No. 665,824. Patented Jan. 8, 1901.

P. B. BELCHES.

REVERSING GEARING.

(Application filed July 18, 1900.)

(No Model.) 2 Sheets—Sheet 1

Fig. 1.

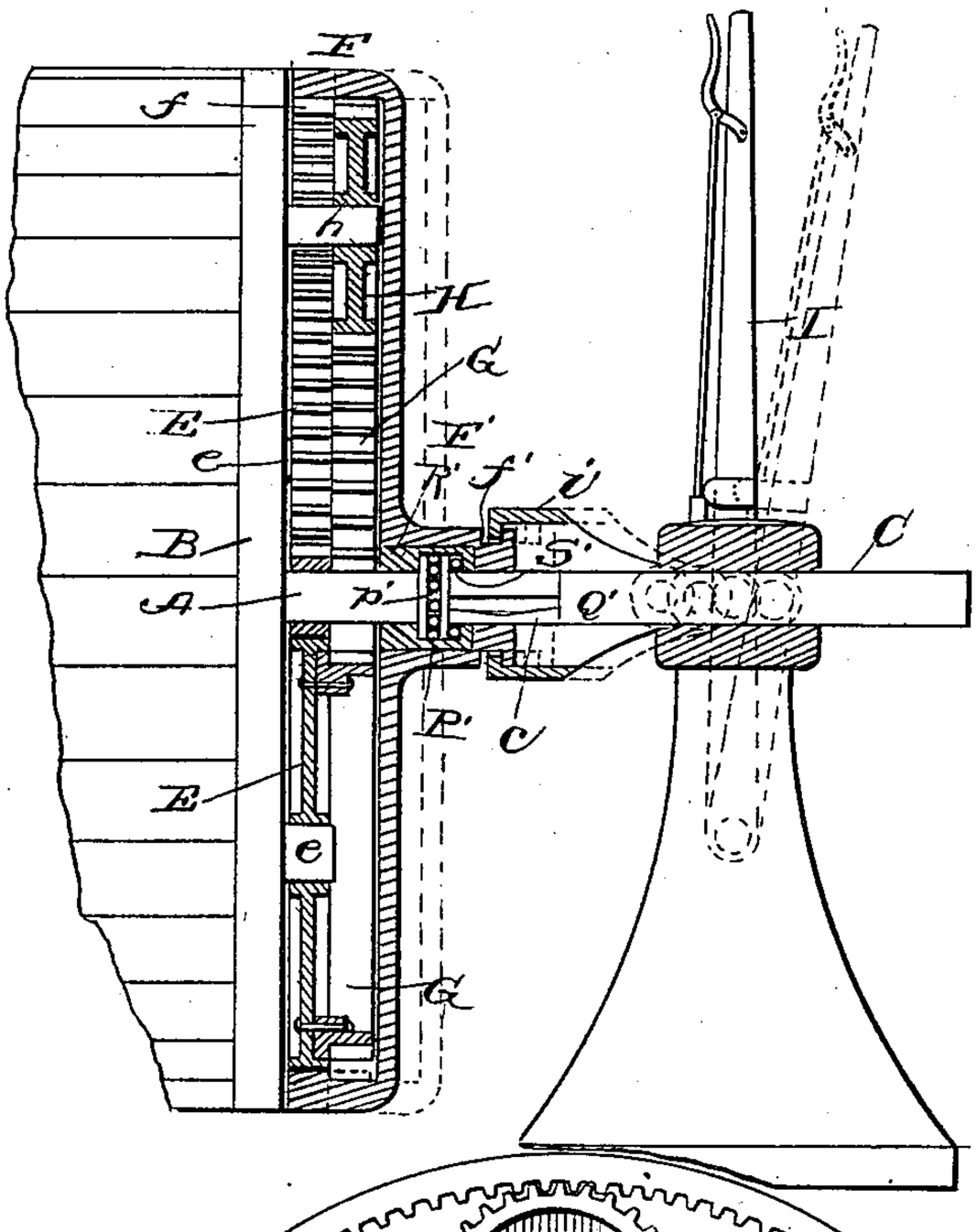

Fig. 2.

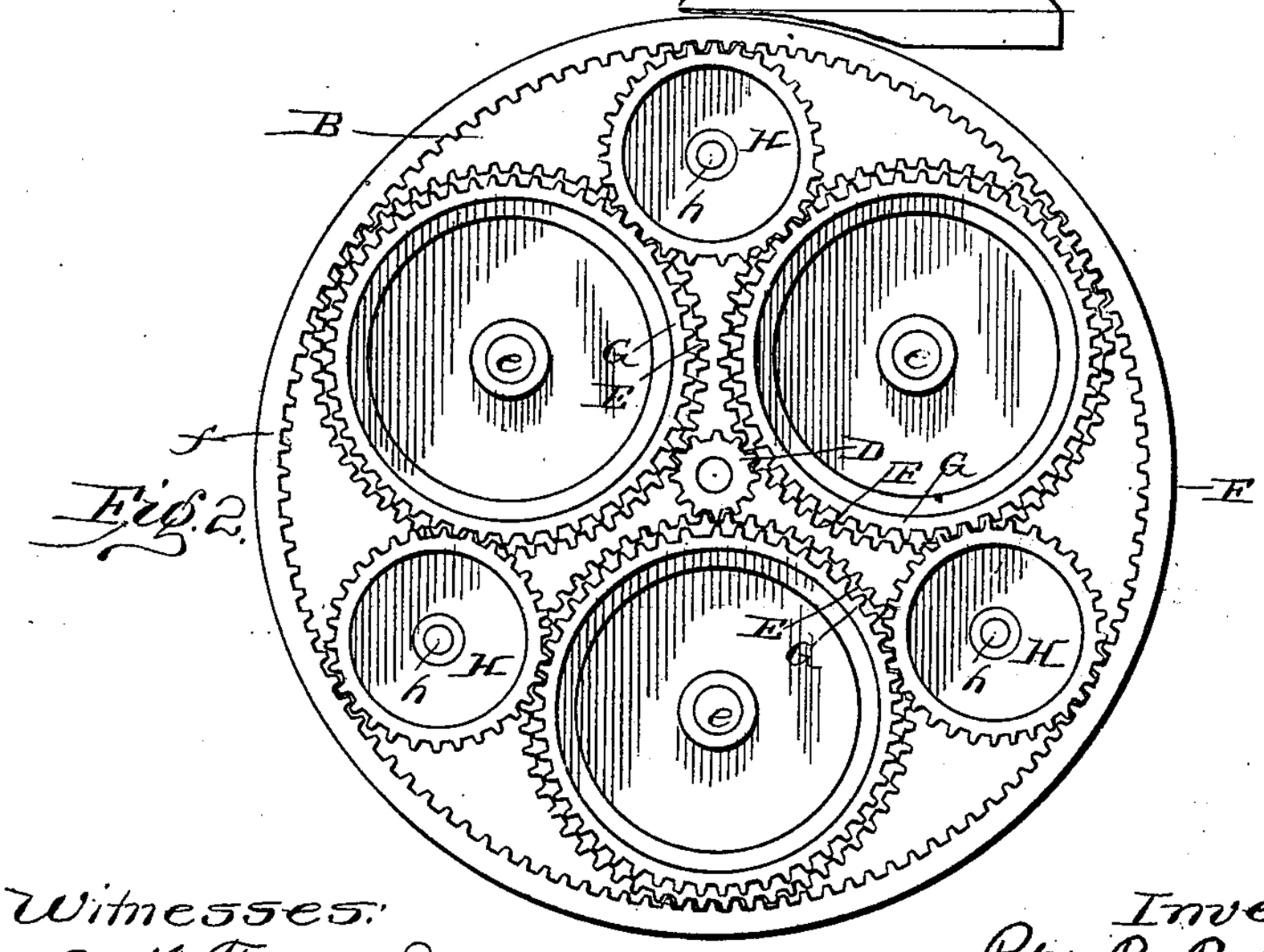

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Fig. 3.

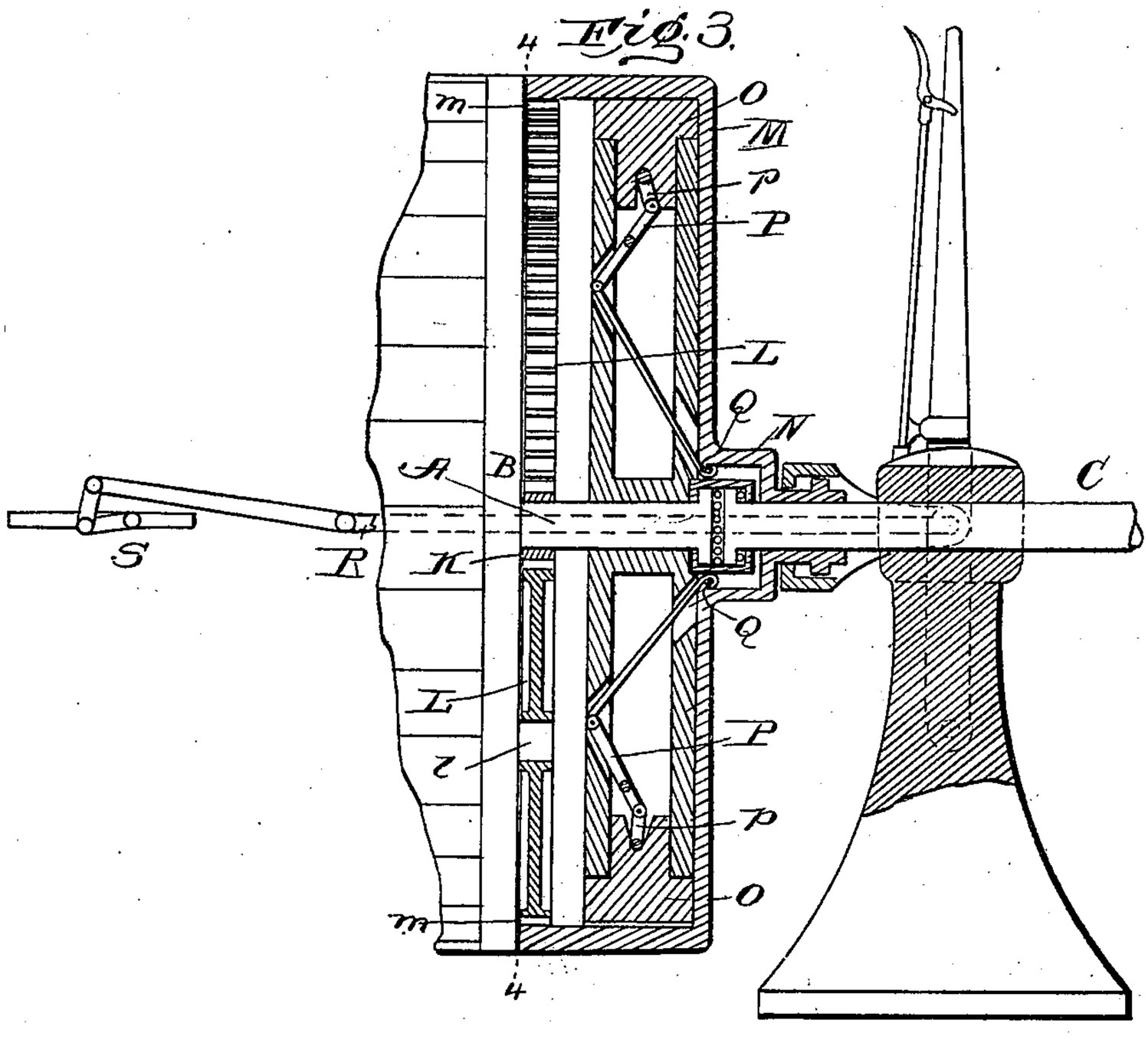
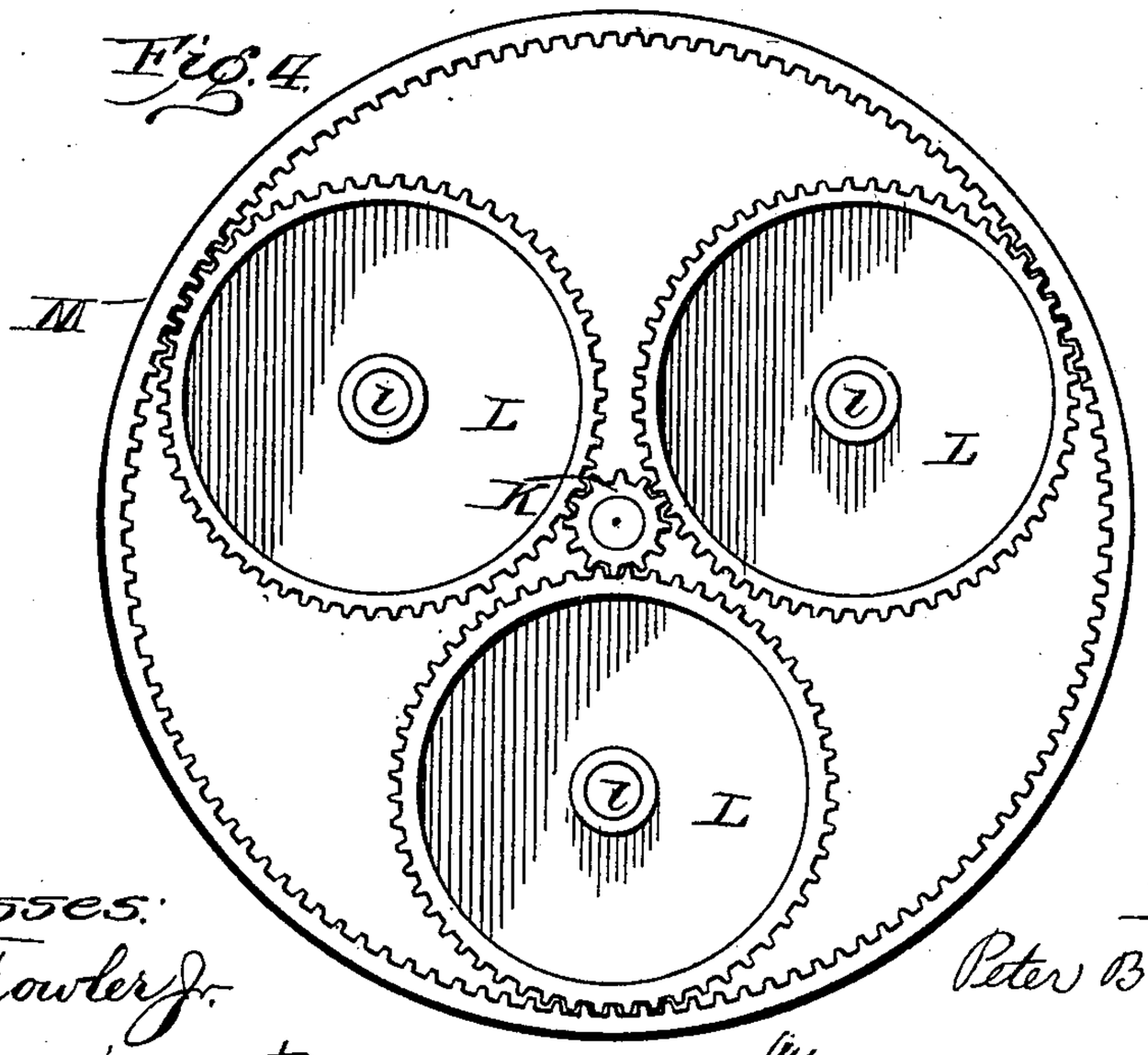


Fig. 4.



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UNITED STATES PATENT OFFICE.

PETER BERKELEY BELCHES, OF HAYMARKET, VIRGINIA.

REVERSING-GEARING.

SPECIFICATION forming part of Letters Patent No. 665,824, dated January 8, 1901.

Application filed July 18, 1900. Serial No. 24,100. (No model.)

To all whom it may concern:

Be it known that I, PETER BERKELEY BELCHES, a subject of the Queen of Great Britain, residing at Haymarket, in the county of Prince William, State of Virginia, have invented certain new and useful Improvements in Reversing-Gearing; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the letters of reference marked thereon.

This invention relates to improvements in gearing designed to be interposed between a driving and a driven shaft for enabling the direction of rotation of the driven shaft to be reversed at will and where desired a different speed imparted to the driven shaft without varying the speed of the driving-shaft.

The invention finds its most general application in the driving of propellers of boats where a non-reversing turbine or gas-engine constitutes the motor, and although, as illustrated, it is especially designed for such use it will be understood that the gearing is capable of a general application for use wherever it is desired to reverse the direction of rotation of a driven shaft without reversing the drive-shaft or engine.

Referring to the accompanying drawings, Figure 1 is a vertical section through a gearing embodying my present improvements. Fig. 2 is a sectional elevation at right angles to Fig. 1 and showing the rim only of the casing. Fig. 3 is a section corresponding to Fig. 1 of a modified arrangement. Fig. 4 is a vertical section on the line 4 4, Fig. 3.

Like letters of reference in the several figures indicate the same parts.

The letter A in the accompanying drawings indicates the engine or drive-shaft from which the power is derived, and B indicates a fixed plate or member on which the intermediate gears or idlers are journaled.

C is the driven shaft—such, for instance, as a propeller-shaft of a boat—arranged in alinement with the shaft A and preferably with an antifriction-bearing between them, as will be hereinafter explained.

Referring particularly to Figs. 1 and 2, it will be seen that the shaft A is provided with a pinion D, keyed thereon and adapted to mesh with a series, preferably three, intermediate idlers or wheels E, each journaled on a stud-axle *e*, carried by the fixed part or plate B. Meshing with these intermediate wheels E is an internally-toothed casing F, which casing F is connected so as to rotate in unison with the drive-shaft C, but is capable of a longitudinal movement, so as to move its toothed portion *f* into or out of mesh with the wheels E. In connecting the casing F with the shaft C it is preferred that said shaft shall be squared for a small portion of its length, as at *c*, and the hub F′ of the casing F correspondingly formed and fitted thereon. With such an arrangement when the casing is moved to the position indicated in full lines in Fig. 1 the rotation of the shaft A will impart to the casing and shaft C a rotation in a relatively reverse direction through the intermediate idlers or wheels E, and in order to impart a rotation in a forward direction a secondary set of intermediate idlers or wheels are preferably employed, which consist of gears G, rigidly mounted on the intermediate wheels E, and secondary idlers H, journaled on stud-axles *h*, extending outwardly from the fixed plate B between the wheels E. The secondary idlers are adapted to be brought into mesh with the toothed section *f* of the casing F when said casing is moved longitudinally to the position indicated in dotted lines in Fig. 1. In the latter position the casing F is driven by the secondary idlers H, and by reason of the fact that trains of two gears are interposed between the shaft A and casing the direction of rotation imparted to the casing corresponds to the direction of rotation of the shaft A, and the propeller or shaft C will be correspondingly rotated.

By varying the relative proportions of the intermediate gear-wheels and pinions it is obvious that the speed of the driven parts may be fixed at any desired relation to the speed of the drive-shaft A in either direction.

As a convenient means for shifting the casing its hub F′ may be provided with an annular groove *f′* and a shifting-lever I of any approved pattern, connected therewith through a shifting-ring *i′* of usual construction, which ring, however, does not rotate with the cas-

ing, but is moved longitudinally of the shaft by means of the lever I and correspondingly moves the casing, so as to throw it into mesh with one or the other of the sets of intermediate idlers or wheels E H.

It will be particularly observed that the intermediate wheels are grouped uniformly about the shaft A, so as to substantially balance the strains, and thus any tendency to transversely displace the casing F is avoided.

Obviously the longitudinal movement of the casing may be utilized for shifting or varying the connection between the driven shaft C and the driving-shaft through other forms of intermediate gearing or connections than two sets of intermediate wheels, and in Figs. 3 and 4 I have illustrated one such arrangement, wherein instead of driving the driven shaft in both directions through intermediate idlers said shaft is driven in one direction through a direct clutch connection with the drive-shaft and in the other direction through a suitable intermediate train of gears. Referring to these figures, it will be seen that the shaft A is provided with a pinion K, (corresponding to the pinion D,) and intermediate wheels L, journaled on stud-axles *l*, (corresponding to the gears E and stud-axle *e*,) are adapted to mesh with said pinion K. The casing M is also provided with a toothed portion *m* within its periphery and preferably near its edge, which when the casing is moved inwardly will mesh with the wheels L and impart a rotation in a reverse direction to the driven shaft C; but when said casing is moved outwardly (corresponding to the movement indicated by the dotted lines in Fig. 1) said toothed section M will be moved out of mesh with the intermediate wheels L. When in the latter position, in order to connect the drive and driven shafts I provide a clutch operated by the casing and consisting of a hub N, mounted rigidly on the drive-shaft A and provided with radially-movable clutch-shoes O, which are adapted to be moved radially by the longitudinal movement of the casing M. To effect this movement, a lever P is pivoted in the hub N inside of each of the shoes and adapted to coöperate with a link *p*, forming toggles, which when straightened out by the movement of the inner ends of the levers P will move the shoes outwardly and into contact with the inner surface of the casing M. The hub of the casing M is in this instance provided with a groove Q for coöperating with the inner ends of the levers P to move them in each direction in unison with the longitudinal movement of the casing, and the casing itself is moved correspondingly by means of a shifting lever and ring similar to that described in connection with Fig. 1. A movement of the shifting-lever in one direction will move the casing M into engagement with the intermediate idlers L and release the clutch-sections O; but a movement in the opposite direction will disengage the teeth of the casing and wheels L and throw the shoes O outwardly, so as to clutch the drive-shaft and casing together, and thereby impart a direct rotation to the shaft C.

Obviously the shifting-lever may be employed for controlling the throttle-valve of the engine, so as to stop the engine during the shifting or changing of the direction of rotation, and for this purpose the said lever may be provided with a control-rod R, connected with a throttle-valve S, (shown diagrammatically in Fig. 3;) but it will be understood that I do not limit my invention to a use in connection with valve-controlling devices, for, as before stated, it is capable of a general application for reversing the direction of rotation and the speed of movement of a driven part wherever the power is derived from a drive-shaft or similar power appliance.

Between the abutting ends of the shafts A and C an antifriction-bearing is introduced to take up thrust strains, and in the preferred construction this bearing is formed by rings of balls P′, separated by annular separators *p′* between the ends of the shafts, which latter may be headed or enlarged for the purpose, as at Q′. Surrounding the enlargements or heads is a coupler-casing R′, preferably made in halves and fast on one of the shafts, while another set of balls S′ is preferably introduced behind the head on the opposite shaft, within the coupler-casing, to reduce friction when the strain on the shaft is a pulling strain.

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

1. In a gearing the combination with a drive-shaft, a driven shaft and a relatively-fixed part, of a pinion on the drive-shaft, intermediate idlers meshing with said pinion and mounted on the fixed part, a longitudinally-movable internally-toothed casing mounted to rotate in unison with the drive-shaft and adapted to be moved into and out of mesh with the intermediate idlers and secondary connections between said casing and drive-shaft thrown into action by the longitudinal movement of the casing; substantially as described.

2. In a reversing-gearing, the combination with the drive and driven shafts arranged in alinement, of a casing mounted to rotate with one of but movable longitudinally of said shafts and having an internally-toothed section, of a train of gears intermediate said casing and opposite shaft and into mesh with which said casing is adapted to move when moved longitudinally in one direction and a mechanism for imparting reverse rotation with which said casing coöperates when moved in the opposite direction; substantially as described.

3. In a reversing-gearing, the combination with a drive and driven shafts, a fixed part surrounding one of said shafts and uniformly-distributed trains of gearing grouped about

and driven by said last-mentioned shaft, of a casing mounted to rotate with, but movable longitudinally of, the opposite shaft and having an internally-toothed section inclosing and meshing with one or the other of said trains of gearing, said casing when moved in one direction being adapted to impart rotation to the shaft in one direction, and when moved in the opposite direction to impart opposite rotation to said shaft through the intermediate trains of gearing; substantially as described.

4. In a reversing-gearing, the combination with the drive and driven shafts, a pinion mounted on the drive-shaft, a series of idlers grouped about and meshing with said pinion, a second series of idlers meshing with the first series and occupying a different plane transversely of the shaft, of a longitudinally-movable casing surrounding said idlers and having a toothed section adapted when said casing is in one position of longitudinal adjustment to mesh with the first-mentioned set of idlers and when moved to the other position of longitudinal adjustment to mesh with the secondary set of idlers, whereby the direction of rotation of the driven shaft may be reversed at will by the longitudinal movement of the casing; substantially as described.

5. In a reversing-gearing, the combination with the drive and driven shafts arranged in alinement with each other, an interposed bearing and coupling, a casing mounted to rotate with but movable longitudinally of one of said shafts and having an internally-toothed section adjacent its edge, a train of gearing interposed between the other shaft and said toothed section, a second train of gearing driven by said first train of gearing and comprising gears located in position to mesh with said toothed section of the casing when said casing is moved longitudinally of the shaft; substantially as described.

6. In a reversing-gear the combination with the drive and driven shafts, the train of gearing comprising the pinion D and idlers E, a second train of gearing comprising the secondary idlers H and gear-wheels G mounted on the idlers E, the idlers H and E being grouped about the pinion D, but located in different planes transversely of the pinion, of the casing F having the toothed section *f* and movable longitudinally to bring said toothed section *f* into mesh with either the idlers E or the idlers H; substantially as described.

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