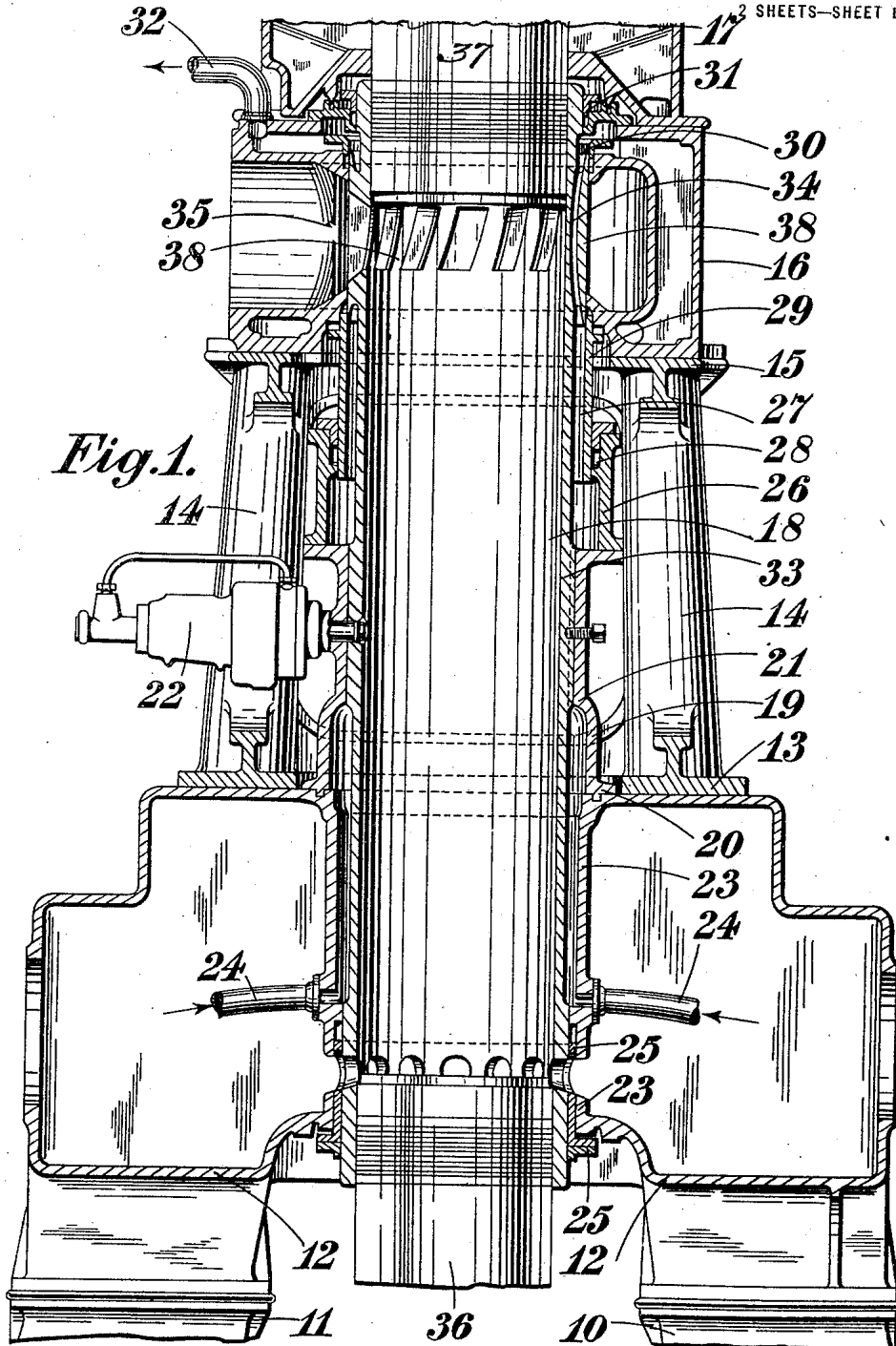


K. O. KELLER.  
INTERNAL COMBUSTION ENGINE.  
APPLICATION FILED JAN. 6, 1921.

1,393,626.

Patented Oct. 11, 1921.

SHEETS—SHEET 1.



*Fig. 1.*

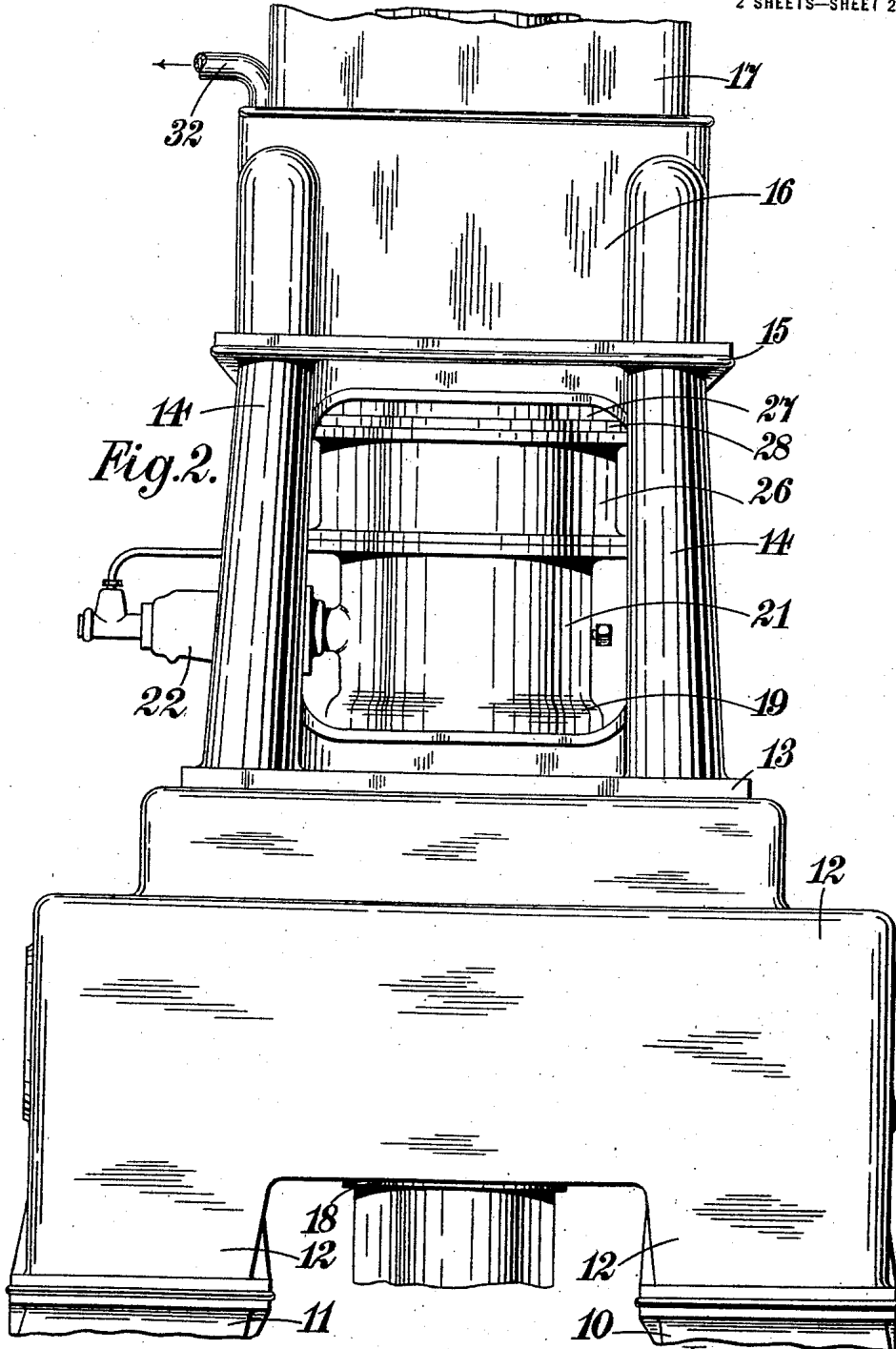
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2 SHEETS—SHEET 2.



Inventor  
Karl Otto Keller  
by *Richard Rogers & Hambley*  
his Attorneys

# UNITED STATES PATENT OFFICE.

KARL OTTO KELLER, OF SUNDERLAND, ENGLAND, ASSIGNOR OF ONE-HALF TO  
ROBERT PILE DOXFORD, OF SUNDERLAND, DURHAM, ENGLAND.

## INTERNAL-COMBUSTION ENGINE.

1,393,626.

Specification of Letters Patent.

Patented Oct. 11, 1921.

Application filed January 6, 1921. Serial No. 435,353.

*To all whom it may concern:*

Be it known that I, KARL OTTO KELLER, a citizen of the Swiss Confederation, residing at Sunderland, in the county of Durham, England, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention is for improvements in or relating to internal-combustion engines, and has for its object to provide an improved construction of the same which shall facilitate and simplify the manufacture of the engines and also render them more convenient in use. It is particularly applicable to large marine oil-engines of the type having vertical cylinders in which there are two oppositely moving pistons, such for example, as described in our patent application Serial No. 394,681, dated 8th July, 1920, but it may also advantageously be used with other types of engine.

In large internal-combustion engines, the working-cylinder proper is either made integrally with its surrounding water-jacket, or else a steel jacket is used with a cast-iron liner, the jacket being designed to take all the pressures due to compression and combustion. In either case it has been customary to arrange that the cylinder and liner support the weight of any other parts of the engine above them, and also take all the working stresses and vibrations which are set up when the engine is running. It will be realized, therefore, that the cylinder casting or the water-jacket casing, as the case might be, became a very complicated structure.

Furthermore, in the construction in which the jacket and the liner are separate castings, it is usual for them both to be secured at one end to the main frame of the engine, in order to provide adequately for their support. Under working conditions the liner attains a higher temperature than the jacket, so that the attachment of the valves or any other part which has to communicate with the interior of a cylinder must be made in such a way that it can accommodate the difference of expansion between the liner and the jacket.

The object of the present invention is to provide a construction such that any vibrations or lateral stresses set up on the part of the engine remote from the main frame are diverted from the cylinder and its water-

jacket casing, and also to provide for easy access to that part of the cylinder which contains the valves, that is, the fuel-injection valve, air-starting and relief-valve, and also to the water glands which are used on the jacket.

According to this invention there is provided in an internal-combustion engine, the combination with a cylinder located upon supports so arranged as to permit it to expand lengthwise, and a water-jacket casing surrounding it, but free from it at places where the cylinder and casing are permitted relative lengthwise movement due to differences of expansion between them, of an entablature that is separate from the said cylinder and the said casing, that carries the weight of the standing upper portion of the engine structure, and that diverts through itself away from the lower parts of the cylinder and casing to the standing lower portion of the engine structure, the lateral stresses that otherwise would travel down to the said standing lower portion by way of the said lower parts of the cylinder and casing.

Preferably the said parts are so constructed that the water-jacket casing is in two portions, upper and lower, that there can be relative movement between these two portions, that a packing device constituting a sliding joint between the bottom and the said upper portion and the top of the said lower portion is provided, and that the entablature is of skeleton form to permit access to the said packing device and to any other parts or devices used on the cylinder or jacket.

In the accompanying drawings, which illustrate the application of the present invention to a marine oil-engine having a vertical cylinder with its opposed pistons working in it,

Figure 1 is a central section through a cylinder showing such parts as are necessary to the understanding of this invention, and

Fig. 2 is an elevation of the same.

Referring to these drawings, the main supporting columns of the engine are indicated at 10, 11, only the upper ends of the columns being shown. Upon these columns there is secured a bridge-piece 12 which extends over all the columns and is secured to them. On top of the bridge-piece there is mounted an entablature comprising a base 13 which rests upon the bridge-piece

12 and columns 14 which terminate at their upper end in a platform 15. Upon the platform 15 there rests, and is secured, the water-jacketed exhaust belt of the engine 5 indicated generally by the reference 16. This exhaust belt 16 supports in turn the crosshead guides and other parts for the upper piston of the engine, which are indicated generally by the reference 17.

10 The working-cylinder is constituted by a liner 18 surrounded and supported by a water-jacket casing 19. This casing 19 is seated at its lower end 20 upon the bridge-piece 12 aforesaid, and any convenient form of watertight joint is used at this seating.

15 The water-jacket casing 19 is made of such a size at 21 that it fits closely to the liner 18, at the middle of the length of the liner, and the two parts are there secured together

20 so that the weight of the liner 18 is supported by the casing 19. The fuel-injection valve indicated diagrammatically at 22 and any other valves which are required to communicate with the interior of the cylinder are also

25 located at this point, since there can be no relative movement between the liner and the jacket due to differences in expansion between them. No other rigid connection between the liner and the cylinder-jacket is

30 made anywhere so that the ends of the liner are free to expand relatively to the ends of the jacket.

The parts of the cylinder-jacket, other than part 19, already mentioned, may be

35 constructed in any desired manner. In the construction illustrated, the lower end of the jacket is constituted by an internal wall 23 of the bridge-piece 12, and suitable pipe-connections 24 are made thereto for the ad-

40 mission of water to the jacket. The lower end of the jacket is rendered watertight by any desired form of packing-gland indicated at 25.

The upper part of the water-jacket is

45 constituted by a cylindrical portion 26 which is seated on the upper end of the part 19 and engages by a sliding connection the lower end of an upper cylindrical part 27, suitable packing being provided at 28 for

50 these two parts. The part 27 aforesaid, is shaped at its upper end 29 to provide a packing-gland between the lower end of the exhaust belt 16 and the cylinder-liner 18. A further gland 30 is provided at the upper

55 end of the exhaust belt. 20 to provide a watertight joint between it and the cylinder-liner 18, and the uppermost end of the liner 18 is also provided with a gland 31 where it enters the part 17 aforesaid.

60 The water outlet on the jacket is constituted by a suitable pipe-connection or connections 32 which communicate with the upper end of the jacket space of the exhaust belt 16.

65 The circulating water enters the jacket

by the inlet 24 and passes upward inside the parts 23, 19, as far as the part 21 of the casing. From this point it passes upward through a series of longitudinal grooves which may be formed either in the liner or in the casing 70 into the interior of the part 26. By using grooves 33 for the passage of the water, the desired close fit of the casing 21 to the liner 18 is not impaired. The water passes upward to the exhaust belt and passes the exhaust ports 35 by means of longitudinal pas- 75 sages 34 formed in the bars 38 of the liner between the ports 35. This construction insures adequate cooling of the exhaust bars 38 which are the parts always liable to trouble 80 through overheating. The water passes from the passages 34 into the jacket of the exhaust belt 16 and thence to the outlet pipe 32.

The invention is illustrated as applied to 85 an engine in which there are two oppositely-moving pistons 36, 37 in one cylinder, but if it is applied to an engine of the type having only one piston in each cylinder, the exhaust- 90 belt 16 would be replaced by the cylinder-head, and the weight of the cylinder-head and associated parts would be supported by the entablature 13, 14, 15 in the same way. The water-jacket could be of any desired 95 construction, and it will be appreciated that in this type of engine the use of the entablature aforesaid provides the same advantage of relieving the cylinder and jacket of the vibrations and lateral stresses which, arising at the upper end, would travel down 100 through them to the lower main structure of the engine.

An important advantage arising from the use of an entablature as above-described, is that the casting for the liner can be made of 105 plain cylindrical or tubular form provided only with flanges and bosses where necessary, and the various parts of the water-jacket also can be made of simple construction. Furthermore, by using an entablature 110 of skeleton form, that is to say, an entablature consisting of top and bottom plates connected by columns, the accessibility of the cylinder jacket glands and the valves is satisfactorily provided for. 115

What I claim as my invention and desire to secure by Letters Patent is:—

1. For an internal-combustion engine the combination with a cylinder located upon supports so arranged as to permit it to 120 expand lengthwise, and a water-jacket casing surrounding it but free from it at places where the cylinder and casing are permitted lengthwise movement in relation to one another due to differences of expansion between the casing and the cylinder, of an entablature that is separate from the said 125 cylinder and the said casing, carries the weight of and the stresses set up in and by the standing upper portion of the engine 130

structure, and diverts through itself away  
from the lower parts of the cylinder and  
casing to the standing lower portion of the  
engine structure the lateral stresses, that  
5 otherwise would travel down to said stand-  
ing lower portion by way of said lower parts  
of the cylinder and casing.

2. For an internal-combustion engine comprising two pistons working in opposite directions in one and the same cylinder bore,  
10 the combination according to claim No. 1, so constructed that the water-jacket casing comprises two portions, upper and lower,

that there can be relative movement between these two portions, that a packing device  
15 constituting a sliding joint between the bottom of the said upper portion and the top of said lower portion is provided and that the entablature is, for the purpose described,  
20 of skeleton form.

In testimony whereof I affix my signature.

KARL OTTO KELLER.

Witnesses:

WILLIAM RAWLINGS,  
WILLIAM HAMILTON PURDIE.