No. 827,175.

PATENTED JULY 31, 1906.

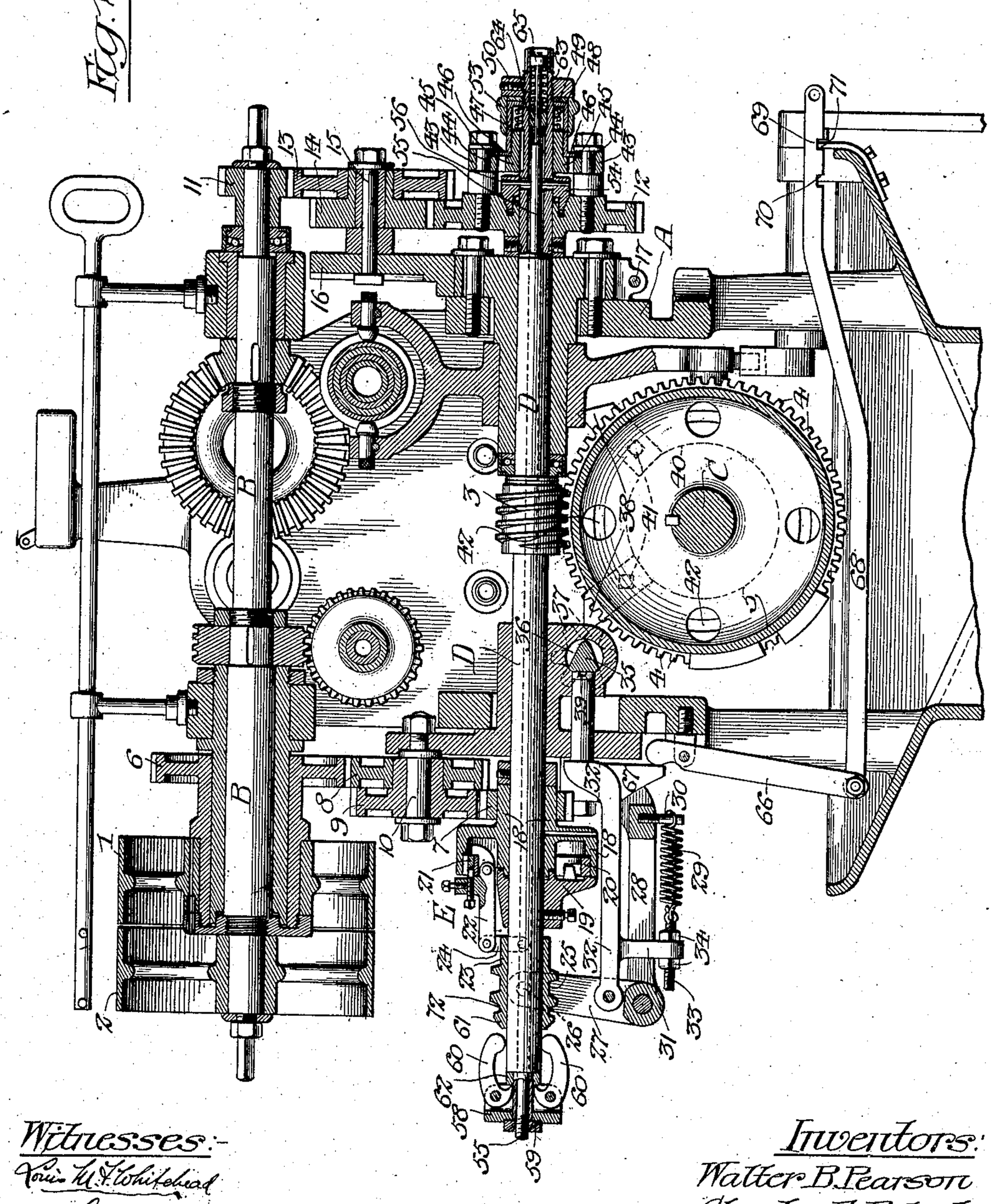
W. B. PEARSON & C. E. ROBERTS.

CHANGE SPEED GEARING.

APPLICATION FILED OCT. 18, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 3.

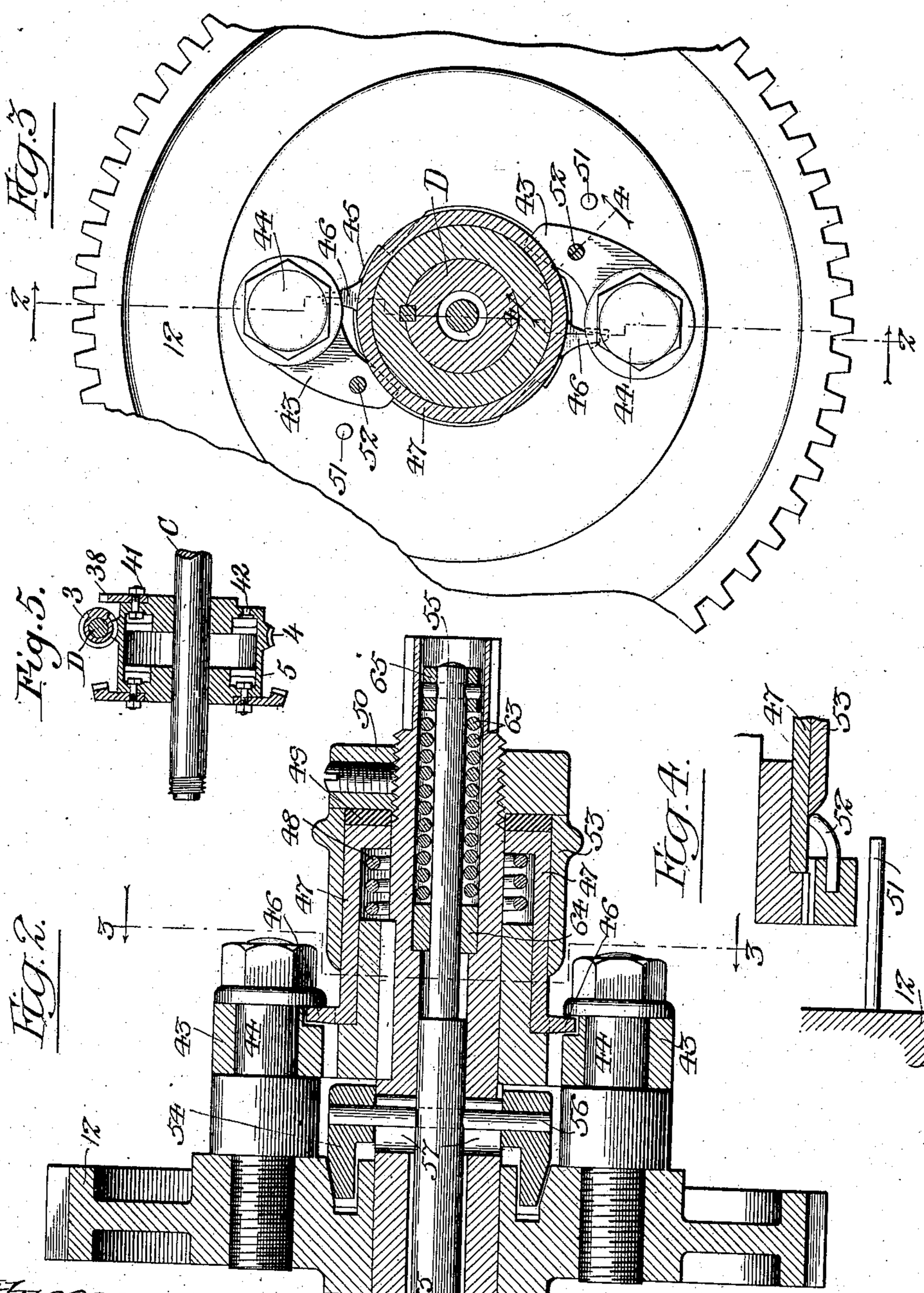

Fig. 5.

Fig. 2.

Fig. 4.

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UNITED STATES PATENT OFFICE.

WALTER B. PEARSON, OF DETROIT, MICHIGAN, AND CHARLES E. ROBERTS, OF OAK PARK, ILLINOIS, ASSIGNORS TO STANDARD SCREW COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF NEW JERSEY.

CHANGE-SPEED GEARING.

No. 827,175. Specification of Letters Patent. Patented July 31, 1906.

Original application filed May 9, 1902, Serial No. 106,620. Divided and this application filed October 18, 1904. Serial No. 229,033.

To all whom it may concern:

Be it known that we, WALTER B. PEARSON, a resident of Detroit, Wayne county, Michigan, and CHARLES E. ROBERTS, a resident of Oak Park, Cook county, Illinois, citizens of the United States, have invented certain new and useful Improvements in Change-Speed Gearing, of which the following is a specification.

This invention relates to change-speed gearing.

This application is filed as a division of an application heretofore filed by us in the Patent Office on May 9, 1902, Serial No. 106,620, in which a change-speed gearing of our invention is shown and described, but is not separately claimed.

A primary object of the invention is to provide a driving-gear for imparting rotation to a shaft, as the cam-shaft of a machine for making metal screws from a power-shaft at relatively fast and slow speeds.

A change-speed gearing of our invention consists of the various features, combinations of features, and details of construction hereinafter described and claimed.

In the accompanying drawings, in which a change-speed gearing of our invention is fully illustrated, Figure 1 is a transverse vertical sectional view of the screw-machine which forms the subject-matter of our main application, Serial No. 106,620, showing a change-speed gearing of our invention applied for driving the cam-shaft of said machine; and Figs. 2, 3, and 4 are enlarged detail views of certain parts shown in Fig. 1.

In the drawings, a change-speed gearing of our invention is shown as applied for driving the cam-shaft of a machine for making metal screws, fully shown and described in said application, Serial No. 106,620, of which the present application is a division and to which reference is made as to features herein shown, but not fully described.

Referring now to the drawings, A designates the frame of the machine, revolubly mounted in which is a shaft C, to which rotation is imparted from a shaft B, mounted in suitable bearings in the machine-frame and which is driven from any suitable source of power by means of a belt (not shown) applied to fast and loose pulleys 1 and 2 thereon.

As shown, the driving connection between the shafts B and C comprises a shaft D, mounted in suitable bearings in the machine-frame intermediate said shafts B and C, and a worm 3, on which engages a worm-gear 4 on a drum 5, secured to the shaft C. The shaft D is driven from the shaft B by means of trains of gears adapted to rotate said shaft D at relatively fast and slow speeds. The fast-driving train of gears comprises relatively large and small gears 6 and 7, secured to the shafts B and D, respectively, and connected intermediate gears or pinions 8 and 9, revolubly mounted on a stud 10, secured in the machine-frame, which respectively mesh with the gears 6 and 7. The slow-driving train of gears comprises relatively small and large gears 11 and 12, secured to the shafts B and D, respectively, and connected intermediate gears or pinions 13 and 14, which are revolubly mounted on a stud 15 and which respectively mesh with the gears 11 and 12 on the shafts B and D. In the preferable construction shown the stud 15 is secured in a swinging arm 16, adjustably mounted on a suitable bearing on the machine-frame and adapted to be secured in any desired angular adjustment thereon by a clamping-bolt 17. Provision is thus made for changing the gears 13 and 14 to vary the slow speed of the shaft D. To provide for driving said shaft D at different rates of speed, the gears 7 and 12 are normally loose on said shaft and are adapted to be secured thereto by suitable means, when desired. As shown, the gear 7 is adapted to be secured to said shaft D by means of a suitable friction-clutch. The clutch shown in the drawings and designated as a whole by the reference-letter E comprises a section 18, mounted so as to rotate freely on said shaft D, a section 19, secured to said shaft, a split friction-ring 20, adapted to engage a suitable seat or bearing on the loose clutch member 18, a wedge 21, for expanding said friction-ring into engagement with its seat or bearing on said loose clutch member 18, a lever 22, pivoted upon the clutch member 19, a projection on said lever, preferably consisting of a screw threaded through a lug on said lever, adapted for forcing the wedge 21 between the ends of the split friction-ring 20 to expand said friction-ring into en-

gagement with its seat on said loose clutch member 18 when the lever 22 is moved pivotally in the proper direction, and a sleeve 23, longitudinally movable on the shaft D, to which the end of the lever 22 is connected by means of a link 24. Movement of the sleeve 23 longitudinally of said shaft D will thus impart pivotal movement to the lever 22 to effect engagement and disengagement of the friction-ring 20 with its seat or bearing on the loose clutch member 18 in an obvious manner. The gear 7 is rigidly secured to the loose clutch member 18 and will thus be locked to or released from the shaft D by the operation of said clutch E.

A spring applied to the clutch E operates to maintain the same normally locked, and thus to secure the gear 7 rigidly to the shaft D and to maintain the fast-driving train normally in operative engagement with said shaft. In the specific construction shown, said clutch is controlled in the following manner: Formed in the exterior surface of the sleeve 23 is a peripheral groove 25, which is engaged by pins 26, secured in the free ends of lever-arms 27, pivotally supported upon a bracket 28 on the machine-frame. The clutch E is maintained normally locked by a spring 29, the opposite ends of which are attached to a pin 30 in the bracket 28 and to a lug or projection 31 on a rod 32, one end of which is connected to the lever-arms 27 and the other end of which is fitted to and longitudinally movable in a suitable bearing in the machine-frame. In order to provide for regulating the tension of the spring 29, it is connected to the projection 31 by means of an eyebolt 33, to which nuts 34 are threaded on opposite sides of the projection 31. With this construction it is obvious that said spring 29 will maintain the clutch E normally locked and the fast-driving train normally in engagement with the shaft D.

The fast-driving train of gears is designed and adapted to be disengaged from the shaft D at desired predetermined intervals by suitable means. As shown, said means consist of what may be called a "triangular cam" 35 on a stub-shaft 36, revolubly mounted in a suitable bearing in the machine-frame. The cam 35 is located closely adjacent to the end of the rod 32, its position being such that when the side of said cam is parallel to the end of said rod said rod will be free to move inwardly under the influence of the spring 29 to lock the clutch E in the manner heretofore described. The dimensions of the cam 35 are such, however, that as said cam is rotated the corners thereof will come into contact with the ends of said rods 32 and will operate to move it outwardly against the force of the spring 29 to disengage the clutch E, thus disengaging the fast-driving train of gears from the shaft D. As shown, intermittent rotary movement is imparted to said cam in the following manner: Secured to the shaft 36, which carries the cam 35, is a star-wheel 37, the teeth of which are in the path of travel of projections 38 on the drum 5, secured to the shaft C, the relation of parts shown being such that each of said projections will rotate said star-wheel 37 through sixty degrees, or one-sixth ($\frac{1}{6}$) of a revolution. Starting with the cam in the initial position shown in Fig. 1 of the drawings, it is obvious that rotation of the star-wheel 37 under the influence of a projection 38 will rotate said cam sixty degrees and will bring a corner of said cam into engagement with the end of the rod 32, thereby disengaging the clutch E. To maintain the cam 35 in position with a corner thereof in contact with the rod 32, a notch 39 is formed in the end of said rod adapted to be engaged by the corners of said cam when in proper position. Subsequent actuations of said cam 35 by the projections 38 will operate in the manner described to effect alternate engagement and disengagements of the clutch E.

To provide for regulating the intermittent or step-by-step rotation of the star-wheel 37, and thus of the cam 35, the projections 38 on the drum 5 are formed separate from said drum and are adjustable circumferentially thereof. As shown, the inner ends of said projections 38 are fitted to a circular shoulder 40, formed on said drum, and said projections are secured to said drum by means of bolts 41, which extend through a T-slot 42, formed therein. With this construction it is obvious that the intervals and duration of engagement and disengagement of said clutch relatively to the rotation of the shaft C may be varied by properly adjusting the projections 38 on the drum 5.

The gear 12 of the slow-driving train of gears is connected to the shaft D by means of pawls 43, pivoted upon studs 44, secured in said gear, and which are adapted to engage the teeth of a ratchet-wheel 45, keyed or otherwise rigidly secured to the shaft D. As shown, the pawls 43 are adapted to be moved pivotally upon the studs 44 to effect engagement and disengagement thereof with the teeth of the ratchet-wheel 45 by means of teeth or projections 46 on a friction-ring 47, revolubly mounted on a hub or extension of said ratchet-wheel 45, which engage corresponding teeth or notches formed in the hubs of said pawls. As shown, also, frictional resistance to the rotation of the ring 47 is provided by means of a spring 48, inserted between the end of said ring and the adjacent face of the ratchet-wheel hub, which operates to force said ring outwardly into frictional engagement with a fiber washer 49, inserted between the outer end of said ring and a nut 50, threaded to the end of the shaft D. With this construction it is obvious that when the shaft D is rotating under the influ-

ence of the fast-driving train it will tend to rotate the friction ring or collar 47 faster than the gear 12 of the slow-driving train, and will thus throw the pawls 43 outwardly, so that they will not run over the teeth of the ratchet-wheel 45, and will thus prevent all noise due to this cause. When, however, the fast-driving train is disengaged from the shaft D, leaving said shaft free to rotate under the influence of the slow-driving train, the shaft D will very soon lose its momentum and will rotate at a slower rate of speed than the gear-wheel 12. When said shaft D rotates slower than the gear 12, the projections on the friction-ring 47 will operate to throw the pawls 43 inwardly into engagement with the teeth of the ratchet-wheel 45, thus causing said shaft D to rotate with said gear 12. Stop-pins 51 limit the outward movement of the pawls 43. Provision is also made for locking or securing the pawls 43 out of engagement with the ratchet-wheel 45 when for any reason this may be desired, as when for any reason it may be desired to turn the shaft D backward. As shown, said means consist of pins 52, secured in said pawls, which are adapted to be forced outwardly to effect permanent disengagement of said pawls from the teeth of the ratchet-wheel 45 by means of an inclined surface or wedge on a sleeve 53, which is fitted to and is longitudinally movable toward and from said pawls on the exterior surface of the friction-ring 47 as a bearing. The sleeve 53 is designed to be manually operated as occasion may arise.

It is found in practice that when the shaft D is released from the fast-driving train of gears under the influence of which it has been rotating its momentum causes it to make one or more revolutions at a higher rate of speed than the slow-driving train. To prevent this and to cause the speed of said shaft D to fall at once to that of the slow-driving train of gears, a brake is provided adapted to check the rotation of said shaft D as soon as it is released from the fast-driving train. In the preferable construction shown said brake consists of a ring 54, which is fitted to and is longitudinally movable on the shaft D toward and from the gear 12 and is provided with a tapered surface adapted to engage a correspondingly-tapered seat formd on said gear. Engagement and disengagement of said tapered ring 54 with its seat in the gear 12 is effected automatically by movement of the sleeve 23, which controls the clutch E in the following manner: The shaft D is hollow and extending through the same is a rod 55, to which the brake-ring 54 is secured by means of a pin 56, which passes through an elongated slot or opening 57 in said shaft D. Loosely fitted to a reduced portion of the shaft D at the opposite side of the machine is a ring 58, which bears against a nut 59, threaded to the rod 55. Pivoted upon said ring 58 are bell-crank levers 60, the long arms of which extend into close proximity to the sleeve 23 and are adapted to be forced outwardly by means of an inclined surface or wedge 61 on said sleeve as said sleeve is moved to disengage the clutch E. The opposite ends of the bell-crank levers 60 bear against a hardened thrust-ring 62, which abuts against a shoulder on the shaft D in such manner that as the bell-crank levers 60 are forced apart by the wedge 61 on the sleeve 23 they will exert a strong pressure against said thrust-ring 62, which will operate to force the ring 58 on the rod 55 outwardly, and thus to exert a strong pull on said rod, tending to draw the brake-ring 54 into engagement with its seat on the gear 12, checking the shaft D in the desired manner. The nut 59 affords convenient means for adjusting the strength of the engagement of the brake-ring 54. A spring 63, inserted between a collar 64, which bears against an interior shoulder on the shaft D and a ring 65, pinned to the end of the rod 55, operates to disengage the brake-ring 54 from its seat in the gear 12 as soon as the bell-crank levers 60 are released by the wedge 61, thus leaving said shaft free to rotate under the influence of the fast-driving train and preventing any jar which might otherwise be caused if said fast-driving train were thrown in while the brake-ring 54 was seated in said gear 12.

In the preferable construction shown means are provided whereby the fast-driving train may be permanently disengaged from the shaft D and the brake-ring 54 from the gear 12 when for any reason this may be desired. As shown, said means are as follows: Pivoted between its ends upon the machine-frame is a lever 66, one end of which is adapted to bear against a projection 67 on the rod 32 and to move said rod so as to disengage the clutch E, when pivotal movement in the proper direction is imparted to said lever 66. Pivoted to the opposite end of said lever 66 is a rod 68, in which are formed notches 69 and 70, adapted to engage a catch 71 on the machine-frame, the relation of parts being such that when the notch 69 is in engagement with the catch 71 the rod 32 will be free to move to effect engagement and disengagement of the clutch E and of the brake 54, and when the notch 70 is in engagement with said catch 71 that said rod 32 will be moved outwardly to disengage said clutch E. To provide for disengagement of the brake-ring 54, which would otherwise be locked by the movement of the sleeve 23, caused by the outward movement of the rod 32, a peripheral groove 72 is formed in said sleeve, into which the ends of the bell-crank levers 60 will drop when the notch 70 in the rod 68 is in engagement with the catch 71, the relation of parts being such that when the ends of the bell-

crank levers 60 are in engagement with said grooves 72 the rod 55 will be free to move under the influence of the spring 63 to disengage the brake-ring 54 from the gear 12 in the desired manner. The throw of the cam 35 is such, however, that the rod 32 will be moved thereby only a sufficient distance to bring the ends of the bell-crank levers 60 into engagement with the surface of the sleeve between the wedge 61 thereon and the groove 72, the diameter of said sleeve at this point being such as to separate the ends of the bell-crank levers 60 a sufficient distance to effect engagement of the brake-ring 54 with its seat in the gear 12 in the manner heretofore described.

We claim as our invention—

1. The combination with revoluble members, of driving connections between said members, comprising relatively fast and slow driving connections, the slow-driving connection comprising a ratchet-wheel and pawl and the fast-driving connection comprising a clutch, a sleeve for operating said clutch, a lever applied to said sleeve, a spring applied to said lever, a rod connected to said lever, a cam applied to said rod to move the same against the force of said spring and means for actuating said cam.

2. The combination with revoluble members, of driving connections between said members, comprising relatively fast and slow driving connections, means to effect engagement and disengagement of said driving connections and means for braking the driven member when the fast-driving connection is disengaged.

3. The combination with revoluble members, of driving connections between said members, comprising relatively fast and slow driving connections, means to effect engagement and disengagement of said driving connections and means controlled by the disengagement of said fast-driving connections for braking the driven member.

4. The combination with revoluble members, of driving connections between said members, comprising relatively fast and slow driving connections, means for effecting engagement and disengagement of the slow-driving connection, a clutch for effecting engagement and disengagement of the fast-driving connection, means for operating said clutch, a brake adapted to be applied to the driven member and connections between said brake and clutch-operating mechanism whereby disengaging said clutch will apply said brake.

5. The combination with revoluble members, of driving connections between said members comprising relatively fast and slow driving connections, the slow-driving connection comprising a ratchet-wheel and pawl and the fast-driving connection comprising a clutch, a sleeve which operates said clutch, a brake adapted to be applied to the driven member and connection between said brake and clutch-operating sleeve whereby movement of said sleeve to disengage said clutch will apply said brake.

6. The combination with revoluble members, of driving connections between said members, comprising relatively fast and slow driving connections, the driven member being hollow, the slow-driving connection comprising a ratchet-wheel and pawl and the fast-driving connection comprising a clutch, a sleeve for operating said clutch, a rod which extends through said hollow driven member, a brake-ring secured to said rod which engages a suitable seat on said driven member, means to apply said brake comprising a collar on said brake-rod, thrust-levers pivoted thereon which engage thrust-bearings on said driven member and a wedge on said clutch-operating sleeve for operating said thrust-levers.

7. The combination with revoluble members, of driving connections between said members, comprising relatively fast and slow driving connections, means to effect engagement and disengagement of said driving connections, means to brake the driven member when the fast-driving connection is thrown out of engagement and means to release said brake when the fast-driving connection is thrown into engagement.

8. The combination with revoluble members, of driving connections between said members, comprising relatively fast and slow driving connections, the slow-driving connection comprising a ratchet-wheel and pawl and the fast-driving connection comprising a clutch, a sleeve for operating said clutch, a brake adapted to be applied to the driven member, connection between said clutch-operating sleeve and brake whereby movement of said sleeve to disengage said clutch will apply said brake and a spring applied to said brake for releasing the same.

9. The combination with revoluble members, of driving connections between said members, comprising relatively fast and slow driving connections, the driven member being hollow, the slow-driving connection comprising a ratchet-wheel and pawl and the fast-driving connection comprising a clutch, a sleeve for operating said clutch, a rod which extends through said hollow driven member, a brake-ring on said rod which engages a suitable seat on said driven member, means to apply said brake comprising a collar on said brake-rod, thrust-levers pivoted thereon which engage thrust-bearings on said driven member and a wedge on said clutch-operating sleeve for operating said thrust-levers and a spring applied to said brake for releasing the same.

10. The combination with revoluble members, of driving connections between said

members, comprising relatively fast and slow driving connections, means to effect engagement and disengagement of said driving connections and manually-operated means for securing said driving connections in disengaged positions.

11. The combination with revoluble members, of driving connections between said members, comprising relatively fast and slow driving connections, the slow-driving connection comprising a ratchet-wheel and pawl and the fast-driving connection comprising a clutch, means to disengage said pawl from said ratchet-wheel comprising a projection on said pawl and a wedge for engagement therewith, means for operating said clutch and manually-operated means for securing said clutch in disengaged position.

12. The combination with revoluble members, of driving connections between said members, comprising relatively fast and slow driving connections, the slow-driving connection comprising a ratchet-wheel and pawl and the fast-driving connection comprising a clutch, a sleeve for operating said clutch, means for imparting movement to said sleeve to operate said clutch, a hand-rod applied to said sleeve for imparting movement thereto, to disengage said clutch and means for securing said hand-rod in position to disengage said clutch.

13. The combination with revoluble members, of driving connections between said members, comprising relatively fast and slow driving connections, the driven member being hollow, the fast-driving connection comprising a clutch, means to effect engagement and disengagement of the slow-driving connection, a sleeve for operating the clutch of the fast-driving connection, means for imparting movement to said sleeve to operate said clutch, means to secure said sleeve in position to disengage said clutch, a rod which extends through said driven member, a brake ring on said rod which engages a suitable seat on said driven member, means to apply said brake comprising a collar on said brake-rod, thrust-levers pivoted thereon which engage thrust-bearings on said driven member and a wedge on said clutch-operating sleeve for operating said thrust-levers, said sleeve being provided with a groove at a distance from said wedge to receive the ends of said thrust-levers when said clutch is disengaged.

14. The combination with revoluble members, of driving connections between said members, comprising relatively fast and slow driving connections, the driven member being hollow, the slow-driving connection comprising a ratchet-wheel and pawl, and the fast-driving connection comprising a clutch, means to disengage said pawl from said ratchet-wheel comprising a projection on said pawl and a wedge for engagement therewith, a sleeve for operating said clutch, means for imparting movement to said sleeve to operate said clutch, means to secure said sleeve in position to disengage said clutch, a rod which extends through said driven member, a brake-ring secured to said rod which engages a suitable seat on said driven member, means to apply said brake comprising a collar on said brake-rod, thrust-levers pivoted thereon which engage thrust-bearings on said driven member and a wedge on said clutch-operating sleeve for operating said thrust-levers, said sleeve being provided with a groove at a distance from said wedge to receive the ends of said thrust-levers when said clutch is disengaged and a spring applied to said brake-ring for releasing the same.

15. The combination of revoluble members, driving connections between said members, comprising relatively fast and slow driving connections, the fast-driving connection comprising a clutch, means for effecting engagement and disengagement of the slow-driving connection and means for operating said clutch comprising a cam applied thereto, a star-wheel secured to rotate with said cam, a driven member and a projection or projections thereon which engage the teeth of said star-wheel.

16. The combination of revoluble members, driving connections between said members, comprising relatively fast and slow driving connections, the fast-driving connection comprising a clutch, means for effecting engagement and disengagement of the slow-driving connection and means for operating said clutch, said means comprising a spring applied to said clutch for maintaining the same normally locked, a cam for effecting intermittent disengagement of said clutch and means to impart step-by-step rotation to said cam, said means comprising a star-wheel secured to rotate with said cam, a driven shaft and a projection or projections thereon which engage the teeth of said star-wheel.

17. The combination with revoluble members, of driving connection between said members, said driving connection comprising a clutch, means to operate said clutch, comprising a cam applied thereto and means to impart step-by-step rotation to said cam, said means comprising a star-wheel secured to rotate with said cam, a driven shaft and a projection or projections on said driven shaft which engage the teeth of said star-wheel.

18. The combination with revoluble members, of driving connection between said members, said driving connection comprising a clutch, a spring applied to said clutch for maintaining the same normally locked, a cam applied to said clutch for effecting intermittent disengagement thereof, and means to impart step-by-step rotation to said cam, said means comprising a star-wheel secured

to rotate with said cam, a driven shaft and a projection or projections on said driven shaft which engage the teeth of said star-wheel.

19. Clutch mechanism comprising a clutch and driven shaft, a movable member, means for intermittently rotating said member, by said shaft, means for throwing said clutch by said movable member, locking mechanism arranged so that the movement of said shaft will automatically lock said movable member after it throws said clutch and holds said clutch during the further movement of said shaft.

20. Clutch mechanism comprising a clutch and a movable member, an intermediate member between said clutch and the movable member, a plurality of operating devices connected with said movable member, a driven shaft for operating intermittently said movable member, locking means intermediate of said movable member and said clutch controlled by said shaft for automatically locking said movable member at the end of successive rotary movements.

21. The combination of fast and slow driving mechanism with clutch mechanism, comprising a clutch, a movable member, and an intermediate member between said clutch and movable member, a brake connected to said clutch, a plurality of operating devices connected with said movable member, a driven shaft for operating intermittently said movable member, and locking mechanism for automatically locking said intermediate member at the end of successive rotary movements of the movable member and after said brake has been operated by said clutch, for the purpose specified.

22. The combination with revoluble members, of driving connections between said members including in clutch, an intermittently-rotated member, provided with a plurality of operating-faces for operating said clutch, and intermediate faces for permitting movement of said clutch independent of said rotating member, for the purpose specified.

In testimony that we claim the foregoing as our invention we affix our signatures, in presence of two subscribing witnesses, this 6th day of October, A. D. 1904.

WALTER B. PEARSON.
CHARLES E. ROBERTS.

Witnesses:
E. M. KLATCHER,
K. A. COSTELLO.