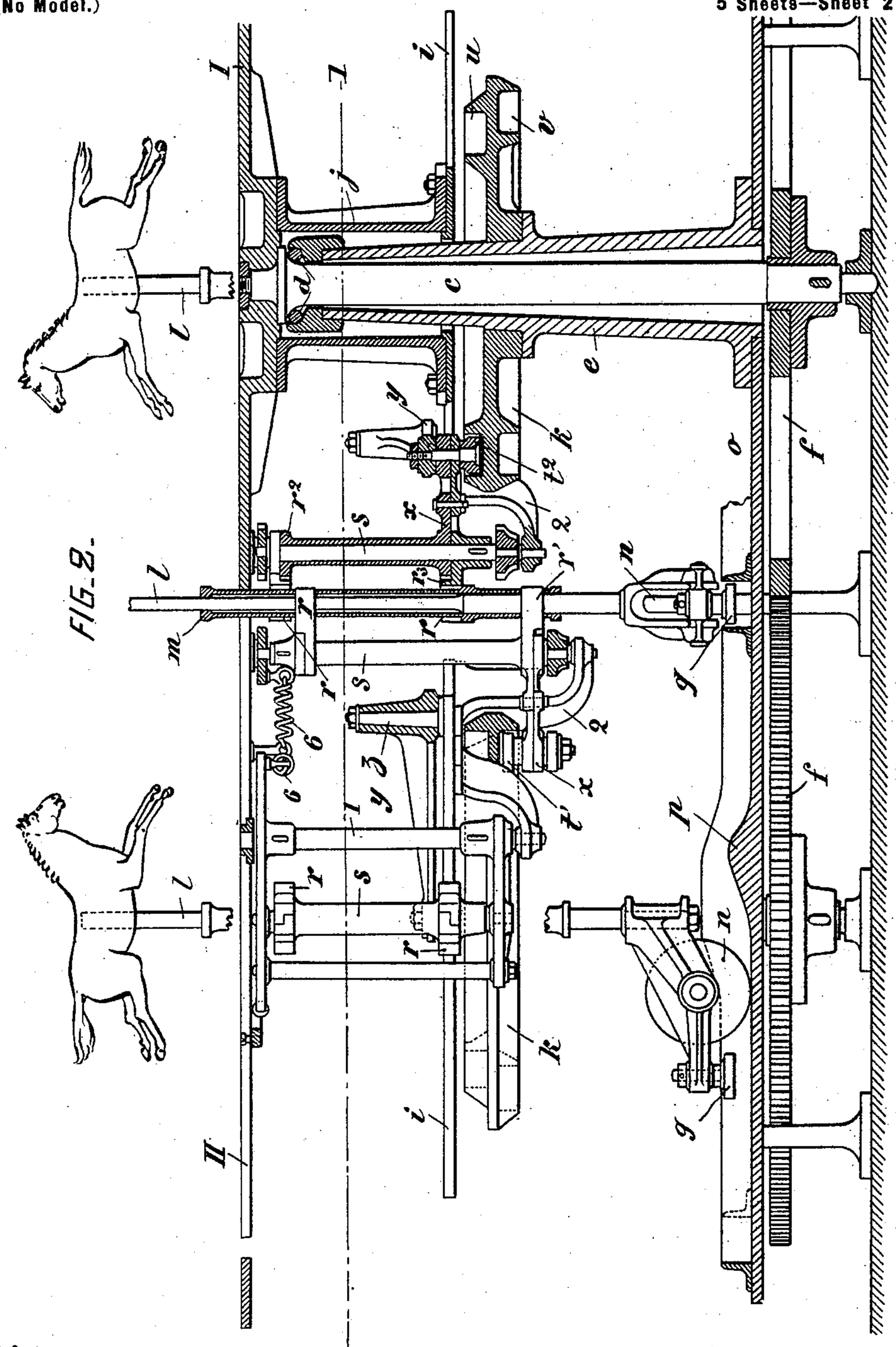

FIG. 2.

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(No Model.) 5 Sheets—Sheet 3.

FIG. 3.

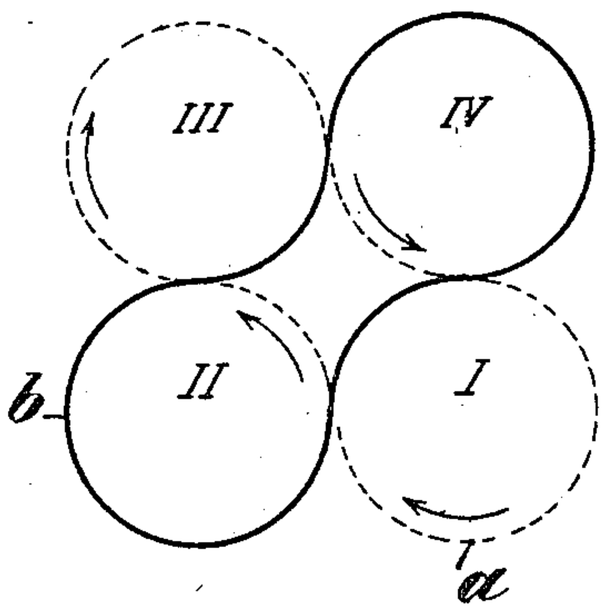


FIG. 4.

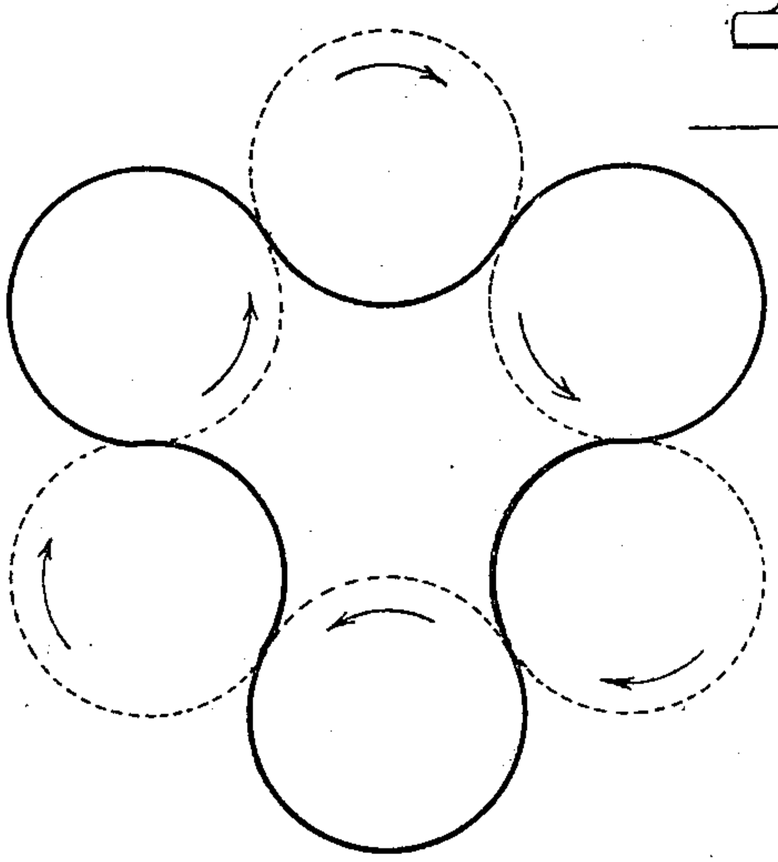
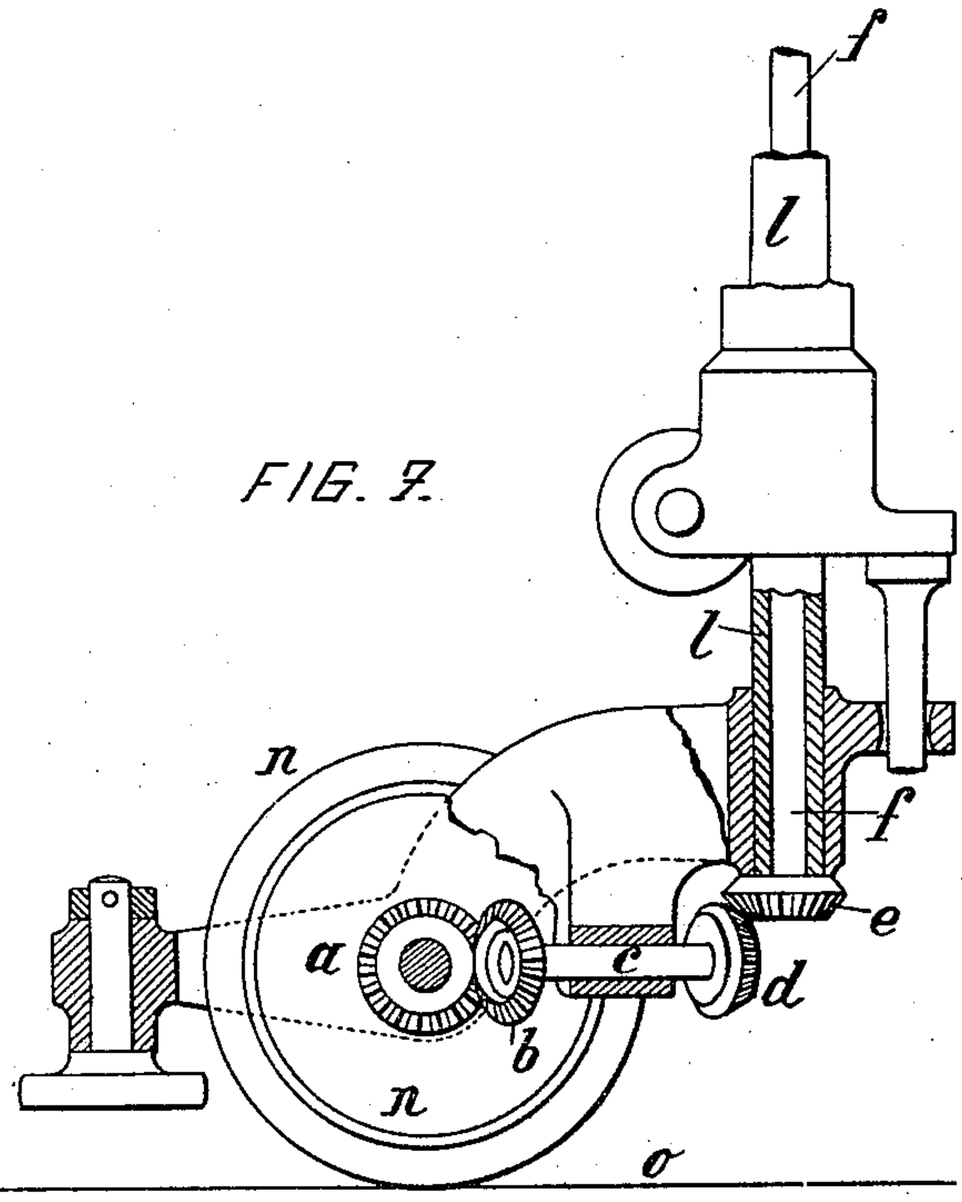


FIG. 7.



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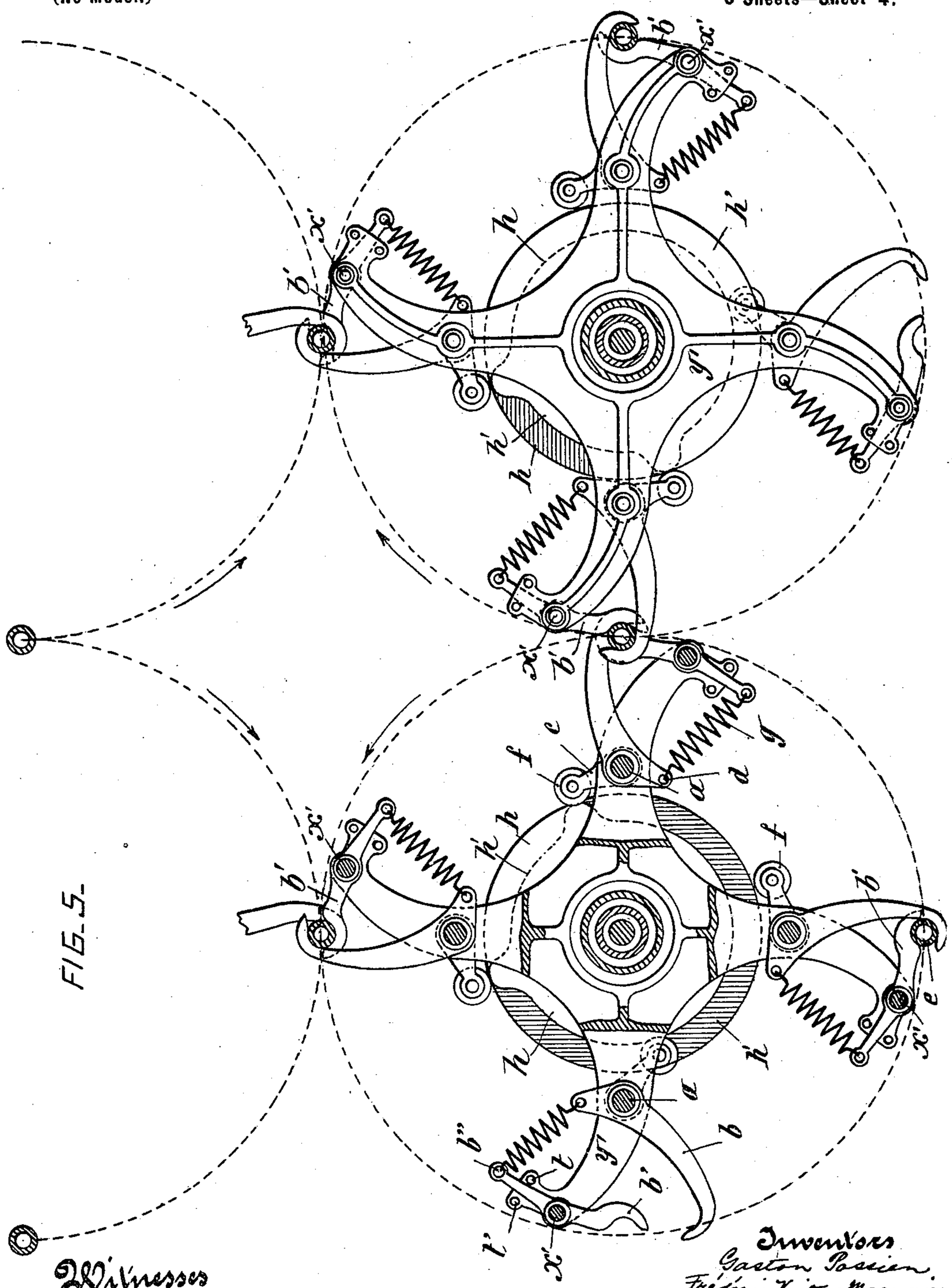
(Application filed Aug. 2, 1899.)

(No Model.) 5 Sheets—Sheet 4.

FIG. 5.



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ROTARY TRANSPORTING DEVICE.

(Application filed Aug. 2, 1899.)

(No Model.) 5 Sheets—Sheet 5.

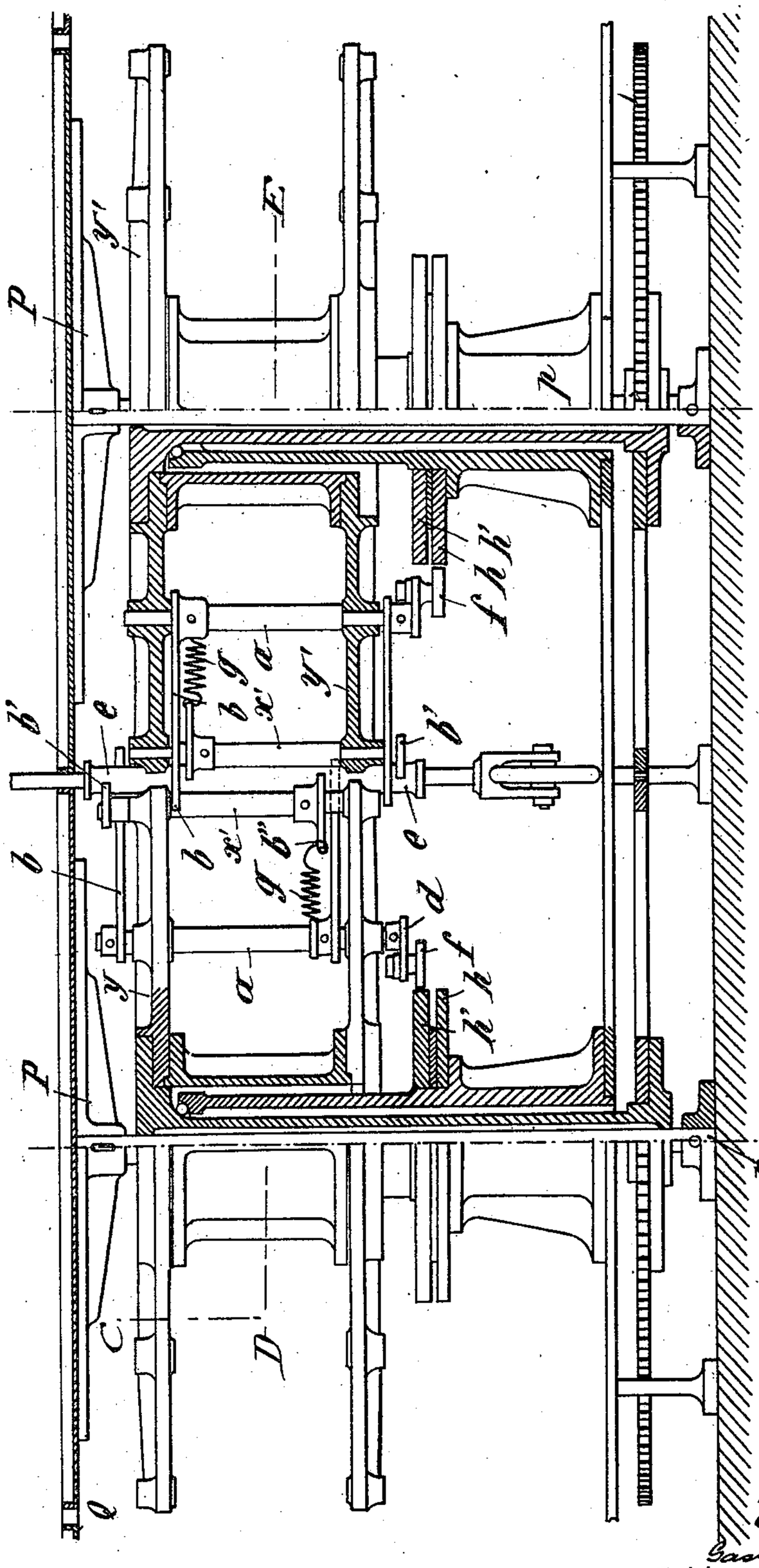

FIG. 6.

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UNITED STATES PATENT OFFICE.

GASTON POSSIEN AND FRÉDÉRIC VICTOR MAQUAIRE, OF PARIS, FRANCE.

ROTARY TRANSPORTING DEVICE.

SPECIFICATION forming part of Letters Patent No. 659,693, dated October 16, 1900.

Application filed August 2, 1899. Serial No. 725,837. (No model.)

To all whom it may concern:

Be it known that we, GASTON POSSIEN, composer, of 31 Rue Vital, and FRÉDÉRIC VICTOR MAQUAIRE, engineer, of 3 Avenue du Maine, in the city of Paris, France, have invented an Apparatus for Transporting Movable Objects in a Curvilinear Path of Varying Direction, of which the following is a full, clear, and exact description.

This invention relates to apparatus for effecting the transport and exchange of one or of a number of movable objects upon and between a series of supports moving relatively to one another.

The invention is illustrated in the accompanying drawings, wherein—

Figure 1 represents a sectional view of the apparatus as applied to mechanical moving devices—such as roundabouts or carousels, toys, and the like—the section being taken on the line 1 1 of Fig. 1. Fig. 2 is an elevation, partly in section, on line A B, Fig. 1. Fig. 3 is a diagram illustrating a double crossing movement made by a series of movable objects with the aid of a series of four disks. Fig. 4 is a diagram illustrating the movement in a sinuous course and in reverse directions of a series of movable objects with the aid of a series of six or a greater number of disks. Fig. 5 is a top view of a modified form of device embodying our invention, the view showing the top disks F removed and partly in section. Fig. 6 is a side view of the same, partly in section. Fig. 7 is an enlarged detail side view, partly in section, of a portion of the apparatus to be hereinafter described.

The same characters of reference denote like parts in all the figures.

Figs. 1 and 3 represent a group of four disks, of which two only are fully shown in Fig. 1. These disks receive rotary motion at the same peripheral speed by being geared together at their circumferences by means of toothed gearing or otherwise. Under these conditions if it be assumed that a movable object is placed at the point *a* in the circumference of the disk I said object will be moved in the direction of the arrows toward disk II, around a portion of the circumference of which it will pass from the moment of its contact with the two disks and in a similar manner will pass from disk II to disk III, thence to disk IV, and back to disk I, and so on. The movable object will thus describe during its cycle of movement a series of arcs of circles alternately upon the interior and the exterior portions of the circumference of the group of four disks, the course described being that of a double loop. If now a second moving object be placed at, say, point *b* upon disk II, a series of movements similar to the preceding will be performed by this object, but in a path crossing that above described, the number of moving objects which may be employed for producing this double crossing movement, as represented in Fig. 3, being determined by the relative dimensions of the disks and moving objects.

If the number of disks be increased to six or upward, the path traversed by each moving object will be a sinuous line winding around the common center of the group of disks, as shown in Fig. 4.

The disks carrying the moving objects may be of different diameters, provided that the number of positions (of the moving objects) on each disk is constant and at least equal to four and that the arcs of circles comprised between two positions of said objects shall be identical in all the disks—that is to say, that all the objects shall pass between the points of contact of the disks in equal times, as will be hereinafter explained.

It will be seen from an inspection of Figs. 1 and 2 in the first place that the position occupied by the moving objects upon the disks should be such that no two of said objects can meet at the same moment at the same point of translation from one disk to another. The disks should therefore be so arranged as to present alternately a free point and a point occupied by a moving object, thus causing a space to coincide with a plenum in order to render possible the exchange or translation of the moving objects.

Having thus defined our invention in general terms, we will now proceed to describe the mechanical combinations with the aid of which the three following phases of action may be executed: first, maintenance of the objects in motion during their transport between the points of exchange and during the passage of the objects from one disk to another; second, retention of the moving ob-

jects (by means of operating mechanism) momentarily out of action, and, third, release of the moving objects by the operating mechanism momentarily in action, these two latter actions being accomplished alternately according to the rule previously indicated.

In the example of the application of the invention which we will now describe the object aimed at is that of effecting the translation of the objects ordinarily employed in connection with roundabouts and the like—such as animals, vehicles, and figures of various kinds—either to be ridden by those participating in the exercise or as a means of transport or for displaying pictures, &c., by causing the latter to traverse with safety the varied directions before indicated. To this end we employ the arrangements represented in the first place in Figs. 1 and 2.

I II are two disks or platforms forming part of a four-disk system, these disks being fixed on the upper ends of vertical shafts *c*, which rotate on ball-bearings *d* to lessen the resistance to movement and are journaled at their lower ends in footstep-bearings. These revolving parts are supported on hollow columns *e* and receive motion in common from gear-wheels *f* of the same diameter, for example, as the disks, meshing the one in another, and which receive their motion from a driving-wheel that may be placed at *g* or *h*, according as the motor is to be placed at the center of or at one side of the roundabout. Beneath each upper revolving disk or platform is suspended a second disk *i*, the two disks being rigidly connected by means of a hollow pillar *j*, and at a still lower level is fixed to another pillar *e* a third disk *k*, provided with two cam-grooves, as hereinafter explained. In these figures the moving objects are represented by their supporting-spindles *l*, which are capable of rotating freely in tubes *m* and are provided at their lower ends with rubber-tired rollers *n*, running on a track *o*, which may either be a plane horizontal surface or be formed with raised portions *p*, as shown. The support for the moving object is further provided with a roller *q* for the purpose of controlling and varying at will by means of lateral guides the partial rotation of the spindles *l* at each point of the traverse of the object.

The action of the apparatus is as follows: Each object is successively seized, transferred from one platform to the next, and then released for the purpose of rendering it free to take a new direction by the automatic action of a series of double gripper or pair of jaws *r*, each pair of which is jointed on a common axis *s*. The perfect accuracy with which the three functions of seizing, holding, and releasing the objects by means of the mechanical hands constituted by the grippers *r* are performed is insured by the action of rollers t' and t^2, running in cam-grooves *u v* in the stationary cam-disk *k*, the movement of said rollers t' t^2 being transmitted by means of lever connections *x*. Each of the rollers t' and t^2 turns freely on a spindle carried on the end of levers *y*, pivoted on axes *z*, mounted on disk *i*. Assuming the cam-grooves to have an appropriate form and relative position, it follows that the rollers t' and t^2 will accomplish a periodical movement in the direction of the radii of the revolving disks each time that one of the rollers passes the line joining the centers of two adjacent disks. The levers *y* are alternately disposed above and below the cam-disk *k*, so that the rollers t' and t^2 in participating in the rotation of the disks pass the points of contact of adjacent disks, the one roller in the upper and another in the lower groove, and so on alternately. The bend of the upper and lower cam-grooves being disposed inversely to each other, it follows that the grippers mounted on the same disk succeed each other also in the alternately open and closed—that is to say, in the inoperative and operative—positions. The cams of each revolving disk are further disposed inversely to those of the disks immediately in contact therewith, so that the grippers (which are themselves arranged alternately in two different horizontal planes) will always be presented at their point of coincidence, the one open and the other closed upon the spindle which carries the moving object. In consequence of the inverse movements imparted by the cams to the rollers (passing the tangent-points of the disks) and through said rollers to the grippers those of the latter which hold the object abandon their hold and transfer the object to those grippers which are next to receive it, and in order that this exchange may be effected with the necessary security the parts are so arranged that the grippers shall have seized the object before it has been released by the preceding grippers. To obtain this result, the common axis *s* of each pair of grippers is mounted in a frame oscillating upon another axis 1, pivoted in the upper disk or platform I, II, III, &c., and in a support 2, fixed to the lower platform *i*. The extremity 3 of this frame is adapted to abut against suitably-mounted stops 4 and 5, a spring 6 tending to force the part 3 against stop 4, and thus bring the axis of rod *l* in the corresponding gripper-arms into a radius slightly greater than that of the disks at their tangent-point, and consequently in the neighborhood of the points of coincidence of the separate sets of grippers, (*i. e.*, in the plane in which lie the axes of two adjacent disks,) and for a certain time the two circular paths of the moving objects tend to intersect one another. In reality (assuming the springs 6 to be of equal strength) this tendency causes the object to travel in a rectilinear path during the time, for example, that the cams, first, force the roller t' to still hold the grippers r r' closed; second, cause the rollers t^3 to effect the closing of grippers r^2 r^3, and, third, cause the roller t' a moment afterward to effect the opening of grippers r r'. The prac-

tical realization of this kinematic function is insured by allowing the two rollers to have sufficient play according to the radius of their respective disks. In effect there elapses a certain time during which the rods *l* are held by the pairs of grippers of both the disks between which the exchange of the object is to be effected, the object being abandoned by the one disk only after it has been seized by the following disk and securely held for the purpose of being carried along and transported toward a series of fresh points in the track which it has to traverse. The same effects are produced for all the other exchanges of the objects according to the rules of alternation and inversion of direction of motion previously described. A simpler arrangement of mechanism may also be employed, such as that represented in plan and vertical section in Figs. 5 and 6. In Fig. 5 the movements of the object are effected by means of multiple levers pivoted at *a* and having three arms *b c d*. The arm *b* of each of these levers is curved at its extremity to exactly conform to the exterior contour of the guide-tube *e*, by which the movement of the object is effected. The arm *c* of the lever has pivoted upon its extremity a roller *f*, by which the common working of these multiple levers is controlled. The arm *d* of each of said multiple levers serves as the point of attachment for a spring *g*, whereby the rollers *f* are constantly and firmly pressed against the cams *h h'*, whereas in the previous arrangement the rollers through which the movements are effected are engaged between the parallel curvatures of two cams, which conduce to the production of the same movement. From an examination of Fig. 5 of the drawings it will be observed that the cam *h'* is uppermost upon the right-hand side of the device, whereas it is lowermost on the left-hand side. The disposition of these cams is such that the depression in the cam *h'* is coincident with the elevation of the cam *h* of each carrier. The roller *f* of one carrier will bear upon a cam *h*, whereas the next roller will bear upon the cam *h'*. It will be understood that from this arrangement and the disposition of each set of cams with relation to another a roller *f* on one carrier will bear on the elevated portion of its cam *h* after leaving an intersecting position, whereas the roller *f* of the coöperating gripper on another carrier will bear upon a depressed portion of its cam *h'*. It will likewise be understood that the rollers *f* of alternate grippers on the same carrier bear upon the same cam. Thus, for instance, the rollers of the first and third gripper upon the right-hand side of Fig. 5 and counting from the upper gripper bear upon the cam *h*, whereas the rollers of the second and fourth grippers bear upon the cam *h'*. As shown in Fig. 5, the movement and retention of the objects are effected partly by the terminal curvature of the levers *b* and partly by a seating of the guide-tube *e* in a depression formed in a second lever *b'*, pivoted on a center *x'*. The pivots *a* and *x'* are both carried upon the same frame *y'* and are duplicated to take the place of the disks I II, &c., and the disks *i* of the first arrangement. The levers *b'* have each an arm *b''*, which serves as a point of attachment for the spring *g*, which tends to constantly press the rollers *f* firmly against the cams *h h'*, and thus insures the requisite control of the movements for seizing and releasing the objects by the hooked levers *b*. The same spring *g* tends to bring the depression for the guide-tube *e*, formed in the arm of lever *b''*, to bear against the stop *t*. A second stop limits the oscillations of *b''* either in case of the accidental breakage of spring *g* or at the moment of intersection of the two circular paths of the supports of the moving objects, at which point their paths are momentarily converted into a rectilinear path. As in the arrangement illustrated in Figs. 1 and 2, there is provided in a second plane parallel to the first a second series of levers *b b'*, of similar form to those already described and fast on the same axes *a* and *x*, so that each of the guide-tubes which supports a moving object may be always held and acted on at two points in its height and that the several guide-tubes may thus move constantly parallel to each other. Both members of the pair of lever-arms *b b'* (corresponding to each position capable of being occupied by the moving objects) are thus amenable to the action of a single roller *f* and a single spring *g*. Fixed disks P are supported upon columns *p*, concentric with each rotary apparatus, these columns being supported upon the ground or foundation of the runabout. The rods which support the objects alone pass through an opening made between the stationary disks P and the platform Q. The same rules of working previously described will also apply in this arrangement—viz., alternation of the positions occupied and unoccupied by the objects, so as to avoid their mutual collision, permit of their exchange and of the continuity of their traveling movement from point to point, and of the requisite reversal of the movements of the gripping and releasing levers.

The arrangement represented in Fig. 7 permits the transmission of any kind of movement to the objects during their travel and of utilizing said movements to produce varied effects. This arrangement provides means for utilizing the rotary motion of the wheels *n*, which support the moving objects during their travel along the track *o*. For example, the motion of wheels *n* may be transmitted to the upper part of the object. To this end upon the axis of wheel *n* is keyed a bevel-pinion *a*, whose motion is transmitted through bevel-pinion *b*, shaft *c*, and bevel-gear *d e*, the latter keyed on a shaft *f*, turning easily

in the interior of the rod *l*, which supports the object under the same conditions as those previously described.

Although we have described several applications of our system of automatic translation, it should be understood that the general arrangements on which the apparatus is based may be applied in all cases in which an object or body of any kind may be or is required to be transferred or transported by exchange between any suitable organs of translation.

We claim—

1. In a device of the character specified, the combination of a plurality of rotatable carriers, grasping devices carried by said carriers, an object having a stem that is adapted to be engaged by the grasping devices and means for automatically actuating said grasping devices to release one grasping device when another has been operated to grasp the object, whereby the object is caused to move continuously from one grasping device to another and in a curvilinear path of varying direction.

2. In a device of the character specified, the combination of a plurality of coöperating rotary carriers, means for rotating all of said carriers at the same rate of speed, a grasping device carried by each of said carriers, a two-part object one part of which is adapted to be engaged by each of said grasping devices and to prevent a movement of the portion of the object grasped by the grasping device with relation to the carrier and means independent of the carriers for automatically actuating one grasping device when another grasping device has been operated to grasp the object, whereby the object is caused to be moved by said grasping devices continuously from one grasping device to another and in a curvilinear path of varying direction.

3. In a device of the character specified, the combination of a plurality of coöperating rotatable carriers grasping devices carried by said carriers, an object-carrying device adapted to be grasped by the grasping devices, an object carried by the said object-carrying device and movable independently thereof and means independent of the carriers for automatically releasing one grasping device when another has been operated to grasp the object-carrying device, whereby the object is caused to be successively grasped by the grasping devices and to move continuously from one grasping device to another and caused by the grasping devices to move in a curvilinear path of varying directions and to permit a movement of the object in a direction different from that produced by the carriers.

4. In a device of the character specified, the combination of a plurality of rotatable carriers, grasping devices carried by said carriers, an object-carrying device adapted to be grasped by the grasping devices, an object carried by the said object-carrying device and movable independently thereof, a cam-track upon which an extension of the object is adapted to bear in order to support the object and means independent of the carriers for automatically actuating the carriers to release one grasping device when another has been operated to grasp the object-carrying device, whereby the object is moved continuously from one grasping device to another and caused by said devices to move in a curvilinear path of varying directions and in a direction at right angles to the plane of movement of the carriers in a curvilinear path.

5. In a device of the character specified, the combination of a plurality of rotatable coöperating carriers, means for rotating said carriers, a gripping device carried by each of said carriers, the carriers being so related that the path of movement of the gripping device of one carrier intersects with the path of movement of the gripping device of another carrier, a spindle adapted to be grasped by the gripping devices, an object carried by and movable independently of said spindle, means for automatically releasing the gripping device of one carrier when said gripping device is coincident with the gripping device of another carrier and for automatically operating said second-named gripping device to grasp the spindle when the first-named gripping device has released it and means for automatically turning the object on the spindle during the translation of said spindle.

6. In a device of the character specified, the combination of a plurality of rotatable coöperating carriers, means for rotating said carriers and gripping devices carried by each of said carriers, the carriers being so related that the path of movement of the gripping device of one carrier intersects with the path of movement of the gripping device of another carrier, a spindle adapted to be grasped by the gripping devices, an object carried by and movable independently of said spindle, means for automatically releasing the gripping device of one carrier when said gripping device is coincident with the gripping device of another carrier and for automatically operating said second-named gripping device to grasp the spindle when the first-named gripping device has released it, means for automatically turning the object on the spindle during the translation of said spindle and means for automatically moving said object independently of its spindle in a vertical direction.

7. In a device of the character specified, the combination of a plurality of rotatable coöperating carriers, means for rotating said carriers and gripping devices carried by each of said carriers, the carriers being so related that the path of movement of the gripping device of one carrier intersects with the path of movement of the gripping device of another carrier, a spindle adapted to be grasped by the gripping devices, an object-supporting rod carried by and movable independently of said spindle, a lateral projection extending

from said rod, a cam-track which coöperates with said lateral extension to effect a turning of the object with relation to the spindle, means for automatically releasing the gripping device of one carrier when said gripping device is coincident with the gripping device of another carrier and for automatically operating said second-named gripping device to grasp the spindle when the first-named gripping device has released it, a cam-track which supports the object-supporting rod and which automatically moves the object in a vertical direction without affecting the turning and curvilinear movement thereof.

The foregoing specification of our apparatus for transporting movable objects in a curvilinear path of varying direction signed by us this 21st day of July, 1899.

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