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H. E. TWOMLEY

VARIABLE SPEED TRANSMITTING MECHANISM

Filed June 2, 1921

2 Sheets-Sheet 1

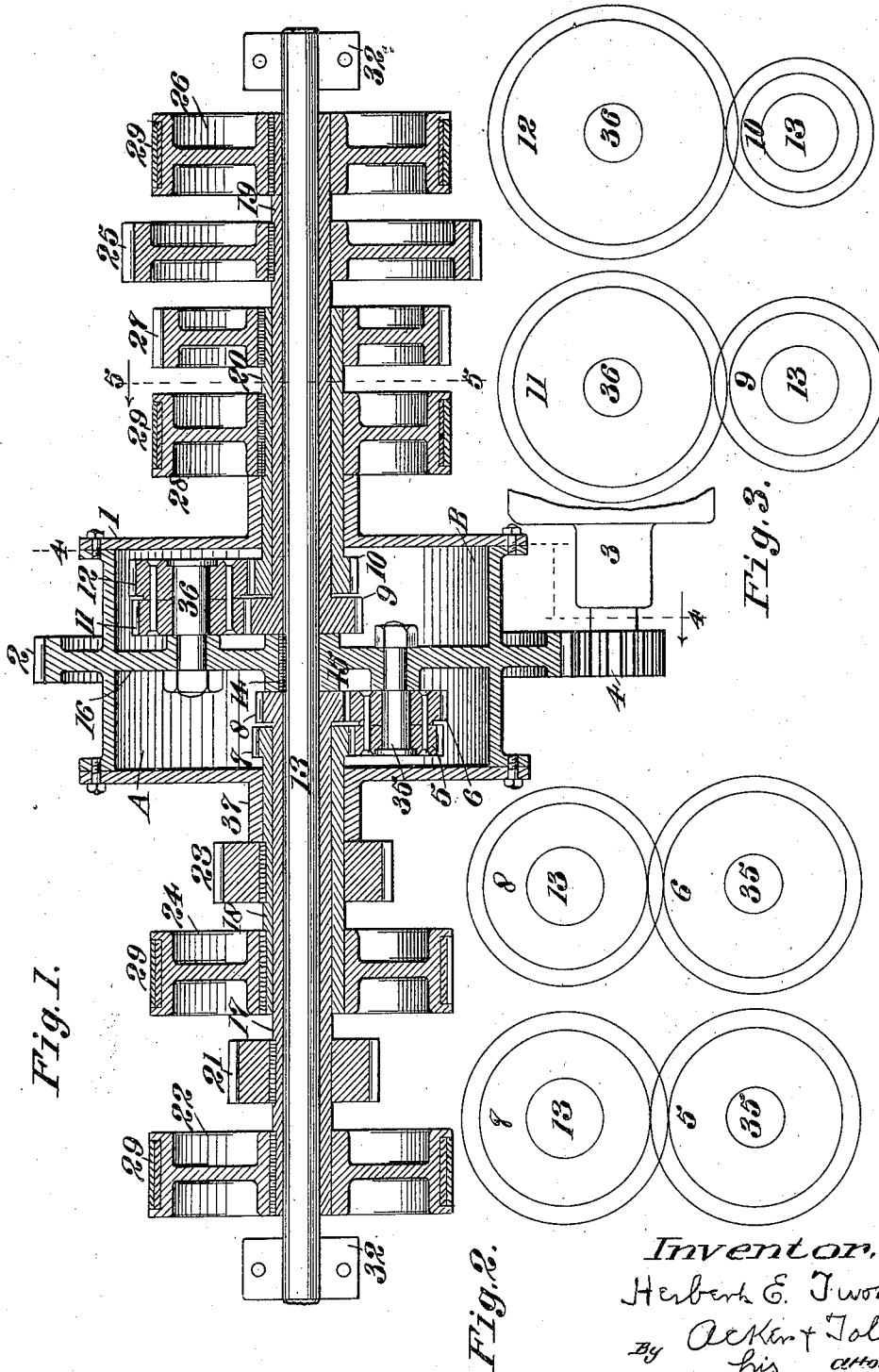


Fig. 1.

Fig. 2.

Fig. 3.

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2 Sheets-Sheet 2

Fig. 4.

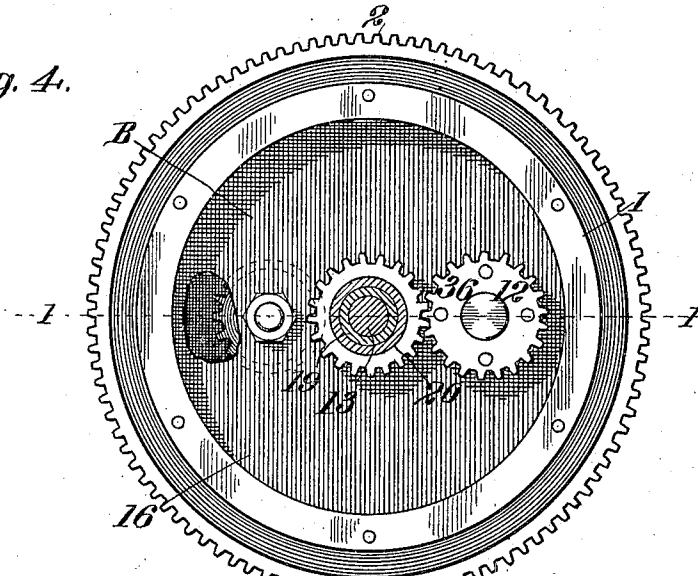


Fig. 6.

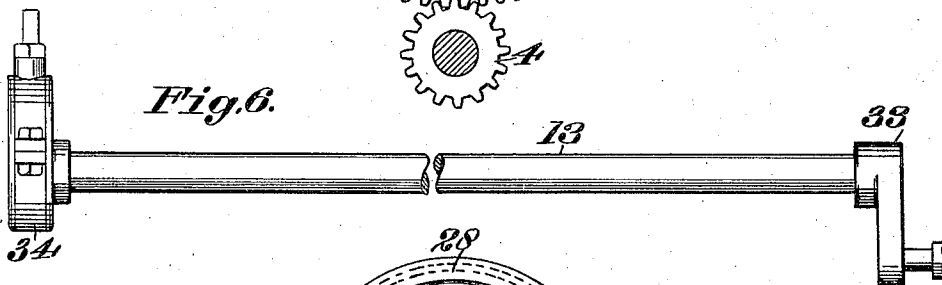
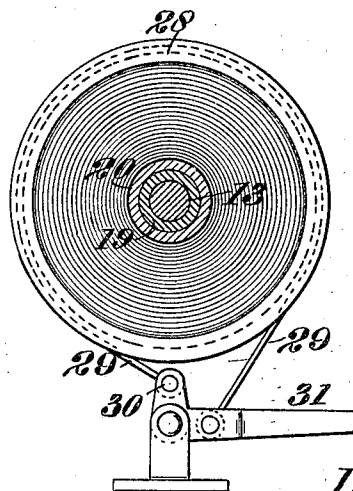


Fig. 5.



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# UNITED STATES PATENT OFFICE.

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## VARIABLE-SPEED-TRANSMITTING MECHANISM.

Application filed June 2, 1921. Serial No. 474,462.

*To all whom it may concern:*

Be it known that I, HERBERT E. TWOMLEY, a citizen of the United States, residing at Riverside, in the county of Riverside and State of California, have invented certain new and useful Improvements in Variable-Speed-Transmitting Mechanism, of which the following is a specification.

The hereinafter described invention relates to mechanism whereby variable speed may be transmitted at will to power driven actuating means, and whereby a plurality of said mechanisms may be actuated or driven simultaneously at variable rates of speed, or actuated in variable timed relation, the object of the invention being the production of a compact form of variable speed transmission mechanism whereby a plurality of speed reductions, or a plurality of timed movements may be obtained from a common source of power for the driving simultaneously of a plurality of mechanisms to be actuated from such common source of power, the variable speed transmission mechanism being of such a type as to permit of a plurality of speed reductions, or a plurality of timed operations to be transmitted to mechanisms contained within a single machine where a varied or plurality of mechanical movements are required to be operated either at different speeds, or at different timed operations, such as the operating of cams, gears, eccentrics, cranks and similar actuating parts for power mechanism.

To comprehend the invention, reference should be had to the accompanying drawings, wherein:—

Figure 1 is a longitudinal sectional view taken on line 1—1, Figure 4 of the drawings, disclosing the shaft for supporting the variable speed transmitting mechanism, the drive casing or drum keyed thereto, means within the casing or drum for transmitting variable speeds or movements from the drive casing or drum, the concentric hubs of the respective driven gears within the casing or drum and loosely mounted relative to the supporting shaft, and the means for throwing or placing the respective driven gears into or out of operating relation relative to the drive casing or drum, the drive casing or drum being illustrated in the present case as sub-divided centrally into two compartments by means of a partition wall or web.

Figure 2 is a diagrammatic plan view of

the operating gears located in one compartment of the drive casing or drum, said view illustrating the ratios of the respective gears.

Figure 3 is a view similar to Figure 2 disclosing the relative ratio of the operating gears situated in the opposite compartment of the casing or drum to that containing the gears disclosed by Figure 2 of the drawings.

Figure 4 is a vertical sectional view taken on the irregular line 4—4, Figure 1 of the drawings, and viewed in the direction of the arrow.

Figure 5 is a vertical sectional view taken on the line 5—5, Figure 1 of the drawings, and viewed in the direction of the arrow, said view illustrating one of the brake means employed in connection with the variable speed transmitting mechanism, and

Figure 6 is a view of the supporting shaft with the supporting members removed therefrom.

In the drawings, the numeral 1 is used to designate an enclosed casing, shell or drum, to the periphery of which is secured a gear ring 2. Power is transmitted for imparting constant rotation to the casing, shell or drum 1 from any suitable form of power means 3 through the medium of a pinion 4 thereof intermeshing with the gear ring 2 of the casing, shell or drum 1, so that the said casing, shell or drum constitutes the drive member for the variable speed transmitting mechanism.

Within the casing, shell or drum 1 are contained the gears 5, 6, 7 and 8 situated in the present case in the compartment A thereof, and also the gears 9, 10, 11 and 12, which are situated in the compartment B of the casing, shell or drum 1. Through the casing, shell or drum 1 is extended a supporting shaft 13, which is locked thereto by means of the key 14 engaging the hub 15 of the web or partition 16, which divides the interior of the casing, shell or drum into the compartments A and B.

The gear 8 is provided with an extended hub 17 loosely mounted on one end portion of the shaft 13, and the gear 7 is provided with an extended hub 18 which surrounds and is loosely mounted on the hub 17 of the gear 8. From the gear 9 is extended the hub 19 which is loosely mounted on the opposite end portion of the shaft 13, and from the gear 10 is extended a hub 20 which sur-

rounds and is loosely mounted on the hub 19 of the gear 9. The hub 17 of the gear 8 carries a transmitting gear 21 and a brake drum 22, while the hub 18 of the gear 7 carries a transmitting gear 23 and a brake drum 24. To the hub 19 of the gear 9 is secured the speed transmitting gear 25 and the brake drum 26; while to the hub 20 of the gear 10 is secured the speed transmitting gear 27 and the brake drum 28. Each brake drum is adapted to be locked or held against movement or rotation by means of a brake band 29, one end of which is attached to a fixed support 30, while its opposite end is attached to a brake actuating lever 31, Figure 5 of the drawings.

The supporting shaft 13 which sustains the various working parts of the speed transmitting mechanism works within suitable bearings 32, and preferably to one end of the said shaft is attached a crank 33, while the opposite end thereof carries an eccentric 34. By thus providing a crank and an eccentric at the respective ends of the shaft 13, it is possible to utilize the constant driven speed of the shaft for actuating movable parts of power mechanism at timed speed of operation, whereby the rotation of the drum 1 is utilized for the actuating at different rates of speed, or rather at different timed movement independently operated pieces of mechanism or machinery.

The gears 5 and 6 are pinned together and rotate around a stud 35 which holds the same to the web or partition wall 16 of the casing, shell or drum, while the gears 11 and 12 are pinned together and mounted for free rotation on a stud 36 which holds the same to the said partition wall or web 16, and in the inferior compartment thereof opposing the compartment in which the gears 5 and 6 are mounted. The intermeshing gears 5-7, 6-8 and the companion intermeshing gears 9-11 and 10-12 are each of a different ratio, so that rotation transmitted to gears 7-8 will be at a different speed, and the rotation transmitted from gears 11-12 to the intermeshing gears 9-10 respectively will be at a different rate of speed, and the rate of speed at which the gears 9-10 are driven will be at a rate different from that at which the gears 7-8 are driven respectively.

It will be understood that the hub 37 of the casing, shell or drum 1 revolves around the hub extensions 18 and 20 of the gears 7 and 10 respectively, and as the gears 5-6 and 11-12 revolve with the drive casing, shell or drum 1, and as they mesh respectively with the gears 7-8 and 9-10, the said gears will be caused to revolve with the respective gears meshing therewith and carried by the drive casing, shell or drum 1, and as the teeth ratio of the respective gears differ, the speed at which the gears 7, 8, 9 and 10 are driven will respectively be varied.

It will be understood that when the brake drums secured to and controlling the hubs 17, 18, 19 and 20 of the gears 8, 7, 9 and 10 respectively are free all of the gears contained within the casing, shell or drum 1 revolve as idle gears, and no drive power is imparted or transmitted to the gears on the respective hubs for the operating of power mechanism, although power will be transmitted, in the present case from the shaft 13 to suitable mechanisms to be operated through the medium of the crank and eccentric carried by said shaft, and which is a continuously rotating shaft. Of course instead of a crank and an eccentric being united to said shaft for operating independent pieces of mechanism, the same result may be attained by the substitution of gears for the crank and the eccentric, the gear ratio of the said gears being different.

As the shaft 13 is a continuously driven one from the casing shell or drum 1, and carries affixed thereto two power transmitting pieces, as for instance the crank and eccentric, it is apparent that during the continuous movement of the shaft there is transmitted power to two different pieces of mechanism which may be operated in timed relation or driven at different rates of speed depending upon the character of the power transmitting means held to the shaft.

Treating these means as two independent means for actuating two separated pieces of power mechanism, the form of variable power transmitting mechanism shown and described herein is capable of simultaneously operating four independent pieces of power mechanism, two pieces being thrown into action by the transmitting means secured to the shaft 13, and two by means of two of the gears secured to the respective hubs projected outside of the casing, shell or drum 1.

In operation, assuming the brake drums 22 and 26 to be locked against movement by their brake bands, the hubs 17 and 19 will be held against rotation with the result that the gears 6 and 11 located respectively within the compartments A and B of the drive casing, shell, or drum 1 will work respectively over the held gears 8 and 9, which, so to speak, act at such time as fixed racks; the gears 6 and 11 causing by their intermeshing engagement with the fixed gears 8 and 9 to transmit power from the drive casing, shell or drum 1 respectively to the gears 5 and 12 pinned thereto, and as these gears intermesh respectively with the gears 7 and 10 located respectively within the compartments A and B of the casing, shell or drum 1, power will be transmitted to the sleeves 18 and 20 for driving respectively the gears 23 and 27 for actuating simultaneously power means associated therewith. If the brake drums 22 and 26 are released and the brake drums 24 and 28 are held

locked against movement, the hubs 18 and 20 respectively will be held against rotation, with the result that gears 5 and 12 will work over the held gears 7 and 10 respectively, as racks, and transmit power to the gears 6 and 11 respectively to the intermeshing gears 8 and 9 for causing active rotary movement to be transmitted respectively to the hubs 17 and 19 for operatively driving respectively the power transmitting gears 21 and 25.

As the respective gears of the transmitting mechanism differ as to ratio, it is apparent that when any two power gears of the series of concentric hubs have power transmitted thereto from the drive casing, shell or drum 1, they act in conjunction with the drive means carried by the shaft 13 for actuating four independent pieces of mechanism, either for driving the same at different rates of speed or at various timed movement.

By the described mechanism, a plurality of power driven means is thrown into operation simultaneously for the power driving or operating of independent pieces of mechanism at different rates of speed or in different timed relation.

While preference is given to the subdividing interiorly of the casing, shell or drum 1 into serrated compartments, and embodying in each compartment a plurality of independently controlled drive gear means, such is not essential, inasmuch as all of the variable speed transmitting means may be embodied within a single compartment; nor is it to be understood that the invention is limited in any manner whatsoever to the specific number of variable power transmitting means shown and described, inasmuch as the same may be increased or decreased in number as desired. The essential feature of the invention is the providing of means whereby the power of the drive member may be transmitted in such a manner as to simultaneously operate a plurality of power transmitting means for the actuation of a plurality of machine elements or independent power mechanisms driven either at different rates of speed or in various timed relation, and I do not wish to be understood as confining or limiting the invention to the specific form of details of the working parts, as herein shown and described, but on the contrary wish to be understood as claiming the invention as broadly as the state of the art will warrant.

It is apparent that in place of transmitting gears 21, 23, 27 and 29 secured to the concentric hubs 17, 18, 19 and 20 respectively, cams, eccentrics and cranks may be employed for transmitting the power of the drive member to the mechanical parts to be placed into operation thereby, there being no intent to restrict the means employed in connection

with the concentric hubs for transmitting power therefrom to gears.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:—

1. In a variable speed power transmission mechanism, the combination with a supporting shaft, of a power driven drive drum keyed thereto, a plurality of transmission gears within and carried by the drive drum, said gears being arranged in pairs with the gears forming each pair keyed one to the other and normally working as idle gears, a plurality of concentric hubs loosely mounted on the supporting shaft and extended within the drum, a gear secured to the inner end of each hub and one in mesh respectively with one of the gears of each pair of gears secured to and carried by the drive drum, said intermeshing gears having a different gear ratio, an actuating gear secured to each hub at a point removed from the drive drum, and means associated with each concentric hub whereby one hub may be held locked against movement relative to the other, so that its inner gear causes the gear within the drum intermeshing therewith to act as the means for causing power of the drive drum to be transmitted for actuating the companion meshing gear to apply power to the loose concentric hub associated with the locked hub.

2. A variable speed power transmission mechanism, comprising in combination a drive member, a plurality of gears held together of different gear ratio secured to and carried by the drive member as normal idle gears, a plurality of transmitting gears in mesh with said idle gears, concentric hubs extending from said transmitting gears and each carrying a power actuating gear, a supporting shaft on which said hubs are loosely mounted and to which the drive member is keyed, brake mechanism for holding one hub and its gear locked against rotation while leaving its associate hub and gears free for movement, and means secured to and carried by the supporting shaft for transmitting movement to mechanism to be driven independent of the mechanism to be driven by the actuating gears of the concentric hubs.

3. A power transmission mechanism adapted for simultaneously driving a plurality of independent and separated mechanisms either at different rates of speed or with different timed movement, the same comprising a driving member, pairs of connected normally idle power transmitting gears carried thereby, intermediate gears in mesh with the transmitting gears of the drive member, hub extensions projected from the intermediate gears, devices for holding one of said hubs locked against movement while allowing the other to rotate under

power transmitted thereto from the drive member through the medium of the intermeshing gears, one of which is held against rotation by the locked hub, a supporting shaft to which the drive member is keyed and on which the hub extensions are loosely supported, and means actuated by the said shaft and by the non-locked hub for imparting power to and actuating mechanism to be driven at different rates of speed or in varying timed relation.

4. A transmission mechanism adapted for imparting variable movements simultaneously to a plurality of independent mechanical units to be power driven, comprising in combination a drive member, a supporting shaft therefor, a plurality of pairs of united associated gears, each pair loosely mounted on a stud secured to the drive member, a plurality of concentric hubs mounted on the shaft for independent rotary movement, a transmission gear secured to the inner end of each hub held in meshed relation with one of the loosely mounted gears of each pair, means for locking either of the concentric hubs at will against rotation while leaving the companion hub free to rotate, whereby the gear of the locked hub serves as a rack to cause the gear meshing therewith to transmit through its companion gear to the gear of the loose hub power of the drive member, means carried by each hub for transmitting the power applied thereto when not held against movement to mechanism to be driven, and means secured to the supporting shaft for independently transmitting its movement to mechanism to be driven.

5. The combination with a shaft, of means carried thereby for transmitting its movement to mechanism to be driven, a drive member keyed to said shaft, a plurality of pairs of concentric hubs loosely mounted on each end portion of the shaft for independent rotation, means secured to each of said hubs for transmitting its motion when power driven to actuate independent mechanism, intergeared connections between the drive member and the concentric hubs whereby a plurality of said hubs may be

simultaneously power driven at variable speeds relatively to one another, and means associated with each of the hubs for selectively locking either or a plurality thereof against rotation for the purposes described.

6. A transmission mechanism adapted to impart variable speed or variable time movements simultaneously to a plurality of mechanical means to be power driven, the same comprising a shaft, a power driven drive drum keyed thereto and having its interior divided into a plurality of compartments, a plurality of pairs of united transmission gears loosely mounted in each of said compartments, a plurality of pairs of driven gears in said compartments in mesh respectively with the transmission gears of said pairs held therein, a hub extended from each driven gear and concentrically mounted in pairs at opposite sides of the drum for independent rotation about the supporting shaft, a power transmitting gear secured to each of said hubs exteriorly of the drum, and means associated with the respective hubs exteriorly of the drum for selectively locking one or a plurality of the hubs against movement, whereby the power of the drive shaft is transmitted through the intermeshing gears to the non-held hubs for the purpose described.

7. In a variable speed transmission mechanism, the combination with a supporting shaft, a drum rotatable thereon, means for driving the drum, a plurality of pairs of pinion gears rotatably mounted within the drum, the gears of each pair being of different diameter and united to rotate in unison, a plurality of concentric hubs rotatably mounted on said shaft and arranged in pairs to extend one pair from opposite sides of the drum, a gear on the inner end of the hubs of each pair, said gears being of different diameter adapted one to mesh with a gear of said pinion gears, and a gear and brake band pulley associated with each hub exteriorly of the drum, said gears differing in diameter.

In testimony whereof I have signed my name to this specification.

HERBERT E. TWOMLEY.