No. 829,068. PATENTED AUG. 21, 1906.

W. R. FOX.

CHANGEABLE GEAR.

APPLICATION FILED OCT. 24, 1904.

3 SHEETS—SHEET 1.

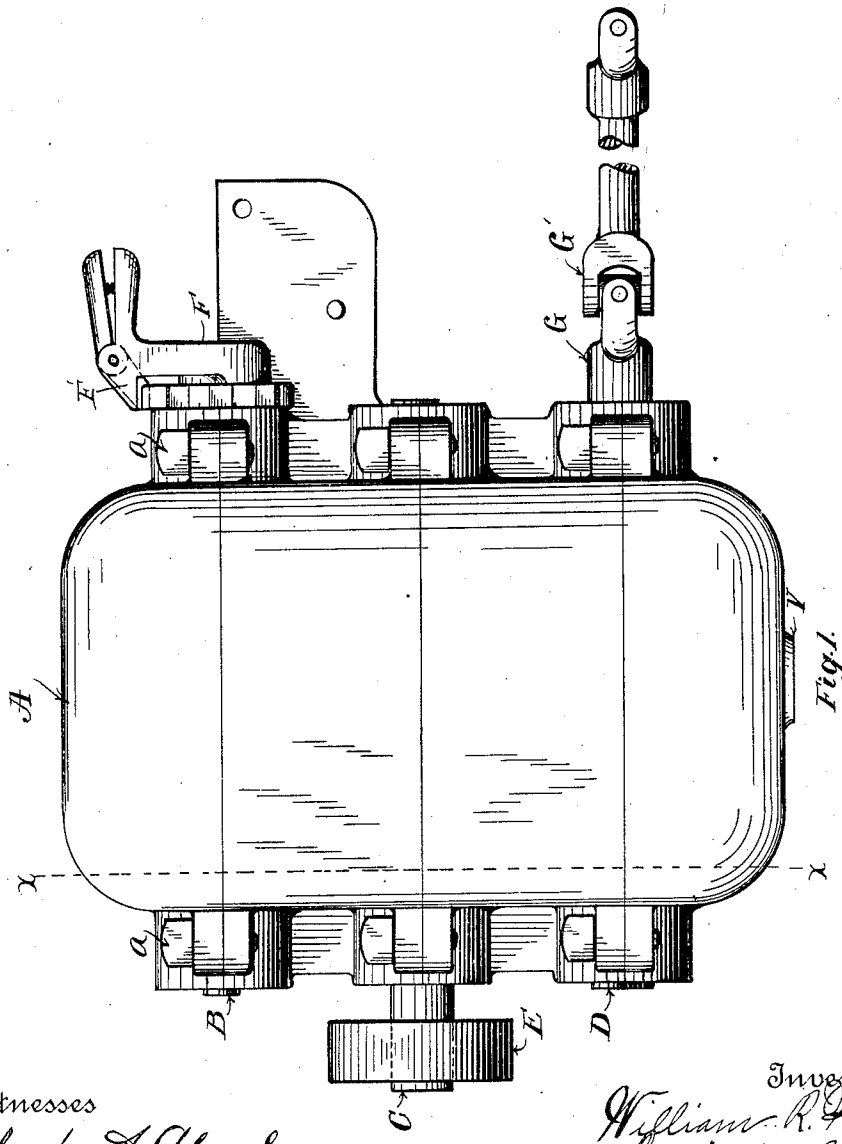

Fig. 1.

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3 SHEETS—SHEET 2.

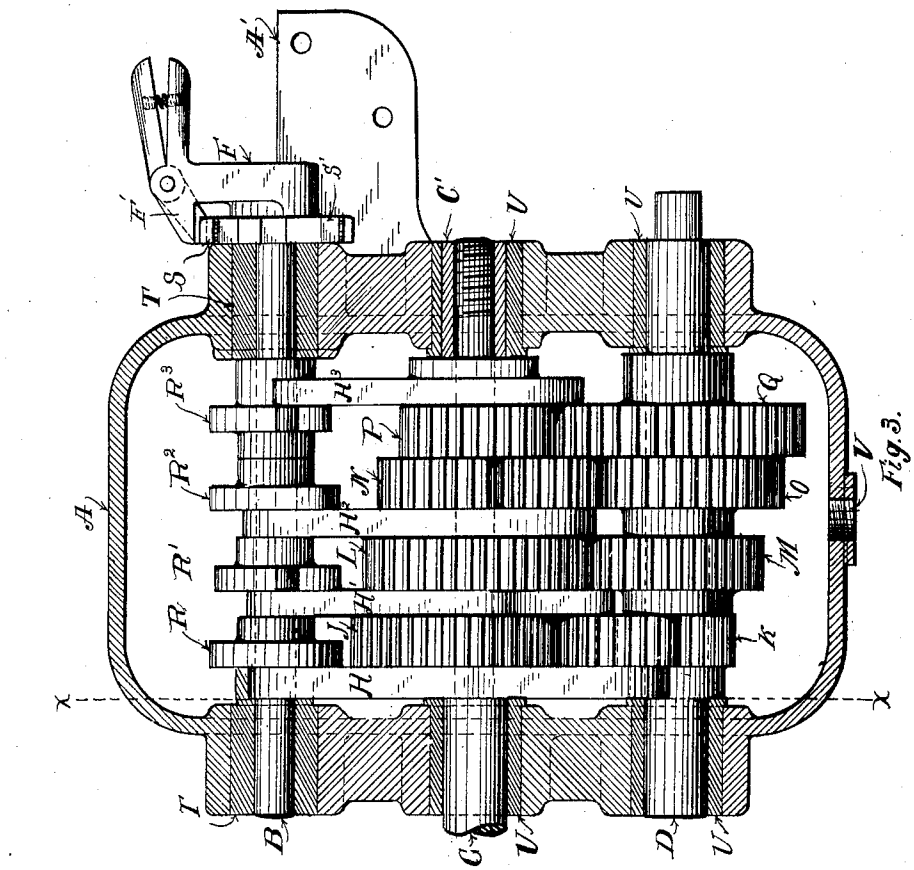

Fig. 3.

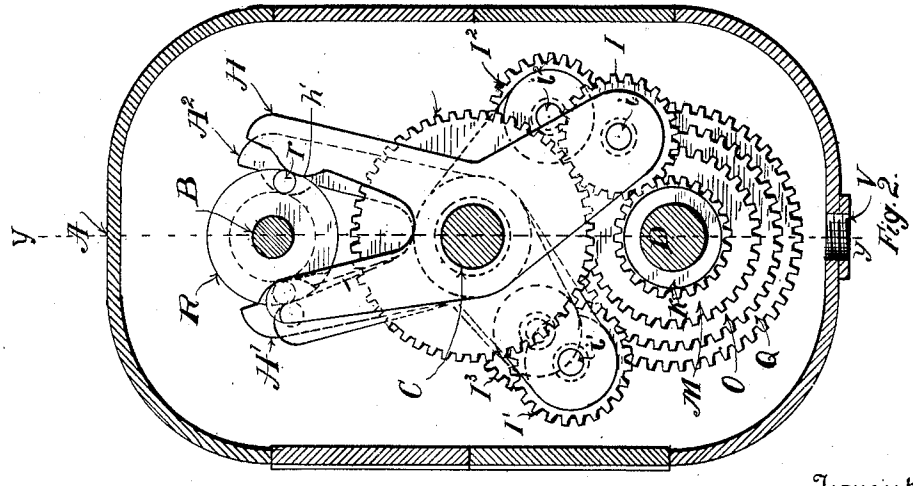

Fig. 2.

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3 SHEETS—SHEET 3.

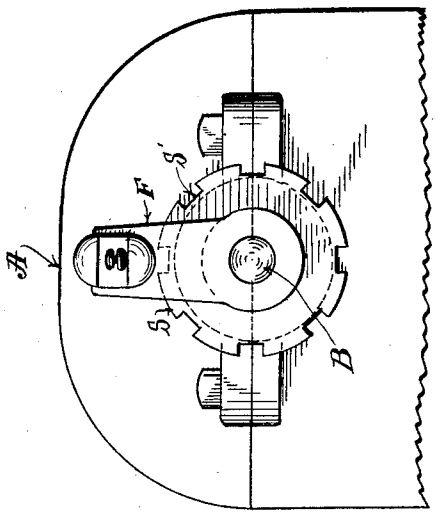

Fig. 6.

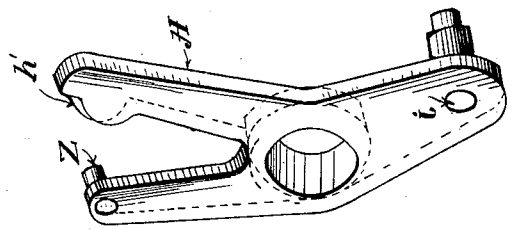

Fig. 5.

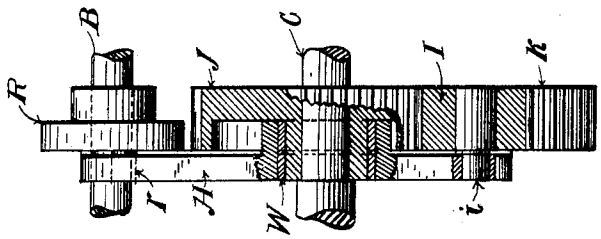

Fig. 4.

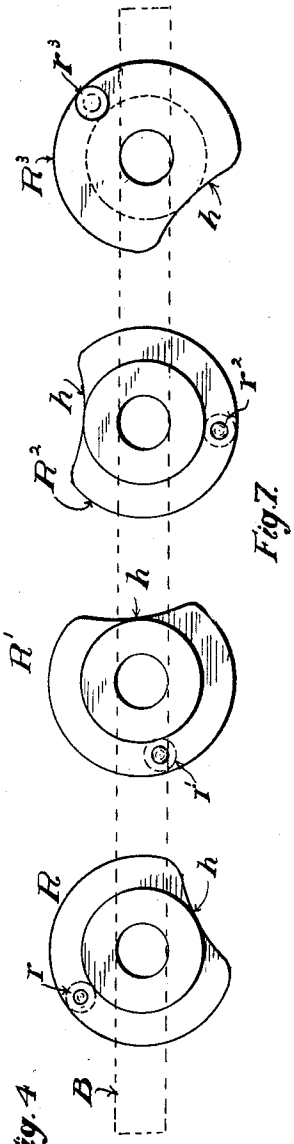

Fig. 7.

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UNITED STATES PATENT OFFICE.

WILLIAM R. FOX, OF GRAND RAPIDS, MICHIGAN.

CHANGEABLE GEAR.

No. 829,068. Specification of Letters Patent. Patented Aug. 21, 1906.

Application filed October 24, 1904. Serial No. 229,793.

To all whom it may concern:

Be it known that I, WILLIAM R. FOX, a citizen of the United States, residing at the city of Grand Rapids, county of Kent, State of Michigan, have invented certain new and useful Improvements in Changeable Gears, of which the following is a specification.

This invention relates to improvements in changeable gears.

The objects of the invention are, first, to provide a changeable gear which contains the minimum number of parts; second, to provide a compact, effective, and powerful changeable gear which can be effectively used on lathes, milling-machines, and similar tools, as well as in automobile construction or wherever changeable gears may be desired, and which shall be readily adjustable.

Further objects pertaining to the details of construction will definitely appear from the detailed description to follow.

I accomplish the objects of my invention by the devices and means described in the following specification, the invention being clearly defined, and pointed out in the claims.

A structure embodying the features of my invention is clearly illustrated in the accompanying drawings, forming a part of this specification, in which—

Figure 1 is an elevation view of the structure suitably incased. Fig. 2 is a sectional view taken on lines X X of Figs. 1 and 3 looking toward the right of such figures. Fig. 3 is a vertical longitudinal sectional view taken on line Y Y of Fig. 2, the gears being shown in full lines. Fig. 4 is a detail view, partly in section, of one of the series or trains of gears constituting the changeable mechanism. Fig. 5 is an enlarged detail perspective view of one of the levers carrying the intermeshing connecting-wheels of one of the gearings of the series. Fig. 6 is a detail elevation of the adjusting-lever for rocking the cam-shaft which controls the several levers which throw the different gearings of the series into or out of gear. Fig. 7 is a detail view of the different cams, showing their relations to each other on the cam-shaft B, there indicated by dotted lines in the diagram.

In the drawings similar letters of reference refer to similar parts throughout the several views.

The casing A is supported by suitable brackets or otherwise to the frame of the machine to which it is applied, or it may be secured to a suitable base by attachment at V. The casing A has suitable journal-bearings at each end, which receive the journals of the cam-shaft B and of the driving-shaft C and of the driven shaft D of the mechanism. On the outer end of the driving-shaft C is a pulley E, and on the driven shaft D is a suitable tumbling-rod G G′ for transmitting power therefrom. Of course any effective means of transmitting power, as a pulley or gear, could be employed. On the shaft C are driving-gears J L N P, varying in size, J being the largest and P being the smallest, the others being of intermediate size. On the driven shaft D are gears K M O Q, which are in alinement with the gears J L N P, respectively, so that the gear J will through connections drive the gear K; the gear L, the gear M; the gear N, the gear O, and the gear P the gear Q. On the shaft C are supported a series of levers H H′ H^2 H^3, each in juxtaposition to the successive gears J L N P. On the lower end of each of these levers is a journal-pin *i*, on which is mounted a gear, as I I′ I^2 I^3 on the levers H H′ H^2 H^3, respectively. Two of the levers H and H^3 extend to one side and the other two levers H′ and H^2 to the opposite side of the said shafts and gears. The upper ends of these levers are forked and embrace cams R R′ R^2 R^3, respectively. These cams each have a cylindrical hub and are mounted upon the cam-shaft B, which is parallel with the shafts C and D. Each of the cams is provided with a depression *h*, and on the opposite side a pin *r r′ r² r³* is on the face of each cam. Pins Z on the lever H contact with the cams, and a projection *h′* is on the opposite fork of the lever and travels on the hub of the cam. These projections *h′* contact with pins *r r′ r² r³* to make the actuation of the levers positive, so that when the cams are rotated they act on the levers successively, holding them so that the gears I I′ I^2 I^3 are out of gear respectively, except when the pin Z of each lever enters the depression on the cam, and the lever is thrown over by the contact of the roller-pins *r r′ r² r³* with the projection *h′* of the lever. The position of the cam-shaft B is controlled by the lever or arm F, which has a spring-catch F′, adapted to engage notches S′ on a notched disk S, so that by withdrawing the spring-catch and adjusting the lever to the different notches S a different lever H, H′, H^2, or H^3 will be acted upon and its corresponding gear thrown into mesh with the driving-gear and the driven gear corresponding thereto, so that by a sim-

ple manipulation of this lever any one of the four different speeds constituting the capacity of this device can be brought into operation.

It is obvious that this device is adapted for producing a structure in which but two different speeds are required. By increasing the number of cams and the number of gears the variations in the speed can be indefinitely increased, depending on the length of the shaft and the arrangement of the cams thereon. I have shown a structure made very compact, the hubs on the levers extending into depressions in the sides of the gear and the levers being made comparatively thin, thereby securing a very compact device. However, the principle is applicable where this expedient for securing compactness is not adopted, and I wish to claim in detail the specific construction as well as the broad features of the invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a changeable-speed gear, the combination of the casing or support A; a driving-shaft C; a driven shaft D; a cam-shaft B parallel with said shafts; a series of gears of various sizes on the driving-shaft C; corresponding gears alined therewith on the driven shaft D, and of various proportions to the gears on the driving-shaft; cams on the said cam-shaft corresponding to each of the said gears, having suitable hubs, the said cams having depressions out of alinement with each other, and each of said cams having a pin in its face, diametrically opposite the depression thereof; forked levers H H′ H″ H‴ with suitable hubs fulcrumed on the driving-shaft, one fork of the lever being provided with a pin Z on the periphery of its corresponding cam, and the other fork being provided with a projection h' for contacting with the pin on the face of the cam, to insure the actuation of the lever, as indicated; gears I I′ I″ I‴ journaled on corresponding pins on the opposite ends of the said levers, meshing with the gears on the driving-shaft and adapted to be carried by said levers into engagement with the gears on the driven shaft; a lever with an adjusting-catch secured to the said cam-shaft whereby the same can be adjusted in various positions, for throwing the levers to throw the successive gears into and out of engagement, whereby the speed of the driven shaft can be changed for the purpose specified.

2. In a changeable-speed gear, the combination of the casing or support A; a driving-shaft C; a driven shaft D; a cam-shaft B parallel with said shafts; a series of gears on the driving-shaft C; corresponding gears alined therewith on the driven shaft D; cams on the said cam-shaft corresponding to each of the said gears, having suitable hubs, the said cams having depressions out of alinement with each other, and each of said cams having a pin in its face, diametrically opposite the depressions thereof; forked levers extending to each of the gears on the driving-shaft C fulcrumed on said driving-shaft, the forks embracing the corresponding cams on the cam-shaft, one fork resting on the hub and the other being provided with a projecting pin to drop into the depression on the periphery of the cam; and a pin arranged on the face of each cam, to actuate the levers; gears journaled on pins on the opposite ends of the said levers, meshing with the gears on the driving-shaft and adapted to be carried by said levers into engagement with the gears on the driven shaft; a lever with an adjusting-catch secured to the said cam-shaft whereby the same can be adjusted in various positions, for throwing the levers to throw the successive gears into and out of engagement, whereby the speed of the driven shaft can be changed, for the purpose specified.

3. In a changeable gear, the combination of the casing or support A; a driving-shaft C; a driven shaft D; a cam-shaft parallel with said shafts; a series of gears on the driving-shaft C; corresponding gears of various proportions alined therewith on the driven shaft D; cams on the said cam-shaft corresponding to each of the said gears, having suitable hubs, the said cams having depressions out of alinement with each other, and each of said cams having a pin in its face, diametrically opposite the depression thereof; gears journaled on pins on the opposite ends of the said levers, meshing with the gears on the driving-shaft and adapted to be carried by said levers into engagement with the gears on the driven shaft; and adjusting means for the cam-shaft, for the purpose specified.

4. In a changeable gear, the combination of the casing or support A; a driving-shaft C; a driven shaft D; a cam-shaft B parallel with said shafts; a series of gears on the driving-shaft C; corresponding gears of various proportions alined therewith on the driven shaft D; cams on the said cam-shaft corresponding to each of the said gears, having suitable hubs, the said cams having depressions out of alinement with each other, and each of said cams having a pin in its face, diametrically opposite the depression thereof; forked levers corresponding to each of the gears on the driving-shaft C, fulcrumed on said shaft, the forks embracing the corresponding cams on the cam-shaft, whereby they will be actutated to connect the corresponding gears successively; gears journaled on pins on the opposite ends of the said levers, meshing with the gears on the driving-shaft and adapted to be carried by said levers into engagement with the gears on the driven shaft; and means for adjusting the cam-shaft, for the purpose specified.

5. In a changeable-gear mechanism, the combination with a suitable support of a driving-shaft; a driven shaft with series of corresponding gears, the gears of the series being differently proportioned to each other; a lever with intermeshing gears for coupling the corresponding gears of the series together, and a shaft with a series of cams thereon for actuating the said levers successively, whereby the speed of the driving-shaft can be varied, for the purpose specified.

6. In a changeable-gear mechanism, the combination of a suitable casing or support; a driving-shaft and a driven shaft, with series of corresponding gears of different diameters; suitable levers with intermeshing gears carried thereby; a shaft with connections timed to actuate the levers successively whereby the gear mechanism is varied by adjustment of the shaft, and its connections, for the purpose specified.

7. In a changeable-gear mechanism, the combination of a coupling-gear with a forked lever, one of the prongs of which is provided with a laterally-projecting pin, and the other of which is provided with a projecting boss; a cam with a depression in its periphery, to receive the laterally-projecting pin, and a pin in its face to contact with the lug of the opposite fork, for the purpose specified.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

WILLIAM R. FOX.

Witnesses:

CHARLES B. HAMILTON,

BEATRICE MAHONY.