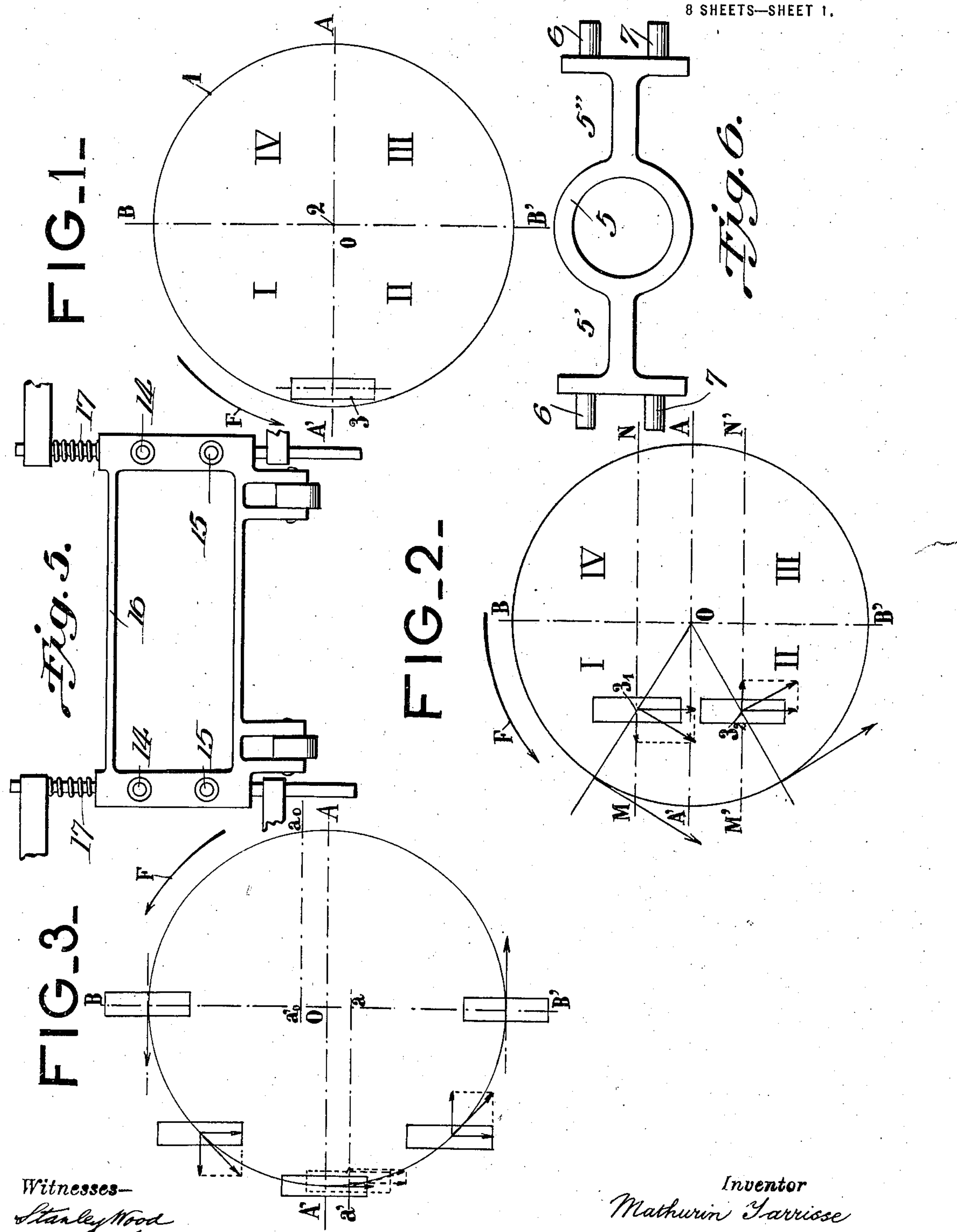
M. TARRISSE.

AUTOMATIC CHANGE SPEED DEVICE.

APPLICATION FILED APR. 29, 1912.

1,216,626. Patented Feb. 20, 1917.

8 SHEETS—SHEET 1.



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8 SHEETS—SHEET 2.

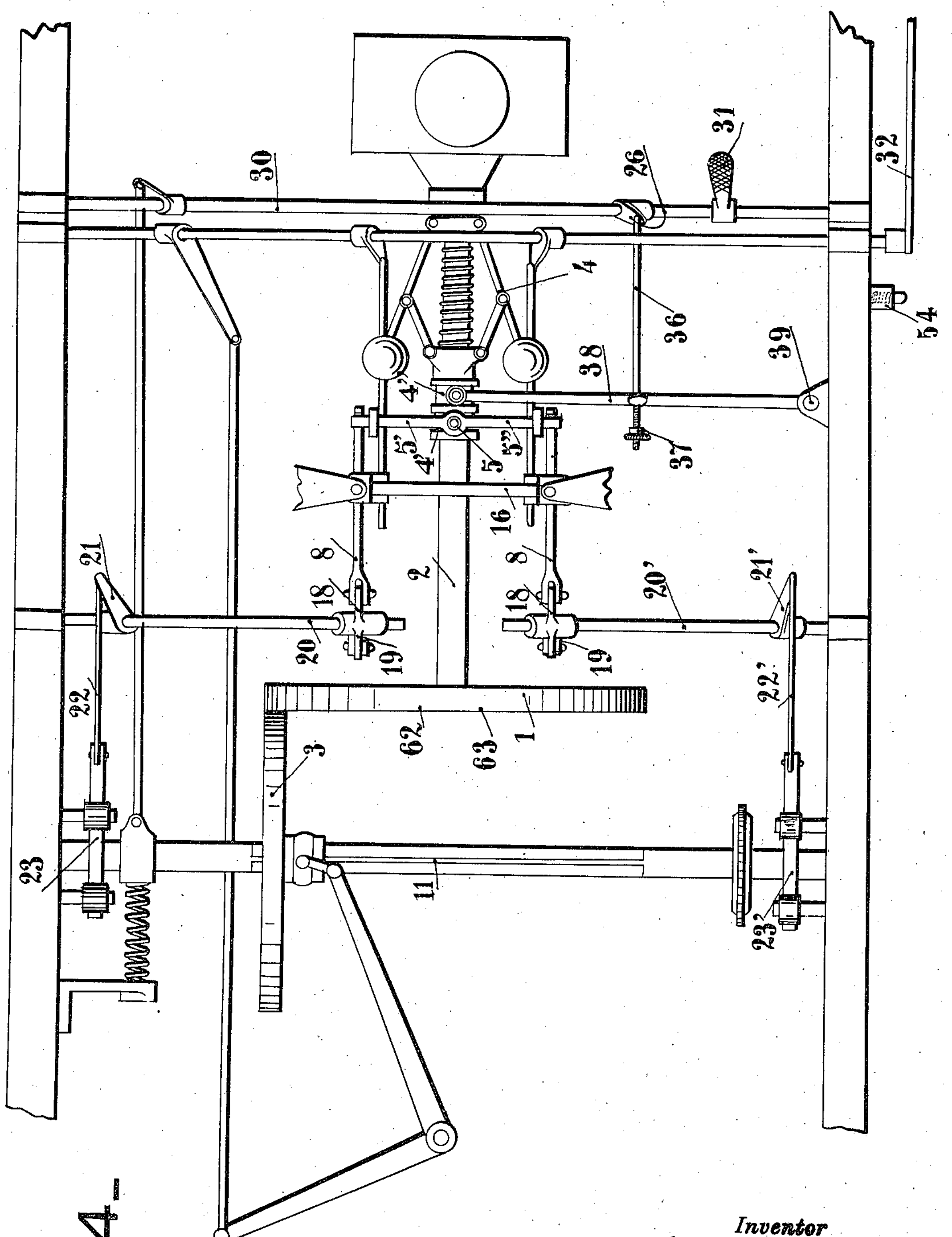

FIG_4_

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8 SHEETS—SHEET 3.

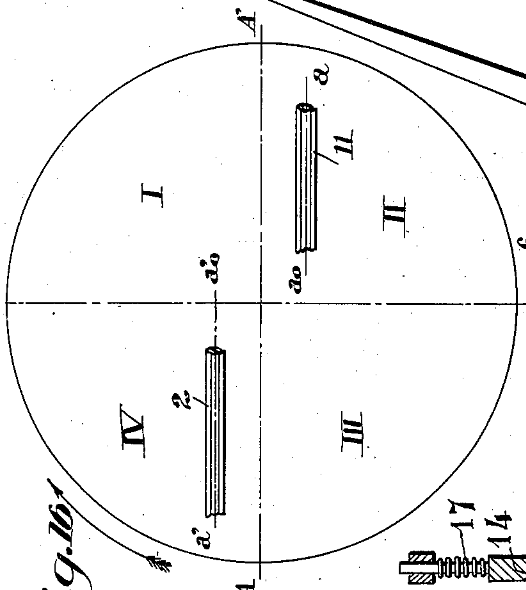

Fig. 16

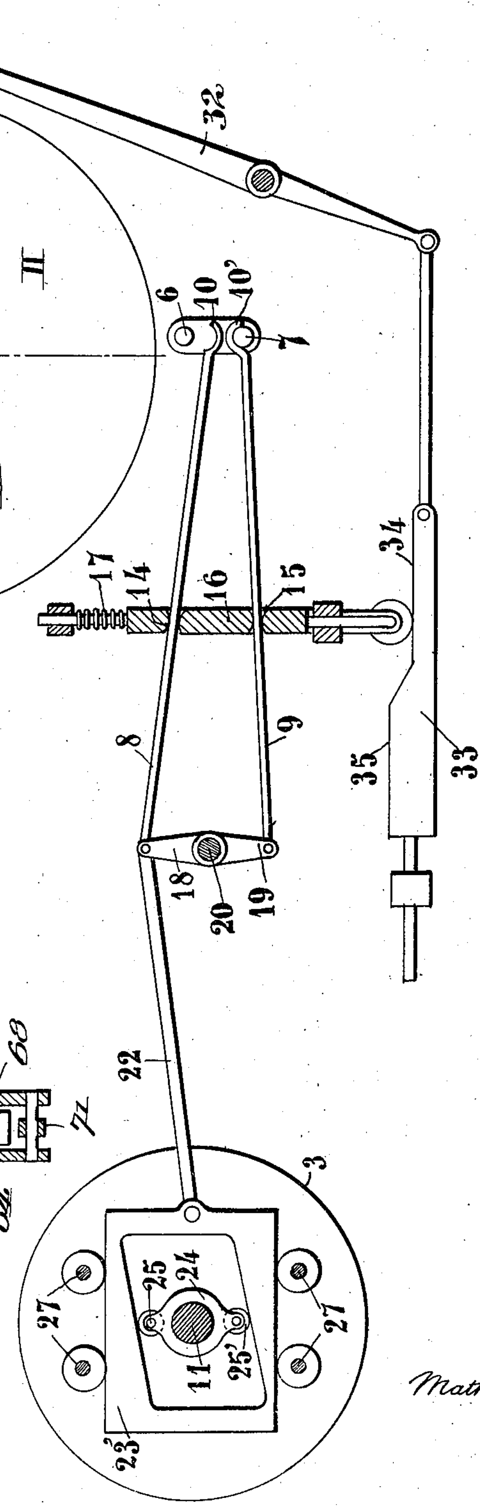

FIG. 7.

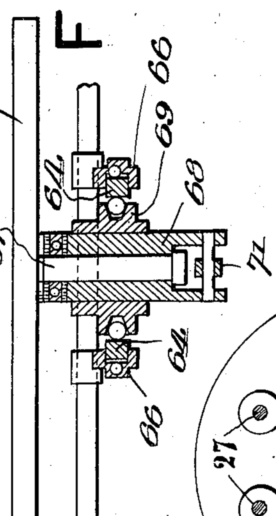

Fig. 14.

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8 SHEETS—SHEET 4.

FIG_11_

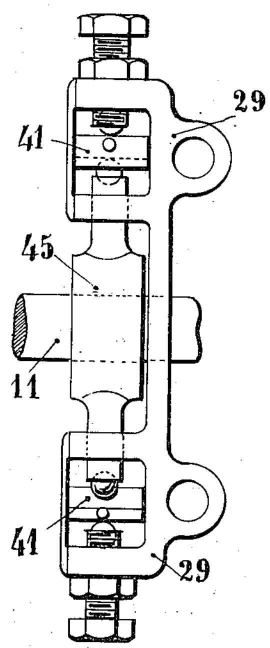


FIG_10_

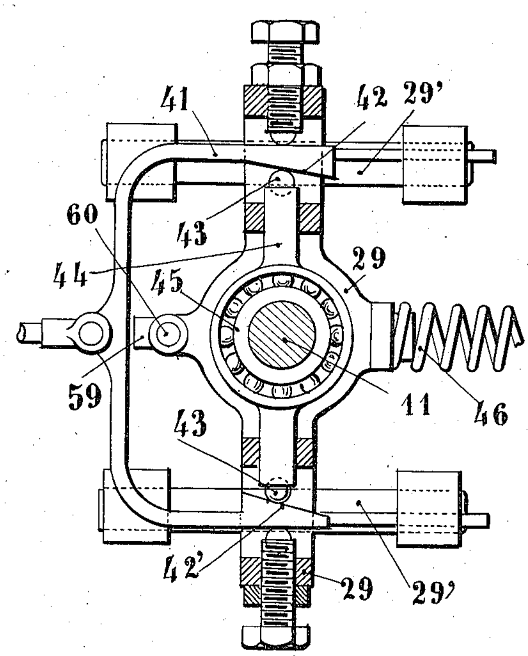
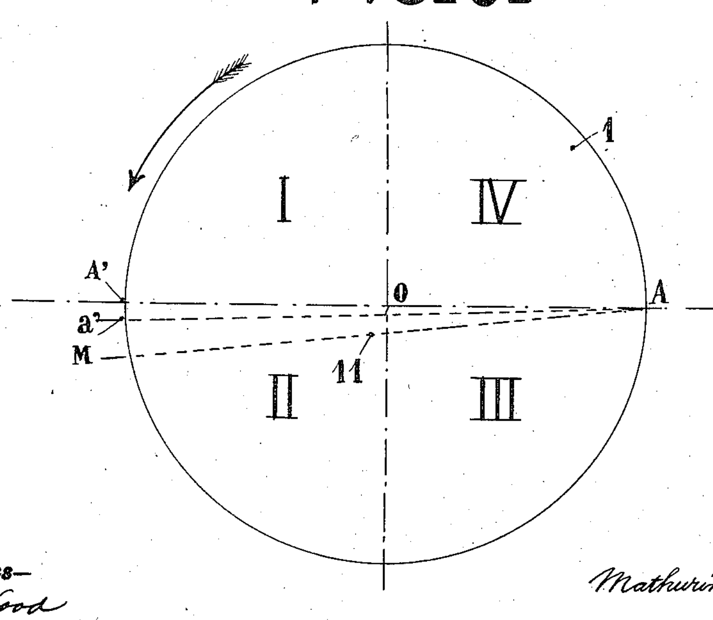


FIG_8_



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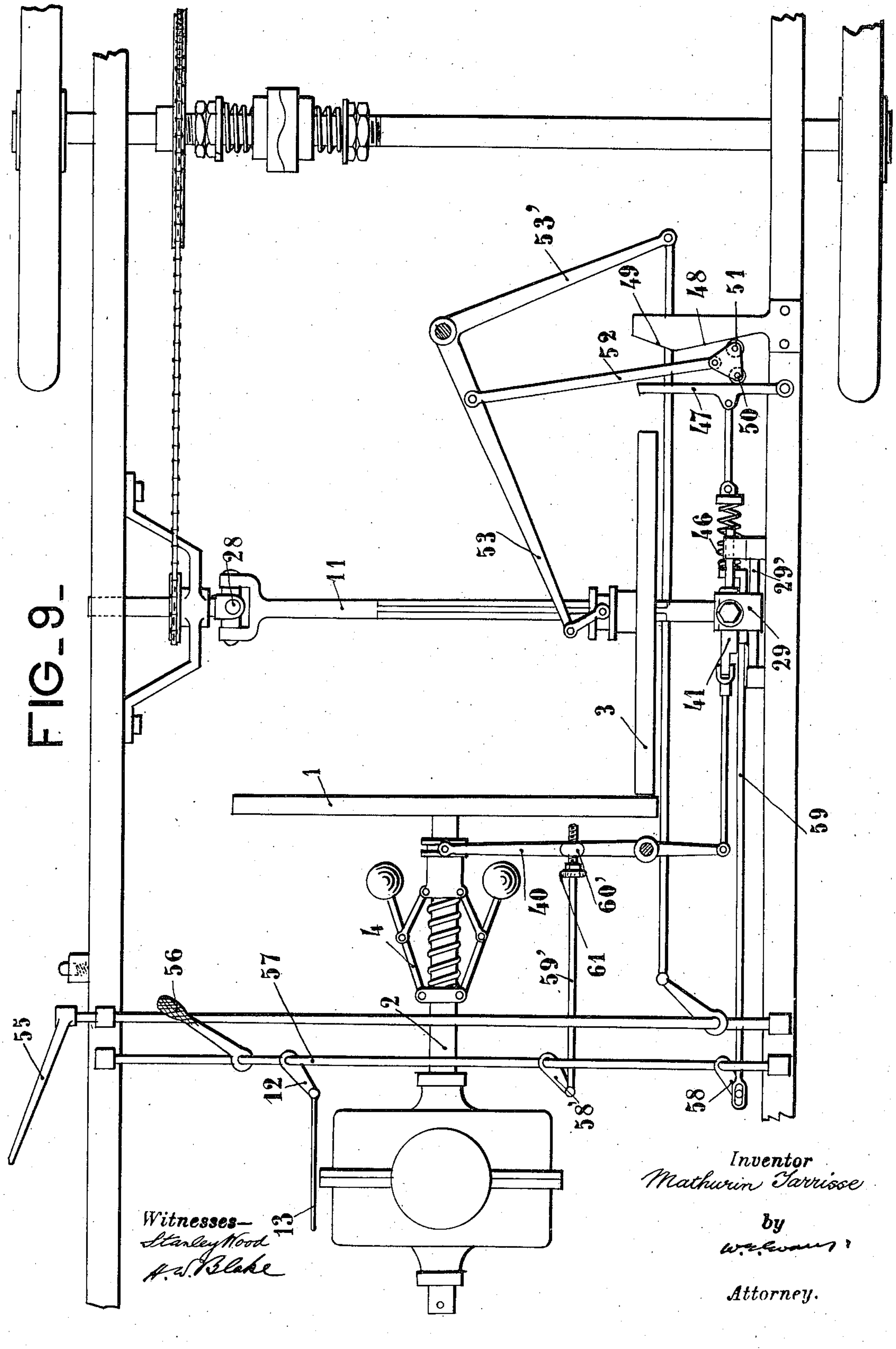
8 SHEETS—SHEET 5.



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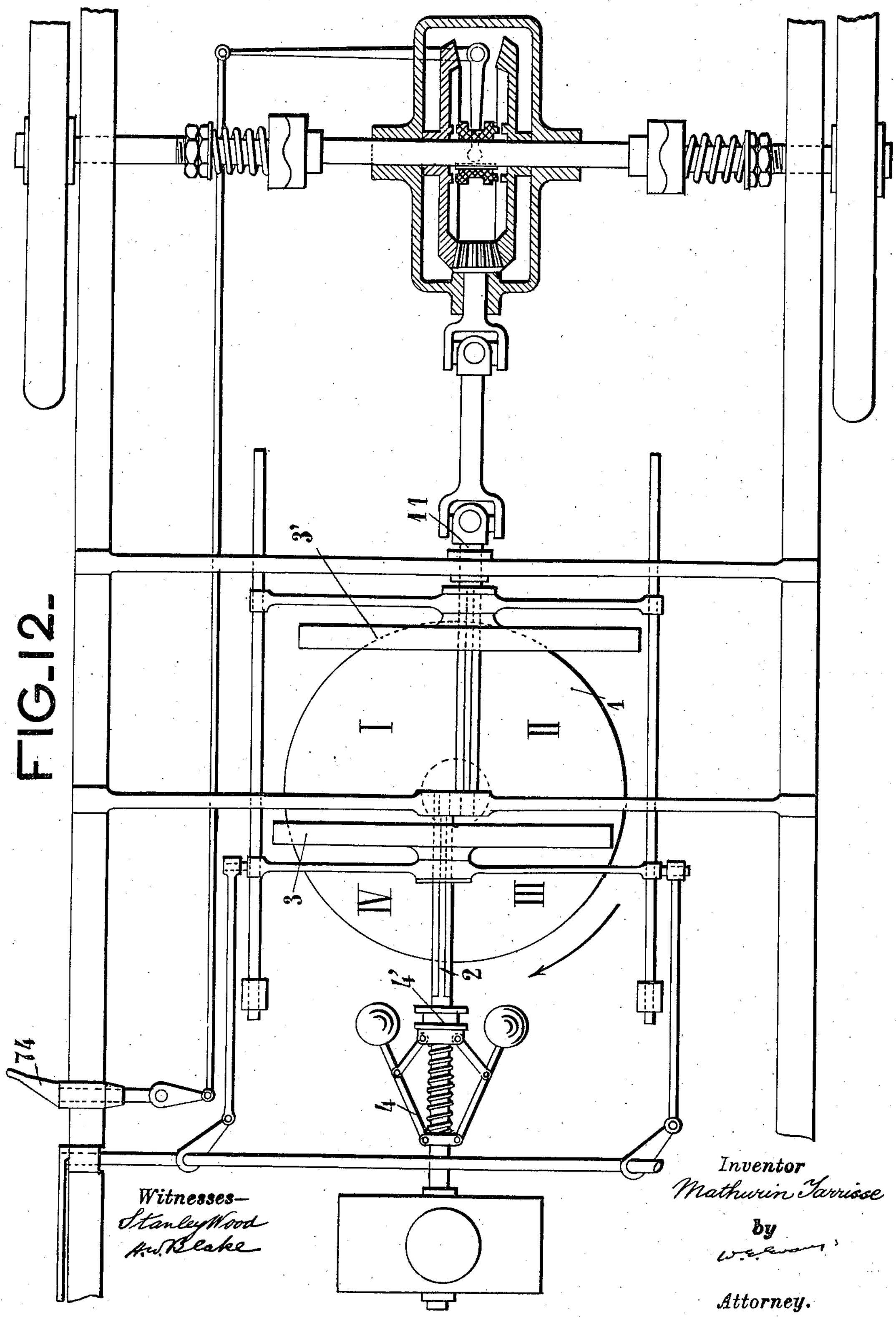
8 SHEETS—SHEET 6.

FIG_12_



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1,216,626. Patented Feb. 20, 1917.

8 SHEETS—SHEET 7.

FIG. 13.

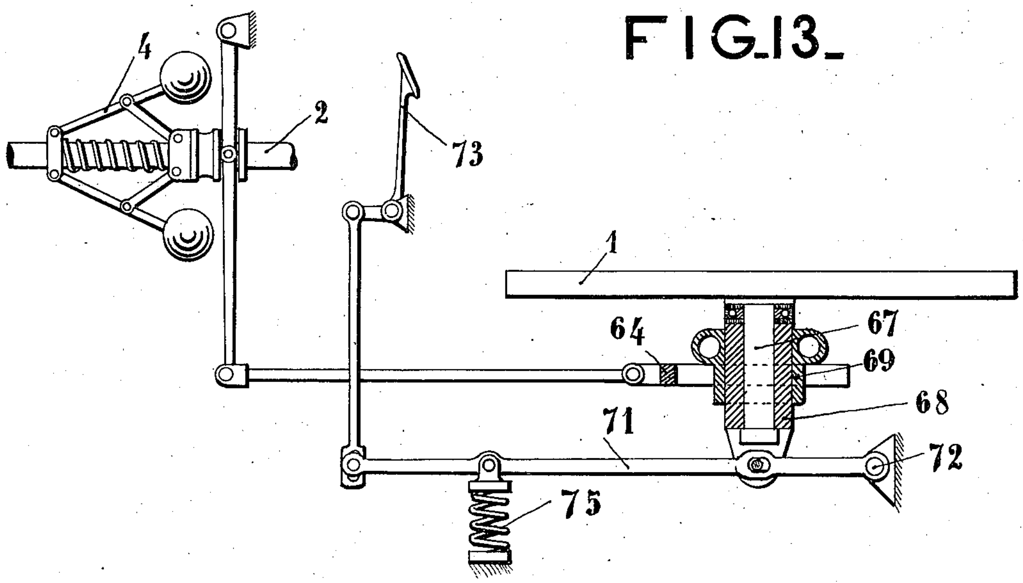
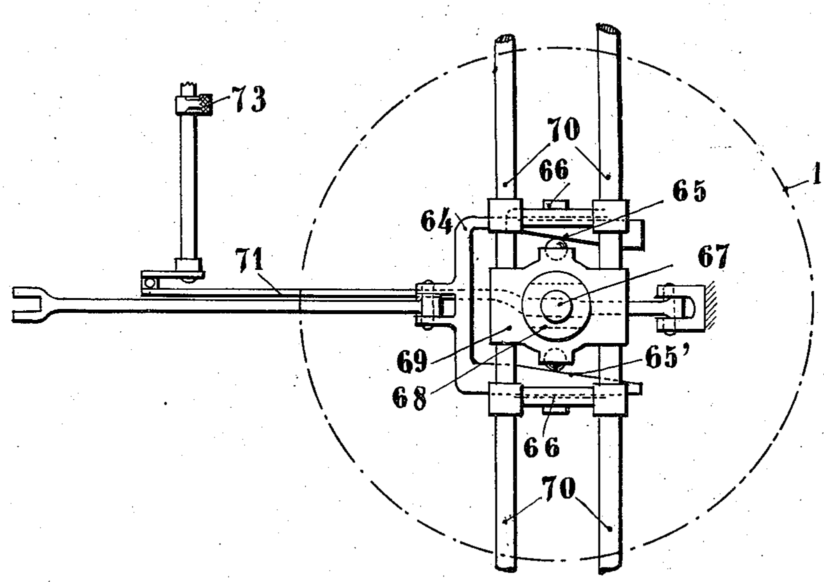


FIG. 15.



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APPLICATION FILED APR. 29, 1912.

1,216,626.

Patented Feb. 20, 1917.
8 SHEETS—SHEET 8.

FIG_14_

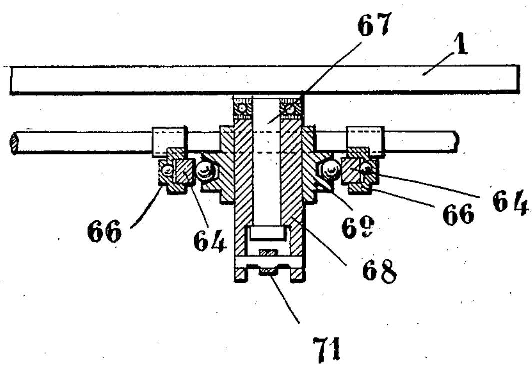
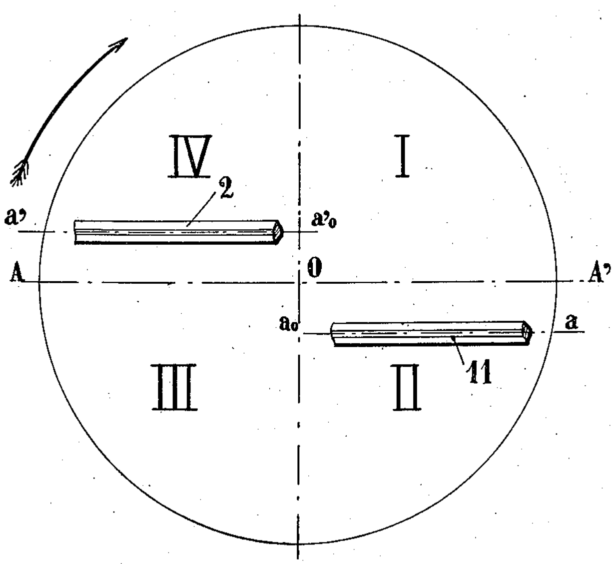


FIG_16_



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UNITED STATES PATENT OFFICE.

MATHURIN TARRISSE, OF SURESNES, FRANCE.

AUTOMATIC CHANGE-SPEED DEVICE.

1,216,626. Specification of Letters Patent. Patented Feb. 20, 1917.

Application filed April 29, 1912. Serial No. 694,023.

To all whom it may concern:

Be it known that I, MATHURIN TARRISSE, a citizen of the French Republic, residing at 18 Rue Carnot, Suresnes, Seine, France, have invented certain new and useful Improvements in Automatic Change-Speed Devices, of which the following is a specification.

The present invention has for its object a method of transmission of motion by friction disks in which the displacements of the disk which slides on its axis are automatically assured by mere displacement of the axis of one of the disks with regard to the axis of the other. This device is capable of immediate industrial application to speed gears of all types.

The invention is illustrated in the accompanying drawings in which:—

Figures 1, 2 and 3 are diagrammatic views showing relative positions of the friction disks and the forces acting thereon.

Fig. 4 is a diagrammatic plan view showing a constructional form of the invention applied to an automobile vehicle.

Fig. 5 is a detail end view of the supporting member through which pass the links operated by the collar the movements of which are controlled by the governor.

Fig. 6 is a detail view of the collar controlled by the governor.

Fig. 7 is a side elevation, partly in section, and on a larger scale, of the mechanism for effecting the displacements of the axis of the driven disk with regard to the axis of the driving disk.

Fig. 8 is a diagrammatic view showing the relative positions of the friction disks in the case in which the shaft carrying the driven disk is pivotally mounted at one end, the other end being relatively free.

Fig. 9 is a diagrammatic plan view showing a constructional form of the modification illustrated by Fig. 8.

Figs. 10 and 11 are respectively side and end elevations of the guide frame which effects the displacements of the axis of the driven disk with regard to the axis of the driving disk.

Fig. 12 is a diagrammatic plan view of a modification in which an intermediate transmission disk is interposed between the driving and driven disks.

Figs. 13, 14, 15 are detail views on a larger scale of the modification shown in Fig. 12.

Fig. 16 is a diagrammatic view showing the relative positions of the driving disk, the intermediate disk and the driven disk in the modification illustrated by Fig. 12.

The following is the principle according to which the industrial application described hereinafter has been conceived.

If we consider a disk 1 having a rotary movement around its axis 2 in a certain direction, for example, in that of the arrow F in Fig. 1; and if we consider further a friction roller 3 in contact with this disk and the axis of which, parallel to the plane of the disk 1, lies in a perpendicular from the center of this disk, it will be seen that the disk 1 may be considered as divided into four parts in the following manner:—

If we consider the projection A—O—A′, on the disk 1 of the axis of the roller 3, this projection A—O—A′ and the line B—O—B′ perpendicular thereto divide the disk into four quadrants I, II, III, IV. In those quadrants in which, for a certain direction of rotation the different points of the quadrant move toward the axis A—O—A′, the roller is submitted to a thrust which tends to move it away from the axis B—O—B′; on the contrary, in those quadrants in which, for a certain direction of rotation, the different points of the quadrant move away from the axis A—O—A′, the roller placed in this quadrant is submitted to a thrust which tends to move it toward the diameter B—O—B′. It will thus be seen that in the opposite quadrants 1 and 3 the roller tends to move away on its axis from the axis B—O—B′ and that it tends on the contrary, to approach the axis B—O—B′ in the two other opposite quadrants II and IV.

In order to complete this first indication and to show the variations in this thrust according to the quadrant in which the friction roller is situated and according to the positions which it occupies in each quadrant, it is necessary to examine with regard to Fig. 2 the different positions which this roller may occupy by displacing its axis, for example in a direction parallel to the line A—O—A′.

When the roller occupies the position 3_1 in the quadrant I, it is submitted to the action of a force which is exerted in a direction parallel to the tangent to the circumference of the disk this tangent corresponding to the radius passing practically through the mean point of contact between the roller and the disk; this force may be resolved into a force directed along the axis M N of the roller and another force which tends to rotate the roller around this axis.

It will be seen that the component directed along the axis of the roller will increase as the roller approaches the point B, to which corresponds the maximum thrust exerted.

If we now consider the successive positions which the roller may take on its axis, for example, when this axis occupies the position M—N, it will be seen that the component along the axle diminishes in proportion as the roller approaches the point M on the circumference of the disk, in such a manner that the value of this component, which is precisely the value of the thrust indicated above, diminishes for the positions of the roller from the line B—O—B′ toward the point M. It follows of course that on approaching the point M, the speed of rotation of the roller around its axis increases. The consideration of these facts allows of applying them industrially for the purpose of construction of a change-speed gear.

When the roller occupies the position 3_2 in the quadrant II, it is always submitted to the action of a force which is exercised in a direction parallel to the tangent to the circumference of the disk; this tangent corresponding to the radius passing practically through the mean point of contact between the roller and the disk; this force may be resolved into a force directed along the axis M′—N′ of the roller and another force which tends to rotate the roller around this axis.

It will be seen that if M′—N′ is symmetrical with M—N with regard to A—O—A′ and if the position 3_2 is symmetrical with the position 3_1 the two components at 3_2 will have the same value as at 3_1. Although, however, the component of rotation at 3_2, that is to say, that component which assures the rotation of the roller around its axis, has the same direction and the same value as the component of rotation at 3_1, it is not the same for the component representing the thrust along the axis of the roller; at 3_1 and at 3_2 this component will have the same value, but in opposite direction and it will tend in the latter case to move the roller toward B—O—B′.

If we consider the application of the principle which has been described to a change speed gear, for example, in the case of an automobile vehicle, it will be seen that the quadrants I and II constitute, for motion forward, two zones appropriated respectively for the increase and decrease of the speed of rotation of the roller which receives motion.

The examination of Figs. 1 and 2 shows clearly, without the necessity for further explanation, that the same phenomena which have been already examined are reproduced in quadrants III and IV. In the ultimate application of this device to a change speed gear in an automobile vehicle, which will be described later, the quadrants III and IV form, for motion backward, the two zones of operation which assure the increase and decrease of the speeds of the roller which receives motion.

If we consider Fig. 3, it will easily be seen by the examination of the different positions, indicated diagrammatically, of the friction roller on the same circumference, that the value of the component is at a maximum at B, decreases constantly from B to A′ and is zero at the latter point and that from A′ to B′ it increases from zero and attains a maximum at B′ equal to the maximum at B, but in the opposite direction.

The axis *a a′* chosen presents a slight disadvantage from the point of view of efficiency, since the component which assures the rotation of the roller around its axis is slightly diminished; but this disadvantage is very slight and it is largely compensated by the fact that it frees the constructor from the obligation of providing a lock device which shall maintain the friction roller in the position chosen. It would otherwise be necessary to employ this lock device and it has moreover, been previously employed when the axis A—O—A′ was chosen as the axis of operation.

It is evident that the phenomena which have been described and the industrial applications, the possibility of which has been indicated, also exist in the case in which the roller, instead of being a driven member, becomes a driving member as regards the friction disk, and also in the case in which it is the axis of the friction disk which is displaced along a perpendicular to the stationary axis of the sliding roller.

On the Figs. 4, 5, 6 and 7 which follow an example is given of the practical realization of a change-speed gear for an automobile vehicle, in which the present invention is applied.

As will be seen on the drawings, a governor 4 controls by the displacements of the grooved part 4′, the displacements, in the direction of the axis of the driving shaft 2, of a collar 5 which is seen in elevation in Fig. 6; this collar is prolonged on each side of the shaft 2 by two arms 5′, 5″ each provided on a base plate with projections 6, 6, 7, 7; these projections serve as a rest or as a lock device as will be explained later to small links 8, 8, 9, 9, which are terminated between the projections 6 and 7, by bearings 10, 10, 10′, 10′; these small cranks pass through apertures in a supporting and guiding member 16, capable of receiving in a vertical plane, displacements of a determined value against the action of counter springs 17 which tend constantly to press the guide member against the surface of a cam-lever which will be described farther on. The small links 8, pass through the apertures 14 of this guide-member, the small links 9 pass through the apertures 15.

The details of this supporting and guiding member are seen in front elevation on Fig. 5.

The small links 8 and 9 operate respectively the upper extremity and the lower extremity of the levers 18 and 19 each keyed on a shaft 20, 20′, the two shafts 20 and 20′ being situated in the same line and symmetrically with regard to the axis of the motor. A single shaft might also be provided by joining the shafts 20, 20′ by a crank of any suitable form or by placing the single shaft thus constituted in a different plane from that which contains the axis of the motor.

In the case in the figure, each of the shafts 20, 20′ carries keyed upon it a small lever 21, 21′ at the extremity of which is pivoted a rod 22, 22′ fixed at its extremity to a guide frame 23, 23′ in which is provided a socket supporting the ends of the shaft 11 of the friction roller 3. This socket 24 provided with ball-mounted roller members 25, 25′ rests by means of these rollers on the inclined surfaces, constituted by the interior walls of the guide frame 23; the exterior walls of the chassis frame are suitably mounted on frictionless guides, for example, on rollers 27, the axes of which are fixed to the frame.

In Fig. 7 is shown clearly the method of mounting of this guide-frame which is placed at each end of the shaft 11; it is also seen, how, by means of the hand lever 32, we can effect displacements of the cam 33 provided with two surfaces at different levels 34, 35, this cam being suitably guided in the horizontal plane. The displacements of this cam allow of raising or lowering the supporting and guiding member 16 under the action of the springs 17; this ascent or descent has respectively, as its consequence, the connection or disconnection of the links 8 with the projections 6 and the disconnection and the connection of the links 9 with the projections 7.

The mode of operation of this device will be seen from what has already been said.

When the governor has its normal speed, the axis 11 of the friction roller will be situated at the middle point of the slide 23, that is to say, in a horizontal plane passing slightly below the axis of the friction disk at the most favorable distance which has been indicated previously; the lever 18, 19 is vertical; the guide 16 is situated on the part 34 of the cam 33, this part corresponding to motion forward; the member 10′ of the small link 9 is in contact with the projections 7 of the collar of the governor; the small link 8 is out of contact.

If the motor meets with any resistance, the governor moves the collar 5 toward the left of Fig. 7; this movement has for its consequence to swing the lever 19 which is moved by the small link 9 and to exert a tractive effect on the upper extremity 18 of the lever on the rod 22; this tractive effect moves the guide frame 23 toward the right of the figure and consequently causes the shaft 11 to descend vertically. The descent of this shaft 11 has for its consequence the development of a thrust which as has been explained, moves the roller 3 toward the center of the disk. The roller 3 is arrested in its path at the moment when the motor having taken its normal speed, the governor has brought back all the elements to the position which corresponds to this normal speed, and in particular, has brought back the axis of the roller into the most favorable plane as defined previously. (I have said previously that there are several favorable planes, close to each other corresponding to the different positions of the roller when sliding on its axis; the governor will automatically make the choice between these favorable planes).

If, now, for any cause whatever, the governor rises to an extent which exceeds the height corresponding to the normal speed, the collar 5 will be moved toward the right of Fig. 7; there will consequently be a tractive effect on the small link 9, a tractive effect on the lever 19 which is transmitted to the lever 18 and to the rod 22, and consequently a displacement, toward the left of the figure, of the guide frame 23 and an ascent vertically of the axis 11 of the roller 3. The roller then rapidly moves toward the circumference of the disk until, the motor having regained its normal speed, the governor brings back all the mechanism into the position which corresponds to the normal speed of the motor, and in particular brings back the shaft 11 of the motor, into the most favorable plane, as previously described.

When under a decrease in speed of the motor, the governor has returned the roller 3 toward the center of the disk, this action continuing until the roller 3 arrives in the neighborhood of the axis of the friction disk, for example, at a point 62, a locking device 54 suitably disposed and consisting, for example, of a bolt acted on by a spring, locks the hand lever 32, which allows of the control by hand of the displacements of the friction-roller. This bolt prevents the shifting of the point 62, and consequently prevents the friction roller from passing automatically from motion forward to motion backward.

All that I have said applies to the case of motion forward; it is suitable now to consider what happens when the friction roller is moved across the space 62—63 in the neighborhood of the axis of the friction disk and consequently the roller 3 receives rotary motion in an opposite direction from that considered previously.

In this case, it will be seen from the examination of Fig. 7, that the movement of the lever 32, which has caused the roller 3 to pass from 62—63, has at the same time had the effect of bringing under the guide 16 the incline 35 of the cam 33; that, consequently, the guide 16 has been raised against the action of the springs 17 and that this upward movement has in consequence placed the bearings 10 of the cranks 8 in contact with the projections 6, while at the same time it disengages the bearings 10′ of the small links 9 from the projections 7. This, it should be understood is on the condition that at the time of this movement of the lever 32, there is a disengagement of the roller 3 and the disk 1 in such a manner that the lever 18, 19, becomes vertical; under these conditions, the phenomena which are produced are reversed, as also is the direction of rotation of the roller 3.

If the motor has its usual speed, everything is effected as stated previously in this sense, that the ends of the shaft 11 are situated in the most favorable horizontal plane for motion backward when the roller does not undergo any displacement along the radius of the disk; the lever 18, 19 is vertical.

If the motor meets with any resistance, the descent of the balls will have for its effect to move the collar 5 toward the left of Fig. 7, and consequently to exercise a thrust on the small link 8, on the lever 22 and on the guide-frame 23 which will cause the shaft 11 to rise above the most favorable plane and will bring back the roller toward the center, since it will then be situated in the fourth quadrant of Figs. 1, 2, 3.

This movement of the friction roller will continue as long as the governor has not regained its normal speed, and invariably, this normal speed will return the roller into the most favorable plane for motion backward.

If, on the contrary, the speed of the motor increases for any reason whatever, an opposite displacement of the roller will take place and will tend to return it toward the circumference of the disk, since it will then be situated in the third quadrant.

In order to assure the vertical position of the lever 18, 19, when the roller is in the neighborhood of the points 62, 63 the pedal 31, mounted on the disengaging shaft 30, operates by means of a small lever 26 a rod 36 which through a regulatable stop 37 operates a lever 38 pivoting around a fixed point 39 and connected by a suitable collar to the groove 4″ of the governor. It will be seen on the examination of the figures that on pushing the pedal downward and with a suitable arrangement of the stop 37, the governor will be brought back by the movement of the pedal itself to the position corresponding to the normal speed and consequently the vertical position of the lever 18, 19 will be assured.

In the device which has been described, there is provided, in the method of realization given by way of example a displacement of the roller shaft affecting all the points of this shaft, the two extremities of the shaft being displaced by the same amount in slide frames suitably disposed.

This mechanical realization of the general means described would appear to be the best, but in practice it might be suitable to displace only one of the extremities of the shaft which carries the roller, the other extremity pivoting around a certain point, by means of a suitable transmission mechanism, for example a Cardan transmission mechanism. In this case, it should be remarked that the value of the disalinement of the shaft is measured by the distance from the center of the disk to the shaft which carries the roller.

The simple consideration that the value of the disalinement corresponds exactly to this distance shows the advisability of adopting the solution indicated previously, in which the shaft which carries the roller is displaced in a direction parallel to itself, but also shows that in the case in which only one end of the shaft is moved, it is advisable to remove the other fixed end as far as possible from the center of the disk.

Independently of this, I have shown on the following sheets of the accompanying drawing a method of construction of the invention in which the pivoting point of the shaft which carries the roller is placed approximately at the circumference of the friction disk. In this method of construction, there is only provided a slide frame which itself insures the disalinement by displacing more or less the shaft which carries the roller, with regard to the center of the disk in a plane parallel to the plane of this disk.

Fig. 8 shows in elevation the disk 1 on which the diameter A—O—A′ is determined by the position of the pivoting point of the shaft 11 which carries the roller.

As will be seen on these figures, the governor 4 mounted on the shaft 2 of the motor, transmits through a lever 40 its own variations of position to the slide frame 41 provided with cam-surfaces 42, 42′. On these surfaces rests, by means of a device 43 provided with rollers or balls suitably arranged, a member 44 which supports the shaft 11 which carries the roller; this shaft is mounted in the member 44 by means of a ball race 45 or by any other suitable device. In any case, it is necessary that the ball race in which the shaft 11 rides shall be provided as a ball- and socket joint in order to allow of the displacements of the shaft 11 around the pivoting axis 28. A spring 46, operating by compression acts on the prolongation of the support 29 in which rests the shaft 11. This spring has for its object constantly to press the roller 3 against the disk 1, a device described later insuring a progressive action of this spring 46 in proportion as the roller 3 approaches the center of the disk 1.

This device comprises the combination with the spring 46, of a lever 47, of a cam with two cam-surfaces 48 and 49 and a roller system 50, 51 provided between the lever 47 and the two-surface cam, this roller system being operated in its displacements by the rod 52 pivoted to the arm 53 of the bell-crank lever 53, 53′, allowing of the control by hand by means of the hand lever 55 of the displacements of the roller 3.

It will be easily seen after the examination of the figures how the automatic change of speed is assured:—

In the case shown in Fig. 9, the roller 3 is at the circumference of the disk 1, and the governor occupies the position corresponding to the normal speed of the motor. If the motor meets with any resistance, the balls of the governor fall, and the lever 40 is operated by the governor sleeve and displaces the slide frame 41 toward the left of the figure; this displacement has for its effect to cause the shaft 11 to descend and occupy a position similar to that represented at A—M in Fig. 8. Under these conditions, it will be seen that the roller 3 descends in the quadrant 11 of the disk 1. As soon as the position of the roller on the shaft 11 is such that the motor can return to its normal speed, the governor takes its normal position, causes the shaft 11 to move upward until it attains the favorable position for which the roller 3 remains in equilibrium, and the roller rests in this position so long as the resistance does not vary.

A decrease in resistance brings about a contrary displacement of the shaft 11 owing to the rise of the balls of the governor, this rise having for its effect to move the slide-frame toward the right of the figure and to cause the end of the shaft 11 to rise above the line A a' which constitutes the mean path of the points for which the roller is in equilibrium. The rise of the shaft 11 above this favorable line has for its effect automatically to move the roller 3 toward the circumference of the disk; the shaft 11 returns to the position A a' when the motor has regained its normal speed.

The disengagement is assured by the operation of the pedal 56 keyed on a shaft 57 carrying a lever 58 which operates a rod 59 pivoted by any suitable means 60 (Fig. 10) to the sliding support 29, which may be displaced under the action of a pedal on the guides 29′ which are fixed to the frame.

On the shaft 57 is keyed a small lever 58′ which operates a rod 59′ which passes freely through the lever 40 at 60′ and which is provided with a regulable stop 61, which acts on the lever 40 with a certain amount of lost motion when the pedal 56 is operated; finally a third lever 12 keyed on the shaft 57 controls by means of a rod 13, the admission of the gas.

It will be seen, consequently, that the operation of the disengaging pedal 56 has a triple effect; it reduces the admission of gas to the motors, it artificially brings the governor into the position in which the roller 3 is moved toward the center, and finally it insures the disengagement of the roller 3 from the disk 1.

It should be remarked that the lost motion before the operation of the stop 61 has for its object to leave during normal running free operation to the governor and to the lever 40; further, the lever 58 operates the rod 59 with a certain amount of lost motion, the extent of which is regulated by the time necessary to put the governor 4 into a suitable position.

The solution which has been shown and illustrated on the accompanying drawings may be employed in the case of a chain-driven car, but it is not necessary that the means indicated should necessarily require the use of a chain; these means may be applied to their whole extent and with all their advantages to the case of a Cardan-driven car.

On Figs. 12, 13, 14, 15 and 16 is represented a method of realization of the means previously described, applied to the case of a car in which the movement of the motor shaft is transmitted to the rear axle by means of a Cardan.

Further this method of realization constitutes in itself a new application of the means described in the first part of this description, in the sense that as will be seen later, the combination of two rollers, one a driving roller and the other a driven roller, with an intermediate disk allows of rendering the whole surface of the intermediate disk active, from the point of view of the setting up of the thrusts which are exercised on the rollers in one direction or in the other. In the devices which have hitherto been described, on the contrary this setting up of thrusts would be effected for motion forward over only half of the disk. As will be seen later in the solution which will be described, not only are the thrusts set up in the same direction on both halves of the intermediate disk, but further it is effected simultaneously which increases the effects of these thrusts.

As will be seen on the drawings, the device comprises essentially the combination of two rollers 3 and 3′, the roller 3 keyed on the driving shaft 2 transmitting the movement which it receives to a disk 1 which is horizontal in the case of the figure, and which in its turn transmits its motion to the roller 3′. The roller 3′ is keyed on a shaft 11 independent of the shaft 2, and the axis of which is at the same time parallel to the shaft 2 and to the disk 1; these shafts 11 and 2 are not in the same line. The shaft 11 by means of a Cardan transmission device operates the rear wheels as will be described later.

It will be understood that the disk 1 acts as an intermediate disk, transmitting, increasing or diminishing in a continuous manner the speed of the roller 3 to the roller 3′. It will also be seen that by displacing the rollers 3 and 3′ on their axes in every possible manner with regard to each other, the whole range of changes of speed may be obtained.

In practice it may be advantageous to form the rollers 3 and 3′ connected as regards displacements parallel to their axes. It is this solution which has been represented in the figure.

It will be seen on the figure that the shaft 2 lies on the line passing through a' a_0' (Fig. 16) when the shaft 11 lies on the line passing through a—a_0 and it is known, from what has been said previously that a' a_0' and a a_0 represent the mean favorable position.

It will now be seen how the automatic change speed gear operates:—

The governor 4 operates in its displacements through the collar 4′ a guide frame 64 (Figs. 13, 14 and 15) carrying at its extremities inclined surfaces 65, 65′; these inclined surfaces are supported between balls in a supporting frame 66 fixed to the frame.

The disk 1 carries at its center on its lower face, a nave 67 which engages in a box-like socket 68; this socket is itself situated in a member 69 provided with lugs through which pass rods 70 fixed to the frame, these rods being those which support the frame 66 which is rigidly fixed to them.

At the base of the socket 68 is pivoted, by means of a suitably disposed frame, a lever 71 capable of pivoting around a fixed point 72 and connected to the disengaging pedal.

It will easily be seen that any action of the governor on the guided slide frame 64 will have for its effect to displace the element 69, the box-socket 68 and consequently the disk 1 horizontally and perpendicularly to the axis of the frame. It will also be seen that any displacement of the pedal 73 will have for its effect to impart to the disk 1 vertical displacements through the box-socket 68.

It now remains to be shown how variations of the governor in consequence of variations of resistance act on the disk 1.

In particular, if one considers the case of Fig. 12 and if it is conceded that the position of the governor on that figure corresponds to the normal speed of the motor, then, if the motor meets with any resistance, the balls of the governor fall, act on the frame 64, cause the disk 1 to mount toward the top of the figure and consequently the shafts 2 and 11 come respectively into the active portions of the quadrants III and II, in which quadrants the forces developed tend to move the rollers 3 and 3′ toward the left of the figure. The roller 3 will accordingly transmit to the intermediate disk 1 a speed which will be less the nearer it approaches to the circumference of the disk; the two rollers being connected, the roller 3′ will receive from the disk 1 a speed which is reduced in the same ratio, and consequently the axle of the rear wheels will receive a corresponding reduction in speed.

The rollers 3 and 3′ will remain in the position determined by the governor, this position corresponding to the resistance for which the motor can maintain its normal speed, the governor at this moment regaining its normal position and consequently returning the disk to the position for which the two shafts lie respectively on the lines of favorable position. In the opposite case of a decrease in resistance, similar phenomena are produced under the same conditions, but in the inverse sense.

Any suitable device, interposed between the shaft of the roller 3′ and the axle of the rear wheels, allows of motion backward. In the case of Fig. 12, a reversing gear is shown, controlled by a lever 74, the operation of which is seen from the examination of the figure.

That which has been described constitutes a new combination, which can be applied not only to the case of a Cardan-driven car but also to the case of a chain-driven car. Further, it may be remarked that the invention is not applied necessarily to the case of an automatic change speed gear. In the case of a change speed gear controlled at will, in which the axes which carry the rollers are fixed with regard to the disk, the combination of means, consisting of the two rollers, one a driving roller and the other a driven roller with an intermediate disk, the arrangement of the shafts which carry the rollers in planes symmetrically arranged with regard to the diameter of the disk, allows of placing the axis of each roller in that position in which the roller is not subjected to any force due to the rotation of the disk which would cause a displacement on its shaft.

Moreover, these two shafts need not necessarily be arranged in planes symmetrical with regard to the diameter parallel to the driving shaft. Since the two rollers, as has been explained, always tend to be displaced in the same direction, whatever may be the position which they occupy on the intermediate disk, it is sufficient to counteract the thrusts exercised by the intermediate disk on each roller, and if the rollers are connected to each other as regards their axial displacements, to move the two shafts one with regard to the other, while leaving them parallel, the distance from one shaft to the other being chosen in such a manner that the thrust exercised on one roller shall be exactly equalized by the thrust exercised on the other. This reasoning of course requires that the two shafts which carry the rollers are never situated in the same half of the disk, the limiting position of each of them being exactly fixed by the diameter of the disk parallel to the shafts.

Finally, it should be remarked that whether it is employed as an automatic change-speed gear or as a change-speed gear controlled at will, it is not essential to dispose the shafts which carry the rollers parallel to each other, but they may occupy, with regard to each other, any position in a plane parallel to the disk. In this case, the shafts, if prolonged, intersect, and the amount of the disalinement for each of them is always given by the distance of each shaft from the diameter which is parallel thereto.

What I claim as my invention and desire to secure by Letters Patent is:—

1. Apparatus for the transmission of motion by means of friction disks, comprising a motor, a driving disk, a driven disk, and means automatically controlled by the variation of speed of the motor for displacing into a parallel position the axis of one of the said disks with regard to the axis of the other.

2. Apparatus for the transmission of motion by means of friction disks, comprising a driving disk, a driven disk, means for automatically displacing the axis of one of said disks with regard to the axis of the other, means for driving the driving disk, and means for returning the axis of the displaceable disk to the most favorable position for normal operation.

3. Apparatus for the transmission of motion by means of friction disks, comprising a driving disk, a driven disk, a shaft pivotally mounted, said driven disk being mounted on said shaft, means for automatically displacing the axis of one of the said disks with regard to the axis of the other, means for automatically maintaining the driven disk in contact with the driving disk, and means for driving the driving disk, and means for varying the direction of the drive.

In testimony whereof I have hereunto signed my name to this specification in the presence of two subscribing witnesses.

MATHURIN TARRISSE.

Witnesses:
H. C. Coxe,
Miguel Zerolo.