

Feb. 14, 1933.

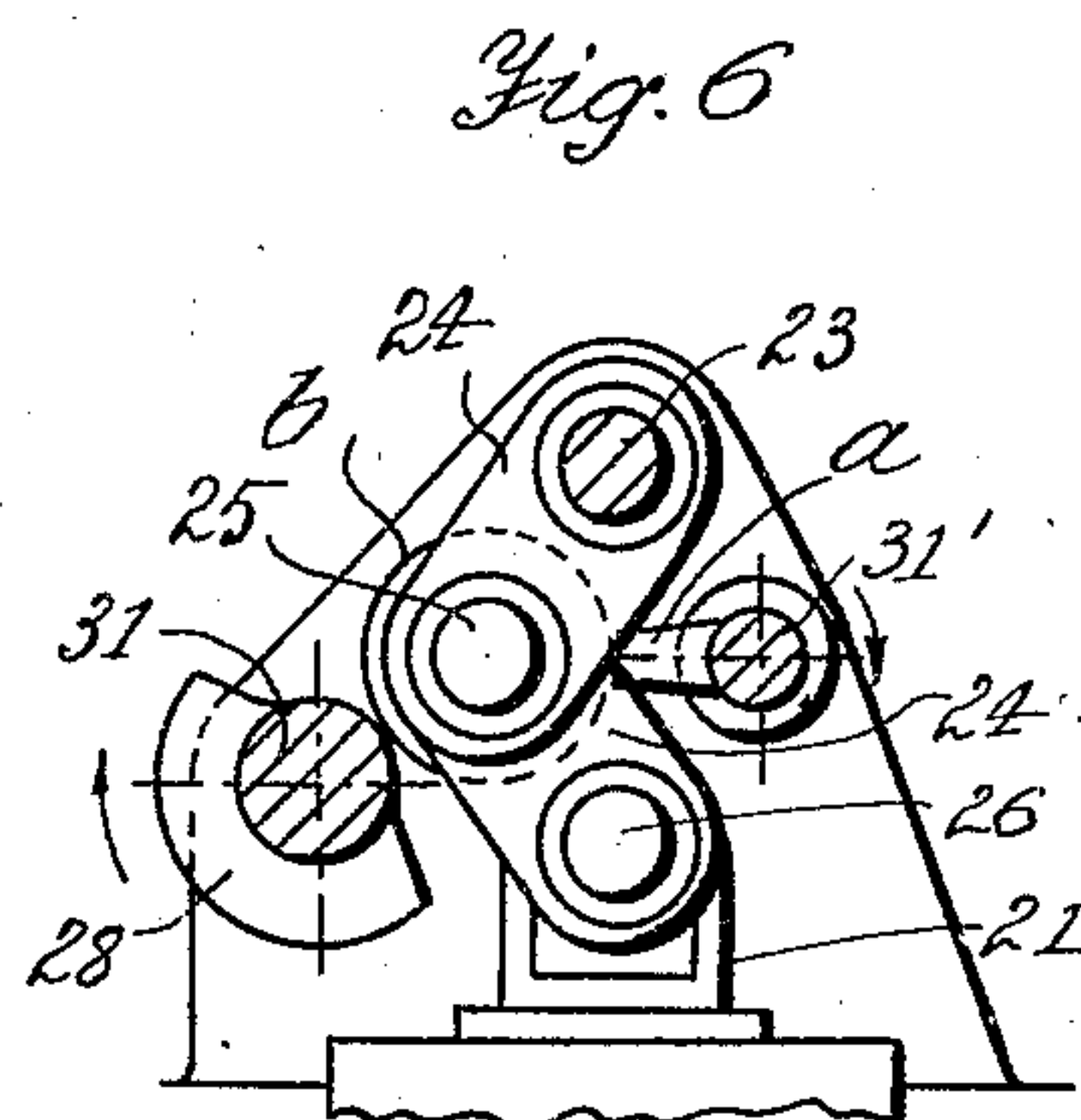
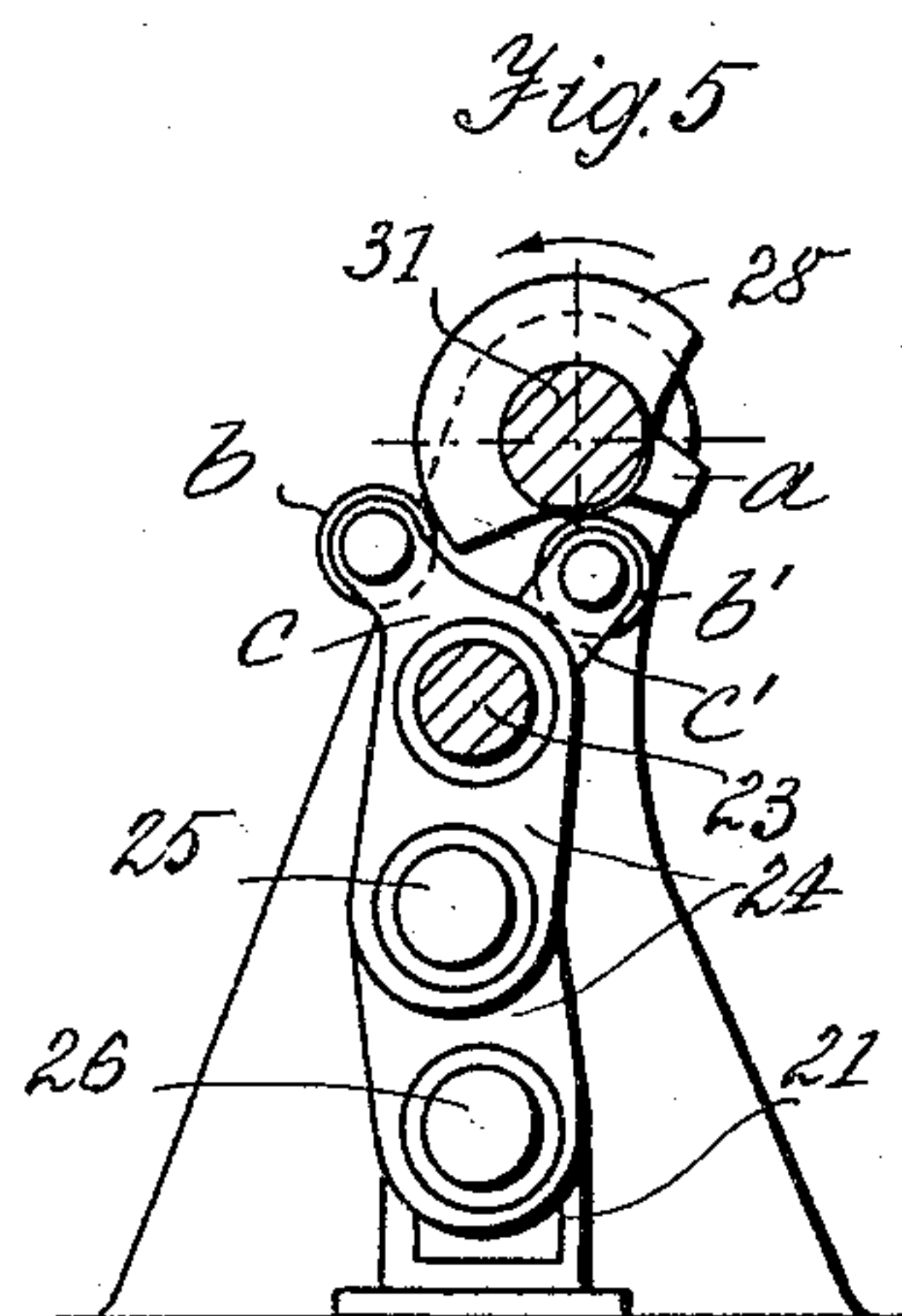
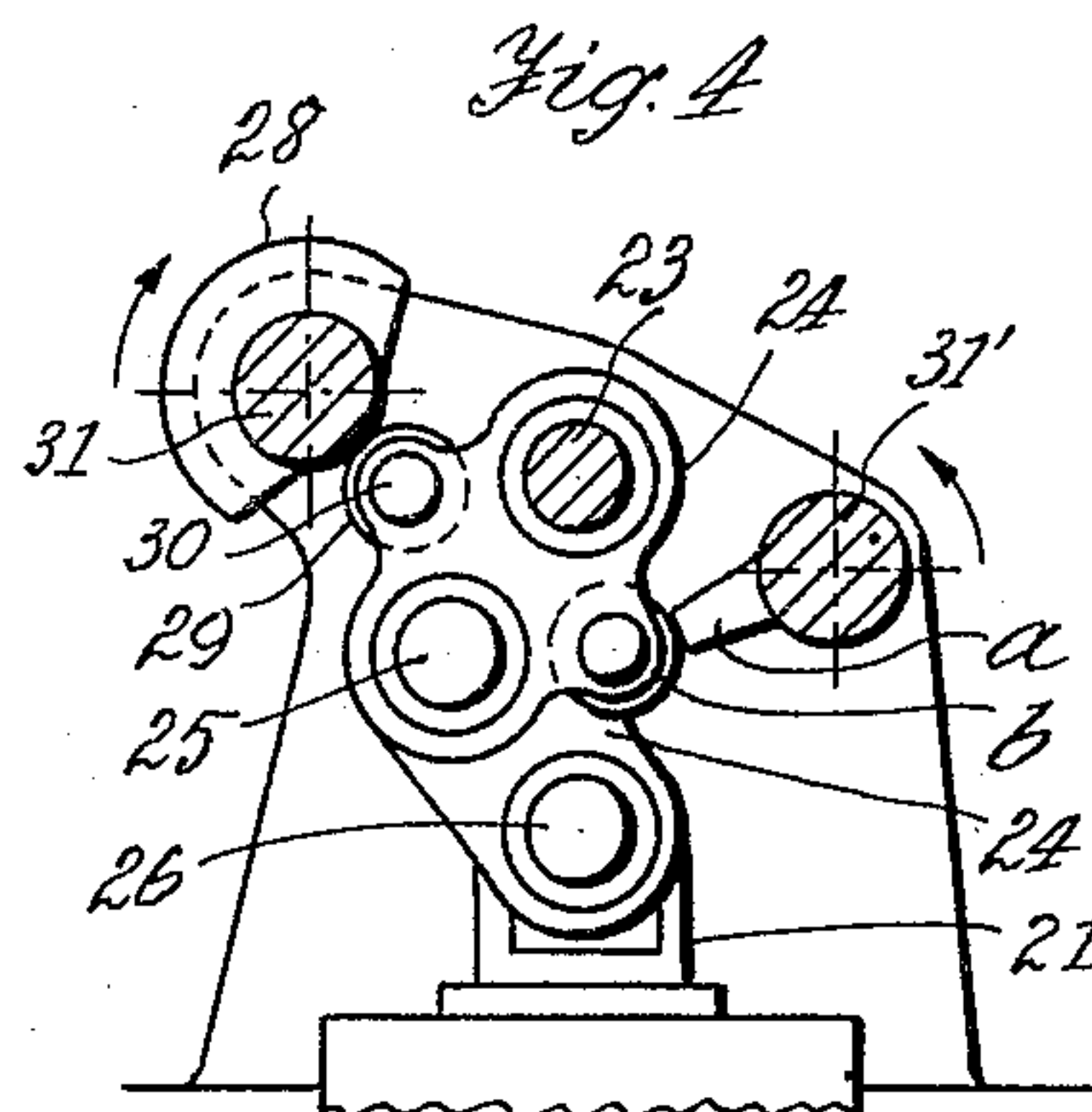
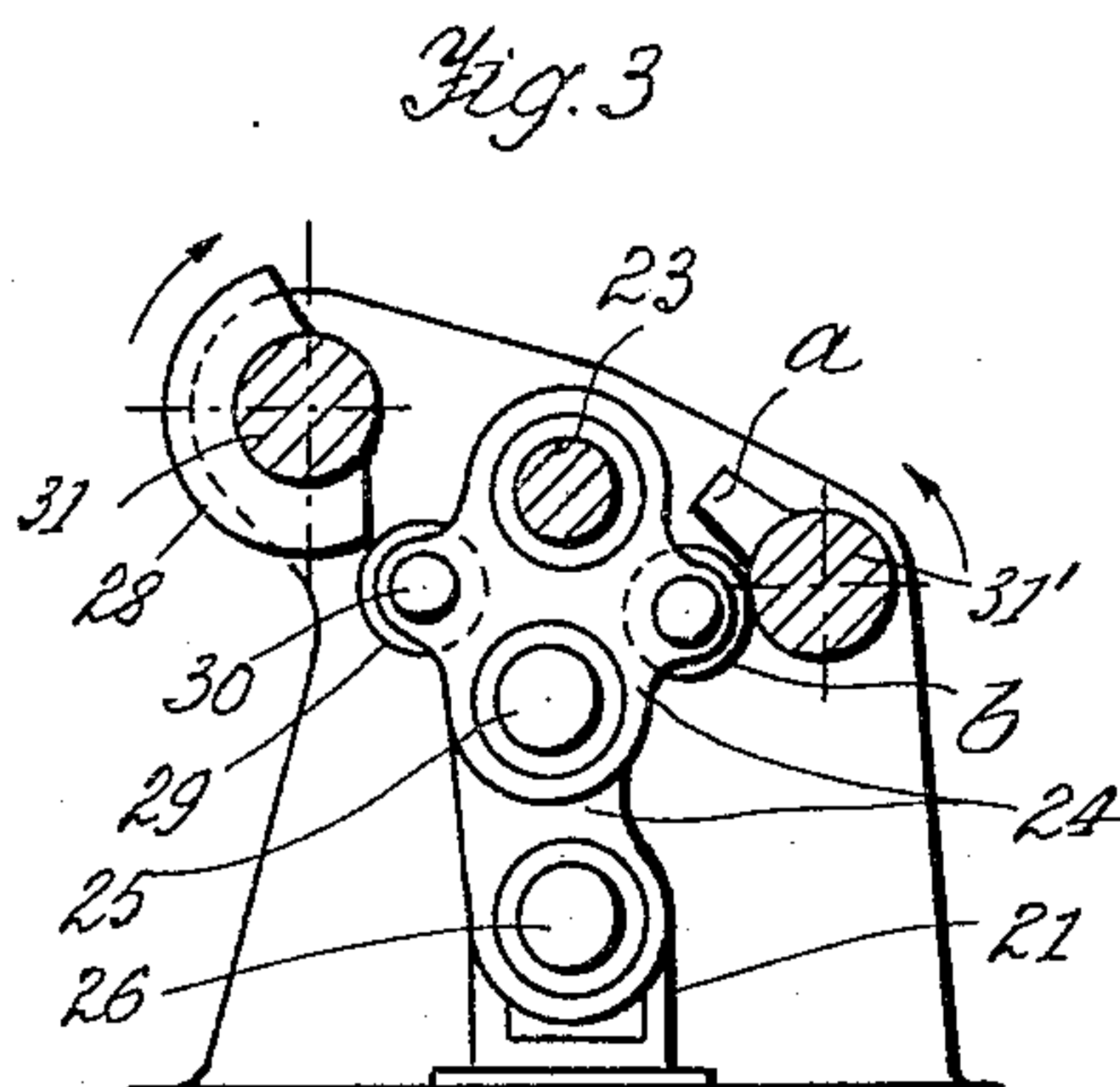
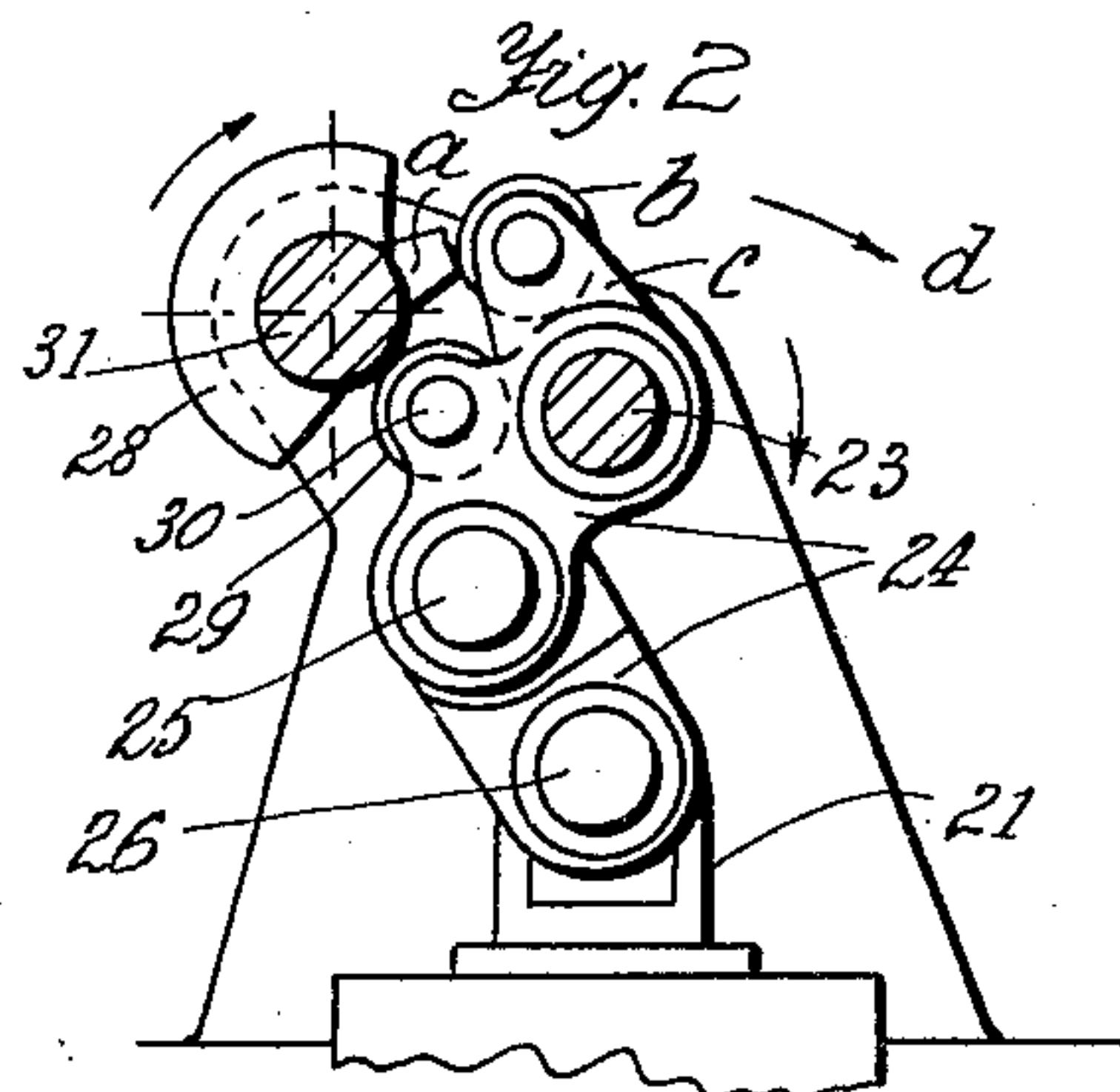
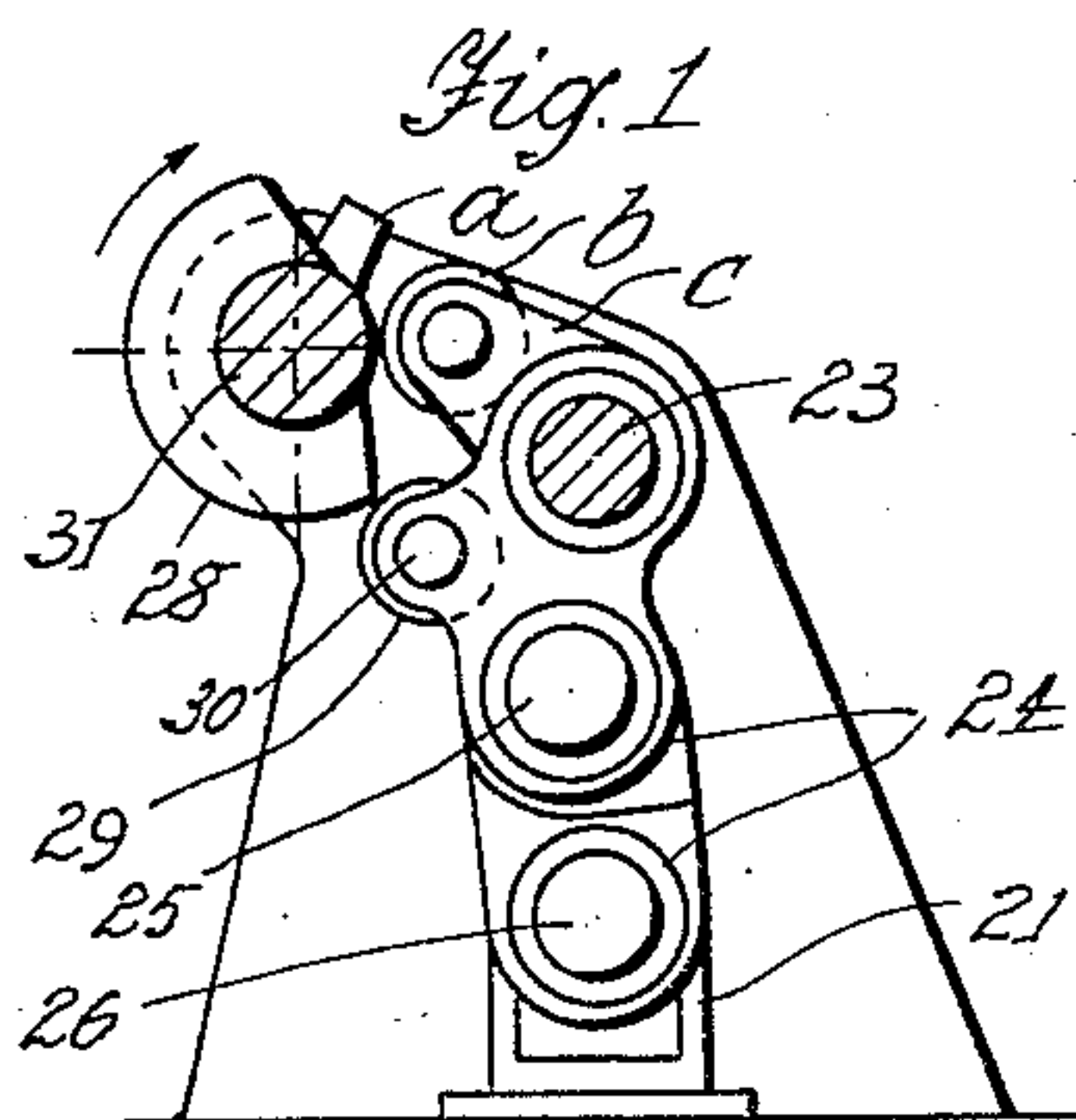
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1,897,825

INTERNAL COMBUSTION ENGINE

Filed Jan. 2, 1932

2 Sheets-Sheet 1



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Fig. 7

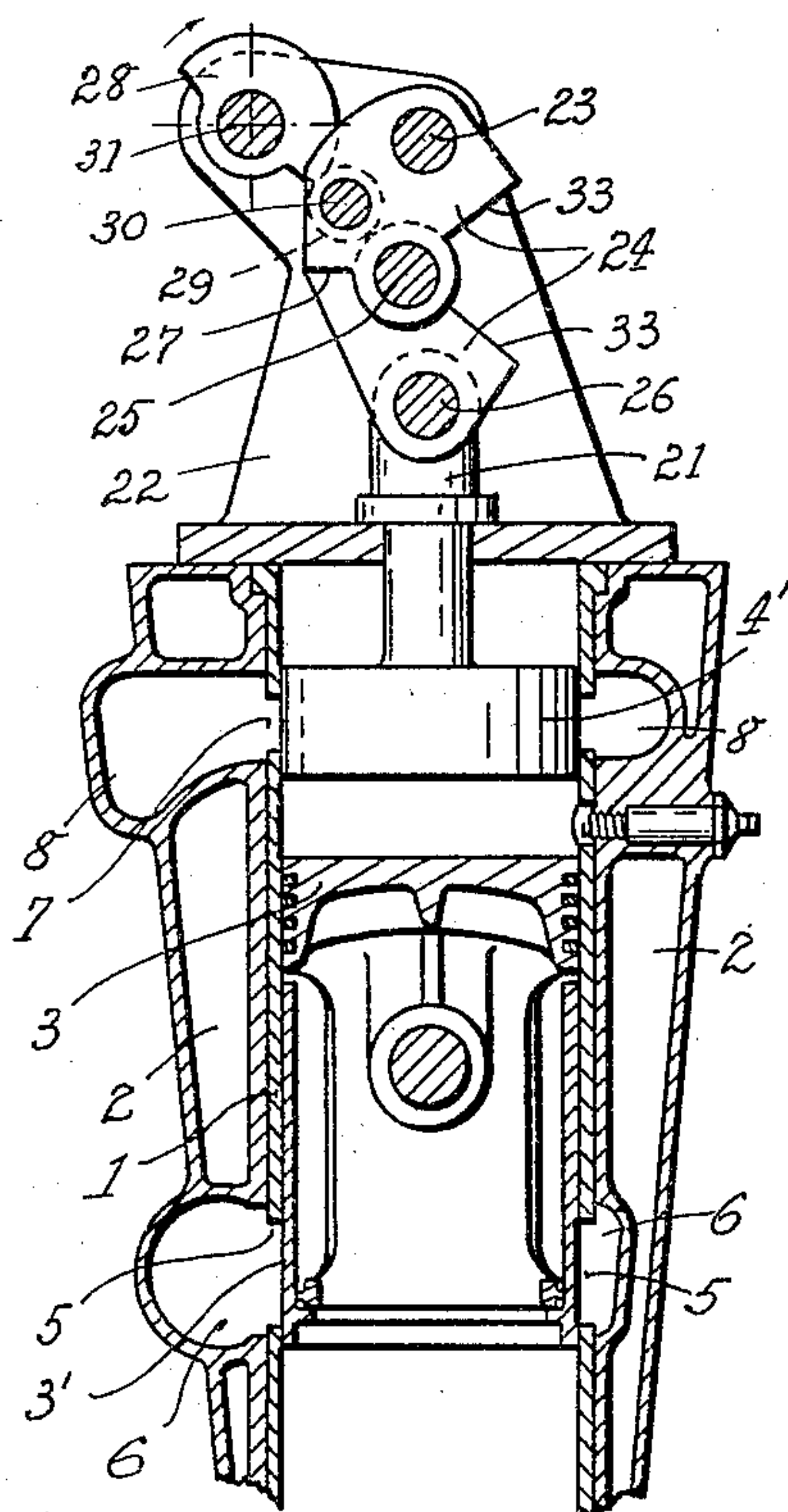
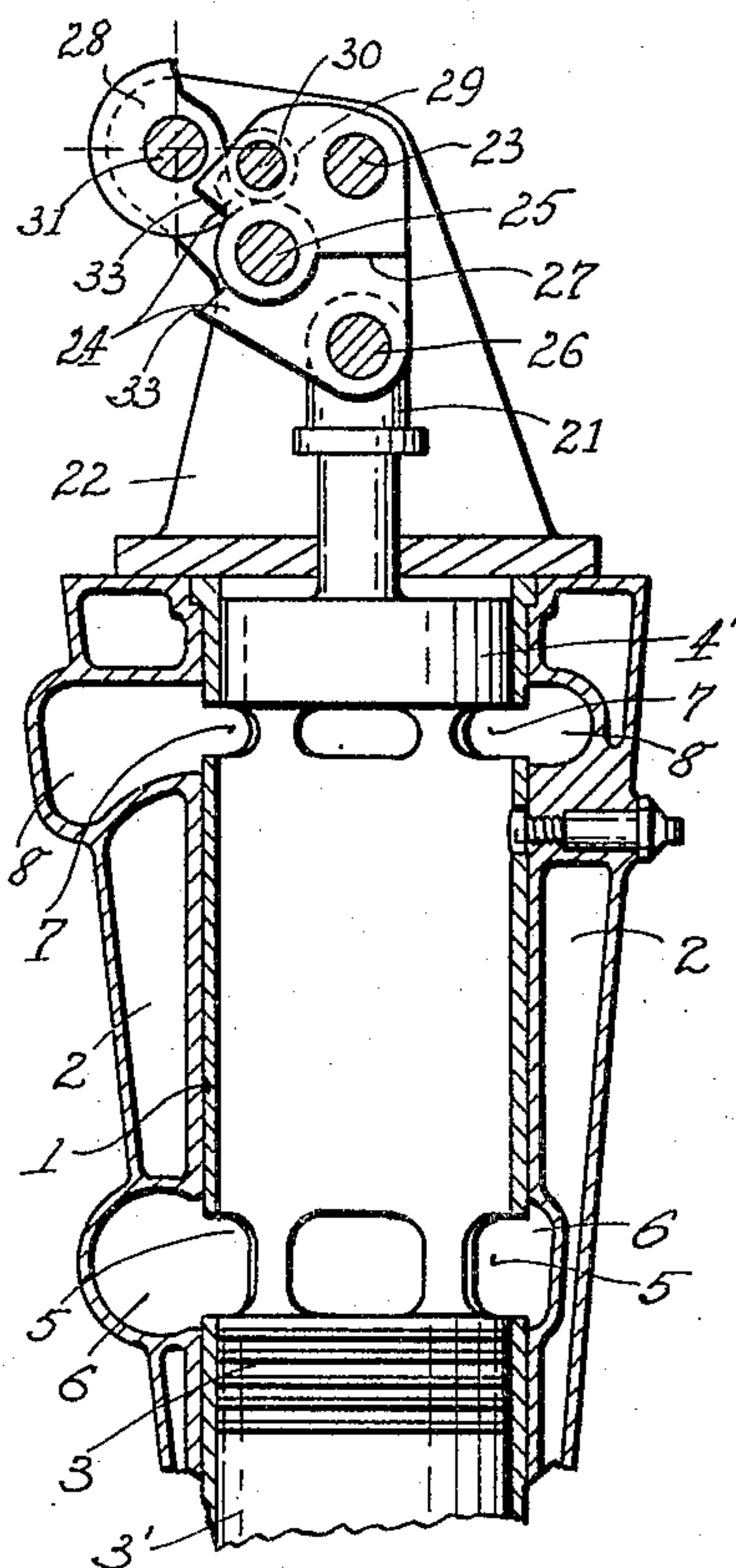


Fig. 8



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INTERNAL COMBUSTION ENGINE

Application filed January 2, 1932, Serial No. 584,375, and in Belgium January 17, 1931.

I have made application as follows: In Belgium, Patent No. 376,583, dated January 17th, 1931; in Belgium, Patent No. 376,584, dated January 17th, 1931; in Germany, Patent No. 536,395, dated January 30th, 1931; in Germany, filed on January 29th, 1931; and in Great Duchy of Luxemburg, Patent No. 18,213, dated March 28th, 1931.

My present invention has for its object to provide certain improvements in the internal combustion engine described in my U. S. Patent No. 1,853,464, of April 12, 1932.

Said engine is primarily characterized in that the movable cylinder head bearing against a fixed point through the agency of a movable toggle lever is moved in one direction by the pressure of exhaust gases in order to uncover the exhaust ports and in opposite direction by means of a cam acting on said toggle lever in order to cover the exhaust ports again during the admission, compression and explosion of a fresh charge.

This arrangement which operates perfectly after the engine has been started may be objectionable for the starting of the engine, as during the first strokes of the piston no explosion will be produced in the cylinder and therefore the movable cylinder head cannot be moved by the pressure of exhaust gases.

In order to avoid this objection and secure the opening of the exhaust ports by the movable cylinder head I provide an auxiliary device cooperating with the cam holding the arms of the toggle lever substantially aligned during the admission, compression and explosion, in such a way that at the moment said cam releases the toggle lever for enabling the same to be folded and the cylinder head to be moved for uncovering the exhaust ports, said device will positively act on the toggle lever for folding the same and thus moving the movable cylinder head even in the absence of any pressure of exhaust gases.

Said auxiliary device may be constructed and arranged in different ways. For instance the shaft of the cam serving to lock the toggle lever may be provided with a finger suitably displaced with relation to said

cam and acting on the arm integral with the upper arm of the toggle lever as the latter is unlocked by the cam, for the purpose of folding said toggle lever positively and thus displacing the movable cylinder head in order to open the exhaust.

The same result may be obtained by arranging said finger on a separate shaft or axle placed on the opposite side of the cam and rotating in opposite direction, so that upon the unlocking of the toggle lever by said cam said finger will act on the upper arm of the latter in order to fold the toggle lever and move the movable cylinder head.

The internal combustion engines described and illustrated in my U. S. Patent No. 1,853,464, of April 12, 1932 are of the four stroke cycle type in order to show the device in its most difficult application.

A further object of my present invention is to provide a particular arrangement in two stroke cycle engines, in which the exhaust is produced by the pressure of exhaust gases, in connection with the toggle lever described in my said patent.

This engine with fuel injection requires excessive amounts of air and therefore perfect suction and exhaust are necessary, that is wide air admission ports and a quick and complete exhaust of burnt gases must be provided. Owing to the size of the exhaust ports and the velocity of the uncovering thereof my present device represents an important technical progress. In fact as the exhaust is produced in equicurrent under full pressure through widely open ports, a strong current will be produced through the cylinder bringing with it the required amount of air, whereby the usual compressor will be avoided and a perfect and high turbulence produced, which is an important feature.

The new arrangement is primarily characterized in that the cylinder head is formed of a piston valve controlling the exhaust ports and connected to the locking device described in my U. S. Patent No. 1,853,464. However in my present arrangement such locking is effective only during the time of compression and explosion, during which

the exhaust and admission ports are widely open in spite of the fact that said ports are provided at the opposite ends of the cylinder and adjustable independently from each other.

In the accompanying drawings I have illustrated several embodiments of my invention.

Figs. 1 and 2 show the device with an operating finger on the shaft of the locking cam for the toggle lever. Fig. 1 shows the moment at which the toggle lever is about to be unlocked by the cam and folded by the operating finger, whilst Fig. 2 shows the toggle lever folded under the action of the finger.

Figs. 3 and 4 show the device with an operating finger mounted on an independent shaft in the same steps of operation as Figs. 1 and 2.

Fig. 5 is an embodiment comprising two cams on a common shaft engaging rollers on the top of the toggle lever.

Fig. 6 shows two separately acting cams engaging opposite sides of a roller on the central axle of the toggle lever.

Fig. 7 is a fragmentary section of the cylinder of the two cycle stroke engine at the moment of the explosion, and

Fig. 8 is a similar view showing the moment of the exhaust and admission.

In all the views of the drawings the various parts are indicated by the same numerals as those used in the drawings annexed to the specification of my U. S. Patent No. 1,853,464.

Referring to the embodiment shown in Figs. 1 and 2, the shaft 31 of the locking cam 28 for the toggle lever 24 is provided with a finger *a* suitably displaced with relation to the cam 28 and adapted to act on the roller *b* on an arm *c* integral with the upper arm 24 of the toggle lever.

As soon as the toggle lever has been unlocked by the cam 28 (see Fig. 1) the finger *a* will engage the roller *b* and force the arm *c* in the direction of the arrow *d* (Fig. 2), in order to fold the toggle lever as shown, even in the absence of any pressure of exhaust gases. As soon as the finger *a* ceases to act on the roller *b* the cam 28 will act again on the roller 29, in order to straighten the toggle lever again as described in the above cited patent.

Referring to the embodiment shown in Figs. 3 and 4, the operating finger *a* is arranged on an independent axle 31' rotating in opposite direction to the axle 31 on the opposite side of the toggle lever. In this arrangement the finger *a* acts on a roller *b* carried by the upper arm itself of the toggle lever in the same way as the roller 29 engaged by the locking cam 28.

At the moment the came 28 is disengaged

from the roller 29, the operating finger *a* (Fig. 3) will engage the roller *b* and force back the upper arm of the toggle lever 24, in order to fold the same positively even in the absence of any pressure of exhaust gases.

Referring to the embodiment shown in Fig. 5, the shaft 31 of the locking cam 28 for the toggle lever 24 carries also the suitably displaced finger *a*. These two members act on rollers *b*, *b'* on the arms *c*, *c'* integral with the upper arm 24 of the toggle lever. The rollers *b*, *b'* are arranged at the left and right respectively of the median plane passing symmetrically through the upper axle 23. The alternate pressure on the rollers *b* and *b'* causes the toggle lever to be folded and straightened again.

Referring to the embodiment shown in Fig. 6, the cam 28 and finger *a* act simultaneously and in opposite directions on the roller *b* carried on the central axle 23 of the toggle lever. The pressure of the finger *a* on the roller *b* causes the toggle lever to be folded, whilst the pressure on the cam 28 on said roller causes the toggle lever to be straightened again.

Referring to the embodiment shown in Figs. 7 and 8, 1 designates the cylinder of a two stroke cycle engine, 2 the water jacket around said cylinder and 3 the piston provided with a sleeve extension 3'. 5 indicates the admission ports and 6 the admission conduit, whilst 7 indicates the exhaust ports and 8 the exhaust conduit. The toggle lever arrangement is indicated by the numerals 21 to 33 as in the drawings of my Patent No. 1,853,464, dated May 8th 1930.

In the present arrangement the movable cylinder head is formed of a tight piston valve 4', the stem of which is connected by the ears 21 to the movable axle 26 of the toggle lever.

The positions of the various members or parts shown in Fig. 7 correspond to the moment at which the explosion of the compressed charge is about to take place.

The explosion causes the piston 3 to be moved downwardly and while said piston uncovers the admission ports, the cam 28 will release the toggle lever in the manner described in my mentioned patent, whereby the piston valve 4' will be suddenly moved upwardly under the pressure of the exhaust gases and the exhaust ports 7 opened, through which the exhaust gases will be released before the head of the piston 3 has reached the admission ports. Upon its continued stroke the piston 3 will in turn uncover the admission ports 5 through which fresh air will be admitted in an engine with fuel injection, or gases in an explosion engine, such fluids being supplied under some pressure.

Upon its upward movement the piston

3 will reach the exhaust ports closed by the piston valve 4' which has been locked by the toggle lever. Upon its continued upward movement the piston 3 will cover the admission ports and compress the air or gases contained in the cylinder, in order to permit an explosion or combustion, as the case may be, at the upper end of its stroke.

It will be seen that in this arrangement applicable to two stroke cycle engines the toggle lever arrangement described may be replaced by any other operating device acting on the piston valve 4' forming the movable cylinder head, without departing from the spirit of the invention.

I wish it to be understood that the invention has been described merely by way of nonlimitative example and that modifications may be made in the details thereof without departing from the scope of the invention.

I claim:

1. In an internal combustion engine, the combination with a cylinder provided with exhaust and admission ports, a movable cylinder head, a toggle lever connected to said movable cylinder head and a fixed pin, and a cam serving to lock said toggle lever in its straightened position during the compression and explosion periods, of means cooperating with said locking cam in such a way that at the moment said cam releases the toggle lever for enabling the same to be folded and the cylinder head to be moved for the purpose of opening the exhaust ports, said means is caused to act positively on the toggle lever for folding the toggle lever and move the cylinder head even in the absence of any pressure of exhaust gases, substantially as set forth.

2. In an internal combustion engine, the combination with a cylinder provided with exhaust and admission ports, a movable cylinder head, a toggle level connected to said movable cylinder head and a fixed pin, a cam serving to lock said toggle lever in its straightened position during the compression and explosion periods, and a rotatable shaft carrying said cam, a finger mounted on said shaft and suitably displaced with relation to said cam, a short arm integral with one of the arms of the toggle lever, and a roller mounted on said short arm, said finger being adapted to cooperate with said roller in order to fold the toggle lever after the same has been released by said locking cam, substantially as set forth.

3. In an internal combustion engine, the combination with a cylinder, provided with exhaust and admission ports, a movable cylinder head, a toggle lever connected to said movable cylinder head and a fixed pin, a cam serving to lock said toggle lever in its straightened position during the compression and explosion periods, and a rotatable

shaft carrying said cam, of a second rotatable shaft arranged in front of the first named shaft on the opposite side, and a finger on said second shaft suitably displaced with relation to said cam and adapted to cause the toggle lever to be folded as soon as it will be released by said cam, substantially as and for the purpose set forth.

4. In an internal combustion engine, the combination with a cylinder, provided with exhaust and admission ports, a movable cylinder head, a toggle lever connected to said movable cylinder head and a fixed pin, a cam serving to lock said toggle lever in its straightened position during the compression and explosion periods, and a rotatable shaft carrying said cam, of a finger on said shaft suitably displaced with relation to said cam, two short arms integral with the toggle lever, and rollers on the free ends of said short arms, one of said rollers being adapted to be engaged by the locking cam for locking the toggle lever in its straightened position whilst the second roller is adapted to be engaged by said finger upon the release of the toggle lever by said cam, substantially as and for the purpose set forth.

5. In an internal combustion engine, the combination with a cylinder provided with exhaust and admission ports, a movable cylinder head, a toggle lever connected to said movable cylinder head and a fixed pin, a cam serving to lock said toggle lever in its straightened position during the compression and explosion periods, and a rotatable shaft carrying said cam, of a second rotatable shaft, a finger on said second shaft suitably displaced with relation to said cam, and a roller on the central pivot pin of the toggle lever adapted to be alternately engaged by said cam and finger, substantially as and for the purpose set forth.

6. In an internal combustion two stroke cycle engine, the combination of a cylinder and a piston movable within said cylinder, lower admission ports in the wall of said cylinder controlled by said piston, upper exhaust ports in the wall of the cylinder, a piston-valve forming the movable head of said cylinder and controlling said exhaust ports, means for locking said piston-valve in its closed position during the compression and explosion periods, and means for moving said piston-valve to uncover the exhaust valves even in the absence of any pressure of exhaust gases, substantially as set forth.

JACQUES EGIDE SERSTÉ.