

No. 860,505.

PATENTED JULY 16, 1907.

W. WALLACE.  
REVERSING GEAR.  
APPLICATION FILED JUNE 29, 1905.

3 SHEETS—SHEET 1.

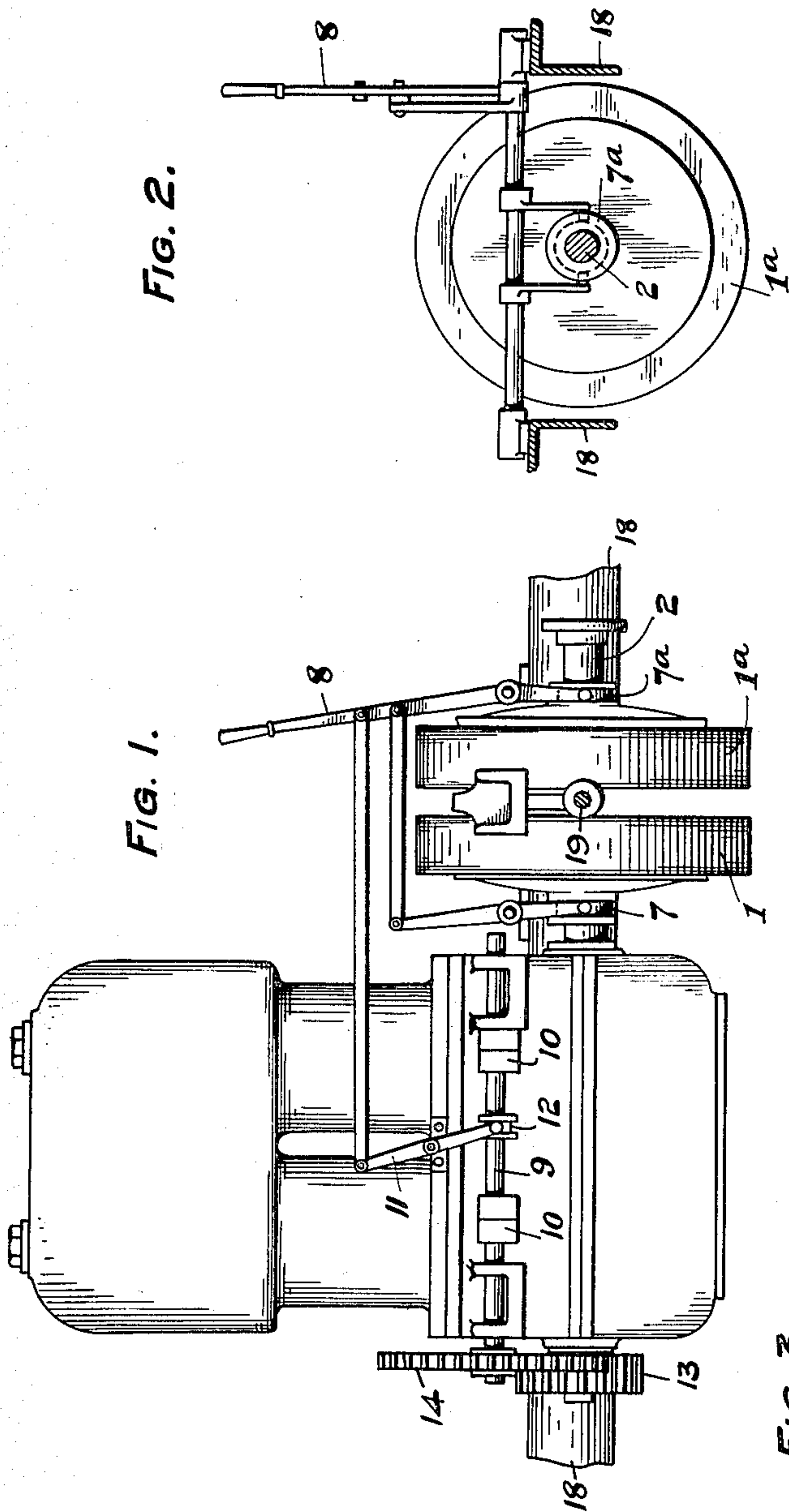


FIG. 2.

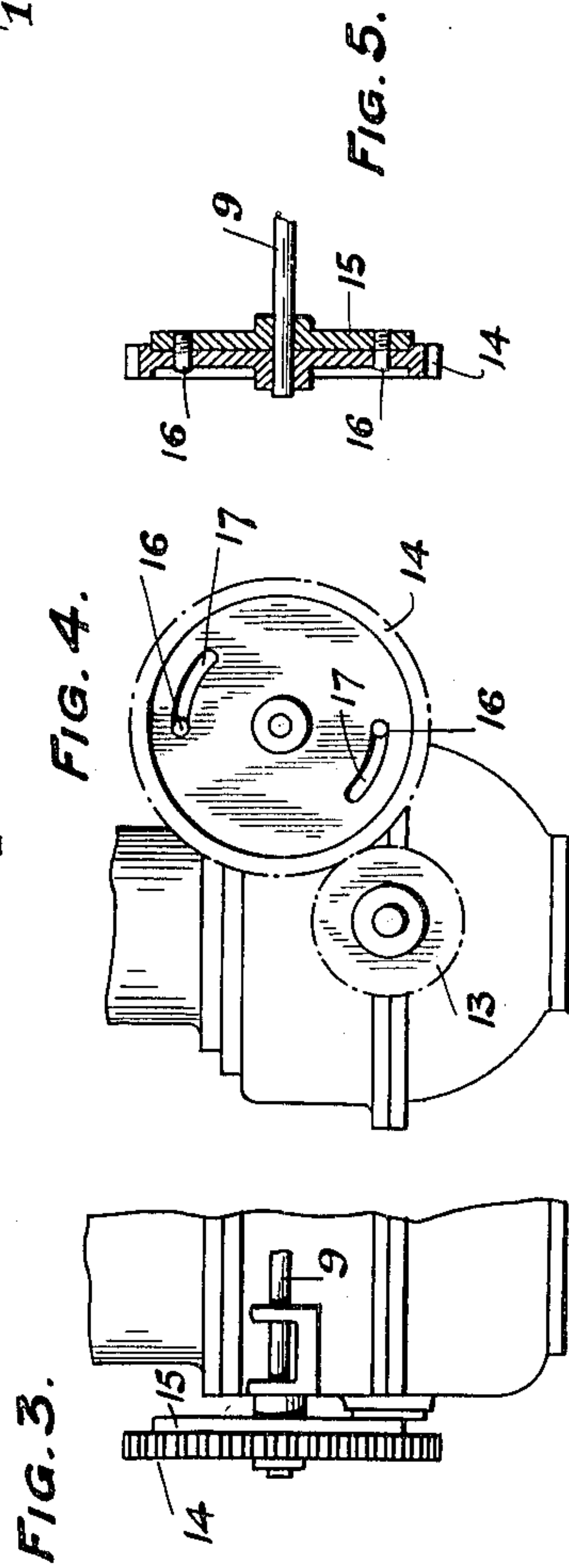
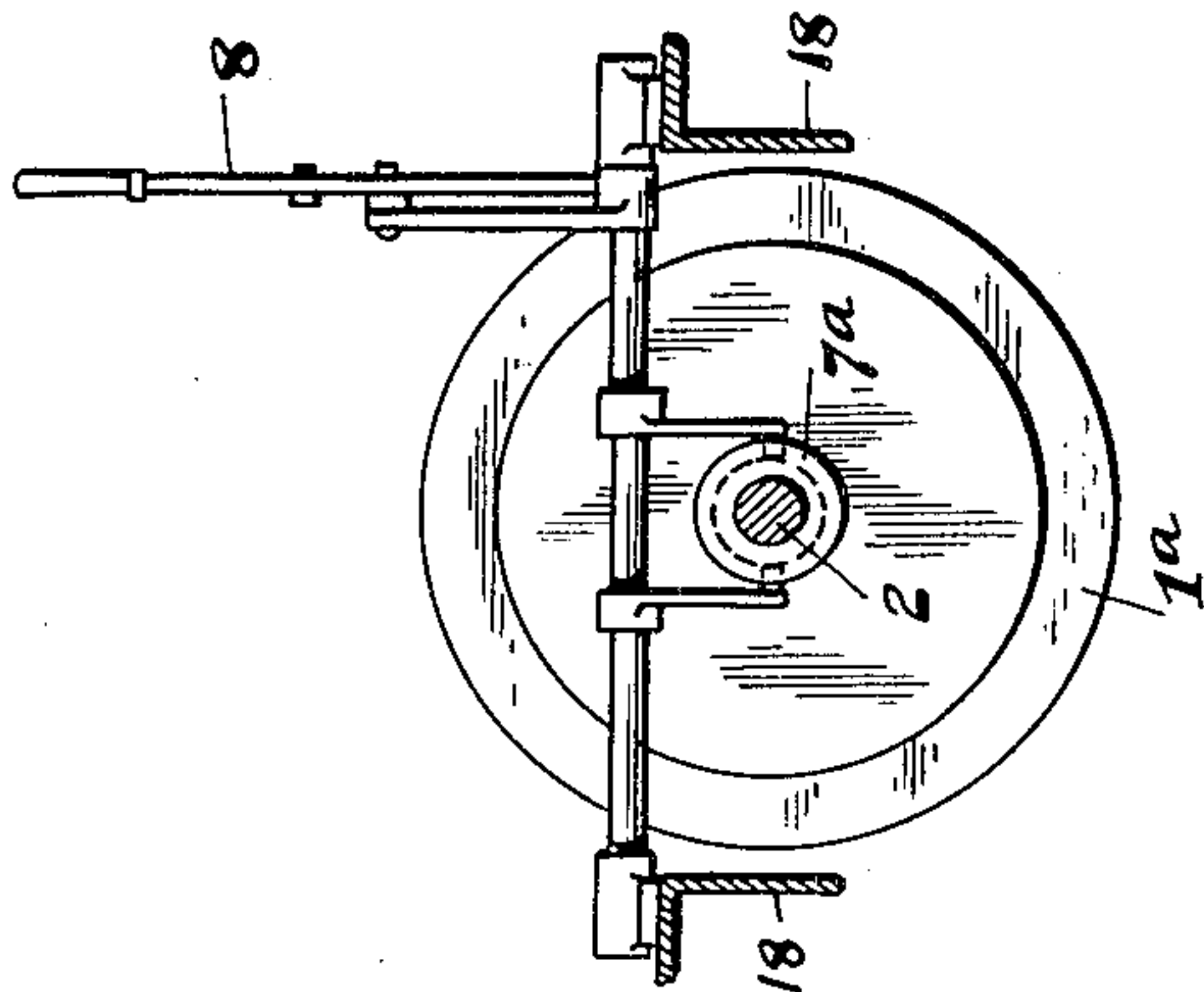


FIG. 4.

FIG. 5.

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C. S. Middleton  
Edward N. Sartor

Inventor.

William Wallace.

by C. S. Middleton Counselor at Law

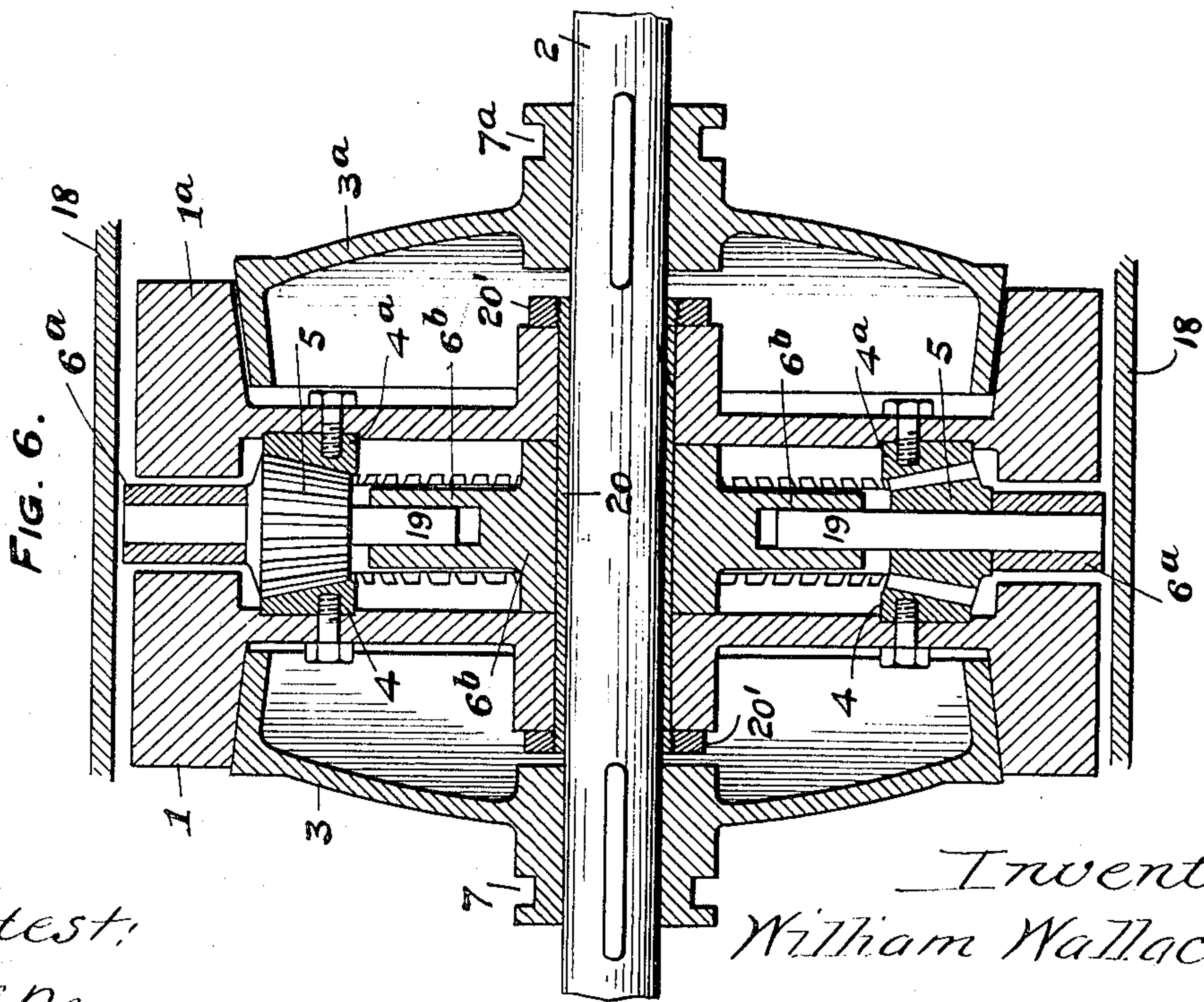
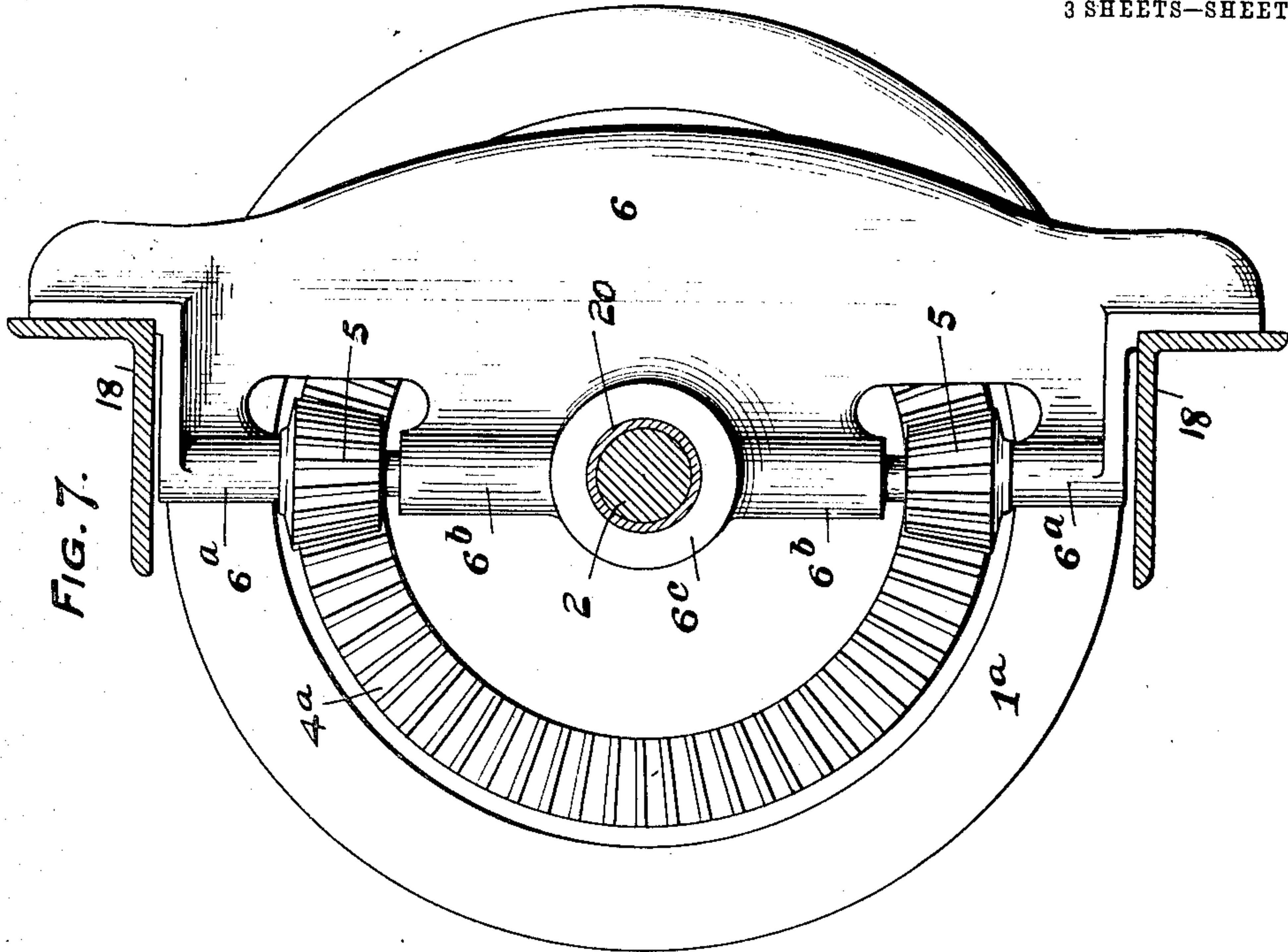
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3 SHEETS—SHEET 2.



Attest:

OS Madden  
Edward H. Sartor

Inventor:  
William Wallace

by *Spur Middleton Donaldson & Co.*  
Attys.

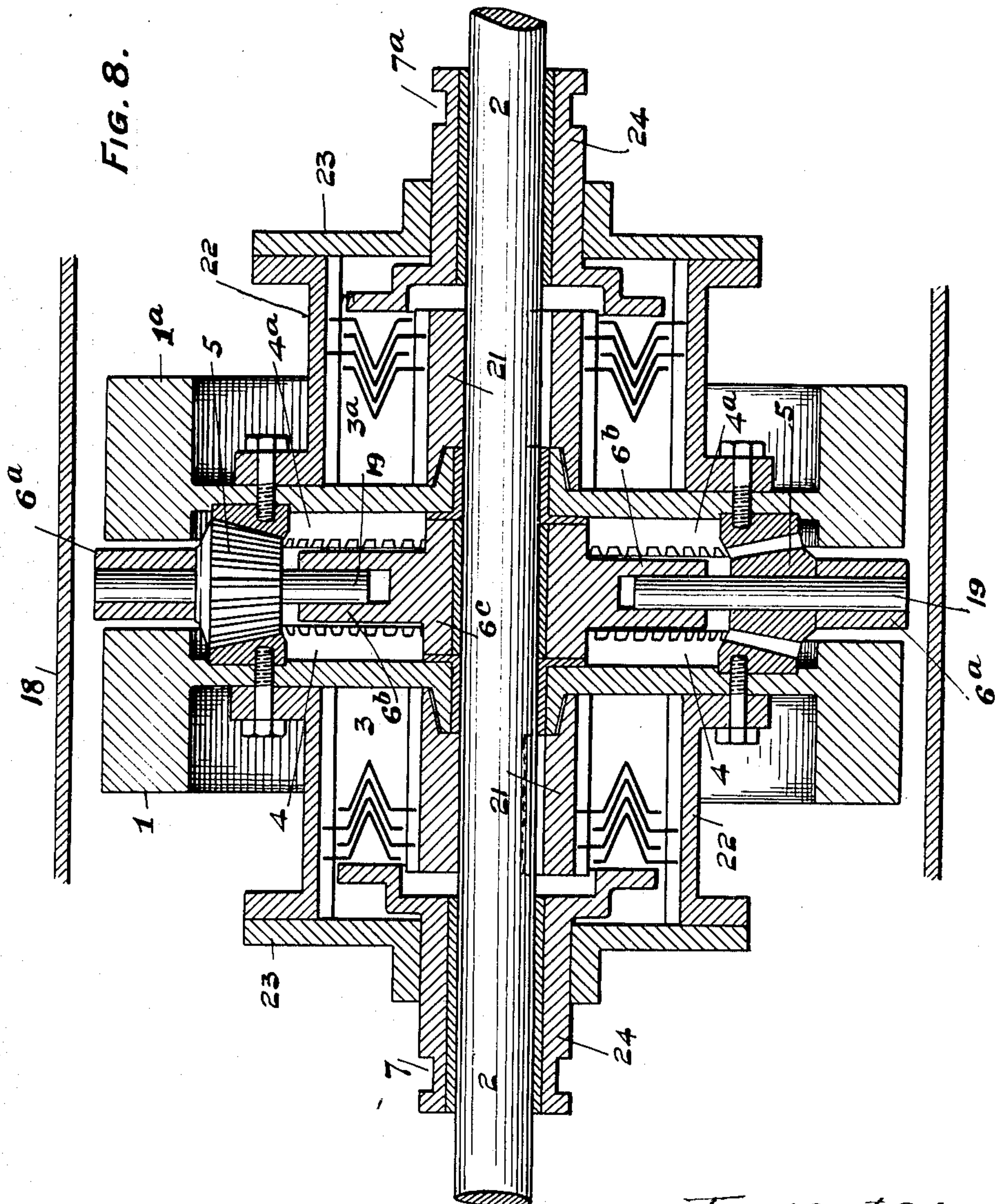


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3 SHEETS—SHEET 3.



Attest:

O. S. Madden  
Edward N. Sartor

Inventor  
William Wallace  
By *Stephen Middleton Madden & Son*  
Attys



# UNITED STATES PATENT OFFICE.

WILLIAM WALLACE, OF LIVERPOOL, ENGLAND.

## REVERSING-GEAR.

No. 860,505.

Specification of Letters Patent.

Patented July 16, 1907.

Application filed June 29, 1905. Serial No. 267,646.

*To all whom it may concern:*

Be it known that I, WILLIAM WALLACE, a subject of the King of Great Britain, residing in Liverpool, in the county of Lancaster, England, have invented certain new and useful Improvements in Reversing-Gears, of which the following is a specification.

This invention relates to reversing gears, and is particularly applicable to cases such as petrol engines, gas engines, alternating current motors and the like, in which when a reversal of the direction of rotation of the motor takes place, and the motor is, in the first instance stopped, energy is required to start it again in the reversed direction; the invention is also applicable to reversing gears generally where it is desired to store up in a rotating mass, during the rotation of the part to be reversed, in the one direction, kinetic energy which is adapted to be utilized in effecting the reversal of rotation.

I have illustrated my invention in the accompanying drawings, in which

Figure 1 is an elevation of the general arrangement of my invention as applied to a petrol engine; Fig. 2 is an end elevation of Fig. 1; Figs. 3, 4 and 5 illustrate a modification, and Figs. 6 to 8 illustrate details of construction.

The invention will be described in the first instance by way of example, as applied to a reversing gear for petrol engines.

To reverse such engines it is necessary of course, first to stop the engine, then to alter the means for actuating the valves and ignition device so that their action provides for rotation in the reverse direction, and then to start the engine rotating in the reverse direction, and according to this invention these conditions are complied with as follows:—

A pair of fly-wheels 1 and 1<sup>a</sup>, see Figs. 6 and 7, which may take the place of the usual engine fly-wheel, are mounted on the engine shaft 2 so as to be adapted to rotate freely relatively thereto, and each is provided with a clutch, 3 and 3<sup>a</sup>, respectively, which is adapted to connect its fly-wheel to the shaft, the clutch being preferably of that type which makes the connection gradually and without shock. The two fly-wheels are geared together in such manner that they rotate in opposite directions, preferably with equal speeds; the gearing preferably comprises bevel wheels 4 and 4<sup>a</sup>, one on each of the two adjacent faces of the fly-wheels, and one or a series of intermediate bevel pinions 5 carried in a bracket 6 which is fixed. Each clutch is provided with an operating collar 7 and 7<sup>a</sup> respectively, and the said two collars may be so connected so that while either of the clutches may be used to separately connect its fly-wheel to the shaft they cannot both connect simultaneously; both however may be free at the same time. Preferably, these collars are connected to the reversing lever 8, which in one extreme po-

sition engages the one clutch and its fly-wheel and the shaft and in the other extreme position engages the other clutch and fly-wheel with the shaft—the degree of engagement of the clutch depending upon the amount by which the lever is moved from mid-position, in which latter position both clutches are free.

The reversing lever may be articulated to the means actuating the ignition device and controlling valves in such manner that when the lever is on the one side of mid-position these means are adapted to provide for rotation say, ahead, and is on the other side, for rotation in the reverse direction. This may be accomplished, as shown in Figs. 1 and 2, by connecting the lever 8 to a cam shaft 9, fitted with two sets of cams 10, so that it moves the shaft axially to bring either one or other of the two sets into operation; this is effected by connecting the lever 8 to one end of a lever 11, the other end of the latter lever engaging in a groove in a grooved sleeve 12, fixed on and rotating with the cam shaft 9; or the lever 8 may be connected to the cams, and operate them to insure the same result.

I have shown in Figs. 3, 4 and 5 a modification which enables me to dispense with the lever 11, the grooved sleeve 12, and the two sets of cams 10. In the modification the cam shaft 9 as before is driven by any suitable form of two-to one gear; in the case illustrated, spur gearing comprising a pinion 13 and wheel 14 is used, but the wheel 14 instead of being keyed to the cam shaft 9 in the usual manner, is connected to the shaft by means of a disk 15; this disk is provided with pins 16 which engage in slots 17 in the wheel 14 so that the wheel 14 can move relatively to the shaft 9 within the limits of the angle between the extreme ends of the slots; these extreme positions correspond with the correct positions of the cam shaft angularly relatively to the crank shaft for the two directions of rotation. If therefore, while the engine is rotating say right-handedly, it be stopped and caused by the inertia in the fly-wheels to rotate left-handedly on changing the clutch engagement, the wheel 14 will, on a reversal of rotation, first move relatively to the shaft through the desired angle, after which the slots will engage the pin and rotate the cam shaft appropriately for the reversed direction of rotation.

The details of construction are shown in Figs. 6 and 7. The side frames 18 which carry the engine are prolonged and serve to carry the bracket 6; this bracket has two end bearings 6<sup>a</sup> and two central bearings 6<sup>b</sup> which carry the spindles 19 and the pinions 5, and the bracket has a further bearing 6<sup>c</sup>, through which a bush 20 on the engine shaft passes; this bush also carries the two fly-wheels and the fly-wheels are kept in proper position by end locking nuts 20' on the bush or by suitable collars on the shaft; in this way it will be seen that the thrust produced by the engagement of the clutches is taken by the bearing 6<sup>c</sup> of the bracket 6.



In Figs. 8 I have illustrated a modification of the gear in which the now well known Hele-Shaw clutches are employed. These clutches are specially adapted for use with my present invention, because with them there is a gradual and easy engagement. The two fly-wheels, the bevel wheels, the pinions, the center bracket and the bush may be constructed as already described. The clutch consists of a core 21 keyed to and rotating with the shaft and provided with a series of feather-ways, an outer casing 22 bolted to the fly-wheel, an end piece 23 bolted to 22, and an axially movable sleeve 24 adapted to press together the two series of "Hele-Shaw" disks, the teeth of the one series engaging in the feather-ways of the core, and the teeth of the other series engaging in the feather-ways of the outer casing, the two sets being arranged alternately, the reversing lever and operating gear operating the sleeve 24 by means of the grooves formed therein.

The action of the apparatus is as follows:—

Assuming the engine to be rotating ahead:—then the ahead clutch would connect its fly-wheel to the shaft and the two fly-wheels would rotate, one in the ahead direction and the other in the reverse direction; to reverse the engine the reversing lever would be pushed over, the ahead clutch released, and the valve and ignition devices put out of operation, whereupon the engine would stop; on a further movement of the lever the said devices would be so operated as to provide for reverse rotation, the reverse clutch would then gradually connect its reversely rotating fly-wheel to the shaft and the inertia of the two rotating fly-wheels would be utilized to start the engine in the reverse direction. The ignition device and other parts which may be of any of the usual well known types, are, for the sake of clearness, omitted from the drawings.

To change the direction of rotation back to ahead, the hand lever is moved back, the reverse clutch disconnected and its fly-wheel released, the engine stopped, the actuating means changed to the ahead position, the ahead clutch engaged to gradually connect the ahead fly-wheel to the shaft, and the inertia of the two rotating fly-wheels utilized to start the engine ahead. It will be noted that there is no reversal of the direction of rotation of the respective fly-wheels when the engine direction is reversed, and that both during ahead and reverse rotation of the engine, the fly-wheels are positively driven always in the same direction.

In the modifications shown in Figs. 3, 4 and 5, the movement of the reversing handle in the act of re-

versing the direction of rotation does not operate the ignition and exhaust devices above described, the operation of these devices being effected automatically when the engine is rotated by the fly-wheels in the desired direction as soon as the pins reach the limits of the slots as described.

Two fly-wheels are used by preference, but as each respectively always rotates in the one direction—the opposite to that of the other—it is evident that one wheel only may be employed, together with means for directly connecting it to the shaft, and means for connecting it to the shaft through a rotation reversing device; with the two fly-wheels, however, one is always directly connected to the shaft at the time the kinetic energy of the two is being given up to the shaft.

The means for operating the clutches in conjunction with the valve and ignition actuating means may, of course, be varied to suit the type of engine to which the invention is applied; in an ordinary gas engine, for example, the ignition, inlet and exhaust valves may be controlled as described in connection with the petrol engine; in a turbine of reversible type, the deflecting vanes, or other part moved to reverse the action, would be articulated to the clutch operating gear.

The invention may also be applied to such cases as:—planing machines, in which the return stroke may be accomplished by the reverse action described, the fly-wheel in this case being driven; lift and hoist apparatus in which energy stored up as the lift descends may be utilized to start the motor in the reverse direction for ascending.

In the case of electric motors the reversing handle would, of course, be connected to the controlling switches.

Having now fully described my invention, I declare that what I claim, and desire to secure by Letters Patent is:—

In a reversing gear, in combination, the shaft, a sleeve thereon, a bracket having a central bearing for said sleeve, two rotatable pieces mounted on the sleeve, one on each side of the bracket, clutches carried on the shaft and adapted to engage with said pieces, a bevel wheel on each rotatable piece, pinions mounted on the bracket and engaging with said bevel wheels and means for operating the clutches.

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

WILLIAM WALLACE.

Witnesses:

J. E. LLOYD BARNES,  
JOSEPH E. HIRST.