No. 751,564. PATENTED FEB. 9, 1904.

C. E. SARGENT.

VARIABLE SPEED MECHANISM.

APPLICATION FILED MAY 8, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

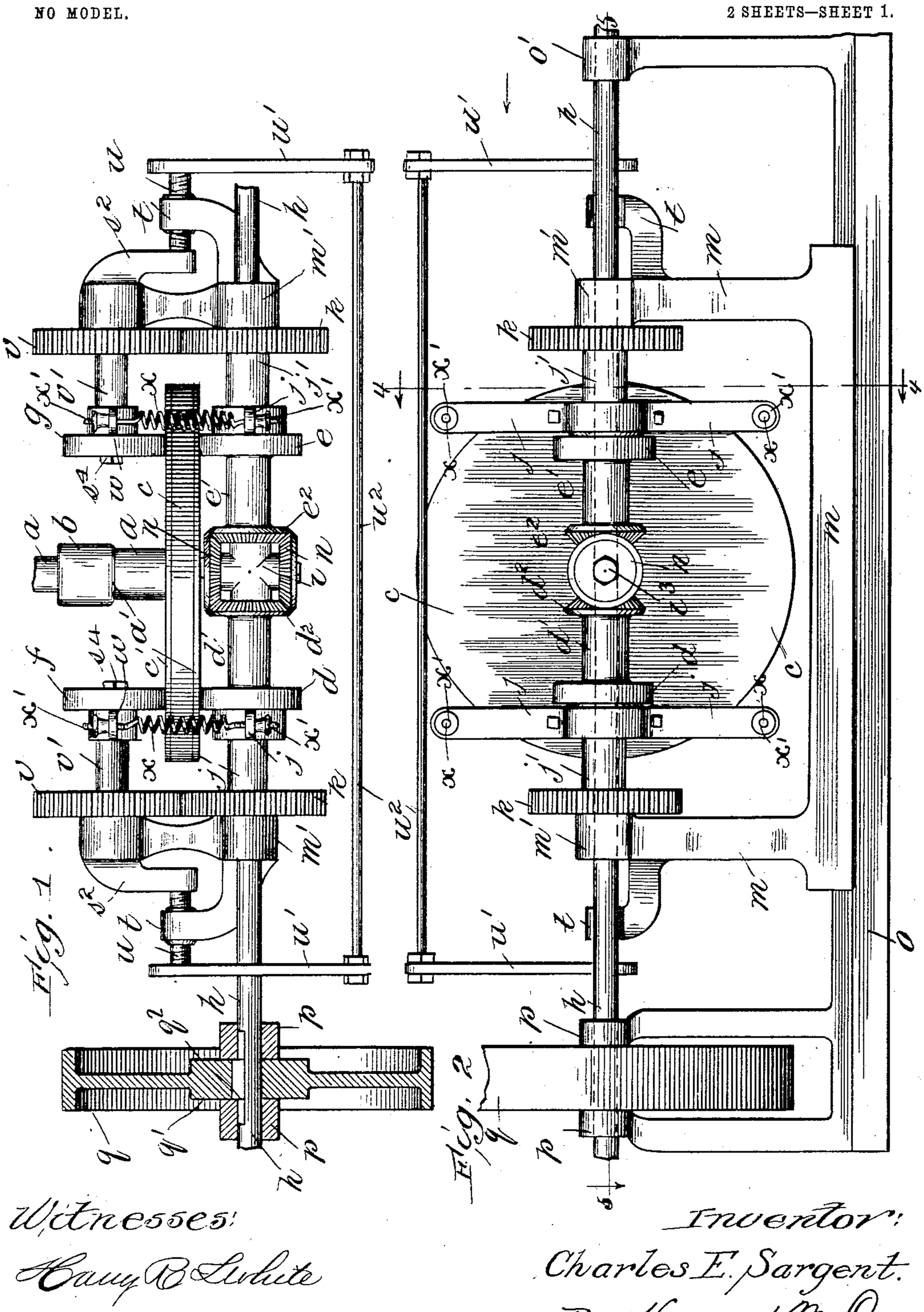

Fig. 1.

Fig. 2.

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

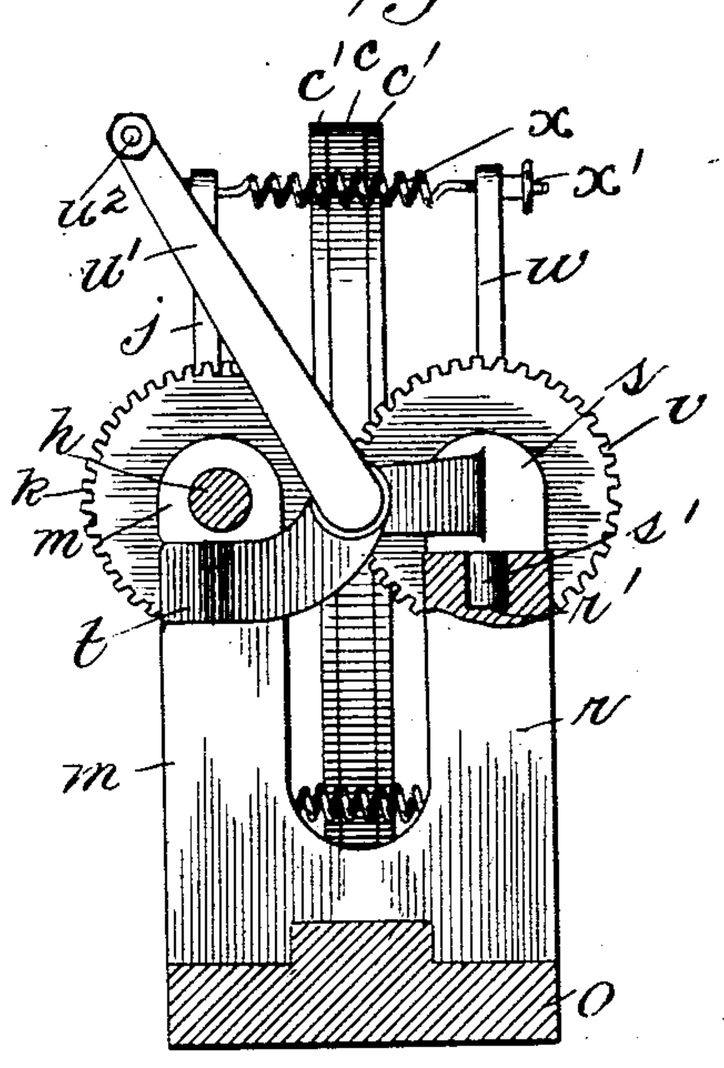


Fig. 4.

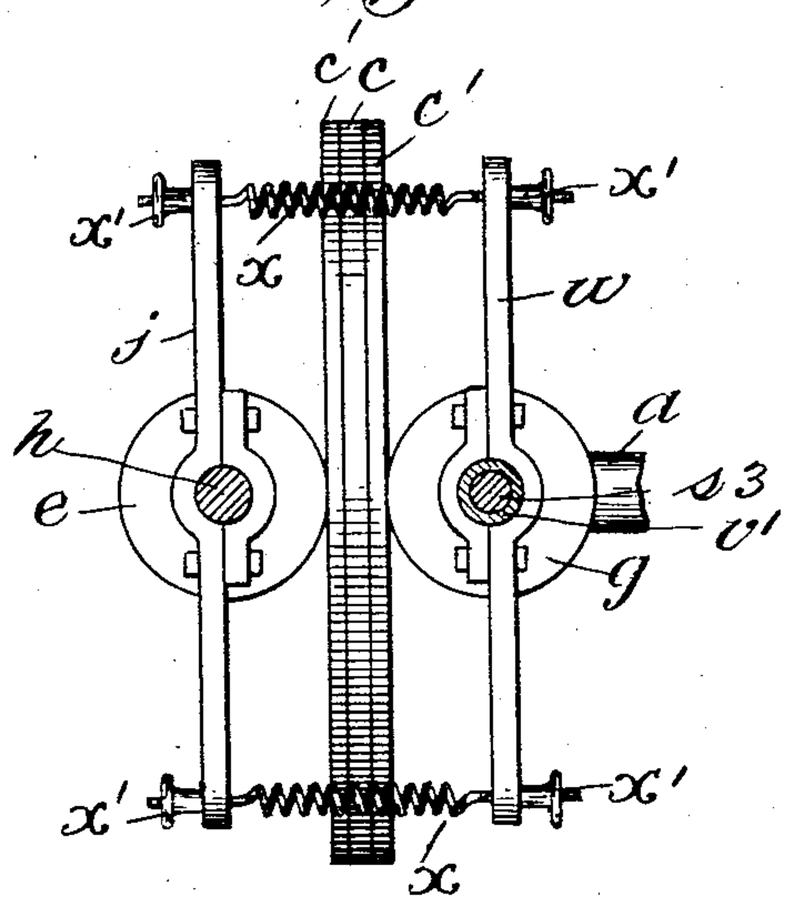


Fig. 5.

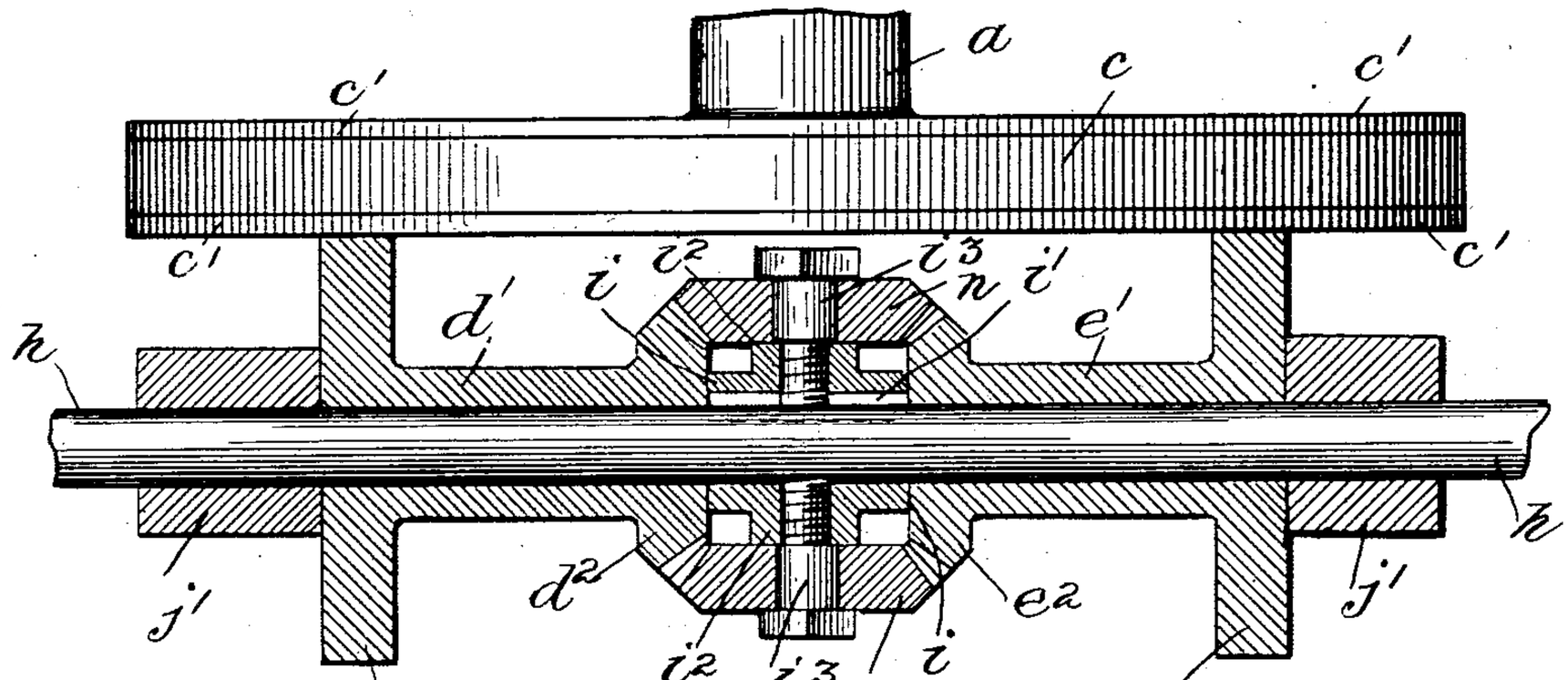
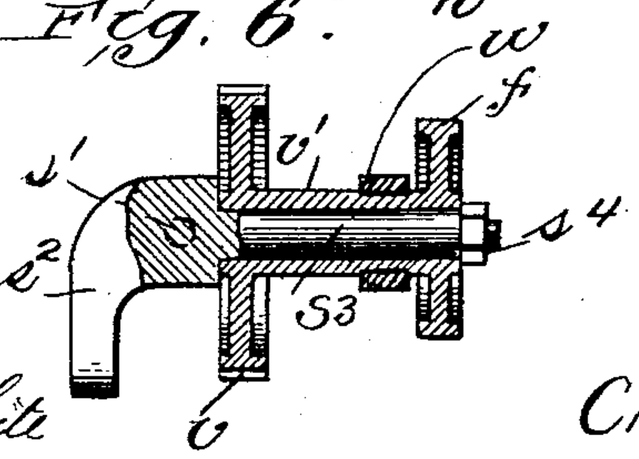


Fig. 6.



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No. 751,564. Patented February 9, 1904.

UNITED STATES PATENT OFFICE.

CHARLES E. SARGENT, OF CHICAGO, ILLINOIS.

VARIABLE-SPEED MECHANISM.

SPECIFICATION forming part of Letters Patent No. 751,564, dated February 9, 1904.

Application filed May 8, 1903. Serial No. 156,203. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SARGENT, a citizen of the United States, residing in the city of Chicago, county of Cook, and State of Illinois, have invented a new and useful Improvement in Variable-Speed Mechanisms, of which the following is a specification.

My invention relates to variable-speed mechanisms wherein power is transmitted from the driving member to the driven member by friction.

It is well understood in connection with friction-gears that the energy which can be transmitted in any given period of time depends on the peripheral speed of the driven friction-roller at the point of contact with the driving-disk, the amount of surface in contact, and the pressure under which the driven surfaces are held in contact.

The object of my invention is to provide a gear in which the power-transmitting factors above enumerated shall be large compared to the size of the mechanism. It is also proposed a mechanism in which the power-transmission shall remain substantially constant for all speeds of the driving member.

Another object of the invention is to provide means whereby the speed may be easily and quickly varied or reversed, while the driving-disk maintains a constant speed in the same direction, and finally the invention contemplates the construction of a mechanism which shall be compact and composed of few parts simply constructed.

I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figures 1 and 2 are plan and side views, respectively, of the complete mechanism. Fig. 3 is an end view thereof looking in the direction of the arrow, Fig. 2. Fig. 4 is similar to Fig. 3, but is in section, taken on the line 4 4, Fig. 2. Fig. 5 is a plan view drawn to an increased scale and taken chiefly in section on the line 4 4, Fig. 2. Fig. 6 is a detail view chiefly in horizontal central section through the axis of the rear friction-spindles.

Similar letters refer to similar parts throughout the several views.

Referring to the drawings, *a* represents a driving-shaft journaled in a fixed bearing *b*. A shoulder *a'* is formed upon said shaft to abut against said bearing to limit the end play of said shaft therein. At the extremity of said driving-shaft is rigidly fixed the driving-disk *c*, which is desirably provided upon its front and rear surfaces with the facings *c' c'*, of leather or other suitable material, for driving the friction-rollers *d*, *e*, *f*, and *g*. The rollers *d* and *e* are formed upon the hubs *d'* and *e'*, respectively, and there are also formed on said hubs the bevel gear-wheels d^2 and e^2, respectively.

h represents the shaft to be driven, and it has a fixed axis extending at right angles to and located substantially in the same plane as the axis of the driving-shaft *a*.

The hubs *d'* and *e'* are each loosely mounted on said shaft and are prevented from sliding thereon by means of the hubs *i*, located between them, and by means of the yoke-arms *j j*, loosely mounted on said shaft at the outer extremities of said hubs *d'* and *e'*. Said yoke-arms are in turn laterally confined by means of the spacing-rollers *j'' j''*, located between hubs *d'* and *e'* and the gears *k k*, which latter are keyed to said shaft *h*.

On the hub *i*, which is secured to shaft *h* by means of the key *i''*, are formed the bosses i^2 i^2, which receive and securely hold the threaded inner extremity of the studs i^3. Said studs are arranged at right angles to the axis of shaft *h* and form axles for the bevel-gears *n n*. Said gears are loosely mounted, so as to revolve upon said studs j^3 and intermesh simultaneously with the gears d^2 e^2. The diameter of the gears d^2 and e^2 are equal, and the diameter of the gears *n* are equal, and by preference all of the said gears are miter-gears. The gears d^2, e^2, and *n* thus form a differential mechanism, and it follows that when gears d^2 and e^2 rotate at the same speed in opposite directions the gears *n* will rotate about their axes on the studs i^3; but said studs will have no rotary motion about the shaft *h* as an axis. When, however, the gears d^2 and e^2 rotate at different speeds, the gears *n* and studs i^3 will be caused to rotate about shaft *h* as an axis,

the direction of rotation depending upon which of the gears d^2 or e^2 is for the time being the faster moving. The rotation of said studs about the shaft h as an axis will cause a corresponding rotation of the hub i, and consequently of said shaft h.

The rollers d and e are of the same size, and consequently when they are equidistant from the axis of the driving-shaft a the gears d^2 and e^2 will rotate at the same speed, and there will be no rotation of the studs i^3; but when said rollers are at unequal distances from the axis of said driving-shaft the gears d^2 and e^2 will rotate at different speeds, and there will be imparted to said studs a rotary motion about the shaft h. Thus the direction of the motion of studs i^3 will correspond to the direction of rotation of such one of the rollers d or e as is temporarily located at the greater distance from the center of said driving-shaft a. It is evident, therefore, that the speed and direction of rotation of studs i^3 about the shaft h may be controlled by shifting said friction-rollers along the shaft h.

The shifting of the friction-rollers d and e and connected parts is accomplished by means of the carriage m, which has bearings m' m' encircling the shaft h at the outer side of the gears k. The carriage-guide o extends parallel to the shaft h, so that said carriage is guided partly by said guide o and partly by the shaft itself. Said shaft is journaled in the fixed bearings o' and p p in such manner as to be laterally shiftable therein. By preference said bearings o' and p are rigidly connected to said carriage-guide o.

In the present instance the transmitted energy is imparted by shaft h to the band-wheel q, the hub q' whereof is confined between said bearings p, and thereby prevented from moving laterally. In order that said band-wheel may not prevent the lateral shifting of the shaft h, a spline or feather q^2 is seated partly in the shaft h and partly in said hub q'.

The parts of the mechanism thus far described are operative in themselves to transmit motion from the driving-shaft a to the driven shaft h and obtain both variation in speed and change of direction of said shaft h without change of speed or direction of the driving-shaft a; but by employing the additional parts hereinafter described a greater area of friction-surfaces is rendered readily available.

The carriage m has two standards r r formed thereon, and these support the pivot-blocks s. The preferred construction is shown in Fig. 3, s' representing a pivot-pin fixed to the block s and rotatably held in the socket r' in the standard r. The arms s^2 are formed on said pivot-blocks so as to extend toward the shaft h. The brackets t are formed on the carriage m near the bearings m' thereon and extend toward said pivot-blocks s. The extremities of said brackets t are threaded to receive the releasing-screws u. The inner extremities of said screws bear against the adjacent extremities of the arms s^2 of the pivot-blocks, and the parts are so arranged that when said screws are rotated in the direction toward said arms the pivot-blocks s will be rotated about the pins s' as an axis. Said screws are rotated by means of the arms u', which are rigidly secured thereto. Said arms u' are parallel and are connected at their extremities by means of the controlling-bar u^2. The screws u have a coarse thread, so that a slight rotation will produce a comparatively large movement of the screws transversely to the brackets t. In the arrangement shown one of said screws has a left-hand thread and the other a right-hand thread, so that when the controlling-bar u^2 is rotated the pivot-blocks s will rotate in opposite directions.

Projecting inwardly from the blocks s are the spindles s^3, whereon the gears v and friction-rollers f and g are loosely mounted. Said gears and friction-rollers are secured to and preferably form an integral part of the hubs v', so as to rotate together. Said gears v and their friction-rollers are held in position on said spindles s^3 by means of the nuts s^4. The parts are so arranged that under normal conditions the gears v will mesh with the gears k and the rollers f and g will make frictional contact with the rear surface of the driving-disk c. Inasmuch as the gears v and k intermesh, the power received by the rollers f and g will be transmitted through said screws to the shaft h to rotate the same. Thus the gears f and g practically double the tractive force of the mechanism—that is to say, the amount of power which can be transmitted from the driving-shaft to the driven shaft.

In order that the friction-rollers f and g may under normal conditions make close contact, the yoke-bars w w are loosely mounted on the hubs v' adjacent to the friction-rollers f and g. Said yoke-bars w and also the yoke-bars j, above mentioned, extend vertically and are joined at their extremity by means of the tension-springs x. Said tension-springs have threaded extremities penetrating the apertured extremities of said yoke-bars j and w and carry outside of said yoke-bars the nuts x', whereby the tension of said springs may be adjusted. The length of the bars j and w is sufficient to permit the springs x to clear the driving-disk c. There is a slight amount of end play of the shaft a in the bearing b, so that under normal conditions there will be a self-adjustment of said disk, with the result that the friction-rollers on opposite sides of the disk will be held in contact therewith under equal pressures. The slight end play of shaft a in its bearing is also useful, for the reason that when the friction-rollers f and g are withdrawn from contact with the driving-disk the pressure between the said driving-disk and the disks d and e will be reduced sufficiently

to permit said rollers *d* and *e* to be shifted along the face of said driving-disk.

In operation the driving-disk is supposed to rotate in the same direction and at the same speed at all times.

When the rollers *d* and *e* are equidistant from the axis of shaft *a*, there will be no rotation imparted to the shaft *h*. When the roller *d* is at a greater distance from the axis of shaft *a*, said shaft *h* will rotate in one direction, and when the roller *e* is at a greater distance from the axis of shaft *a* said shaft *h* will rotate in the opposite direction, and the speed of rotation of said shaft *h* will increase as the distance of the farthest friction-roller from the axis of the driving-shaft increases.

Under normal conditions the tension-springs *f* will hold the rollers *d*, *e*, *f*, and *g* in close contact with the driving-disk *c*, any desired pressure being obtained by adjusting the tension of said springs by means of the adjusting-nuts *x'*.

When it is desired to change the speed of shaft *h* or vary its direction of rotation, the rollers *f* and *g* are forced away from the driving-disk *c* by rotating the controller-rod u^2 in the proper direction to force the screws *u* toward the arms s^2 on the pivot-blocks *s*. Only a slight motion of said pivot-blocks is necessary to withdraw the rollers *f* and *g*, this motion being insufficient to cause the gears *v* to be disengaged from the gears *k*. When the rollers *f* and *g* have thus been withdrawn and the driving-disk *c* released, said driving-disk will retreat slightly from the rollers *d* and *e*. The carriage *m* and parts mounted thereon are then shifted laterally until the rollers *d*, *e*, *f*, and *g* are brought to such distances from shaft *a* as to obtain the speed and direction desired for shaft *h*. The bar u^2 is then thrown back to its normal position, with the result that the screws *u* are retracted from the arms s^2 and the springs *x* are again permitted to hold the friction-rollers in close contact with disk *c*.

This mechanism may be employed for a variety of uses; but it is particularly well adapted for use in automobiles, where it is desirable to transmit high driving powers, but where the available space is restricted. In this mechanism the speed may be controlled from the single bar u^2, the rotary motion or swinging motion of the bar causing the driven shaft to stop and the shifting motion of said bar obtaining the desired direction or speed of rotation.

Another use for which this mechanism may be employed to advantage is in lamp-controllers for photographic-printing apparatus, such as that shown in a companion application for Letters Patent filed by me on even date herewith.

I do not wish to be understood as limiting myself to the particular design of the mechanism as herein shown, for this may be greatly varied without departing from the spirit of my invention.

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

1. In a variable-speed mechanism, the combination of a driving-disk; a pair of friction-rollers adapted to contact one surface of said disk on opposite sides of the axis thereof; and a second pair of friction-rollers adapted to contact the other surface of said disk on opposite sides of the axis thereof; connections between the rollers which lie upon the same side of the disk-axis whereby said rollers supplement each other in their power-transmitting effect; a driven member; and differential gear connections between said driven member and one of said pairs of rollers.

2. In a variable-speed mechanism, the combination of a driving-disk; a pair of friction-rollers adapted to contact one surface of said disk on opposite sides of the axis thereof; and a second pair of friction-rollers adapted to contact the other surface of said disk on opposite sides of the axis thereof, connections between the rollers which lie upon the same side of the disk-axis whereby said rollers supplement each other in their power-transmitting effect; a driven member; differential gear connections between said driven member and one of said pairs of rollers and means for shifting all of said rollers simultaneously along the surfaces of said disk to thereby vary the speed of said driven member.

3. In a variable-speed mechanism, the combination of a driving-disk; two sets of friction-rollers, the rollers of each set being located in position to contact said disk on the same side of the disk-axis but on opposite surfaces of said disk, and the rollers of each set being geared together for supplementing each other; a driven member; a differential mechanism connecting said rollers to said driven member for driving the latter; and means for moving said rollers toward and from said disk.

4. In a variable-speed mechanism, the combination of a driving-disk; two sets of friction-rollers normally held in contact with said disk, the rollers of each set being located in position to contact said disk on the same side of the disk-axis, but on opposite surfaces of said disk, and the rollers of each set being geared together to supplement each other; a driven member; a differential mechanism connecting said roller to said driven member for driving the latter; and means for releasing said rollers from said disk.

5. In a variable-speed mechanism, the combination of a driving-disk; two sets of friction-rollers normally held in contact with said disk, the rollers of each set being located in position to contact said disk on the same side of the disk-axis, but on opposite surfaces of said disk, and the rollers of each set being geared together to supplement each other; a driven member; a differential mechanism connecting said roller to said driven member for driving the latter; means for releasing said rollers

from said disk, and means for shifting all of said rollers simultaneously along the surface of said disk to thereby vary the speed of said driven member.

6. In a variable-speed mechanism, the combination of a driving-disk; a shiftable carriage; a pair of friction-rollers mounted in said carriage in position to contact said disk on the same surface thereof on opposite sides of the disk-axis; a driven shaft; a differential mechanism connecting said rollers to said shaft for driving the same; a second pair of friction-rollers mounted in said carriage and adapted to contact the driving-disk on the remaining surface thereof and gear connections between said first pair and second pair of friction-rollers, whereby said second pair of rollers supplements the action of said first pair of rollers,

7. In a variable-speed mechanism, the combination of a driving-disk; a shiftable carriage; a pair of friction-rollers mounted in said carriage in position to contact said disk on the same surface thereof on opposite sides of the disk-axis; a driven shaft; a differential mechanism connecting said rollers to said shaft for driving the same; a second pair of friction-rollers mounted in said carriage and adapted to contact the driving-disk on the remaining surface thereof for supplementing the action of the first pair of rollers, said second pair of rollers being pivotally mounted to swing toward and from said driving-disk; gear connections between said first and second pairs of rollers; and means for swinging said second pair of rollers toward and from said disk.

8. In a variable-speed mechanism, the combination of a driving-disk; a shiftable carriage; a pair of friction-rollers mounted in said carriage in position to contact said disk on the same surface thereof on opposite sides of the disk-axis; a driven shaft; a differential mechanism connecting said rollers to said shaft for driving the same; a second pair of friction-rollers mounted in said carriage and adapted to contact the driving-disk on the remaining surface thereof for supplementing the action of the first pair of rollers; said second pair of rollers being pivotally mounted to swing toward and from said driving-disk; gear connections between said first and second pairs of rollers; means for swinging said second pair of rollers toward and from said disk; a spring-influenced device for holding said second pair of rollers in frictional contact with the disk; and means for swinging said rollers away from said disk to thereby release the same.

9. In a variable-speed mechanism, the combination of a driving-disk; a shiftable carriage; a pair of friction-rollers mounted in said carriage in position to contact said disk on the same surface thereof on opposite sides of the disk-axis; a driven shaft; a differential mechanism connecting said rollers to said shaft for driving the same; a second pair of friction-rollers mounted in said carriage and adapted to contact the driving-disk on the remaining surface thereof for supplementing the action of the first pair of rollers; said second pair of rollers being pivotally mounted to swing toward and from said driving-disk; gear connections between said first and second pairs of rollers; means for swinging said second pair of rollers toward and from said disk; a screw device for holding the second pair of rollers in frictional contact with the disk and means for swinging said rollers away from said disk to thereby release the same.

10. In a variable-speed mechanism, the combination of a driving-disk; a shiftable carriage; a pair of friction-rollers mounted in said carriage in position to contact said disk on the same surface thereof on opposite sides of the disk-axis; a driven shaft; a differential mechanism connecting said rollers to said shaft for driving the same; a second pair of friction-rollers mounted in said carriage and adapted to contact the driving-disk on the remaining surface thereof for supplementing the action of the first pair of rollers; said second pair of rollers being pivotally mounted to swing toward and from said driving-disk; gear connections between said first and second pairs of rollers; means for swinging said second pair of rollers toward and from said disk; a screw device for holding the second pair of rollers in frictional contact with the disk, means for swinging said rollers away from said disk to thereby release the same and a controlling-rod for operating said screw device.

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