No. 730,597. PATENTED JUNE 9, 1903.

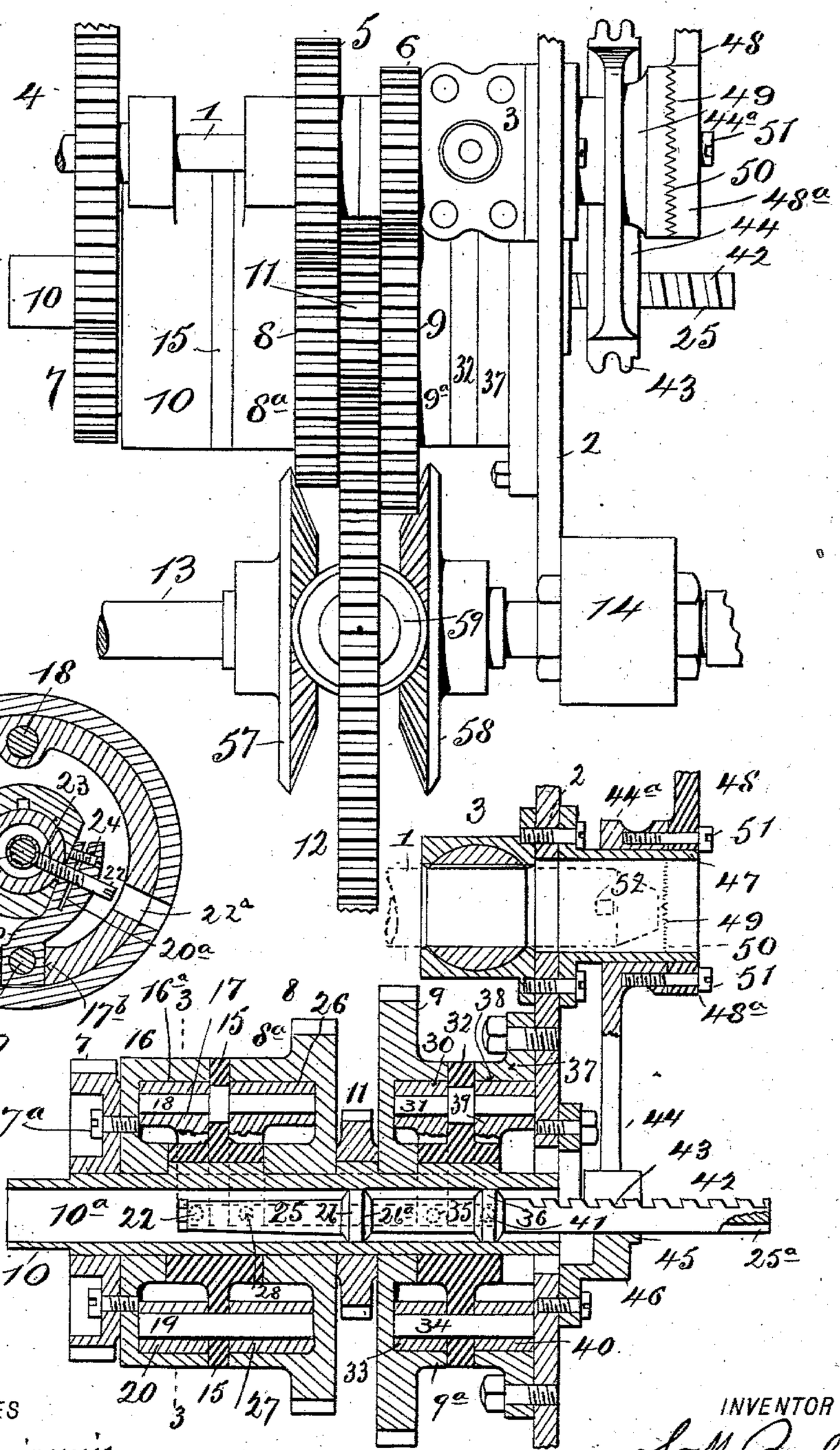
S. M. BALZER.

VARIABLE DRIVING GEAR.

APPLICATION FILED JULY 22, 1898.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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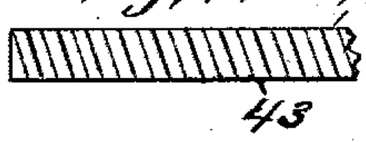
Fig. 4a



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BY

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Fig. 4

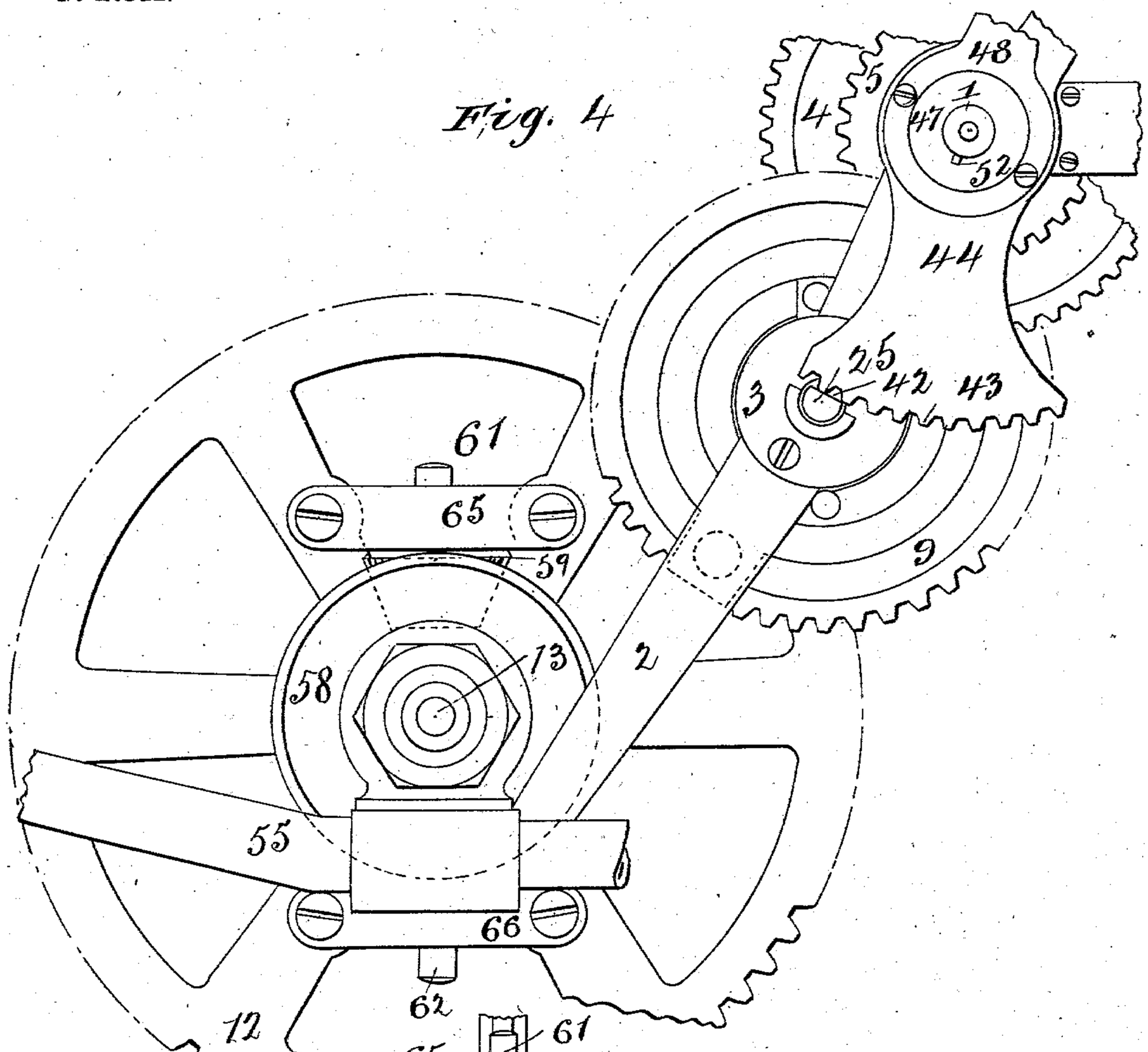
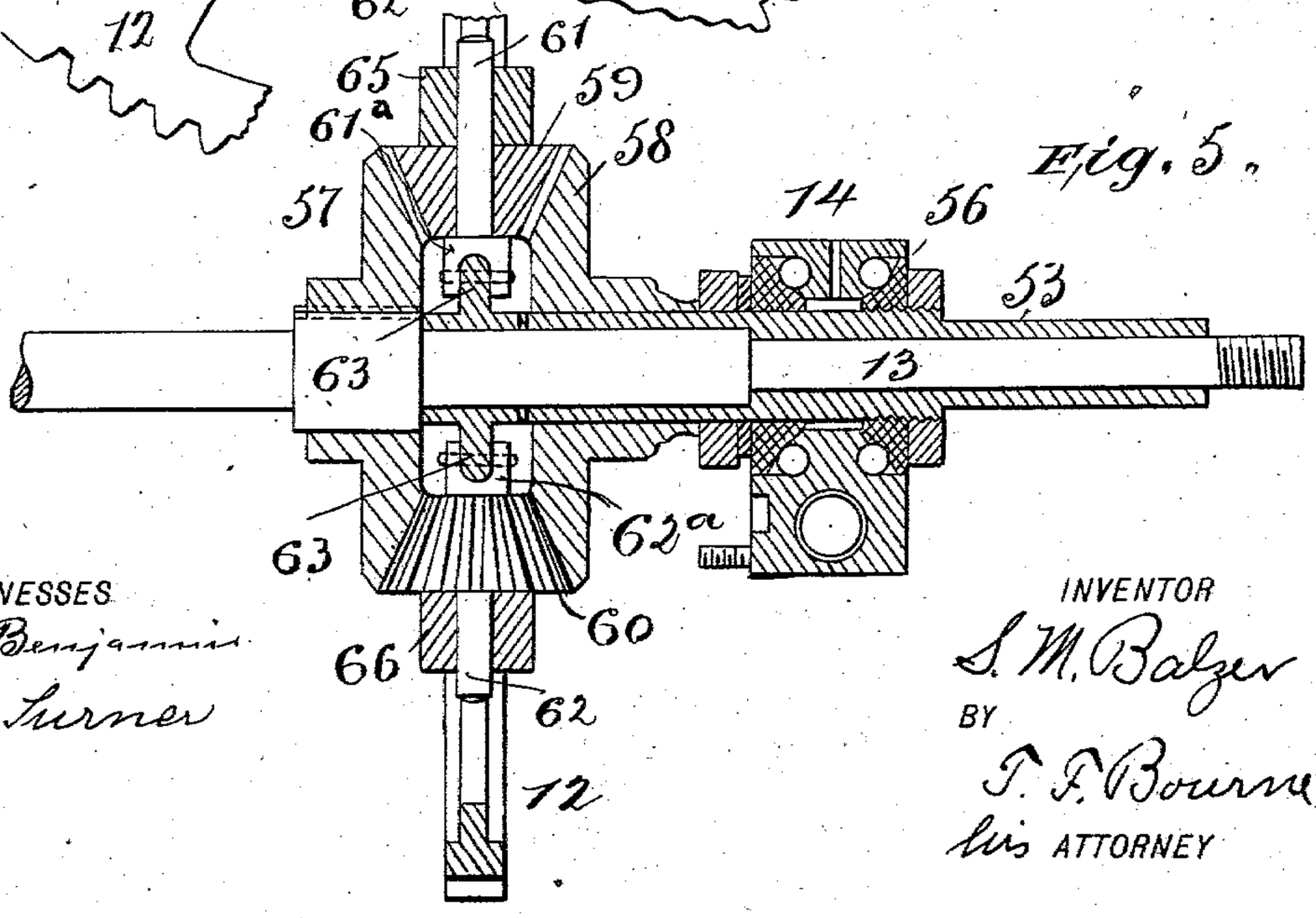


Fig. 5.



WITNESSES

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UNITED STATES PATENT OFFICE.

STEPHEN M. BALZER, OF NEW YORK, N. Y., ASSIGNOR TO WILLIAM H. HUMPHREY, OF NORFOLK, CONNECTICUT.

VARIABLE DRIVING-GEAR.

SPECIFICATION forming part of Letters Patent No. 730,597, dated June 9, 1903.

Original application filed December 17, 1897, Serial No. 662,327. Divided and this application filed July 22, 1898. Serial No. 686,572. (No model.)

To all whom it may concern:

Be it known that I, STEPHEN M. BALZER, a citizen of the United States, residing in New York city, county and State of New York, have invented certain new and useful Improvements in Variable Driving-Gears, of which the following is a specification.

This application is a division of an application filed by me on December 17, 1897, Serial No. 662,327; and the object of my present invention is to provide improved means for communicating different speeds from a driving part to a driven part without altering the speed of the driving part; and another object of my invention is to utilize friction devices in such gearing to prevent undue strain upon the gearing, particularly in changing from one gear to another.

The invention is particularly applicable to a motor-vehicle.

The invention consists in the novel details of improvement and the combinations of parts that will be more fully hereinafter set forth and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming part hereof, wherein—

Figure 1 is a plan view of the gearing embodying my invention. Fig. 2 is a horizontal section through the main portion thereof. Fig. 3 is a cross-section on the line 3 3 in Fig. 2. Fig. 4 is a side elevation of the gearing. Fig. 4ª is a detail of a rack, and Fig. 5 is a detail section of the axle-equalizing devices.

In the accompanying drawings, in which similar numerals of reference indicate corresponding parts in the several views, 1 indicates a driving part, which is shown in the form of a shaft, that may be supported in any suitable bearings and driven by any suitable motive power. (Not shown.) 2 is a portion of a frame having a bearing 3, in which shaft 1 is journaled, the other bearing for said shaft not being shown. Upon the driving part or shaft 1 are secured gears 4 5 6, the arrangement shown being such that gear 4 will produce a high speed, gear 5 an intermediate speed, and gear 6 a low speed or power. The gear 4 meshes with a gear 7, the gear 5 with the gear 8, and the gear 6 with the gear 9. The gears 7 8 9 are loosely mounted upon a part to be driven, such as a shaft 10, whereby shaft 1 rotates the gears 4 5 6 7 8 9, and all rotate in unison, and when the shaft 10 is to be rotated the gear 7, 8, or 9 will be tightly connected therewith, so that one of said gears can rotate said shaft. Upon the shaft 10 is mounted a pinion or gear 11, which meshes with a gear 12, that is adapted to rotate a driven part, such as an axle or shaft 13, with which said gear 12 is properly connected. The axle or shaft 13 may be supported in suitable bearings, one of which, 14, is shown. As the gears 7 8 9 are loosely mounted upon shaft 10 I have provided friction clutches or devices for connecting either one of said gears with said shaft and for disconnecting it therefrom to allow the shaft 1 and the driven axle or shaft 13 to move independently, and in connection therewith I have provided a friction-brake for checking the momentum of the shaft 10 and the parts that it drives, the arrangement I have shown being as follows: Rigidly mounted upon shaft 10 is an arm or extension 15, projecting outwardly from said shaft in two directions and which may be secured thereto by a spline and feather. 16 is a friction drum or disk having an internal bore or socket 16ª, this disk or drum having a central bore to receive the shaft 10, upon which it is loosely mounted. To the drum or disk 16 is secured gear-wheel 7, being shown secured thereto by screws 7ª, the principal reason that the gear 7 is separate from the friction disk or drum 16 being that said gear is smaller in diameter than said drum and is therefore easier to construct in this manner; but it is evident that the parts 7 and 16 can be constructed in a single piece of metal. Within the bore 16ª of the friction drum or disk 16 is located a split friction-ring 17, that is shown carried by a pin 18, projecting from support 15. A pin 19, also carried by the support 15, projects laterally therefrom and carries an arm or finger 20, one portion of which is located between the ends 17ª 17ᵇ of the friction-ring 17, as shown in Fig. 3, so that when arm 20 is turned on its pivot it will expand the ring 17 into frictional engagement with the friction disk or drum 16, whereby as the gear 4 is rotated the

parts 16, 17, 15, and 10 will be driven thereby. The means I have shown for expanding ring 17 through the medium of arm or lever 20 consists of a pin 22, carried by said arm and projecting into the bore of shaft 10 through an aperture 23 in said shaft. (See Fig. 3.) For the purpose of enabling the adjustment of pin 22 I have shown it in the shape of a screw threaded in a suitable aperture in arm 20, and to lock it firmly to said arm I have shown said arm split longitudinally at 20^a and provided with a screw 24, threaded in the two members of arm 20, thus formed so as to expand or contract the members of said arm to lock the pin 22. 22^a indicates an aperture passing through the friction drum or ring 16 and the split ring 17 to permit the passage of a tool to adjust the threaded pin or screw 22. Within the bore 10^a of shaft 10 is a longitudinally-movable rod or presser 25, that is adapted to act upon pin 22 to force the same outwardly in order to turn arm 20 to expand the ring 17, and for this purpose the rod 25 is shown provided with an annular enlargement 26, having a beveled or cone-like surface 26^a on opposite sides adapted to ride against said pin to actuate the same. (See Fig. 2.) The enlargement 26 is shown of a sufficient size to fit snugly within the bore of shaft 10, and the rod 25 is sufficiently small so that it will not itself directly operate pin 22.

In order to drive gear 8 frictionally, an arrangement similar to that just described is provided in which a friction drum or disk 8^a is connected with gear 8 in the arrangement shown, the parts 8 and 8^a being made in a single piece of metal bored out to receive a split ring 26, that is supported on pin 18, and 27 is an arm carried by pin 19 and located between the ends of ring 26 and provided with a pin 28, these parts being substantially similar to parts 17, 18, 19, 20, and 22 and acting in the same manner, the pin 28 passing through an aperture in shaft 10 to be engaged by the enlargement 26 on rod 25. Thus if pin or screw 22 is operated by parts 25 26 gear 7 will drive shaft 10; but if pin 28 is operated by parts 25 26 gear 8 will drive said shaft and at a different speed from that produced by gear 7. It will also be seen that enlargement 26 is not adapted to engage pins 22 and 28 at the same time, but may pass between said pins and is beveled on opposite faces to engage each of said pins. Gear 9 is provided with a drum or ring 9^a, the parts being counterbored to receive a ring 30, that is supported on a pin 31, carried by an extension 32, secured to shaft 10, as by a spline and feather, and an arm 33 is carried by a pin 34, supported by projection 32, the arm 33 having a pin 35, the parts being substantially similar to the arrangement shown in Fig. 3. Upon rod 25 is an enlargement 36, having its opposite sides beveled or cone-like and adapted to operate upon pin 35 to cause gear 9 to be frictionally connected with shaft 10 in manner described with relation to parts 7 16, &c. Thus the shaft 10 may be frictionally driven at three different speeds—that is to say, if rod 25 is adjusted so that enlargement 26 engages pin 22 the shaft will be driven by gears 4 and 7 at the high speed, if rod 25 is adjusted so that enlargement 26 engages pin 28 shaft 10 will be operated by gears 5 and 8 at an intermediate speed, and if rod 25 is so adjusted that enlargement 36 engages pin 35 shaft 10 will be rotated by gears 6 and 9 at a low speed.

In order to resist the rotation of shaft 10, I have shown a friction disk or drum 37, secured to frame 2 and provided with a bore 38, in which is located a split ring 39, supported on pin 31, and between its ends is an arm 40, supported on pin 34 and provided with a pin 41, adapted to be acted upon by enlargement 36 of rod 25, (see Fig. 2,) all in manner similar to that shown in Fig. 3 and described in relation to parts 7 16, &c., the arrangement being such that when enlargement 36 of rod 25 operates pin 41 the split ring 39 will produce frictional engagement with friction-drum 37, and thereby retard or prevent the rotation of shaft 10. The distance between pins 35 and 41 is such that enlargement 41 may rest between them without operating either, and the arrangement is such that after enlargement 36 has passed pin 41 and the rod 25 is moved farther said enlargement will engage pin 35 to frictionally connect shaft 10 with gear 9. If higher speed is desired, rod 25 will be moved (to the left in Fig. 2) until enlargement 41 releases pin 35 and enlargement 26 engages pin 28, whereupon gear 8 will be frictionally connected with shaft 10, and if a still higher speed is desired rod 25 will be moved (to the left in Fig. 2) until enlargement 26 releases pin 28 and engages pin 22, whereupon gear 7 will be frictionally connected with shaft 10. It will be understood that if shaft 10 is rotating at either speed and it is desired to throw off the gear it will only be necessary to move rod 25 far enough to release the pin with which the enlargement is in engagement. At any time that it is desired to apply the brake it is only necessary to move rod 25 (to the right in Fig. 2) until enlargement 36 comes into engagement with pin 41, and although either or both enlargements on rod 25 may pass over one or more of said pins in the meantime no ill effects will arise.

Any suitable means may be provided for moving rod 25 longitudinally back and forth. The arrangement I have shown for this purpose is as follows: Upon one side rod 25 is provided with a series of teeth 42, which are cut in the form of a worm and are adapted to receive corresponding teeth 43 on a sector-like arm or lever 44. These teeth 43 on arm 44 are shown in face view in Fig. 4^a, in which they are placed at an acute angle to a line passing through the longitudinal center of the face of arm 44, and the arrangement is such that as arm 44 is rocked forward or backward the teeth 43 will act upon the teeth

42 to slide the rod 25 longitudinally. To keep rod 25 from rotating under the action of arm 44, I have shown said rod as provided with a spline 25ª, adapted to receive a feather or projection 45 at the end of an arm 46, secured to frame 2. The arm 44 is pivotally hung upon a stud or shaft 47, carried by frame 2, and 48 is a lever or arm secured to arm 44, whereby the latter may be rocked upon its pivot. For the purpose of enabling lever 48 to be brought into convenient position for ready operation, especially when the devices before described are applied to a vehicle, without altering the position of arm 44 relatively to rod 25 I have shown the outer face of hub 44ª of arm 44 provided with teeth 49, that are adapted to mesh with teeth 50, carried by the hub 48ª of lever 48, screws 51 being provided to hold the parts 44 and 48 together.

Where the shaft 1 is to be driven by a gas or oil motor, such as illustrated in my said application, Serial No. 662,327, said shaft is to be rotated by hand in order to start it, and for this purpose I have shown the shaft or stud 47 as tubular and its bore located in line with shaft 1 to enable a suitable crank or handle to be attached to said shaft within or through the bore of shaft or stud 47. (See dotted lines in Fig. 2.) Said shaft 1 is shown provided with a pin 52, upon which a crank or handle (not shown) may operate to turn said shaft in well-known manner.

While the gear 12 may be suitably connected with axle 13, I have shown an arrangement for equalizing the axle, so that when it is applied to a vehicle it will enable the latter to conveniently turn corners. The arrangement I have shown is as follows: The shaft 13 at one end carries a sleeve 53, which is adapted to rotate independently of said shaft (see Fig. 5) and is to be attached to the hub of a wheel when used on a vehicle. Suitable bearings 14 are provided and carried by the frame 55, to which the framing 2 is attached, the sleeve 53 being adapted to rotate in said bearings, and for this purpose said sleeve is shown provided with cones 56 to act with the friction-balls of the bearing. (See Fig. 5.) The gear 12 is movably mounted on shaft 13, and to said shaft is also attached a bevel-gear 57, and to the sleeve 53 is attached a corresponding bevel-gear 58, the gears 57 58 being located on opposite sides of gear 12 and adjacent thereto. (See Figs. 1 and 5.) The gear 12 carries one or more bevel-pinions 59 60, that mesh with the gears 57 58 at the same time. For this purpose I have shown the gear 12 provided with shafts 61 62, upon which the pinions 59 60 are respectively mounted. In order to permit the ready attachment and removal of the shafts 61 62 to and from the gear 12, I have shown the hub of said gear provided with apertured lugs 63 63, adapted to receive the forked ends 61ª 62ª of shafts 61 62, said forked ends of the shaft being provided with apertures to receive pins that pass through them and through the apertured lugs, and the outer ends of said shafts are held between clamps 65 66, secured to the spokes of the gear-wheel 12. (See Fig. 4.) The arrangement is such that as gear 12 is rotated and shaft 13 is traveling in a straight line the pinions 59 60 will act upon gears 57 58 uniformly, so as to carry said gears around bodily in the same direction and at the same speed; but if the vehicle is turning from a straight line one of its wheels will travel faster than the other, and thereupon said pinions will act upon the gears 57 58 in such manner that said gears may rotate at different speeds, in which event the pinions will cause one of said gear-wheels to rotate faster than the other, at which time said pinions will have independent movement on their axes, at the same time causing axle or shaft 13 to continue to rotate.

My improved gearing may be used in many relations where it is desired to transmit variable speeds from a driving part without stopping the rotation of said parts, and I do not limit my invention to the precise details of construction shown and described, as they may be varied without departing from the spirit thereof.

Having now described my invention, what I claim is—

1. The combination of a driving part, a friction-drum, means for communicating motion from the former to the latter, a shaft, means for frictionally connecting said drum with said shaft, an immovable friction-drum, means for frictionally connecting said shaft with said last-mentioned drum, and means for operating said friction means independently, substantially as described.

2. The combination of a driving part, a friction-drum, means for communicating motion from the former to the latter, a hollow shaft, an extension rigidly carried thereby, projections carried by said extension, an immovable friction-drum, said projections passing into said drums, expansible rings located in said drums and connected with one of said projections, arms connected with the other projection and located within said friction-drums respectively, a projection for each arm that passes through an opening in said shaft, and an adjustable rod having an enlargement adapted to operate the last-mentioned projections to connect said shaft frictionally with either of the drums, substantially as described.

3. The combination of a driving part, a driven part, means for communicating motion from one to the other, a hollow shaft, means for frictionally connecting said driven part with said shaft, an adjustable rod located in said shaft and adapted to operate the frictional devices, said rod having rack-teeth, an oscillatory arm having teeth to engage said rack-teeth to move said rod, and means to prevent rotation of said rod, substantially as described.

4. The combination of a driving part, a friction-drum, means for communicating motion from the former to the latter, a hollow shaft, an extension rigidly connected therewith, projections carried by said extension, a split ring carried by one of said projections to act with said drum, an arm carried by the other projection, a projection for said arm passing through an opening in said shaft, an adjustable rod located in said shaft and having means to act on the last-mentioned projection, said rod having rack-teeth, means to prevent rotation of said rod, and an oscillatory arm having teeth to engage said rack-teeth and adapted to move said rod as the arm oscillates, substantially as described.

5. The combination of a driving part, a driven part, means for communicating motion from one to the other, a hollow shaft, means for frictionally connecting said driven part with said shaft, an adjustable rod located in said shaft and adapted to operate the frictional devices, said rod having rack-teeth, an oscillatory arm having teeth to engage said rack-teeth to move said rod, means to prevent rotation of said rod, a lever adjustably connected with said oscillatory arm, and a pivot for said arm and lever, substantially as described.

6. The combination of a shaft, a bearing for said shaft, a frame and a hollow shaft carried by said frame in line with the first-mentioned shaft, a hollow shaft 10, gearing and frictional devices between the first-mentioned shaft and the shaft 10, an adjustable rod adapted to operate said frictional devices, an oscillatory arm journaled on the second-mentioned shaft, means to cause said arm to move said rod, and a lever connected with said arm, substantially as described.

STEPHEN M. BALZER.

Witnesses:
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T. F. BOURNE.