J. J. CONNOLLY.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JULY 23, 1915.

1,312,387. Patented Aug. 5, 1919.

Fig. 1

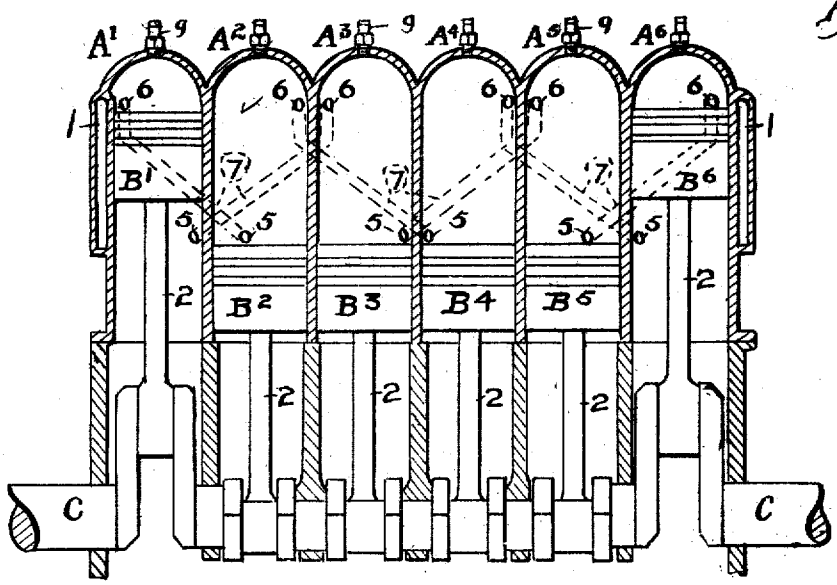


Fig. 2.

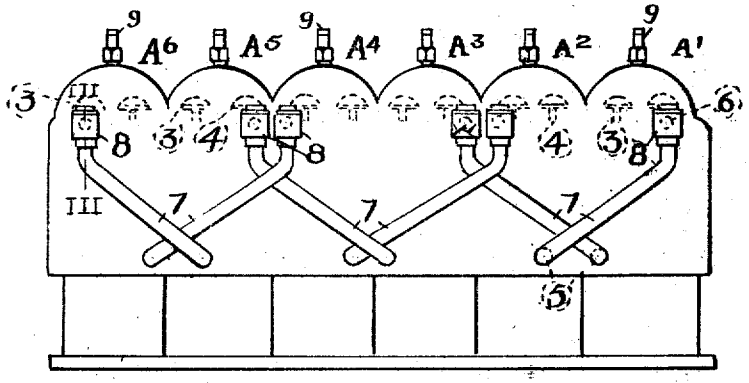
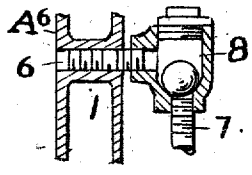


Fig. 3.



WITNESS:

R. A. Dilworth

INVENTOR.

John J. Connolly

by Edward A. Laurence,

his ATTORNEY.

UNITED STATES PATENT OFFICE.

JOHN J. CONNOLLY, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR OF ONE-THIRD TO THOMAS H. FLYNN, OF KNOXVILLE, PENNSYLVANIA, AND ONE-THIRD TO FRANK A. GALLAGHER, OF PITTSBURGH, PENNSYLVANIA.

INTERNAL-COMBUSTION ENGINE.

1,312,387. Specification of Letters Patent. Patented Aug. 5, 1919.

Application filed July 23, 1915. Serial No. 41,445.

To all whom it may concern:

Be it known that I, JOHN J. CONNOLLY, a citizen of the United States, and residing in the city of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented or discovered new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My invention consists in certain new and useful improvements in internal combustion engines and it particularly relates to means for igniting the fuel charges in the engine cylinders.

The object in view is the provision of automatic inter-cylinder firing means whereby the products of combustion in a cylinder ignite in turn the next cylinder in progression, thus doing away with the use of a magneto or other exterior igniting and timing apparatus which is costly to install, adds materially to the weight, and requires frequent and skilled attention to maintain it in efficient operation.

I effect these objects by connecting each cylinder by means of a passage with the cylinder in which the next charge is to be exploded in such a manner that the products of the explosion in the first named cylinder will in turn ignite the charge in the last named cylinder. The result is the progressive explosion of all the cylinders in their proper sequence, means being provided to prevent back firing through said passages.

In the accompanying drawings, Figure 1 is a longitudinal, vertical section of a six cylinder internal combustion engine embodying my invention; Fig. 2 is a side elevation of the same, reversed from the position shown in Fig. 1, and Fig. 3 is an enlarged detail in section along the line III—III in Fig. 2.

The following is a detailed description of the drawings.

A^1, A^2, A^3, A^4, A^5, and A^6, represent the cylinders of the internal combustion engine which, for the sake of illustration are assumed to be ignited in the following sequence A^1, A^3, A^5, A^6, A^4 and A^2.

1 represents the water jackets.

B^1, B^2, B^3, B^4, B^5 and B^6 are the pistons reciprocating in cylinders A^1, A^2, A^3, A^4, A^5 and A^6, respectively, connected by means of piston rods 2 with the crank shaft C. 3 represents the fuel inlet valve and 4 the exhaust valve of each cylinder.

In the lower wall of each cylinder is a port 5 which is exposed by the piston as the same approaches its outermost position while 6 is a port in the upper wall of each cylinder above the innermost position of the piston. The port 5 of each cylinder is connected to the port 6 of the cylinder next to be fired by means of a suitable passage, as for instance the copper tube 7. 8 is a check valve in the tube 7 adjacent to the port 6 to prevent back firing through the passage.

Where the cylinder charges are to be ignited in the order above indicated, the port 5 of cylinder A^1 is connected to the port 6 of cylinder A^3; the port 5 of cylinder A^3 is connected to the port 6 of the cylinder A^5; port 5 of cylinder A^5 is connected to the port 6 of the cylinder A^6; the port 5 of the cylinder A^6 is connected to the port 6 of the cylinder A^4; the port 5 of the cylinder A^4 is connected to the port 6 of the cylinder A^2, and the port 5 of the cylinder A^2 is connected to the port 6 of the cylinder A^1. The length of the passages or pipes 7 should be equal.

9 represents an electric spark plug provided for one or more of the cylinders for starting purposes. But one of said spark plugs is required, but I prefer to provide additional spark plugs to insure positive action.

The operation of the invention is as follows, when the engine is working: Beginning with the cylinder A^2, for the sake of illustration, its piston B^2 has uncovered the port 5 on its explosion stroke permitting a portion of the ignited fuel to pass through the pipe 7, past the valve 8 entering the upper end of the cylinder A^1 through its port 6 and igniting the compressed fuel charge in said cylinder. Back firing through the pipe 7 is prevented by the valve 8 so that no power escapes into the cylinder A^2. The port 5 of each cylinder is positioned to be exposed before the exhaust valve 4 is opened for the scavenging stroke of the piston, while the pressure in the succeeding cylinder holds the valve 8 in place during such scavenging stroke in the preceding cylinder, so that there is no admission of the products of combustion from the preceding cylinder at that time.

During the compression stroke of the piston a certain amount of fuel is driven into the pipe 7 and sealed therein by the ascending piston, so that when the ignited fuel is admitted to the port 5 by the piston descending on the explosion stroke, the light charge in pipe 5 will be fired and assist in shooting an igniting flame into the succeeding cylinder.

When the piston B^1 of cylinder A^1 approaches its outermost position on the explosion stroke, the port 5 of said cylinder will be exposed, permitting the flame to pass through to the head of cylinder A^3, in which a fuel charge is now compressed, and fires the said charge.

In like manner each cylinder as its piston approaches the outer limit of its explosion stroke will ignite the compressed charge in the cylinder next fired, and such progressive firing will continue as long as fuel is admitted to the cylinders and the quantity or richness of the fuel mixture will govern the rapidity of progressive ignition.

To start the engine I prefer to use a battery or other electric circuit sparking plug which will ignite the initial charge in one of the cylinders and establish the progressive ignition above described.

It is evident that the operation of my engine when once started is automatic.

My invention, which for the sake of illustration, I have shown applied to a six cylinder engine, may be applied to any internal combustion engine with more than one cylinder.

The advantages of my invention are manifold. The saving in weight is very substantial and this together with the absence of any electrical mechanism likely to become disarranged by jarring or rough usage especially recommends the invention for automobile and aeroplane use. The use of complicated and expensive mechanism is avoided, and no technical skill is required to maintain the engine in perfect order. The cost of applying my invention to an internal combustion engine is very small while the advantages over the present ignition system are, as has been explained, very substantial.

Although for the sake of clearness, I have minutely described the embodiment of my invention shown in the drawings, I do not wish to limit myself thereby but claim broadly:—

1. In an internal combustion engine comprising a plurality of horizontally arranged cylinders, pistons working in said cylinders and an inlet and a scavenging port for each of said cylinders, means for firing said cylinders progressively consisting of a passage leading from the lower end of each cylinder at a point within the outermost position of the piston thereof to a point in the compression chamber of the cylinder next in turn to be fired, all of said passages being of a uniform length, the entrance to said passage from said first named cylinder being open and being exposed by the outward stroke of the piston previously to the opening of the scavenging port of said cylinder, substantially as and for the purpose set forth.

2. In an internal combustion engine comprising a plurality of horizontally arranged cylinders having inlet and exhaust ports therein, pistons working in said cylinders and means for progressively firing said cylinders consisting of passages of equal lengths leading from the lower end of each cylinder at a point within the outermost position of the piston thereof to a point in the compression chamber of the cylinder next in turn to be fired.

3. In an internal combustion engine, the combination of a plurality of horizontally arranged cylinders connected together by passages of equal lengths leading from a point within the outermost position of the piston in each cylinder to a point in the compression chamber of the next cylinder in turn to be fired.

4. In an internal combustion engine the combination of a plurality of horizontally arranged cylinders connected together by passages of equal lengths leading from a point within the outermost position in each cylinder to a point in the compression chamber of the next cylinder in turn to be fired and means for preventing a back fire in said passages.

Signed at Pittsburgh, Pa., this 22nd day of July, 1915.

JOHN J. CONNOLLY.