No. 707,672. Patented Aug. 26, 1902.

G. S. BAKER.

WHEEL GEAR.

(Application filed Dec. 3, 1901.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.

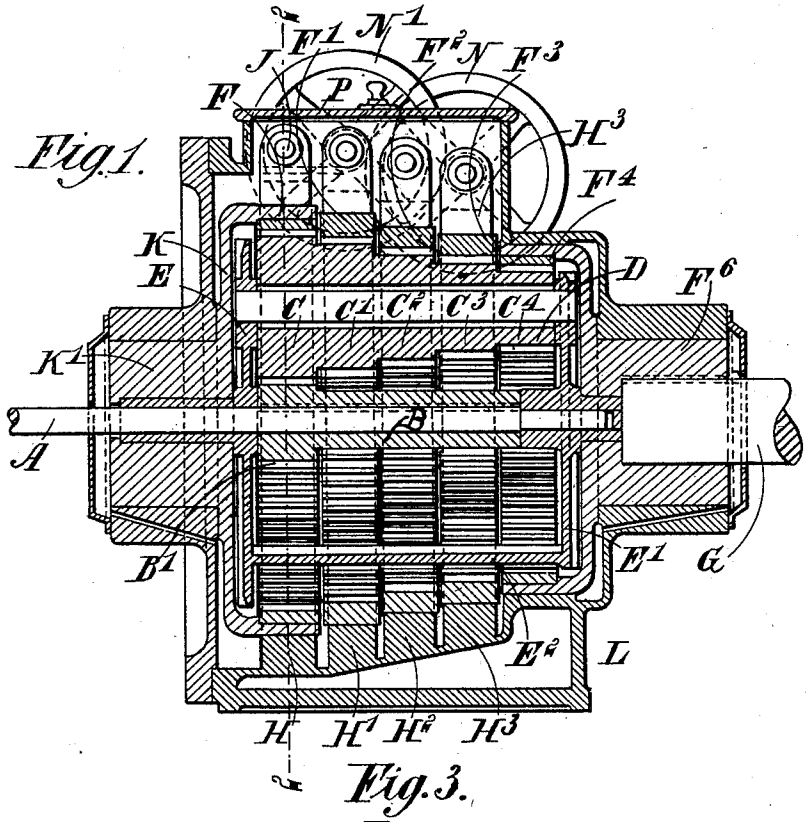
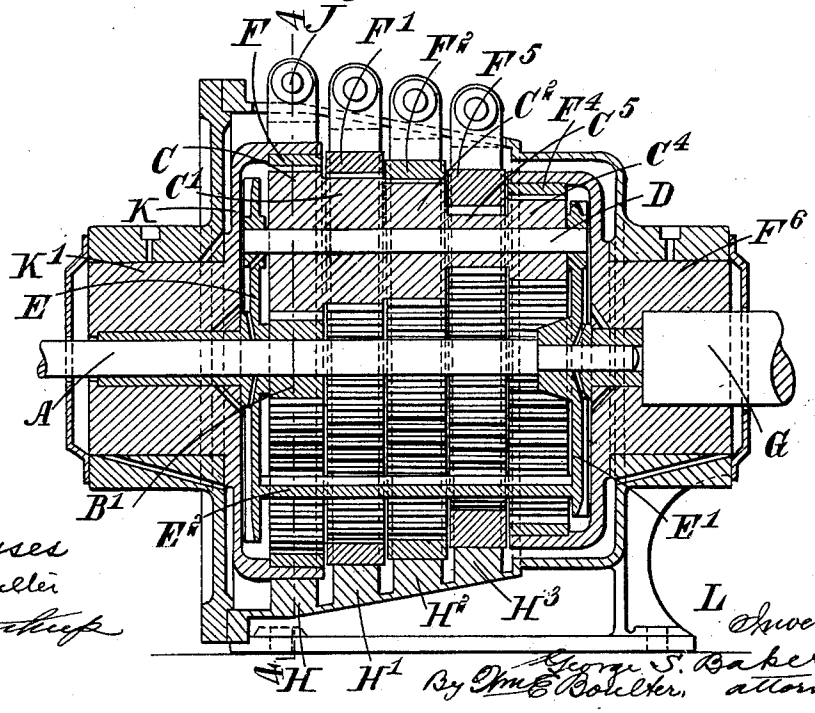


Fig. 3.



Witnesses
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4 Sheets—Sheet 2.

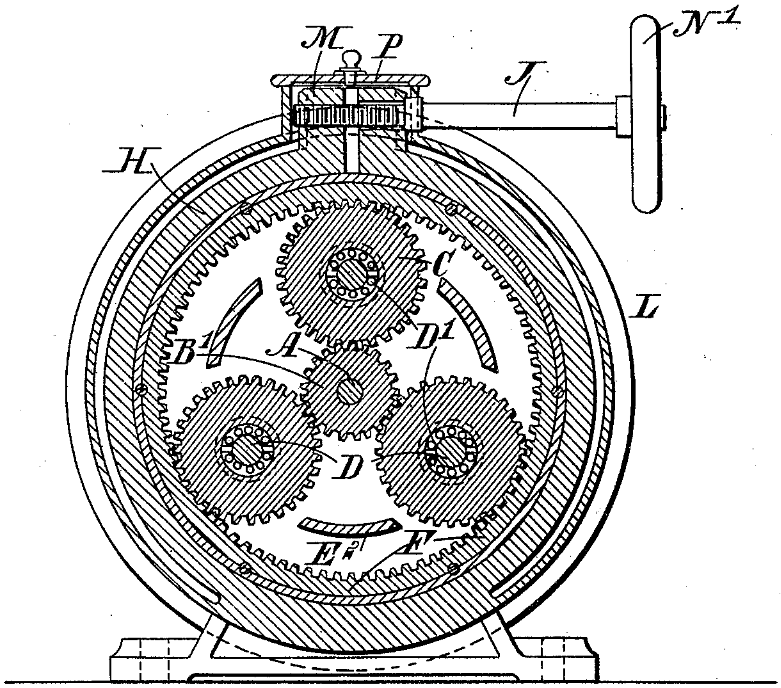

Fig. 2.

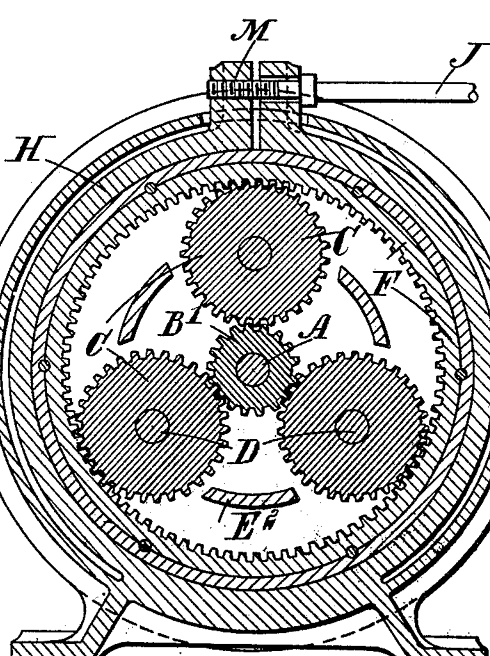

Fig. 4.

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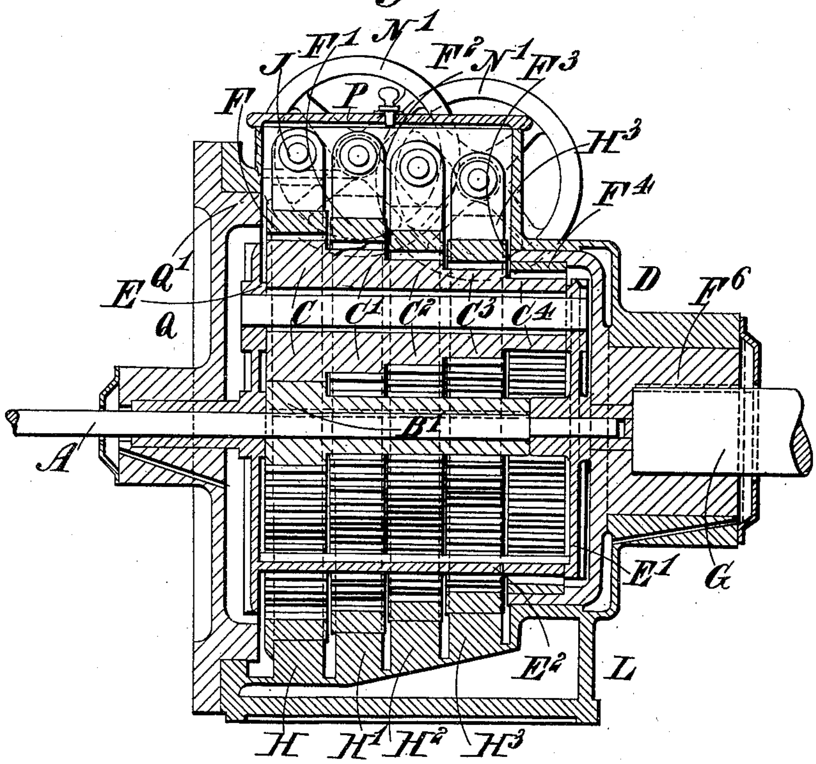
Fig. 5.



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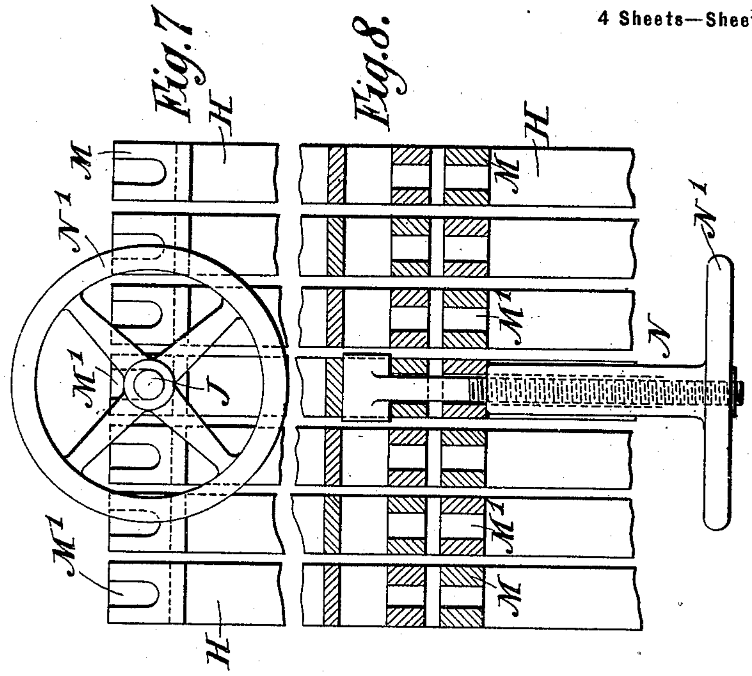

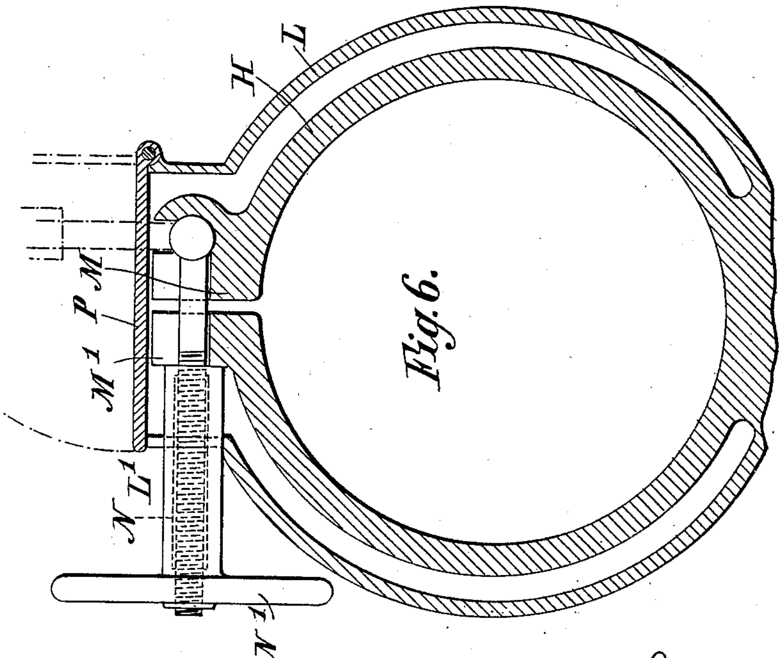

Witnesses

Inventor
George S. Baker
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Attorney

UNITED STATES PATENT OFFICE.

GEORGE SAMUEL BAKER, OF LONDON, ENGLAND.

WHEEL-GEAR.

SPECIFICATION forming part of Letters Patent No. 707,672, dated August 26, 1902.

Application filed December 3, 1901. Serial No. 84,567. (No model.)

To all whom it may concern:

Be it known that I, GEORGE SAMUEL BAKER, a subject of the King of England, residing at London, in England, have invented certain new and useful Improvements in or Relating to Wheel-Gear for the Transmission of Power, (for which I have applied for Letters Patent in Great Britain under No. 17,728, dated September 4, 1901,) of which the following is a specification.

The present invention relates to wheel-gearing for the transmission of power, the principal object being to provide a gear by means of which power may be transmitted from a driving to a driven shaft at any one of a certain number of prearranged speeds.

Another object of this invention is the construction of a spur-gear which will allow of reversal of the driven shaft without disengagement or engagement of any spur-wheels.

A further object of the invention is to provide a simple construction of certain parts of the gear.

According to this invention compound planet-pinions are employed having three or more portions of different diameters. Encircling each portion of the planet-pinions is an internally-toothed rotatable ring. One of these rings is fixed to the driven shaft, and each of the other rings is adapted to be locked to the casing of the gear.

In the accompanying drawings, Figure 1 is a central longitudinal section of a transmission-gear constructed in accordance with one method of carrying out this invention. Fig. 2 is a transverse section of the same apparatus on the line 2 2 of Fig. 1. Fig. 3 is a central longitudinal section of another form of transmission-gear adapted to give both forward and reversed driving. Fig. 4 is a transverse section of the same gear on the line 4 4 of Fig. 3. Fig. 5 is a central longitudinal section of a transmission-gear similar to that shown in Fig. 1, illustrating a convenient constructional form of the gear. Fig. 6 is a transverse section of a combined casing and band-brake constructed in accordance with this invention. Fig. 7 is a side elevation, and Fig. 8 is a plan, of the same device.

Like letters indicate like parts throughout the drawings.

With reference first to Figs. 1 and 2, a high-speed shaft A has keyed on it a sleeve B, bearing a toothed pinion B′. This pinion gears with one or more, preferably three, toothed planet-pinions C, which are disposed about it. The pinions are rotatably supported on shafts D, roller-bearings D′ being preferably employed. The shafts are conveniently carried on a frame rotatable concentrically with the high-speed shaft A, on which it rests, and comprising disks E E′ at opposite ends of the shafts, rigidly connected together by the portions E^2, suitable journals being provided to receive the shafts D of the compound pinions. Each of the outer pinions C forms one portion of a compound planet-pinion having several toothed portions of different diameters C C′ C^2, &c. The different portions may either be cast in one continuous piece or may be formed separately and thereafter keyed to one sleeve, which acts as a boss for the whole set. Encircling and gearing with each portion of these compound pinions is an internally-toothed rotatable ring F F′ F^2, &c., the diameter of each ring being so arranged that each portion of the compound pinions gears with its corresponding toothed ring. The last toothed ring F^4 farthest away from the driving-pinion B′ is keyed to or forms part of a disk F^6, provided with a central boss, which is fixed on the driven shaft G, thus supplying a positive connection between the last ring F^4 and the driven shaft G. Surrounding each rotatable ring is a band-brake H H′ H^2, &c., provided with a tightening device, whereby any one of the loose rings may be locked as desired.

It will now be seen from the drawings that when one of the loose rings F is fixed by its locking device and when the driving-shaft A is rotated power will be transmitted through the pinion B′ and the compound pinion. The portion of the compound pinion appropriated to the locked ring will run around against the inside of that ring, and motion of translation will be imparted to the compound pinion. The last portion C^4 of the compound pinion being of less diameter than the portion appropriated to the locked ring will have a less peripheral velocity than the latter, and the internally-toothed ring F^4, on which the last portion runs, will therefore be forced slowly forward, since both portions of the compound pinion have the same motion of translation.

The less the difference in these peripheral velocities—*i. e.*, the more nearly the diameters of the two portions approximate—the greater will be the reduction of the speed of the driven shaft. The rotation of the last ring F^4 will be communicated to the driven shaft G through the disk F^6, and the speed imparted to the driven shaft will be determined by the choice of the ring which is to be locked.

Referring now to Figs. 3 and 4 the construction in this case is similar to that of the gear above described; but in order to enable the motion of the driven shaft to be reversed the compound planet-pinion is provided with a portion C^5 of less diameter than the last portion C^4. The last portion C^4 gears with the internally-toothed ring which is positively connected to the driven shaft G. When therefore it is desired to reverse the motion of the driven shaft G, the internally-toothed ring of smallest diameter F^5 is locked. This smallest ring then acts as a fixed circular rack, on which the smallest portion C^5 of the compound pinion runs. The last portion C^4 of the compound pinion being of greater diameter than the smallest portion C^5 will have a greater peripheral velocity than the smallest pinion C^5, and the last ring F^4 will thus be forced slowly backward, since the two portions of the compound pinion have the same motion of translation.

When two or more different speeds are required in a reverse direction, two or more portions of the compound pinion are formed of less diameter than the last portion C^4. In the case of a vehicle it is generally necessary to provide several speeds in a forward driving direction and one slow speed in a reverse direction. In such a case the compound pinions are constructed as illustrated in Figs. 3 and 4.

The internally-toothed ring of largest diameter F may conveniently be rigidly connected to a disk K, having a central sleeve K′, the outside of which forms a journal which revolves in a bearing in the fixed casing. Instead of providing the ring F with a supporting-disk K and boss K′ a groove may be formed in the outside of the ring F to receive the band-brake H, as illustrated in Fig. 5. In such a case the door Q, which closes the casing, can conveniently be provided with a projection Q′, abutting against the ring F and coöperating with the band-brake H to prevent lateral motion of the ring F. Conveniently the locking device for the loose rings consists of brake-bands H, H′, H^2, &c., encircling the loose rings F, F′, F^2, &c., each of which bands can be tightened sufficiently to grip its toothed ring and fix it in one position. Normally the toothed rotatable rings are free to turn within the brake-bands.

According to this invention the brake-bands are preferably cast in one with the casing L, convenient apertures being left in the casing in the construction illustrated in Figs. 3 and 4 to allow of the projection of lugs M from the split rings, by means of which the rings may be tightened with a bolt J or the like engaged, as shown, with these projections.

Figs. 6, 7, and 8 illustrate another convenient form of combined casing and band-brake. The casing L and the band-brake H are cast in one piece, lugs M being provided on each brake-band, and the lugs may be brought together in order to tighten the band-brake by means of a T-headed bolt J and an internally-screwed sleeve N, provided with a hand-wheel N′. If several brake-bands are employed, as illustrated, one bolt J and hand-wheel N N′ may serve for the tightening of any one of the whole group. In this case the lugs M are provided with slots M′ in order that the bolt may be raised out of engagement with one pair of lugs and may be slid along into engagement with any other pair. It is not necessary that the lugs should project through an aperture in the casing, but the casing may be provided with a hinged cover, such as P, and the bolt may project through slots L′ in the side of the casing L. This form of band-brake has been described as applied to a multiple epicyclic gear; but of course it is to be understood that this brake could also be applied to a single or double epicyclic gear of the same type.

It is obvious from the above description that a self-contained or compact mechanism can be formed according to this invention, whereby from a high-speed shaft A power can be transmitted to a low-speed shaft G, or from a low-speed shaft G to a high-speed shaft A at any one of several prearranged speeds, and according to one portion of this invention the direction of motion may be reversed, as described.

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

1. In a speed-gear the combination of a driving-pinion, a compound planet-pinion gearing therewith having several portions of greater and of less diameter than the last portion, an internally-toothed rotatable ring engaging with each portion, a driven shaft connected to the last ring and a locking device for each of the other rotatable rings.

2. In a speed-gear the combination of a driving-pinion, a compound planet-pinion gearing therewith having several portions of greater and of less diameter than the last portion, rotatable means for supporting the compound pinion, an internally-toothed rotatable ring engaging with each portion, a driven shaft connected to the last ring and a locking device for each of the other rotatable rings.

3. In a speed-gear the combination of a driving-shaft, a toothed pinion mounted thereon, a plurality of compound planet-pinions gearing therewith each having several toothed portions of greater diameter, and one toothed portion of smaller diameter than the last portion, an internally-toothed rotatable ring engaging with each portion, a driven

shaft positively connected to the last ring and a locking device for each of the other rotatable rings.

4. In a speed-gear the combination of a driving-shaft, a toothed pinion mounted thereon, a plurality of compound planet-pinions gearing therewith each having several toothed portions of greater diameter and one toothed portion of smaller diameter than the last portion, a rotatable floating frame supporting the compound pinions, an internally-toothed rotatable ring engaging with each portion, a driven shaft positively connected to the last ring and a locking device for each of the other rotatable rings.

5. In a speed-gear the combination of a driving-shaft, a toothed pinion mounted thereon, a plurality of compound planet-pinions gearing therewith each having several toothed portions of greater diameter and one toothed portion of smaller diameter than the last portion, a rotatable floating frame supporting the compound pinions, an internally-toothed rotatable ring engaging with each portion a driven shaft positively connected to the last ring and a band-brake, consisting of a split ring encircling each of the other rotatable rings.

6. In a speed-gear the combination of a driving-shaft, a toothed pinion mounted thereon a plurality of compound planet-pinions gearing therewith each having several toothed portions of greater diameter and one toothed portion of smaller diameter than the last portion, a rotatable floating frame supporting the compound pinions, an internally-toothed rotatable ring engaging with each portion, a driven shaft positively connected to the last ring, a casing inclosing the gear, and a band-brake consisting of a split ring encircling each of the other rotatable rings, the brakes being cast in one piece with the casing.

7. In a speed-gear the combination of a driving-shaft, a toothed pinion mounted thereon, a plurality of compound planet-pinions gearing therewith each having several toothed portions of greater diameter and one toothed portion of smaller diameter than the last portion a rotatable floating frame supporting the compound pinions an internally-toothed rotatable ring engaging with each portion, a driving-shaft positively connected to the last ring, a casing inclosing the gear, a band-brake consisting of a split ring encircling each of the other rotatable rings the brakes being cast in one piece with the casing and a tightening-screw engaging with lugs on each split ring projecting through an aperture in the casing.

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

GEORGE SAMUEL BAKER.

Witnesses:
G. F. WARREN,
T. J. OSMAN.