

No. 874,177.

PATENTED DEC. 17, 1907.

F. T. FLINCHBAUGH.
REVERSE GEAR FOR FOUR CYCLE COMBUSTION ENGINES.

APPLICATION FILED JULY 9, 1907.

3 SHEETS—SHEET 1.

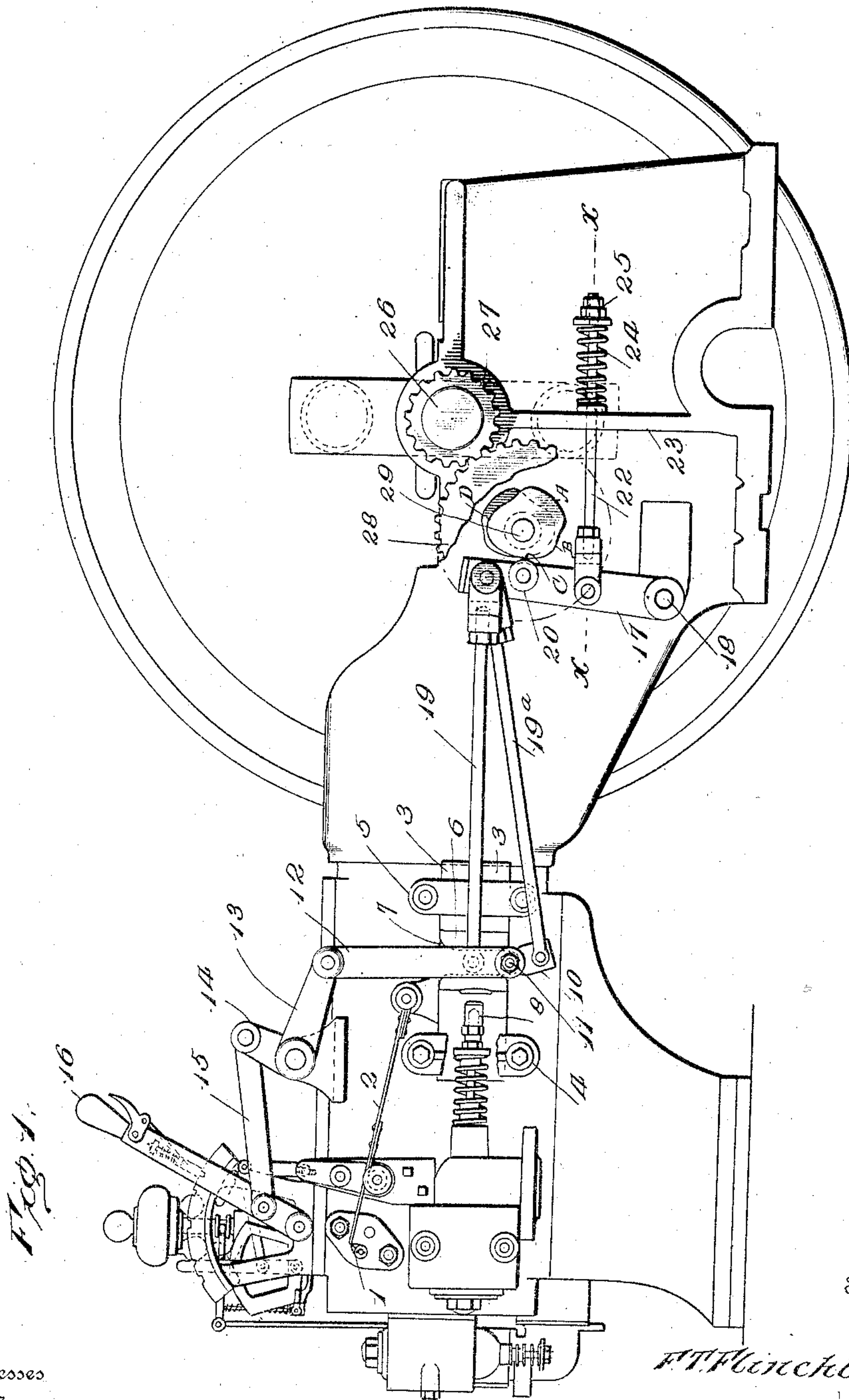


Fig. 1.

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Witnesses

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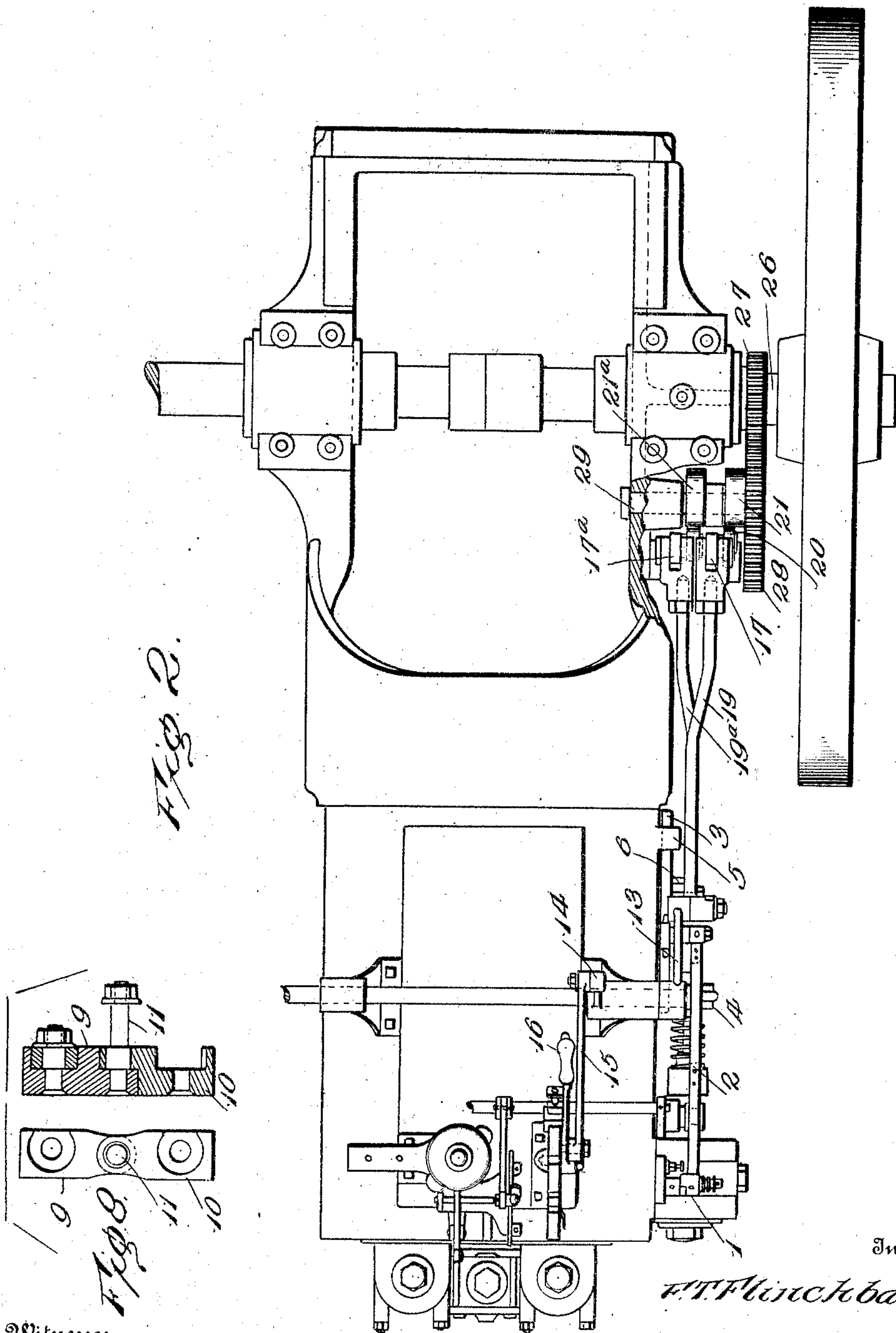
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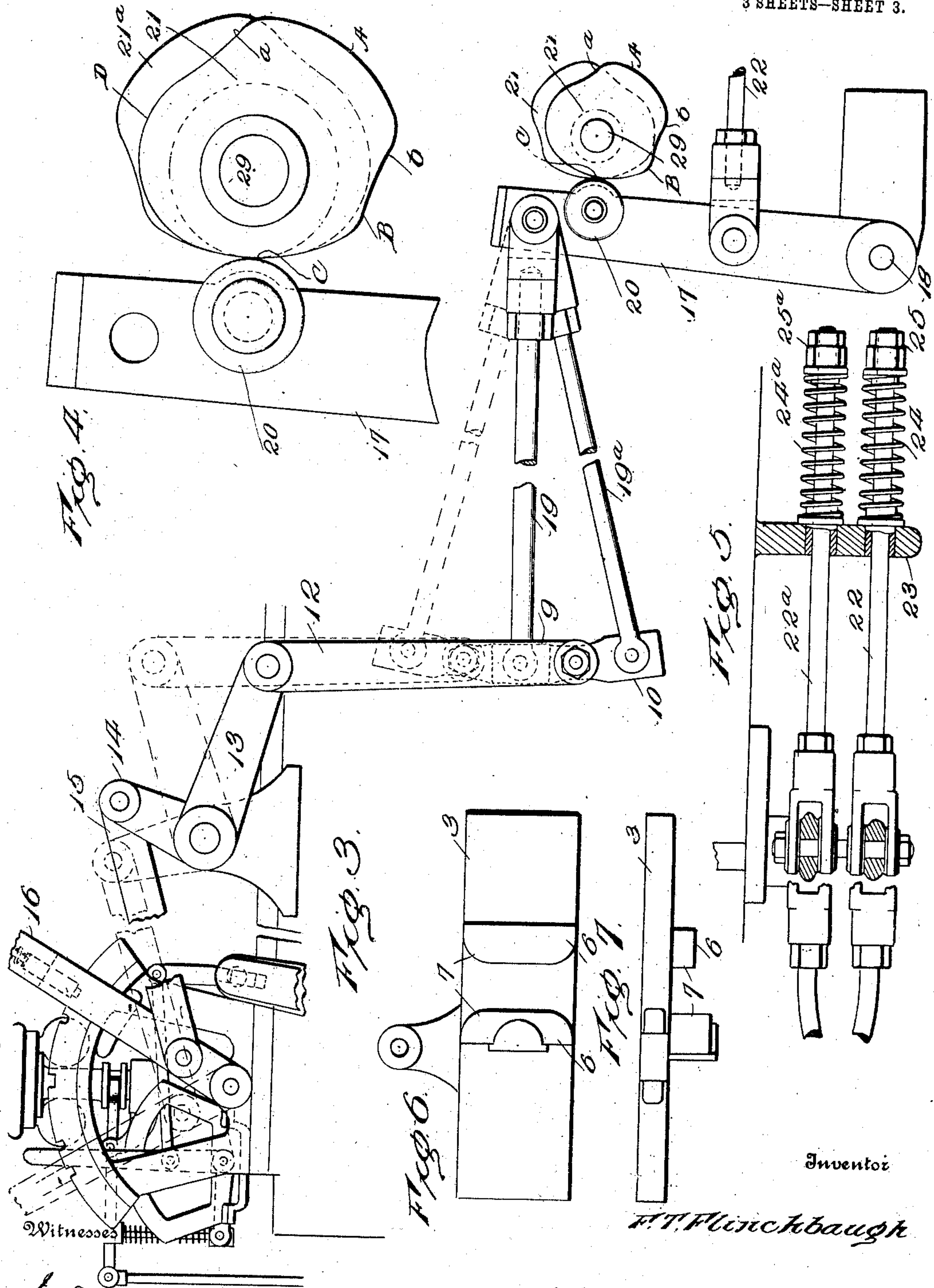
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

FREDERICK T. FLINCHBAUGH, OF YORK, PENNSYLVANIA.

REVERSE-GEAR FOR FOUR-CYCLE COMBUSTION-ENGINES.

No. 874,177.

Specification of Letters Patent.

Patented Dec. 17, 1907.

Application filed July 9, 1907. Serial No. 382,846.

To all whom it may concern:

Be it known that I, FREDERICK T. FLINCHBAUGH, a citizen of the United States, residing at York, in the county of York and State of Pennsylvania, have invented certain new and useful Improvements in Reverse-Gears for Four-Cycle Combustion-Engines, of which the following is a specification.

This invention devises means for utilizing the compressed charge of a gas engine for reversing the same when from any cause it is required to change the direction of motion, thereby being of essential advantage when a quick reverse is desired.

The invention consists of two cams connected with a moving part of the engine and driven thereby, a link movement, and connecting means between the link movement and the cams and comprising two members, only one of which is effective at a time, the cams being of like formation but having a different angular and reverse arrangement, the one to effect operation of the parts to drive the engine in one direction, the other to operate the parts to drive the engine in the reverse direction, each of said cams having a raised portion in addition to the regular raised portion for operating the sparker upon reversing the reverse lever to effect combustion of the charge in the cylinder out of regular order, whereby the piston is driven in the opposite direction, thereby completing the reverse, this auxiliary raised portion of each of the cams coming into play once only, that is to fire the initial charge after operating the reverse lever to start the piston in the opposite direction, the regular cam portion operating the sparker thereafter so long as the engine is running without again changing the position of the reverse lever.

For a full description of the invention and the merits thereof and also to acquire a knowledge of the details of construction and the means for effecting the result, reference is to be had to the following description and accompanying drawings.

While the invention may be adapted to different forms and conditions by changes in the structure and minor details without departing from the spirit or essential features thereof, still the preferred embodiment is shown in the accompanying drawings, in which:

Figure 1 is a side view of a four cycle internal combustion engine provided with a

reverse gear embodying the invention. Fig. 2 is a top plan view of the engine, a portion being broken away to show more clearly the two rocker arms and the parts cooperating therewith. Fig. 3 is a view in elevation of the reverse gear, showing the same on a larger scale. Fig. 4 is a detail view of the two cams and the upper portion of the rocker arm, the parts being on a larger scale. Fig. 5 is a horizontal section on the line $x-x$ of Fig. 1, showing the parts on a larger scale. Fig. 6 is a side view of the slide. Fig. 7 is a top view of the said slide. Fig. 8 is, respectively, a front and a sectional view of the reverse links.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

The engine shown is illustrative of the type for which the invention is adapted, namely, a four cycle internal combustion engine. The gaseous charge is aspirated, whereas the gases resulting from explosion are expelled by the action of the piston, the parts being arranged to acquire positive action only of the sparker and the exhaust valve, the latter being closed automatically with the usual spring and opened and held open by the operating cam.

The sparker 1, which may be of any well known structural type is adapted to be actuated by means of a tappet rod 2 which has connection with a slide 3 held in place and directed in its reciprocating movements by suitable keepers 4 and 5. The slide 3 is provided upon its outer side with spaced lugs 6, the inner corners of which are made rounding, as indicated at 7, to provide for free oscillation of the idle link and at the same time to facilitate the movement of the reverse links when shifting from one position to another, as when reversing the engine. The slot 3 is adapted to operate the exhaust valve by impact with the stem 8 thereof and which takes place upon the forward movement of the slide when actuated by the proper portion of the cam.

The reverse links 9 and 10 are adapted to slide between the spaced lugs 6 and are pivotally connected in any manner, one link being idle and the other active, according to the direction of travel of the engine. As indicated most clearly in Fig. 8, the links 9 and 10 are pivotally connected by means of a pin 11 which is extended at one end to make

connection with the pitman 12 which connects said reverse links with one arm 13 of a bell crank, the other arm 14 of said bell crank being connected by link 15 with the reverse lever 16, the latter being provided with the usual hand latch arranged to cooperate with a notched bar to secure the reverse lever in the required position. In one position of the reverse lever 16, one of the links 9 or 10 occupies a position between the spaced lug 6 and is active, while at the same time the other reverse link is clear of said spaced lugs and is idle so as not to impart any movement to the slide while free to oscillate under action of the operating cam. The two positions of the reverse links are indicated by the full and dotted lines in Fig. 3.

Two rocker arms 17 and 17^a are pivoted at 18 to the frame of the engine and are connected by rods or bars 19 and 19^a with the respective reverse links 9 and 10. Each rocker arm is provided with a roller 20 adapted to bear against the edge of the respective cooperating cam 21 or 21^a. The rocker arms 17 and 17^a are acted upon by means of a yielding force to hold their rollers in contact with the cooperating cams. Rods or bars 22 and 22^a have connection with the respective rocker arms 17 and 17^a and pass through openings in a web 23 of the engine frame and receive springs 24 and 24^a and set nuts 25 and 25^a by means of which the tension of the springs 24 and 24^a is regulated, said springs being confined upon the respective rods between the web 23 and the set nuts 25 and 25^a.

A crank shaft 26 is provided with a gear wheel 27 which is in mesh with a gear wheel 28 mounted upon a stud shaft 29 secured at its inner end to the engine frame and supporting the cams 21 and 21^a which are connected with each other and with the gear wheel 28 to rotate therewith. This arrangement admits of the crank shaft 26 making two revolutions to each revolution of the gear wheel 28 and the cams 21 and 21^a.

The two cams 21 and 21^a are of like formation, but have a different angular arrangement in order to operate the engine in either one direction or the other. Each of the operating cams is formed with the following raised or cam portions, namely, A, B, C and D. The cam portion *a* at one end of the cam portion A effects opening of the exhaust; the latter remaining open until the cam portion *b* at the end of the part A is reached. From *b* to C the engine is aspirating and drawing in a charge and from the point C to D the charge is compressed and at D the sparker is actuated to effect combustion and from D to *a* the engine is operating on the explosion stroke, and at *a* the exhaust begins to open and is held open by the cam portion A until the cam portion *b* is reached when the exhaust closes and the engine again takes a

charge. It is noted that the cam portion B is about opposite to the cam portion D, but when the engine is running in one direction, the part B will not effect explosion of the charge because the engine at this time is beginning to aspirate or draw in a charge preliminary to compressing the same for effective work when combustion takes place. When the cam portion D reaches a position to actuate the rocker arm effectively connected with the slide 3, the charge is properly compressed and the spark is produced to effect explosion of the charge so as to impart an impulse to the engine to continue its movement in the same direction.

From the foregoing it will be understood that only one rocker arm at a time has positive or effective connection with the slide to cause movement of the latter; the other while oscillating being a dead member or idle. Upon reversing the engine by actuating the reverse lever 16, the combination of the links 9 and 10 is changed, that is, the idle link becomes the active member and the previously broken link the idle or dead member. While the position of the links is changed with reference to the slide 3, the shaft 26 continues to rotate in the same direction, and since the cam 21 that was active prior to operating the reverse lever now becomes inactive and the idle cam 21^a is brought into play, the projection or cam portion B of said cam 21^a operates the rocker arm 17^a and through the connecting means operates the slot 3 to effect the spark mechanism, whereby the compressed charge is exploded out of regular order so as to drive the piston in the opposite direction and thereby give an initial impetus to the engine for reversing the same, and after this initial impetus has been imparted to the engine in the reverse direction, the cam portion D of the cam 21^a operates the sparker in the regular way so as to drive the engine continuously in the reverse direction. It is not expedient to operate the reverse mechanism when the engine is running at high speed and it is preferable to materially reduce the speed to bring the reverse mechanism into play. The speed of the engine may be reduced by throwing the sparking mechanism out of action or in any manner usually adopted in the art to produce a slowing down of the engine. Upon operating the reverse lever, the sparker is actuated so as to utilize the compressed charge in the cylinder to effect a reverse of the engine instead of exploding said charge to continue to drive the engine in the same direction, and in this lies the essential feature of the present invention. The supplemental cam portion B comes into play once only and that at about the instant the reverse lever is operated so as to effect combustion of the charge in the engine to drive the piston in the opposite direction.

Having thus described the invention, what is claimed as new is:

1. In a four cycle internal combustion engine and in combination with reverse gear therefor, like cooperating cams, each having a supplemental raised portion for actuating the sparker upon operation of the reverse gear to utilize the compressed charge of the engine to drive the piston in the opposite direction to give an initial impetus in the reverse direction.

2. In an internal combustion engine of the four cycle type, and in combination with the reverse gear embodying a link motion, independent rocker arms, and operating cams, each of the latter having a supplemental raised portion to effect an initial operation of the sparker to explode the charge in the cylinder upon operating the reverse lever to drive the piston in the opposite direction and thereby give an initial impetus to the engine in the opposite direction.

3. In an explosive engine of the type specified and in combination with a reverse gear comprising a slide, pivotally connected reverse links one having effective connection with the slide and the other at the same time being idle, rocker arms having independent connection with said reverse links, and two like cams for actuating the rocker arms and having a different relative angular arrangement, each of said cams having a supplement-

tal raised portion to come into play the instant the engine is reversed to effect explosion of the charge to give an initial impetus to the engine in an opposite direction.

4. In an engine of the explosive type substantially as specified, the combination of reverse gear therefor comprising a slide, pivoted reverse links adapted to cooperate with said slide, the one being active and the other idle, means for shifting said links to bring the idle link into active operation and to throw the working link out of action, rocker arms, connecting means between said rocker arms and the reverse links, like cams for the rocker arms each having a supplemental raised portion, said cams having a different relative angular arrangement, whereby upon reversing the engine the supplemental raised portion of the idle cam comes into play to effect explosion of the compressive charge in the cylinder to give an initial impetus to the piston in the opposite direction, thereby utilizing the charge of the engine to effect reversing the rod, and means for holding said rocker arms in active cooperation with the said cams.

In testimony whereof I affix my signature in presence of two witnesses.

FREDERICK T. FLINCHBAUGH. [L. S.]

Witnesses:

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GEORGE R. BOND.