

# PATENT SPECIFICATION

164,679

Application Date: Dec. 15, 1919. No. 35,537/20.

Complete Left: June 15, 1920.

Complete Accepted: June 15, 1921.



## PROVISIONAL SPECIFICATION.

### Improvements in or relating to Reciprocating Engines.

We, VICKERS LIMITED, a British company, of Vickers House, Broadway, Westminster, in the County of London, and Sir JAMES MCKECHNIE, K.B.E., a subject of the King of Great Britain, Director of Vickers Limited, aforesaid, of Naval Construction Works, Barrow-in-Furness, in the County of Lancaster, do hereby declare the nature of this invention to be as follows:—

This invention relates to reciprocating engines, such as internal combustion or steam engines, of the type employing opposed pistons in a common cylinder and connected in common to a crank shaft. In the Specification of our Application for Patent No. 23,028, dated 18th September, 1919, we have described a duplex engine of this type, in which the pistons of the two cylinders are connected to a pair of rocking levers at opposite ends of the cylinders, the levers themselves being connected by a link or links driving the shaft through a connecting rod. The present invention relates to various improvements or modifications in this construction of engine.

According to one modification twin crank shafts may be employed and the connecting rods connect to the opposite ends of the lower rocking lever instead

of directly to the link. Or the connecting rods may be attached to the opposite ends of a rocking lever carried on the shaft of the upper piston driven rocking lever, the connecting rod lever extending beyond the cylinders so as to allow the connecting rods to clear the latter. The shafts in this case are placed outside the line of the cylinders.

According to a further modification the connecting rod for a shaft placed at one side of the engine may be attached to an arm or lug on the lower rocking lever, to which arm the rocking lever link may also be connected, the opposite rocking lever having a corresponding arm or lug for attachment of the other end of the link, so as to balance the construction.

As in the construction described in the Specification No. 23,028 of 1919 already referred to, the link connecting the rocking levers may be guided or it may be left unguided, since the side stresses are found to be comparatively small.

Dated this 17th day of December, 1920.

HASELTINE, LAKE & Co.,  
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55, Liberty Street, New York, N.Y.,  
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Agents for the Applicants.

## COMPLETE SPECIFICATION.

### Improvements in or relating to Reciprocating Engines.

We, VICKERS LIMITED, a British company, of Vickers House, Broadway, Westminster, in the County of London, and Sir JAMES MCKECHNIE, K.B.E., a subject of the King of Great Britain, Director of Vickers Limited, aforesaid, of Naval Construction Works, Barrow-in-Furness, in the County of Lancaster, do

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hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to reciprocating engines, such as internal combustion or steam engines, of the type employing opposed pistons in a common cylinder and connected in common to a crank shaft. In the Specification of our Application for Patent No. 23,028, dated 18th September, 1919, we have described a duplex engine of this type, in which the pistons of the two cylinders are connected to a pair of rocking levers at opposite ends of the cylinders, the levers themselves being connected by a link or links driving the shaft through a connecting-rod. The present invention relates to various improvements or modifications in this construction of engine.

According to this invention the crank shaft is driven by a connecting-rod attached at one end to one of the rocking levers or to an auxiliary arm or rocking lever on the same axis as the main rocking lever, the said connecting-rod extending beyond the cylinders so that the shaft is situated quite clear of the cylinder structure. A pair of crank shafts may be provided, the connecting-rods of which are attached to opposite ends of the rocking lever, or associated arm or lever.

In order that the said invention may be clearly understood and readily carried into effect, the same will now be described more fully with reference to the accompanying drawings, in which:—

Figures 1, 2 and 3 show diagrammatically three modifications of this invention.

A, A are the cylinders. B, B<sup>1</sup> are the top and bottom pistons, a pair of pistons working in each cylinder. C, C<sup>1</sup> are the top and bottom rocking levers connected to the pistons by the connecting-rods *b*. D is the link connecting crosswise the opposite ends of the top and bottom levers C, C<sup>1</sup>. E is the crank shaft. F is the connecting-rod driving the shaft E. The cylinders are shown merely in outline and it is to be understood that any suitable arrangement of valves and parts is provided to enable the engine to be run as an internal combustion, steam or other fluid pressure engine.

In the arrangement shown in Figure 1, two crank shafts E are employed, placed vertically below the two cylinders A, but one shaft only may be employed, placed at the side, the second shaft with its con-

necting-rod being indicated in dotted lines. The two connecting-rods F are attached to the opposite ends of the lower rocking levers C<sup>1</sup>, the connecting-rods driving the shafts E through the crank pins *e*. The rocking levers are mounted upon the rocking shafts *c*, *c*<sup>1</sup> and the link D connects crosswise the opposite ends of the rocking levers C, C<sup>1</sup> the central pin *d* of the link being guided, if required, as described in the Specification No. 23,028 of 1919 already referred to. If the pin *d* is guided the two arms of the link should be separate to allow for the slight deviation from the vertical due to the reciprocating movement at the centre of the rigid link. A single link may however, be used and left unguided, the side stresses being taken by the rocking shafts *c*, *c*<sup>1</sup>.

The two rocking levers turn in opposite directions, the adjacent ends of the levers approaching to and receding from each other as the respective pistons B, B<sup>1</sup> to which they are connected by the piston connecting-rods *b* move on their inward and outward strokes respectively.

It will be seen that the crank shafts E are placed quite clear of the cylinders so that these may be brought as close together as is found practicable, allowing an engine to be built of small width.

In the modification shown in Figure 2, the crank shafts E are placed outside of the line of the cylinders, reducing the longitudinal dimensions of the engine while extending the lateral dimensions. In this case, in order to allow the connecting-rods F to clear the cylinders, an auxiliary rocking lever C<sup>2</sup> is provided on the upper rocking shaft *c*<sup>1</sup>, forming practically an extension of the rocking lever C and allowing the connecting pins of the rods F to extend over the edges of the cylinder castings or frame of the engine. Otherwise the engine operates similarly to that shown in Figure 1.

In the further modification shown in Figure 3, the rocking levers C, C<sup>1</sup> are not connected together directly by the link D, but are provided with auxiliary arms *c*<sup>2</sup>, *c*<sup>3</sup> to the ends of which the link D is connected. To the lower arm *c*<sup>2</sup> the connecting-rod F is attached. This arrangement allows the crank shaft E to be placed at one side of the engine, the connecting-rod extending at a substantial angle from the vertical line of the engine. The auxiliary arm *c*<sup>2</sup>, *c*<sup>3</sup> may be in the form of lugs on the levers C, C<sup>1</sup> or may be separate arms secured on the rocking shaft *c*.

The link D connecting the rocking

levers are subjected alternately to compression and tension but as mentioned in the Specification No. 23,028 of 1919, the other two ends of the rocking levers C, C<sup>1</sup> may be connected together by a tension rod so as to avoid subjecting the link D to compression.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A reciprocating engine of the kind set forth, in which the crank shaft is driven by a connecting-rod attached at one end to one of the rocking levers or to an auxiliary arm or rocking lever on the same axis as the main rocking lever, the said connecting-rod extending beyond the cylinder so that the shaft is situated quite clear of the cylinder structure.

2. A reciprocating engine of the kind set forth, in which a pair of crank shafts are driven by a pair of connecting-rods attached to opposite ends of one of the rocking levers or an auxiliary lever or extension turning with one of the rocking levers.

3. A reciprocating engine of the kind set forth, having its parts arranged and adapted to operate substantially in the manner hereinbefore described with reference to any one of the examples illustrated in the accompanying drawings.

Dated this 20th day of December, 1920.

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[This Drawing is a full-size reproduction of the Original.]

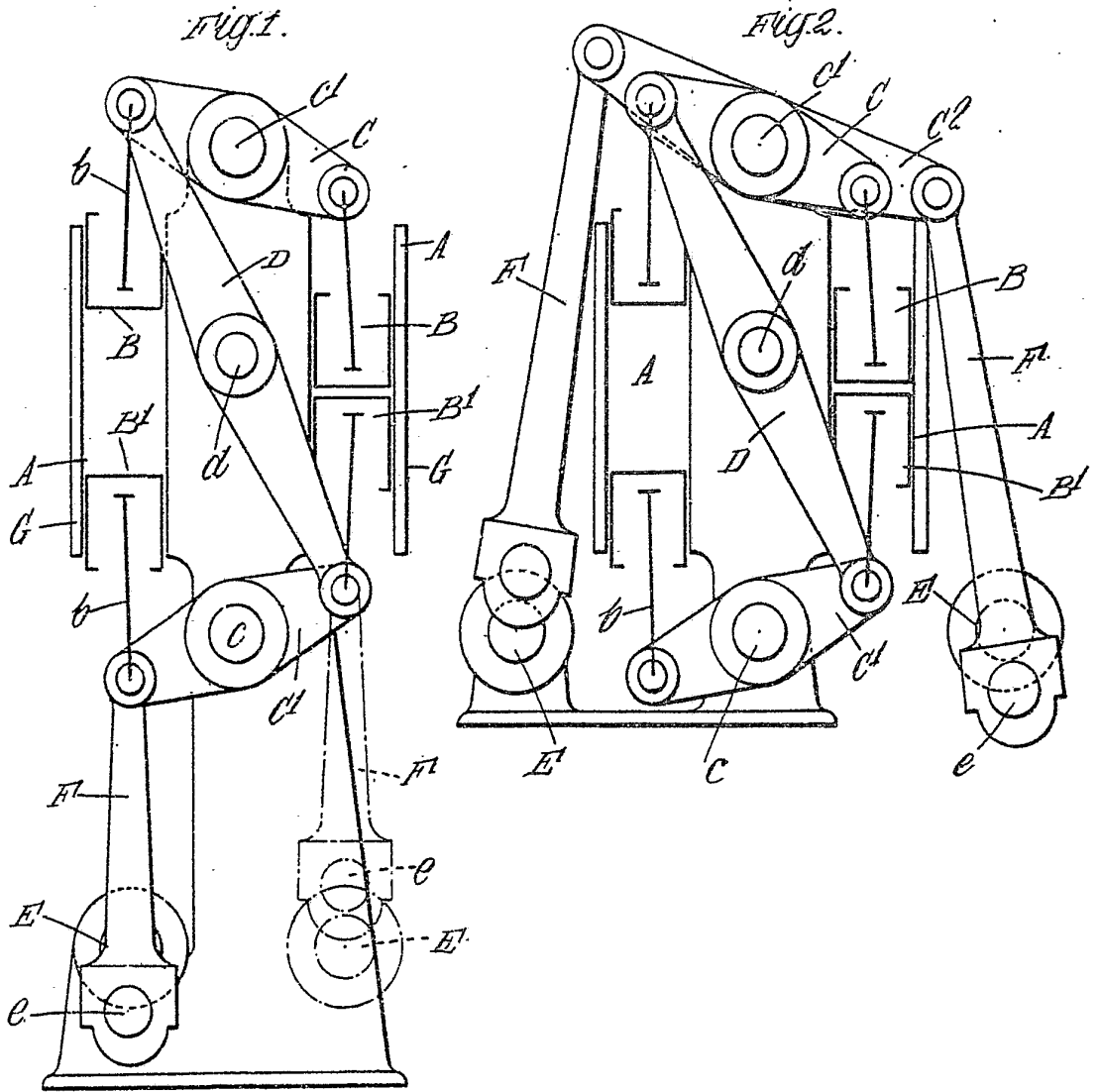


FIG. 2.

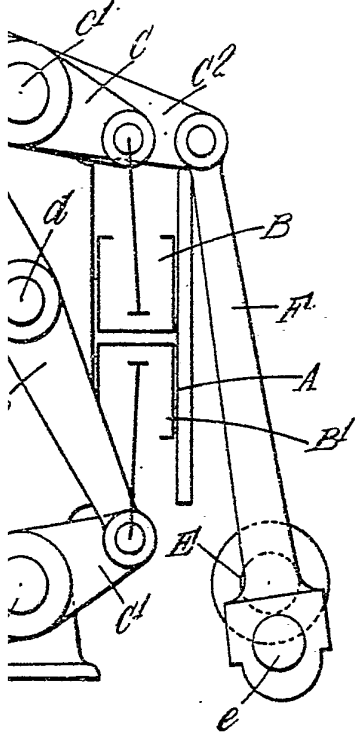
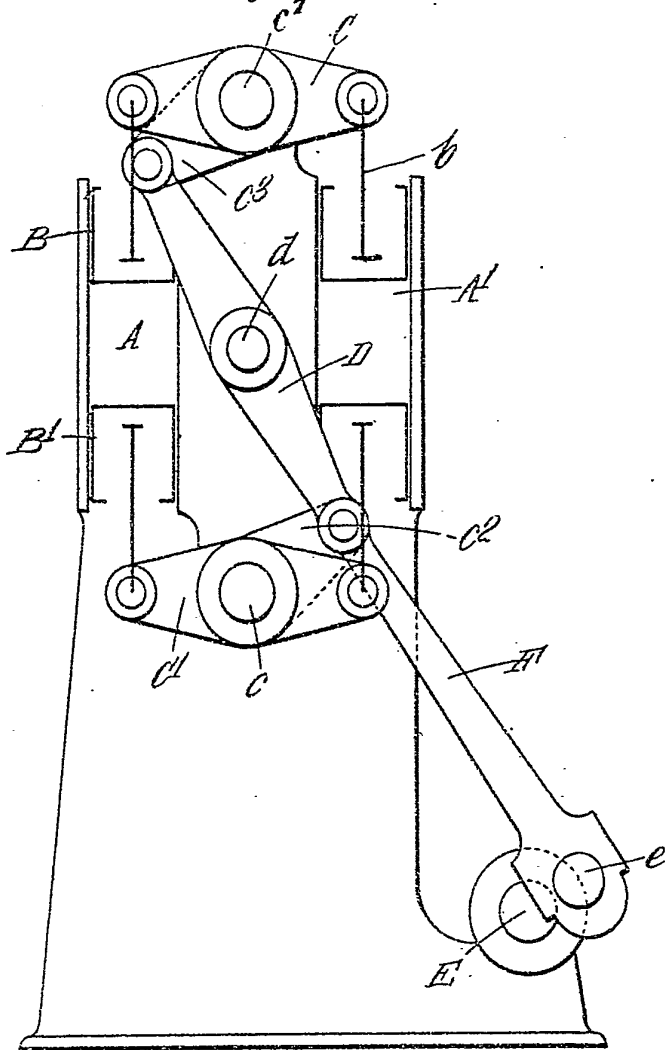
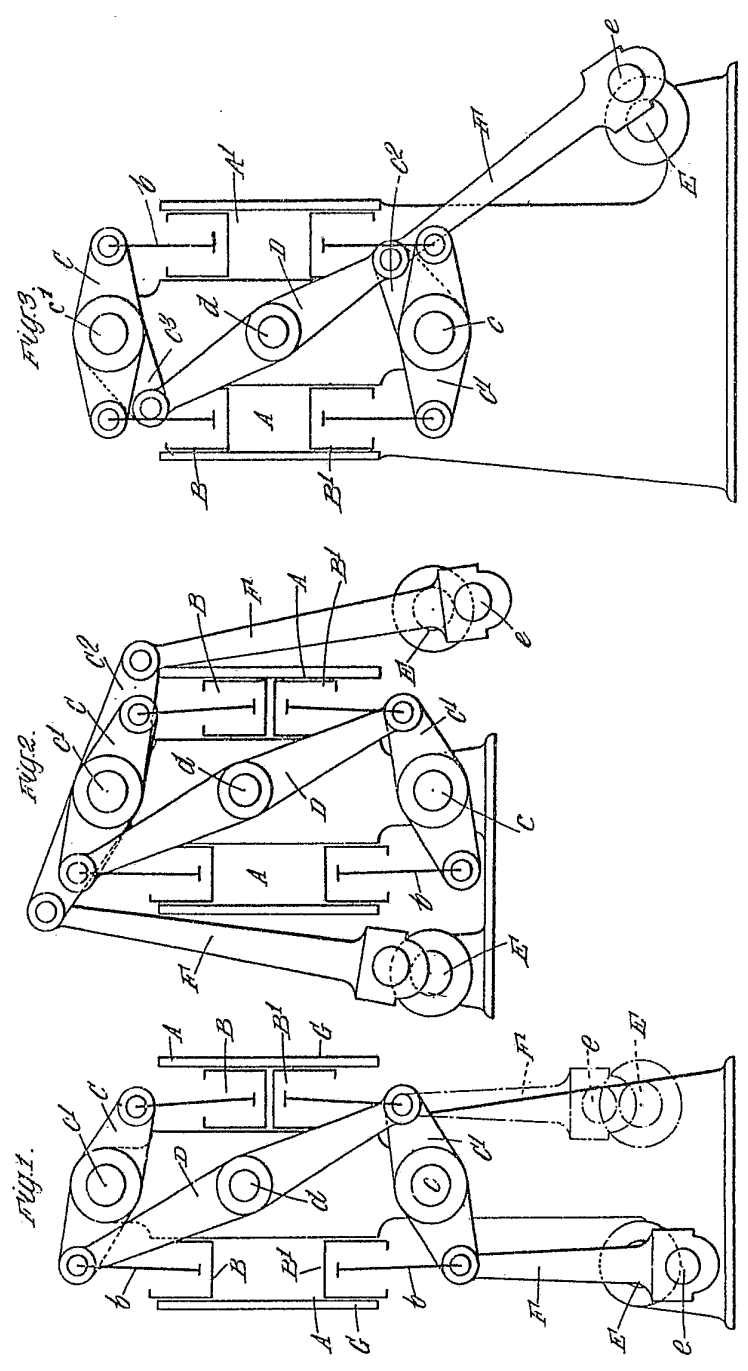


FIG. 3.





[This Drawing is a full-size reproduction of the Original]