Jan. 30, 1923.

1,443,856

S. P. TOWNSEND.
INTERNAL COMBUSTION ENGINE.
FILED JAN. 13, 1917.

8 SHEETS-SHEET 1

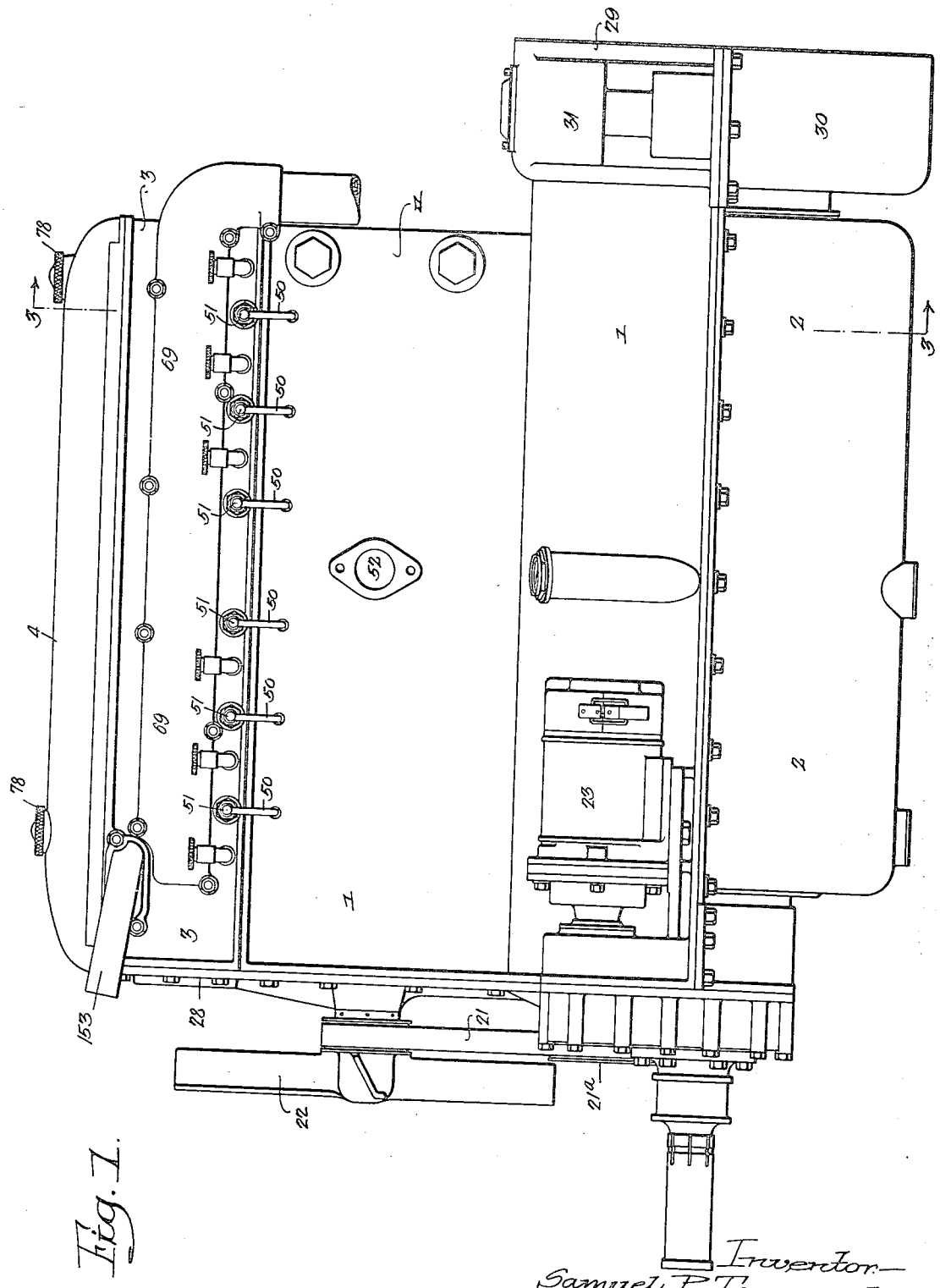


Fig. 1.

Inventor—
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by his Attorneys.—
Howson & Howson

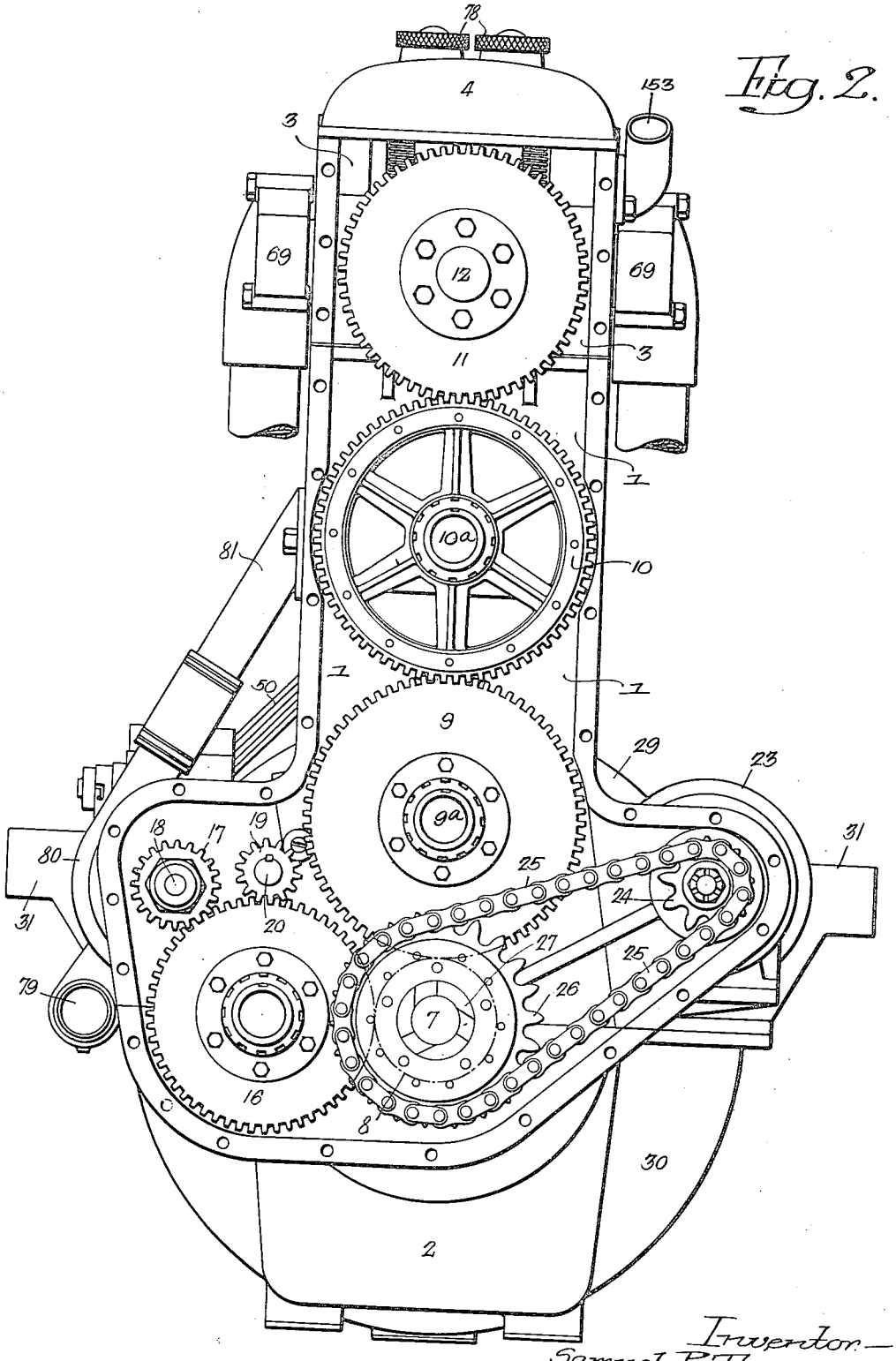
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8 SHEETS-SHEET 2

Fig. 2.



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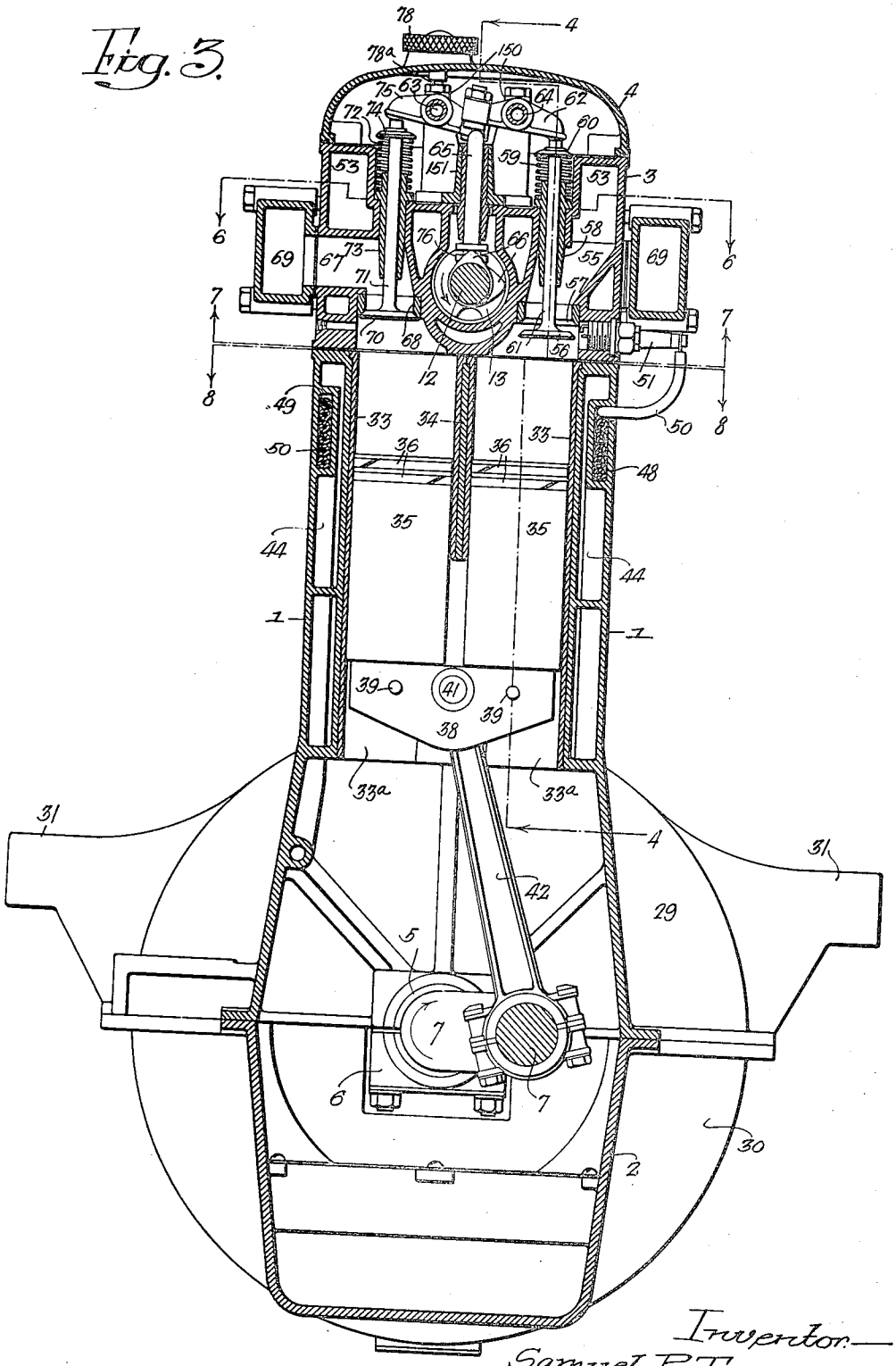
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8 SHEETS-SHEET 3

Fig. 3.



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8 SHEETS-SHEET 4

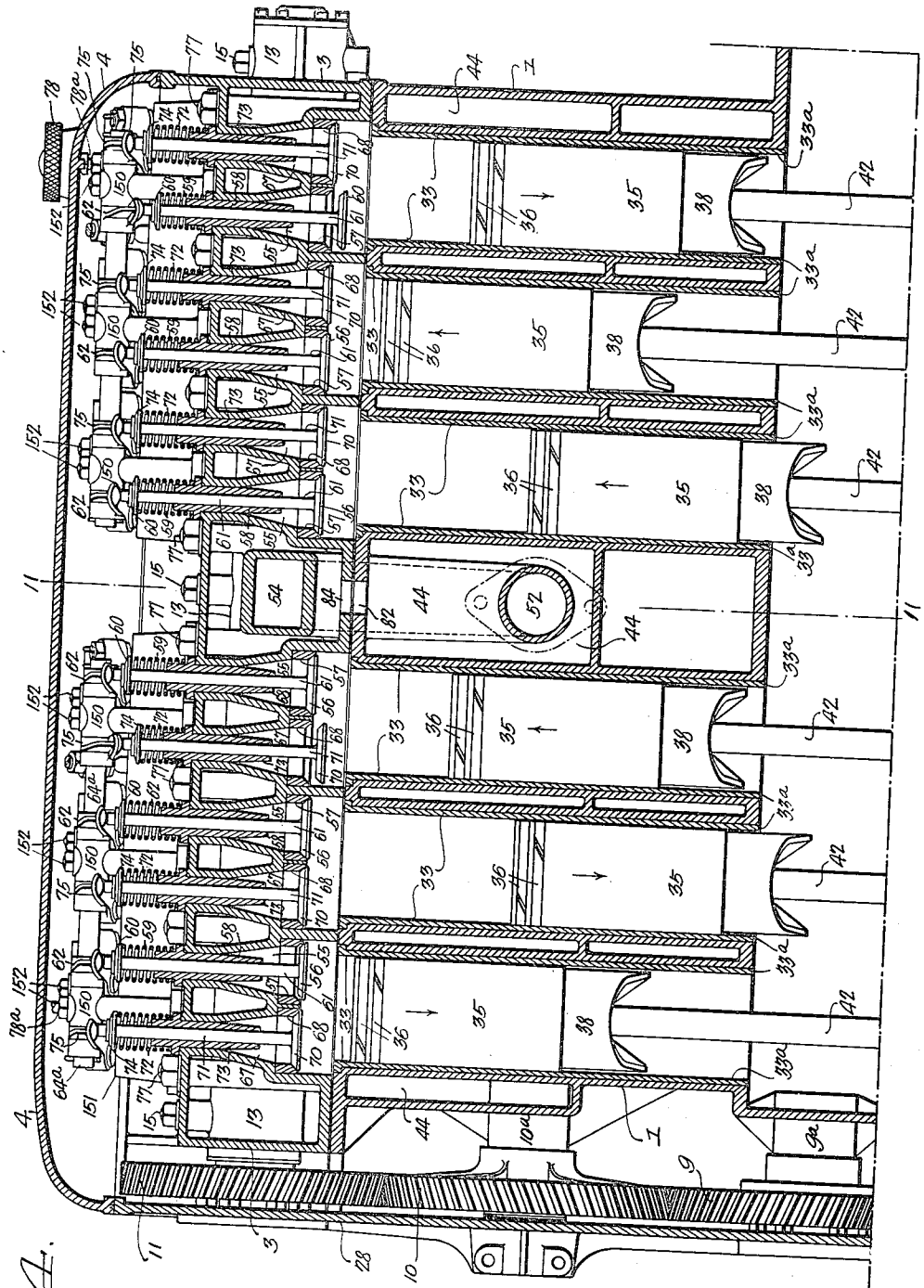


Fig 4.

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8 SHEETS-SHEET 5

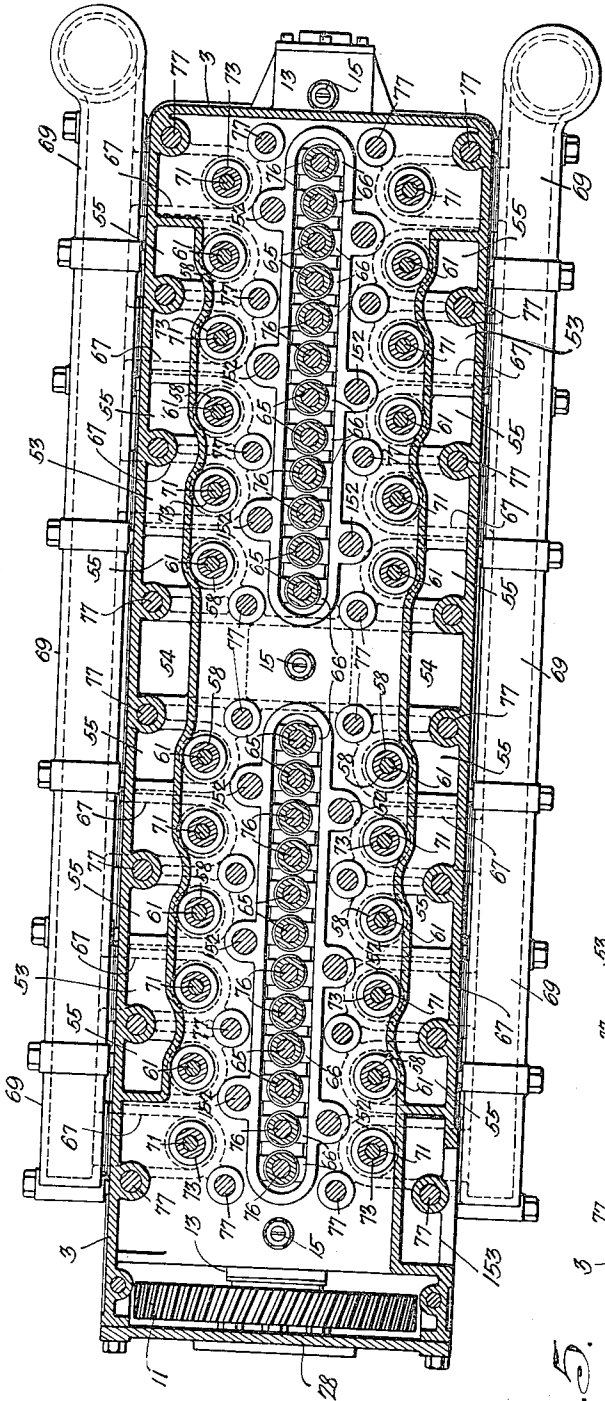


Fig. 6.

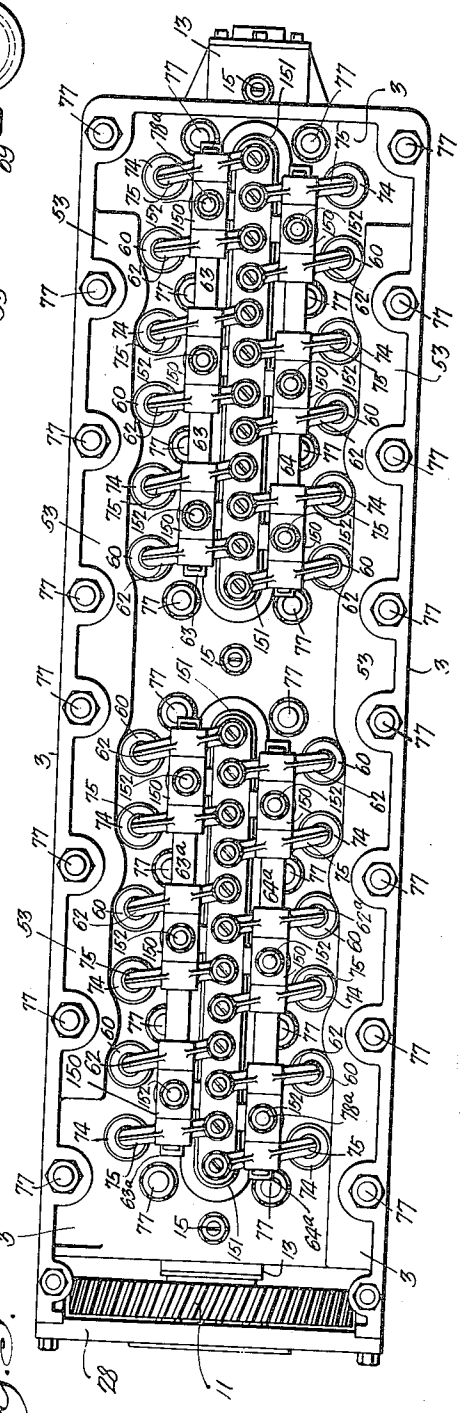


Fig. 5.

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8 SHEETS-SHEET 6

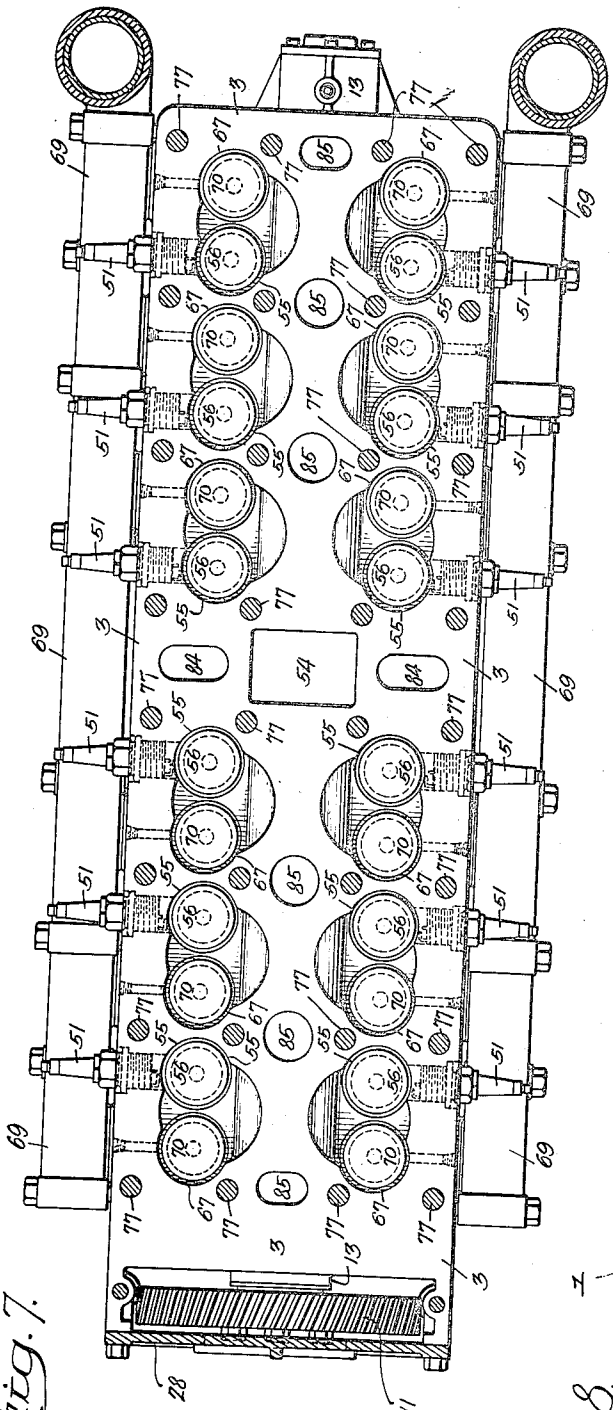


Fig. 7.

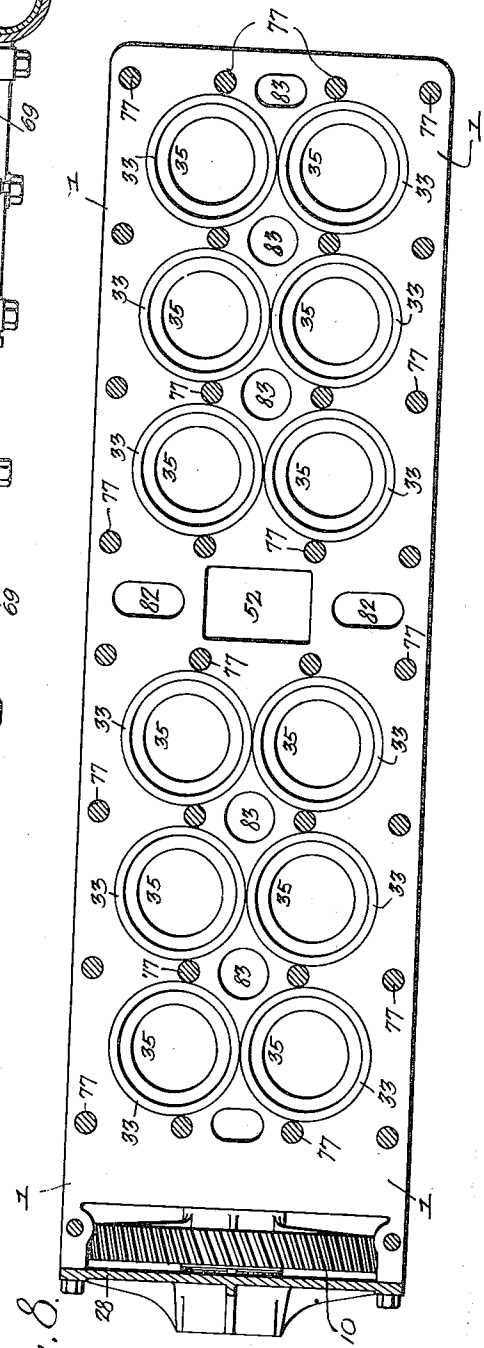


Fig. 8.

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8 SHEETS-SHEET 7

Fig. 9.

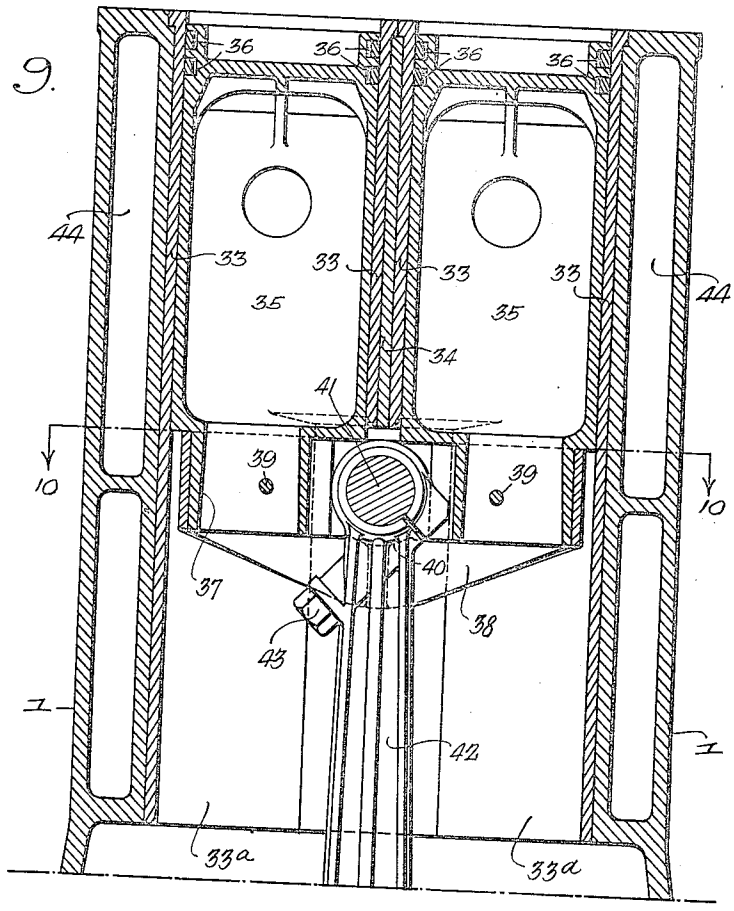
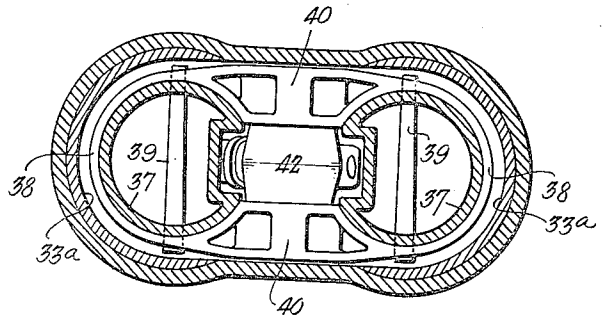


Fig. 10.



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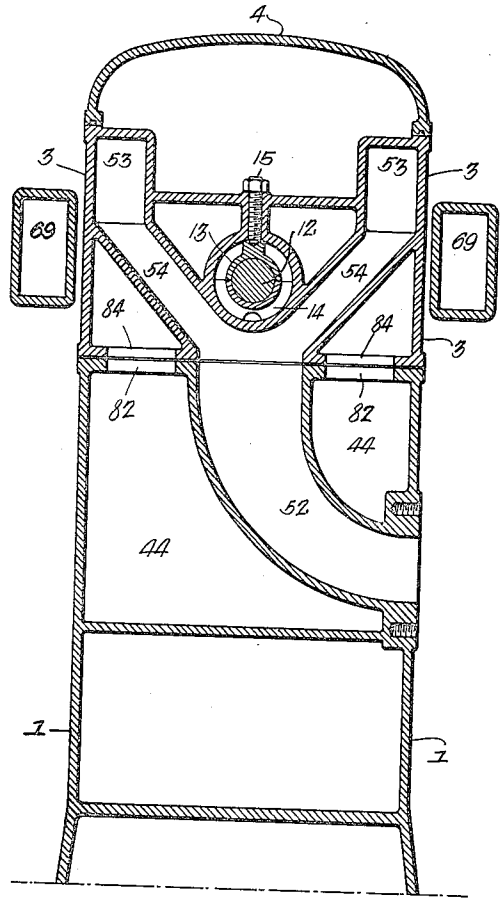
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8 SHEETS-SHEET 8

Fig. 11.



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Patented Jan. 30, 1923. 1,443,856

UNITED STATES PATENT OFFICE.

SAMUEL PERCY TOWNSEND, OF ORANGE, NEW JERSEY.

INTERNAL-COMBUSTION ENGINE.

Application filed January 13, 1917. Serial No. 142,202.

To all whom it may concern:

Be it known that I, SAMUEL PERCY TOWNSEND, a citizen of the United States, residing in Orange, Essex County, State of New Jersey, have invented an Internal-Combustion Engine, of which the following is a specification.

One object of this invention is to provide a novel form of multi-cylinder internal combustion engine which in addition to being compact and substantial in construction, shall have certain of its moving parts so disposed and of such design as to render them conveniently accessible.

It is further desired to provide an engine of the type noted with a novel piston and cylinder construction designed to reduce the number of moving parts necessary in an engine of a given power, the invention more particularly contemplating a novel arrangement of yoked pistons and cooperating cylinder liners designed to serve as guides.

It is also desired to provide an engine with a novel disposition of parts particularly designed to protect and conceal certain of the wiring for the ignition system.

Another object of the invention is to provide an internal combustion engine with a novel disposition of the cam shaft, push rods and the associated valve-actuating mechanism, designed with a view to materially shorten the length of the machine as well as to diminish the likelihood of failure of any of the parts.

These objects and other advantageous ends I secure as hereinafter set forth, reference being had to the accompanying drawings, in which,

Figs. 1 and 2 are respectively an elevation of one side and one end of an internal combustion engine constructed according to my invention;

Fig. 3 is a transverse vertical section on the line 3—3, Fig. 1, omitting certain of the auxiliary apparatus;

Fig. 4 is a vertical longitudinal section on the line 4—4, Fig. 3;

Fig. 5 is a plan of the top of the engine with the enclosing cover removed;

Figs. 6, 7 and 8 are horizontal sections respectively taken on the lines 6—6, 7—7 and 8—8, Fig. 3;

Fig. 9 is an enlarged vertical section taken through a pair of adjacent cylinders and pistons;

Fig. 10 is a horizontal section on the line 10—10, Fig. 9; and

Fig. 11 is a transverse vertical section taken on the line 11—11, Fig. 4.

In the above drawings, 1 represents the main cylinder casting whose lower portion is slightly flared and open at the under side for the attachment of a bottom 2 which cooperates with it to form a closed crank case. On top of the cylinder casting is mounted a head casting 3 which in turn has bolted to it an enclosing cover 4. At suitable intervals the lower part of the cylinder casting is provided with transverse webs which serve to support the upper parts of bearings 5 having detachable bottom caps 6 for the reception of the crank shaft 7.

This shaft at one end of the cylinder casting has fixed to it a gear wheel 8, which through a pair of cooperating gears 9 and 10, carried on suitable studs 9^a and 10^a supported by or forming part of said cylinder casting, drives a third gear 11 fixed to a cam shaft 12 (Fig. 2). Said shaft is supported at a suitable number of points within a tubular passage formed in the head casting 3, by three bearings 13 (Fig. 11) which are tubular in form and include radial webs 14 held from rotation by studs 15, Figs. 6 and 11.

Power is also transmitted from the gear 8 through a gear 16 to a gear 17 fixed to an auxiliary shaft 18 designed to drive a circulating pump as well as an electric generator and a magneto, all of which machines have not been illustrated in detail since they form no part of the present invention. A second gear 19 on a shaft 20 also meshes with the gear 16 and drives an oil circulating pump (not shown). Through a suitable pulley 21^a on the end of the shaft 18 and a belt 21, Fig. 1, is driven a fan 22 for cooling a radiator. On that side of the engine opposite the auxiliary shaft 18 I mount a starting motor 23 on whose armature shaft is fixed a sprocket 24 connected through a chain 25 with a sprocket 26, normally loose on the crank shaft 7, but capable of being connected thereto by means of an automatic releasing clutch 27.

As shown in Figs. 1 and 2, all of the above noted coacting gear wheels are mounted within suitable cavities at one end of the head and cylinder castings 3 and 1 and are enclosed by a single movable end plate 28.

At the opposite end the cylinder casting has a semi-cylindrical enlargement or extension 29 provided with a detachable, semi-cylindrical bottom portion 30 constituting a closed fly-wheel casing and also having laterally projecting arms or lugs 31 whereby one end of the engine structure may be supported.

As shown in Figs. 3, 4, 7 and 8, the cylinder casting is formed with six pairs of vertically extending cylindrical cavities all opening into the upper part of the common crank case chamber and divided with two sets of three pairs each by a central chamber or series of chambers as indicated in Figs. 4 and 11. In each cylinder of each pair is mounted a liner sleeve 33 (Figs. 9 and 10) having a portion 33^a extended downwardly toward the crank case but cut away at its inner side for about one third of its surface. Each of these liner sleeves is flanged at its upper end and fits in a correspondingly formed recess of the cylinder casting which has a partition-like portion 34 between the sleeves of each pair. Each partition however extends downwardly for approximately one half the length of the liner sleeves.

The upper ends of the pistons 35 are formed with annular grooves for the reception of packing rings 36 while their lower portions are contracted in diameter to form necks 37. These necks of the pistons of each pair fit into suitable openings in the opposite ends of a connecting yoke 38 to which they are rigidly connected by pins 39.

The yoke itself is provided with bearings 40 designed to rotatably support a short shaft 41 to the central part of which is clamped one end of a connecting rod 42 whose opposite end rotatably engages one of the cranks. The upper or outer end of each connecting rod is split as shown in Fig. 9, and it may be so contracted by a bolt 43 as to rigidly grip said pin.

With such an arrangement of parts, the lower portions of each pair of sleeves serve as guides for their respective pistons which are rigidly connected by the yoke 38.

It is to be noted that the upper part of the cylinder casting 1 is made hollow to provide a chamber 44 for cooling liquid and is also formed to provide flattened, relatively narrow horizontally extending conduits 48 and 49 respectively on opposite sides of the engine for the reception of insulated conductors 50 leading from the magneto or other high tension current generator to the spark plugs 51 of which one is provided for each cylinder.

As shown in Figs. 6 and 11, the cylinder casting 1 is formed at approximately its middle point with a conduit 52 entering it at one side and opening on its top face. The head casting 3 is formed with two longitudinally extending conduits 53 adjacent the upper part of its opposite sides and these are connected by branch conduits 54 with an opening in the bottom face of said casting which is designed to register with the upper end of said conduit 52 of the cylinder casting.

As shown in Figs. 3 and 6, each of the cylinders on one side of the engine connects through a passage 55 with that one of the fuel supply conduits 53 on the same side, and the flow of fuel from said conduits to each cylinder is controlled by a downwardly opening poppet valve 56 coacting with a seat 57 set in said passage and guided through a flanged sleeve 58 extending downwardly in a suitable opening in the top of the head casting. Each of these valves is normally maintained in a closed position by a spring 59 acting between the flange of said sleeve and a head 60 on the valve stem 61, and as shown in Figs. 3 and 5, the upper end of each stem extends in position to be acted on by one arm of a lever 62 fulcrumed on one of four shafts 63, 63^a, 64 or 64^a as the case may be;—it being noted that the two first of these shafts are respectively mounted in suitable bearings supported by the head casting 3 in line with each other immediately over the six cylinders on one side of the engine. Similarly the fulcrum shafts 64 and 64^a are mounted over the six cylinders on the opposite side of the engine. Each of the levers 62 includes a second arm designed to engage a push rod 65 guided in a suitable sleeve in the central plane of the engine and having its lower end in engagement with one of the cams 66 on the cam shaft 12.

In addition to the fuel intake passages 55, there is provided for each cylinder an exhaust passage 67 in which is mounted a valve seat 68. These passages all open at one or the other side of the head casting and communicate with either of two exhaust pipes 69, fixed to and extending horizontally along the opposite sides of the engine. An exhaust valve 70 is carried by a stem 71 in position to coact with each of the seats 68 against which it is normally held by a spring 72 confined between the upper end of a guide sleeve 73 for the stem and a head 74. Each of the valves is designed to be actuated by a lever 75 fulcrumed on one of the shafts 63 and 63^a, 64 or 64^a, as the case may be, and having one arm placed to engage the upper end of the stem 71 and the other positioned to be engaged by a push rod 76 slidably guided in the central vertical longitudinal plane of the engine and periodically actuated by one of cams 66 on the cam shaft 12.

It is noted that the head casting 3 is rigidly held to the cylinder casting by a series of bolts 77 which pass through suitable bosses in said casting 3. The cover 4 is

retained in place by nuts 78 threaded on bolts 78ª fixed in the casting 3. It is noted that the fulcrum spindles 63, 63ª, 64 and 64ª are supported in brackets 150 forming part of a casting 151 and held to the structure 3 by bolts 15ª which pass through said spindles. Of these bolts those indicated at 78ª are extended to retain the cover 4 in position. The cooling water for the engine is drawn through an inlet conduit 79 which would ordinarily lead from a radiator through a pump 80 by which it is forced through a conduit 81 into the various chambers of the cylinder casting surrounding the cylinders. From this latter the cooling liquid flows through openings 82 and 83 to the top of the cylinder casting, to corresponding openings 84 and 85 in the head casting whereby it likewise circulates in cored passages around the exhaust and inlet conduits and is finally discharged through a conduit 153.

With the above described arrangement of parts it is obvious that by removing the cover 4, access may be had to the various valve-actuating levers with their associated parts. Similarly by removing the head casting, not only may access be had to the interior of all of the cylinders but all of the valves with their seats may be conveniently examined or repaired as may be necessary.

By yoking the pistons together in pairs as shown, I am enabled to materially shorten the engine with a consequent cutting down of its weight as well as of the number of parts required. The method of connecting the pistons to the crank shaft is simple, substantial and relatively easy to make and assemble from a manufacturing standpoint, while the peculiar elongation of each of the cylinder liners serves to facilitate the efficient operation of the engine while making possible the arrangement specified.

By placing the wires leading to the spark plugs within conduits in the sides of the cylinder casting, I materially improve the appearance of the engine and effectually prevent mechanical injury to said conductors as well as their injury by water or oil.

It is particularly to be noted that each of the levers 62 and 75 extends in a line at an obtuse angle to the fulcrum shaft or spindle on which it is mounted, thus making possible the relatively compact arrangement of parts illustrated.

I claim;—

1. The combination in an internal combustion engine of a cylinder casting having a plurality of cylinders and provided with a conduit lying within its side surface; charge igniting devices in the cylinders; and conductors for supplying current to said devices extending through the conduit of said cylinder casting.

2. The combination in an internal combustion engine of a structure having a plurality of cylinders arranged in pairs and having portions formed to provide conduits extending longitudinally along its opposite sides; charge igniting devices for said cylinders having terminals on opposite sides of the structure; with electrical conductors mounted in the conduits and respectively connected to said charge igniting devices.

3. The combination in an internal combustion engine of a structure having a plurality of cylinders and formed to provide longitudinally extending side conduits; a head casting mounted on said cylinders respectively; charge igniting devices extending into certain of said passages of said head casting; with electrical conductors mounted in said conduits and respectively connected to said devices.

4. The combination in an internal combustion engine of a plurality of cylinders arranged in pairs having their central lines parallel; inlet and exhaust valves for said cylinders having stems lying in two parallel planes; a cam shaft; cams thereon; a series of push rods actuated by said cams; two spindles extending longitudinally of the engine respectively between the planes of the valve stems and that of the push rods; with a plurality of levers mounted on said spindles in positions to respectively connect said valve stem with one of the push rods and extending at an obtuse angle to said spindles.

In witness whereof I affix my signature.

SAMUEL PERCY TOWNSEND.