

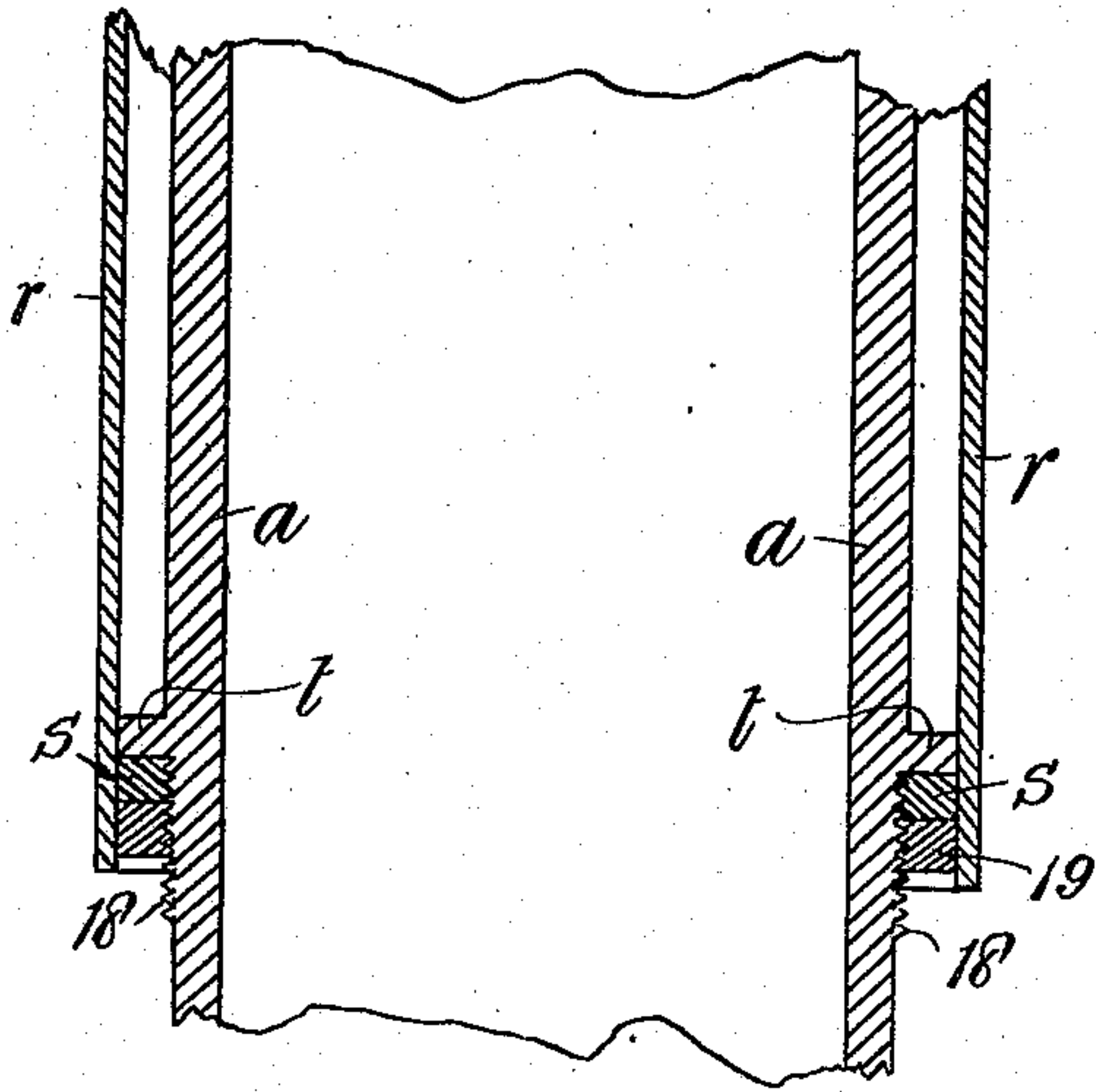
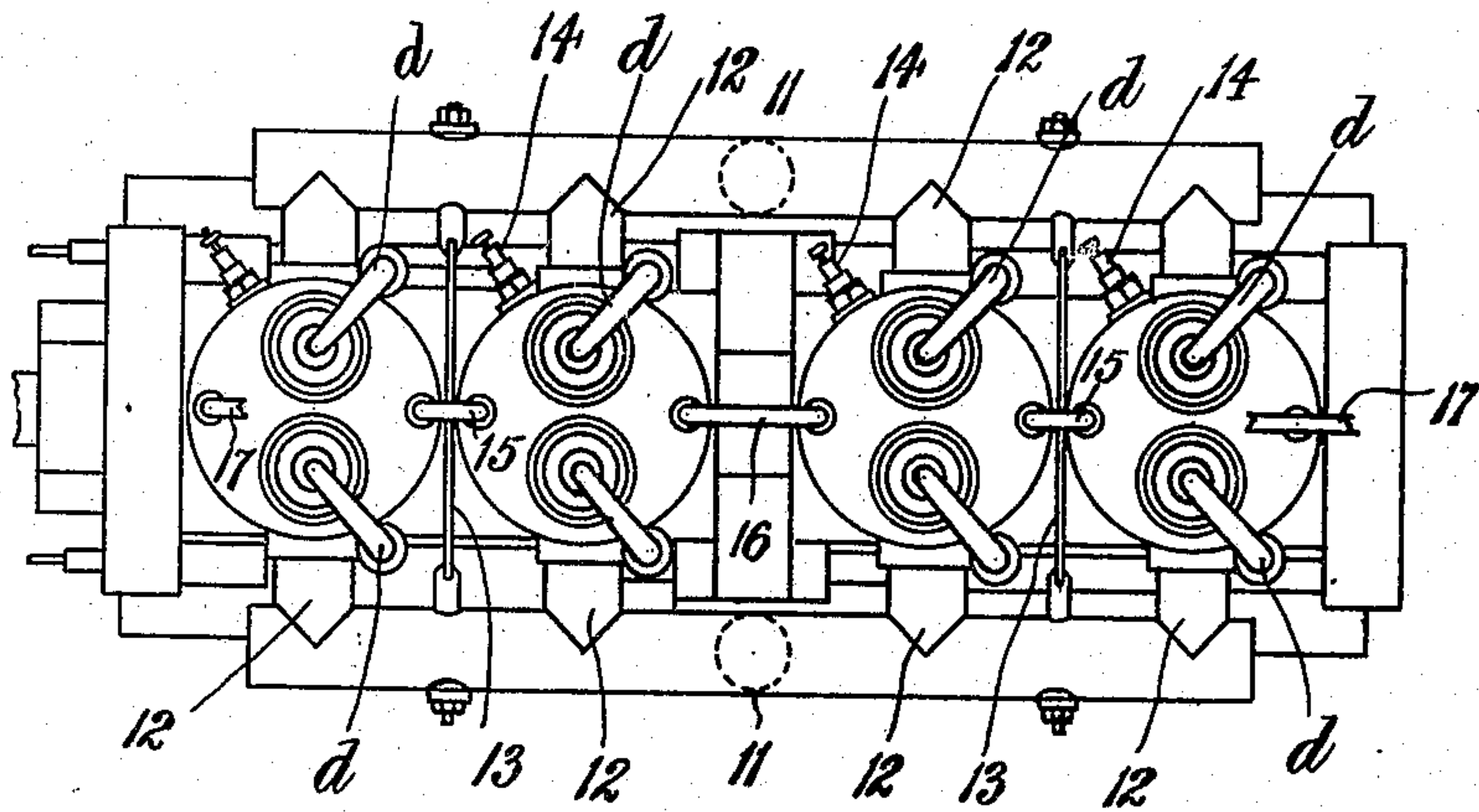
G. GREEN.  
INTERNAL COMBUSTION ENGINE.  
APPLICATION FILED SEPT. 15, 1905.

930,372.

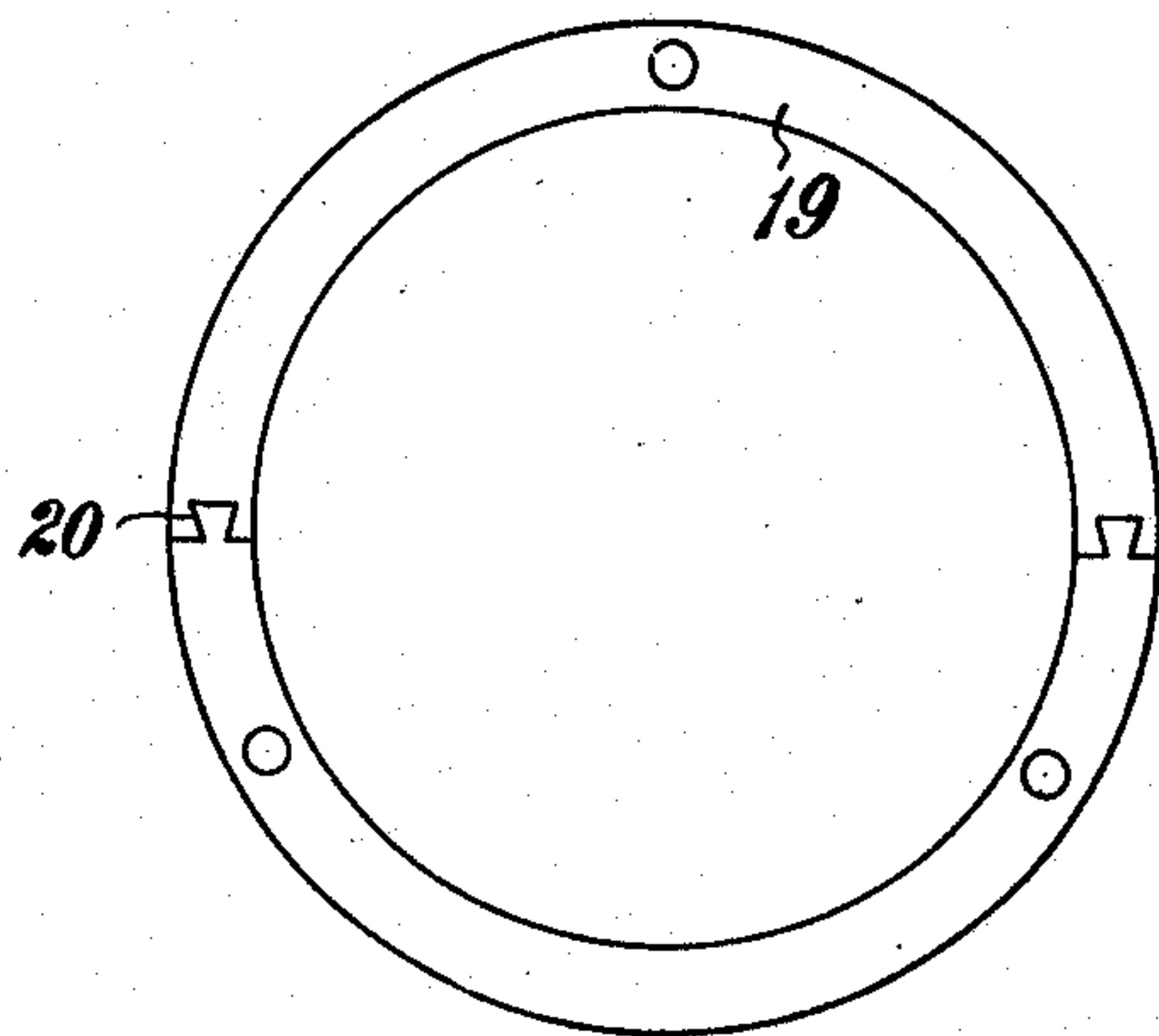
Patented Aug. 10, 1909.

3 SHEETS—SHEET 1.

*Fig: 1.*



*Fig: 6.*



*Fig: 7.*

Witnesses

*E. J. Barlow*  
*Walter J. Cook*

per

Inventor

*Gustavus Green*  
*Hepton Jones*

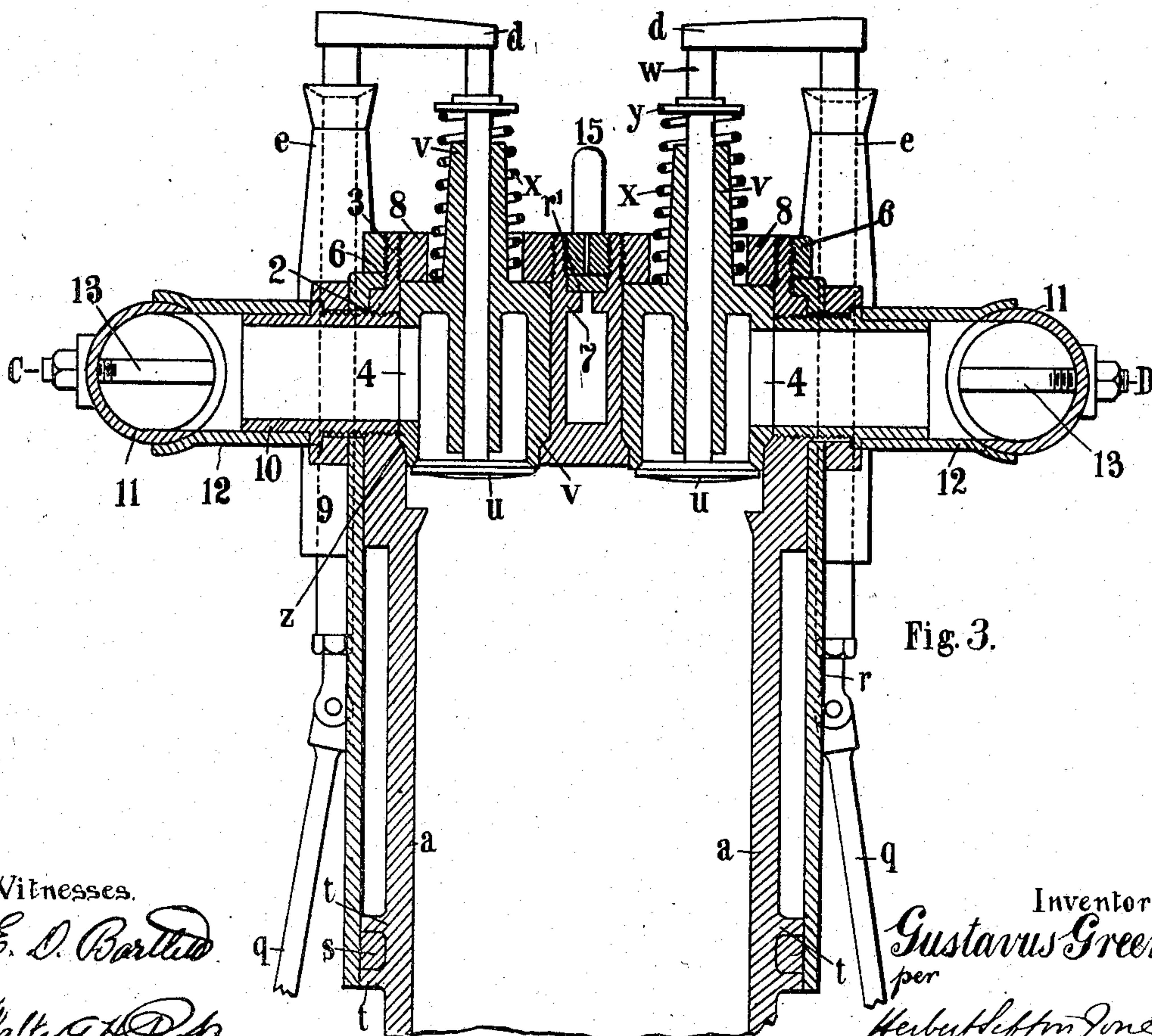
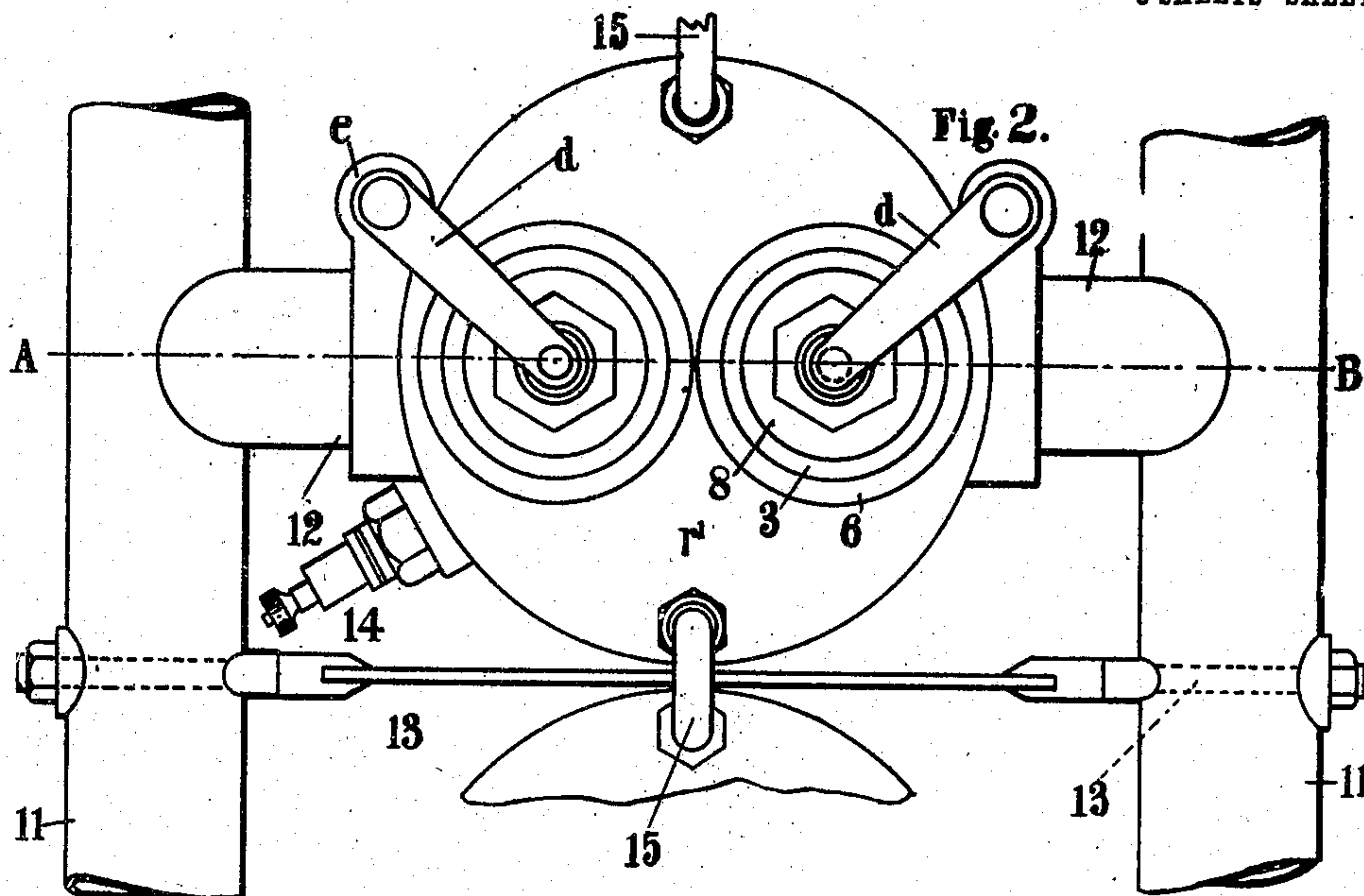
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

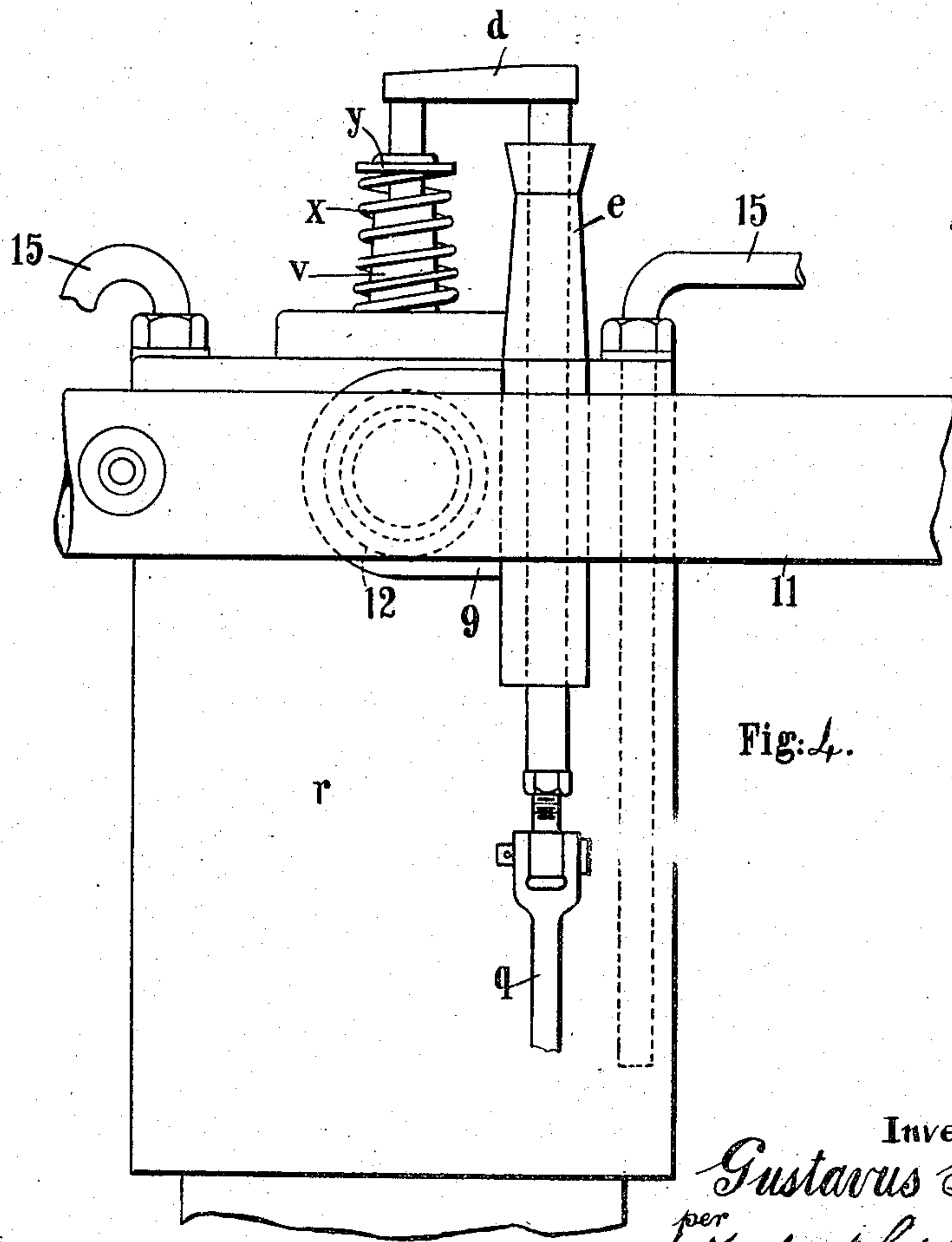
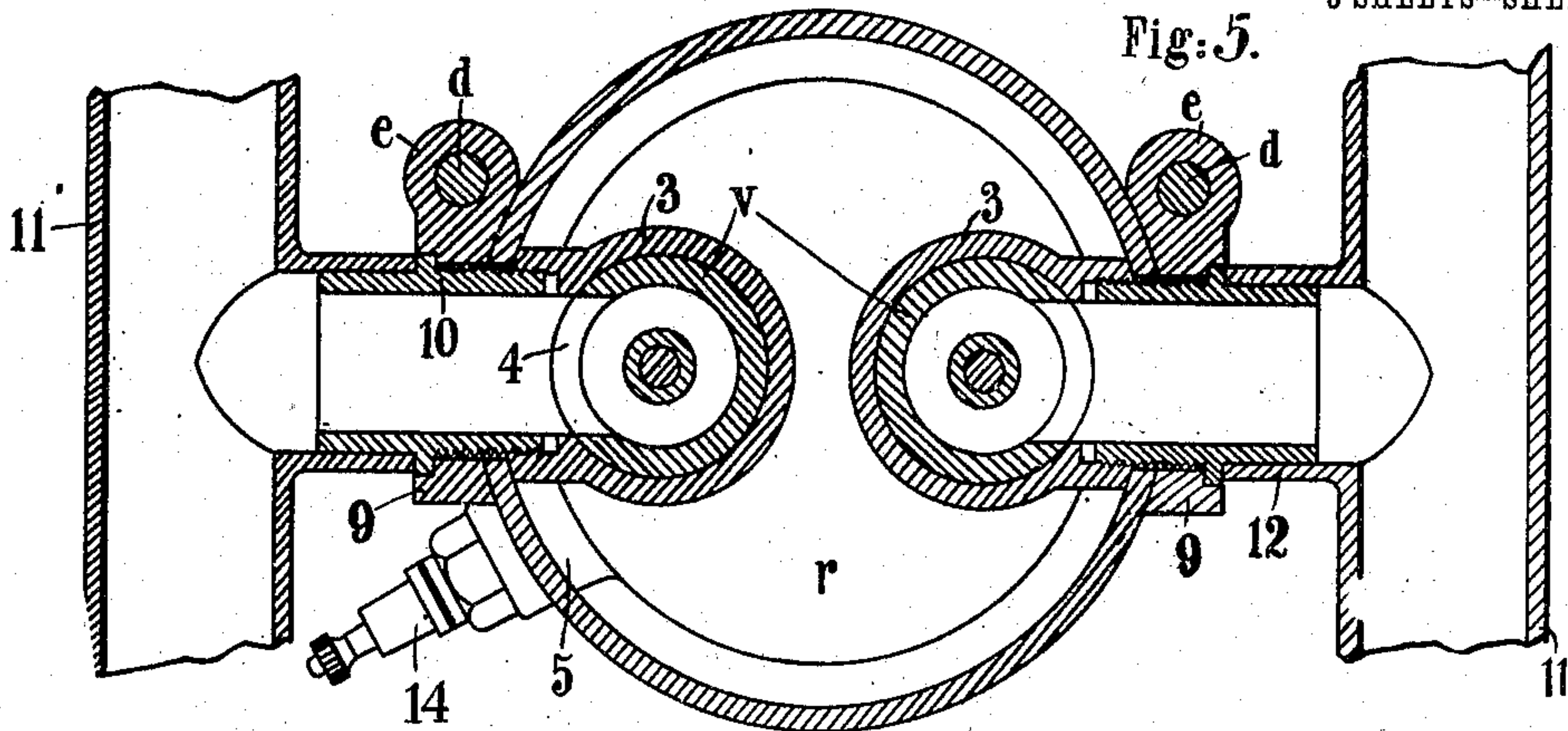


Fig. 4.

Witnesses,

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# UNITED STATES PATENT OFFICE.

GUSTAVUS GREEN, OF BEXHILL, ENGLAND, ASSIGNOR OF ONE-FOURTH TO FRANCIS PELHAM CLINTON HOPE AND ONE-FOURTH TO JOSEPH MILLER, OF BEXHILL, COUNTY OF SUSSEX, ENGLAND.

## INTERNAL-COMBUSTION ENGINE.

No. 930,372.

Specification of Letters Patent.

Patented Aug. 10, 1909.

Application filed September 15, 1905. Serial No. 278,596.

*To all whom it may concern:*

Be it known that I, GUSTAVUS GREEN, engineer, a subject of the King of Great Britain, residing at 49 Reginald road, Bexhill-on-Sea, in the county of Sussex, England, have invented new and useful Improvements in or Relating to Internal-Combustion Engines, of which the following is a specification.

10 This invention relates to internal combustion engines such as are used particularly in motor road vehicles, motor boats and the like, and it has for its object a new construction of the engine designed to produce  
15 a compact and simplified whole, the principal improvements for this object being in the method of mounting the separate water jacket on the cylinder.

20 The invention is illustrated in the accompanying drawings in which—

Figure 1 illustrates in plan view a four-cylinder engine constructed in accordance with the invention. Fig. 2 shows to a larger scale a plan view of one of the cylinders and  
25 parts in connection therewith. Fig. 3 shows a vertical section of the cylinder taken on the line A—B of Fig. 2. Fig. 4 is an enlarged view showing the upper parts of one of the cylinders as seen from the side. Fig.  
30 5 shows a sectional plan of the cylinder taken on the line C—D of Fig. 3. Figs. 6 and 7 are sectional elevation and plan respectively showing a modification.

35 Fig. 1 shows a plan of a four cylinder engine with the invention applied thereto, and the subsequent figures show in each case details of one of the cylinders.

Each cylinder *a* has admission and exhaust valves hereinafter more fully described. The inlet and exhaust valves of  
40 all the cylinders are operated by plungers *d* sliding vertically in guides *e* mounted at the sides of said cylinders near the heads thereof. The plungers are worked by links *g* connecting them to any suitable valve operating  
45 mechanism.

Referring to Figs. 2 to 5, it will be seen that each cylinder *a* is cast separately without a water jacket, the jackets *r* being fixed  
50 on the cylinders subsequently. These jackets may be made from brass or other suitable metal with head plates *r'* formed thereon or fixed thereto, and it will be seen that the use of the separate jackets makes it possible to  
55 turn up to an accurate thickness both the

cylinder walls and the jackets. All the surfaces inside the jackets over which the cooling water circulates will thus be turned smooth so that the cooling water can always flow freely and with a minimum of fluid friction. The jackets are fixed and fitted at the cylinder head as described below. They are open at their lower ends and are slipped over rings *s* of india-rubber or like material held  
60 between collars *t* cast and turned on the cylinder. The valves *u* are mounted in cages or boxes *v* as shown in Fig. 3, and their stems *w* which are operated by the heads of plungers *d* are pressed upward by springs *x* working against collars *y*. The cages *v* are dropped  
65 into sockets *3* formed to receive them in the head of the cylinder *a*, tight jointing being insured by the formation of conical surfaces on the cages and sockets at *z* which can be ground to fit. The cages are pressed  
70 downward and held in place by internal ring nuts *8* in the heads of sockets *3*. Bosses *2* are formed on the sides of the cylinder head and of the sockets *3* in order to form the inlet and exhaust openings; these bosses are bored out  
75 and tapped internally and the cages have holes *4* therein adjacent to the bosses. A similar boss *5* is formed for screwing in the sparking plug, this boss being slightly lower than the others so that the plug comes into  
80 the cylinder head; the boss *5* is seen in Fig. 5. The cylinder is accurately turned up both inside and outside and the bosses *2* and *5* and the collars *t* are also turned at the same time to the exact curvature of the jacket *r*. This  
85 jacket is then slipped down over the cylinder from above and over the packing ring *s* which may be made slippery for the purpose by soap-suds, oil or the like. The jacket *r* has holes to fit over the sockets *3* and the  
90 openings in the bosses *2* and *5*. Ring nuts *6*, screwing on the tops of sockets *3*, press down the head of the jacket onto the shoulders *7* around these sockets, this pressure being sufficient to insure a water tight joint at these  
95 points. At the holes in the jacket over the bosses *2* tight-jointing is insured by the following means. Washers *9* are provided shaped to fit against the jacket walls and threaded pipe sections *10* are passed through  
100 the washers *9* and the jacket *r* and are screwed into the bosses *2*. These pipe sections thus draw together the washers, jacket and bosses forming a tight joint. The ends of the pipe sections are faced by the holes *4* in the cages  
105 110



*v* and hence said pipe sections give communication to the valves *u*. The inlet and exhaust pipes 11 are exactly similar in construction, each having sockets or branches 12 5 formed or fixed thereon to fit over the outwardly extending ends of the pipe sections 10. The pipes 11 are simply applied one at each side of the engine as is seen in Fig. 1 with their sockets 12 fitting over the pipe sections 10 and said pipes 11 are drawn together 10 by one, two or more tie rods 13 according to circumstances, the size of the engine and so forth. One of the pipes 11 is of course connected with the carbureter and supply of 15 combustible mixture, while the other is connected with the silencer and exhaust opening. The guides *e* for the plungers *d* are formed in the washers 9 as seen particularly in Fig. 5. Made and arranged as described 20 above all the valve operating plungers and parts giving communication with the valves are interchangeable and therefore readily replaceable. The sparking plug 14 is screwed in through the boss 5 so that its inner end 25 projects into the combustion space at the cylinder head. The screwing up of plug 14 or the fitting thereof similarly draws the jacket *r* against the boss 5 at this point making a tight joint. 15 are communicating pipes 30 leading from one jacket to another for the purpose of the water circulation. The water is introduced from the usual cooling and circulating apparatus by the pipe 16 and is carried off through the pipes 17 back again to 35 the cooling apparatus. The circulation of water may be provided for in any desired way.

The engine above described embodies all the principal features of this invention. It is to be understood, however, that the details of construction may be modified in 40 many cases. For instance, all the arrangements are applicable for an engine having one, two, three or any other number of cylinders as it will be evident that in the four- 45 cylinder engine shown the mechanism is duplicated for each additional cylinder. Further, such details of construction as the ring nuts holding the jacket on the cylinder and holding the valves in place, the threaded pipe 50 sections fitting in the bosses 2 and the joint at the bottom of the jacket *r* may be constructed in various ways without materially altering the construction of the engine or departing from the scope of the invention. 55 Figs. 6 and 7 for instance indicate another

way in which the joint at the bottom of the jacket *r* may be formed. There is only one collar *t* in this case formed on the cylinder. The packing ring *s* is inserted from below 60 and a ring nut 19 made in two parts fitted together by dove-tail joints 20 is screwed up over the thread 18 cut on the cylinder below the collar *t*. The parts of the ring 19 must of course keep together when on the screw thread and they operate as a ring nut, com- 65 pressing the packing ring *s* and insuring tight jointing against the jacket *r*.

What I claim is:—

1. In an internal combustion engine, the combination of a cylinder formed with 70 bosses at the top and sides to receive the valves and to form the valve passages, a water jacket of thin metal smooth internally and adapted to be passed over the cylinder head to fit over and against said bosses, 75 means for pressing the jacket against said bosses with screw pressure, a packing ring and means on the cylinder for holding said ring so that it will make a watertight joint with the smooth interior of the jacket in 80 proximity to the bottom thereof, allowing the latter to move freely in a longitudinal direction relatively to the cylinder.

2. In an internal combustion engine, the combination of a cylinder, a water jacket of 85 thin metal smooth internally, said jacket and cylinder so formed that the jacket can be passed over the cylinder from the top, means for making a watertight joint between the top of the cylinder and the jacket, said 90 means comprising screw compression members and faces formed on the cylinder between which the top part of the jacket is compressed, a packing ring, a collar on the cylinder adapted to form an abutment for 95 said ring, and a ring nut formed in two parts adapted to be fitted together and to screw upon said cylinder to compress the packing ring against the collar and so to expand it outwardly against the smooth interior walls 100 of the jacket in proximity to the bottom thereof.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GUSTAVUS GREEN.

Witnesses:

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LEON E. HAYNES.