G. B. FULLER.

INTERNAL COMBUSTION ENGINE.

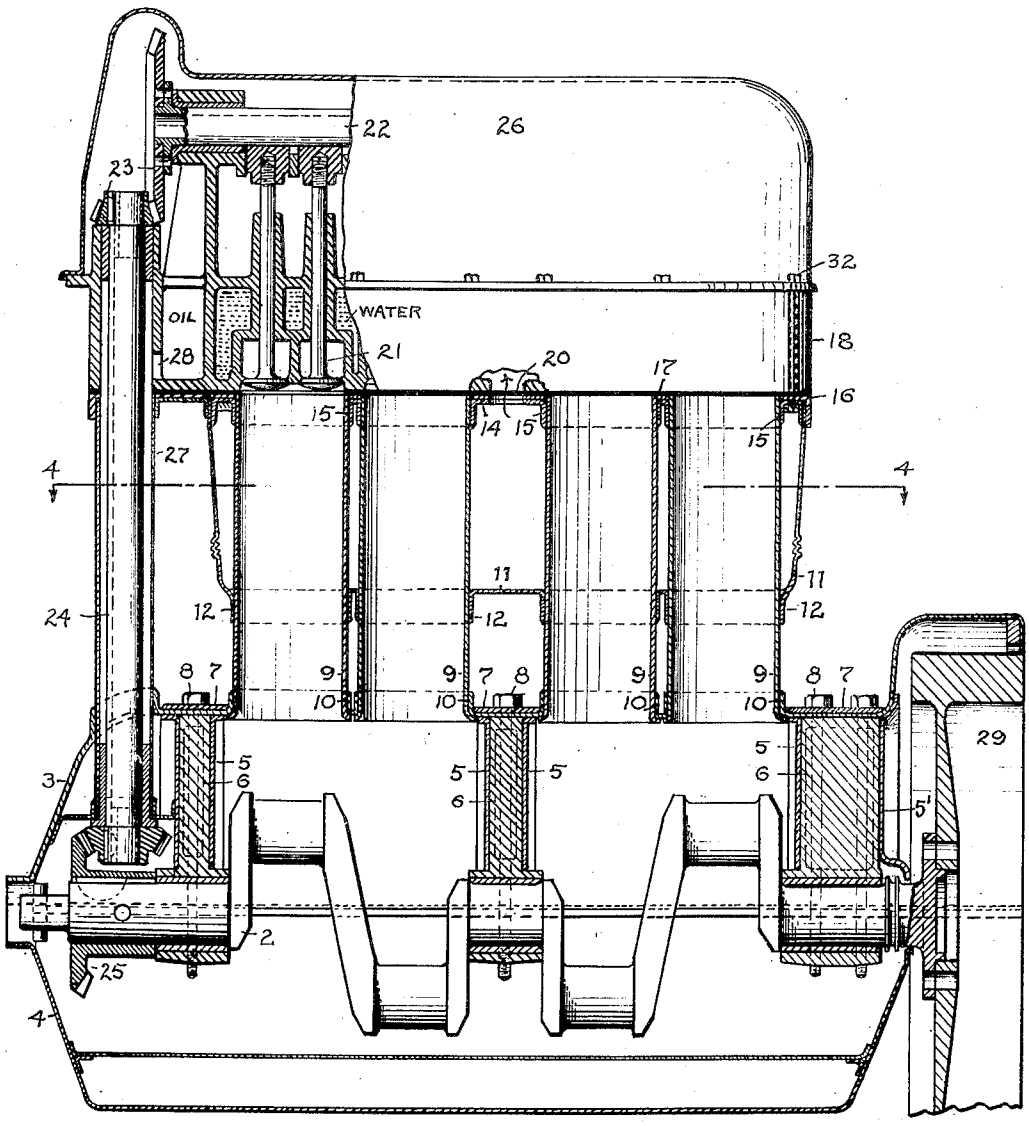
APPLICATION FILED FEB. 10, 1919.

1,382,420.

Patented June 21, 1921.

4 SHEETS—SHEET 1.

FIG. 1



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4 SHEETS—SHEET 2.

FIG. 2

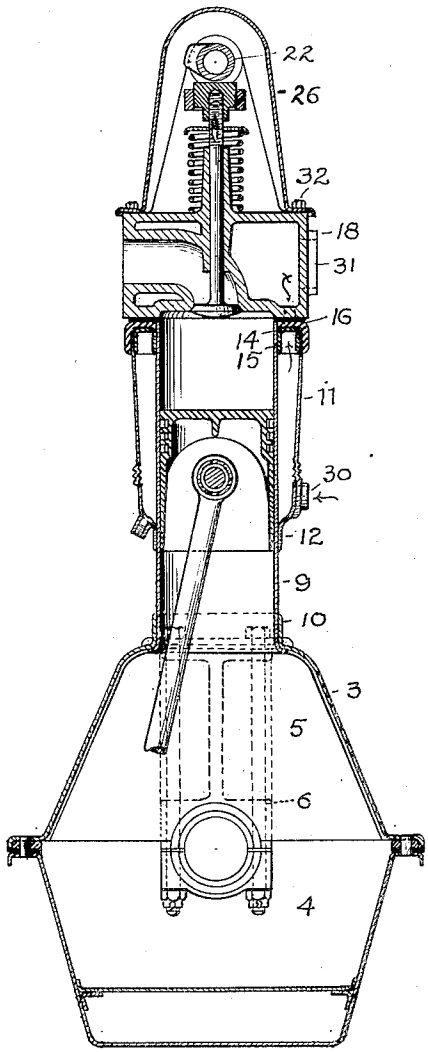
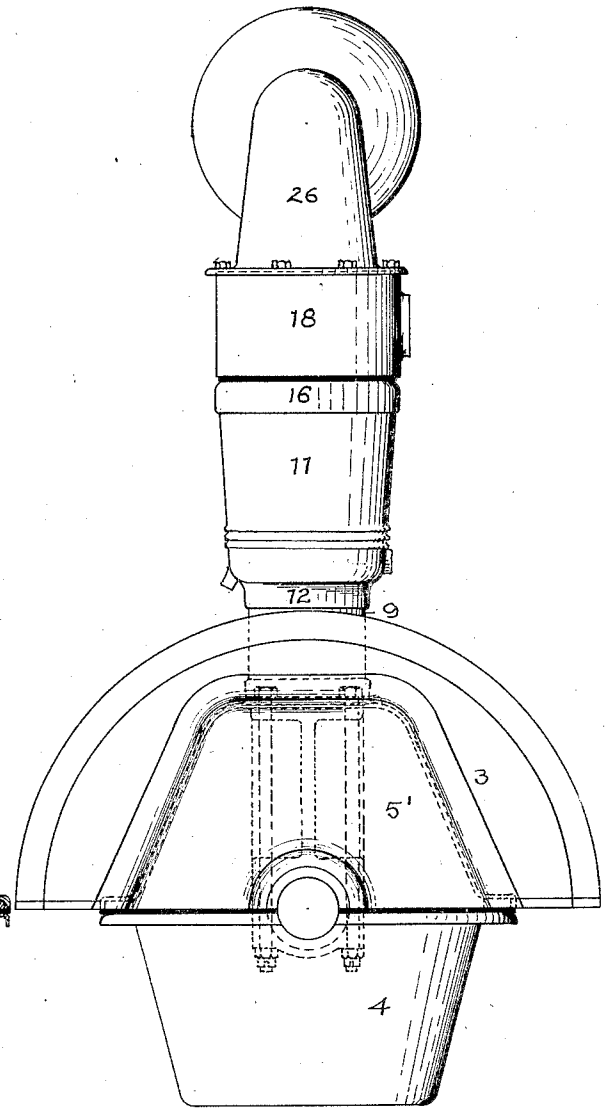


FIG. 3



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4 SHEETS—SHEET 3.

FIG. 4

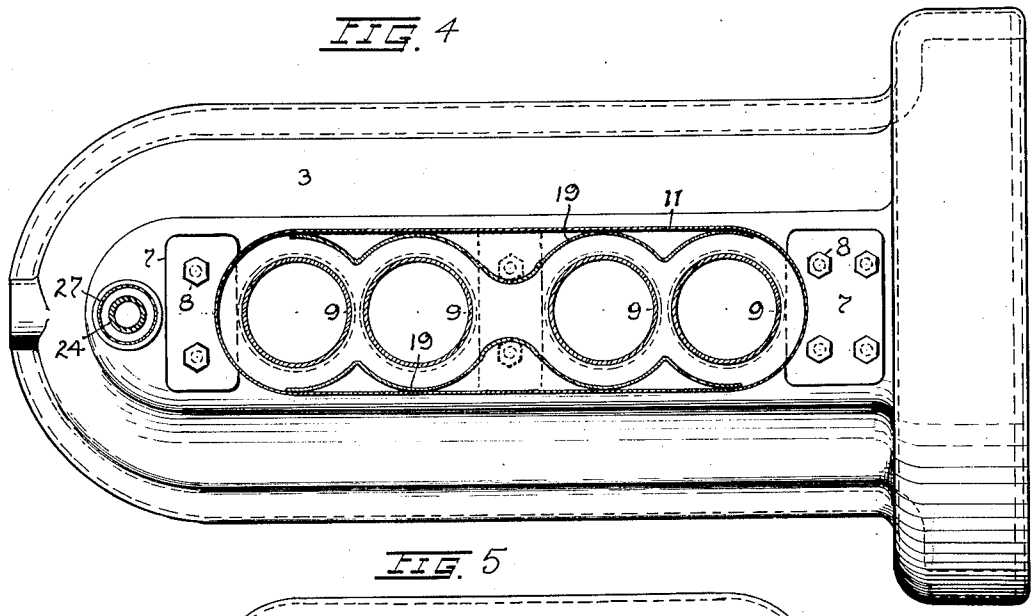


FIG. 5

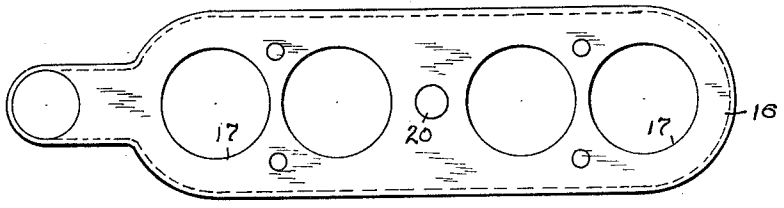


FIG. 6

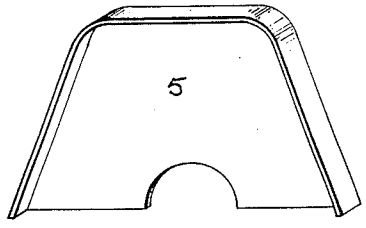
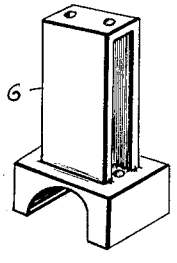


FIG. 7



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4 SHEETS—SHEET 4.

FIG. 8

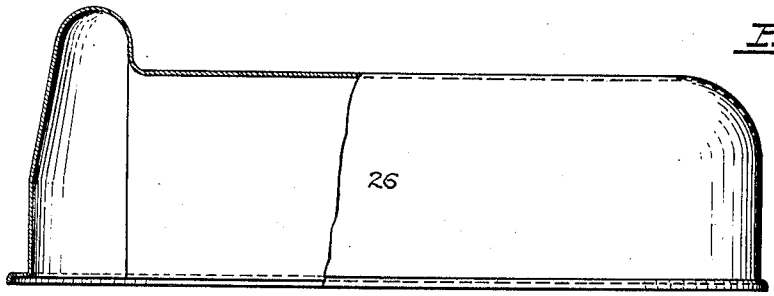


FIG. 9

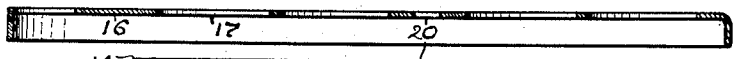


FIG. 10

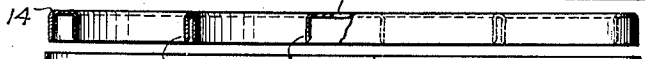


FIG. 11

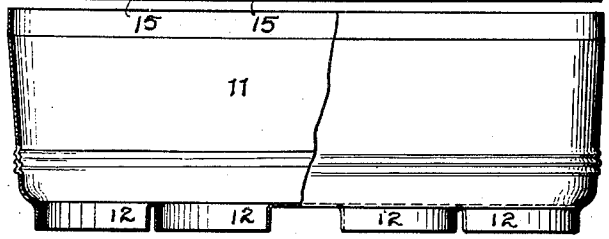


FIG. 12

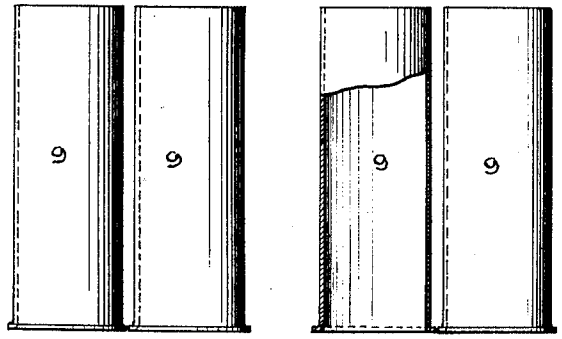


FIG. 13

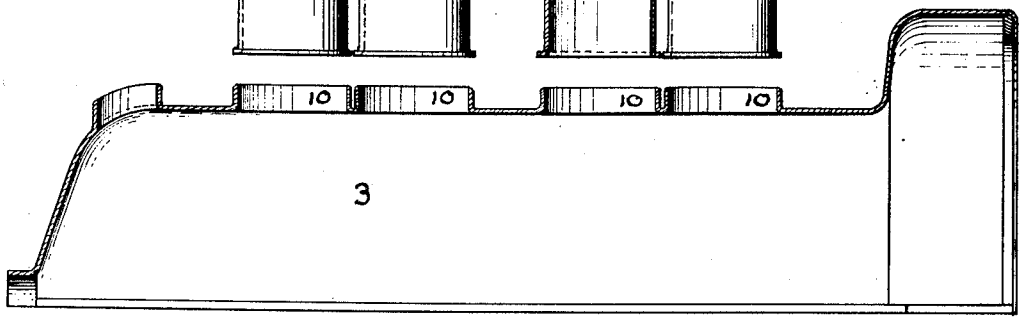
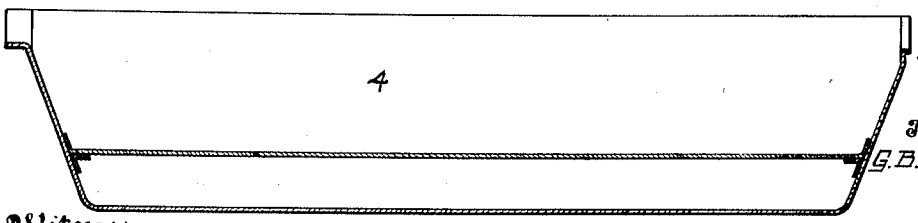


FIG. 14



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UNITED STATES PATENT OFFICE.

GEORGE B. FULLER, OF CLEVELAND, OHIO.

INTERNAL-COMBUSTION ENGINE.

1,382,420. Specification of Letters Patent. Patented June 21, 1921.

Application filed February 10, 1919. Serial No. 276,145.

To all whom it may concern:

Be it known that I, GEORGE B. FULLER, citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to improvements in engines, and more particularly an internal combustion engine, the object being to produce a rigid construction of light weight using in an extensive way flat sheet metal drawn and worked to uniform shape and thickness on punch presses and with dies, and employing a hardened and heat-treated metal for the engine cylinders and soft or low carbon stock for the water jacket and other parts. The invention involves the production of a multiple number of sheet metal cylinders separately, together with a single jacket pressed and formed out of sheet metal and punched with flanged openings to receive and aline the several cylinders, the alinement and support of the cylinders being further fostered by a single stamping sleeved over the upper ends of the cylinders and within the upper end of the one-piece jacket. The crank case is also preferably pressed and formed of sheet metal, while the cylinder heads may be welded to or made integral with the cylinders, or attached thereto as a separate part or casting as shown herein.

In the accompanying drawings, Figure 1 is a side elevation and sectional view of an engine constructed according to my invention, the pistons and connecting rods being omitted. Figs. 2 and 3 are vertical section and end views, respectively, of the engine. Fig. 4 is a horizontal section on line 4—4, Fig. 1. Fig. 5 is a plan view of the cover plate for the jacket and cylinders. Fig. 6 is a perspective view of one of the pressed braces for the crank case, and Fig. 7 is a similar view of one of the forged crank hangers. Figs. 8 to 14, inclusive, are side views of the sheet metal parts of the engine shown separately in about the relation they sustain in the order of their assembly.

As shown, the engine comprises a crank case divided horizontally on the line of the axis of the crank shaft 2 into upper and lower sections 3 and 4 respectively. These sections are pressed or stamped preferably out of sheet metal of suitable gage or thickness, and the lower section 4 provides a drip or oil pan as usual. The upper section 3 is reinforced and braced transversely at its middle and near each end by flanged sheet metal plates 5 arranged in pairs on opposite sides of a series of forged bearing hangers 6 for the crank shaft 2. Flat reinforcing strips or bars of metal 7 are also laid across the top of section 3 above the transverse walls formed by the plates 5 and hangers 6, and the bolts 8 which secure the hangers in place also fasten said strips in place and all these parts together make a rigid supporting structure for a multiple number of cylinders 9. Each cylinder is made of drawn metal and united at its lower flanged end by bolts or by soldering or brazing it to a circular flange 10, where introduced through a round opening punched in the top of section 3, one for each cylinder. These cylinders are separated from each other but nevertheless rigidly united together in parallel alinement by connecting means located about midway of the ends and also at the upper ends thereof. Thus, a sheet metal plate 11 is drawn or pressed into the form of a hollow jacket or casing 11 with slightly tapering side walls terminating in a bottom having a series of round openings punched therein and formed with downwardly extending flanges 12 adapted to sleeve snugly over the respective cylinders. These flanges may be either brazed, soldered or welded to the cylinders, and the jacket or casing 11 is preferably crimped or corrugated on annular lines over a portion or its entire surface to give rigidity thereto, while at the same time any differences of expansion and contraction between the wall of said jacket and the walls of said cylinders may be readily accommodated. The upper end of this water jacket or casing 11 is closed by a flanged plate 14 having the same outline and of the proper size to make a snug fit when inserted into the upper end thereof, and the flange is brazed, soldered or welded at the joint line or meeting surfaces. This cover plate 14 is also punched with round openings which are bordered by depending flanges 15 adapted to sleeve snugly over the upper ends of the cylinders to brace them laterally, and in order to further strengthen this union of parts I mount a second plate 16 having openings 17 upon cover plate 14 with the upper edges of each cylinder extending into one of the openings

17 and braze or weld the joints together. Plate 16 provides a base or seat for the cast metal water circulating and valve containing head 18 for the several cylinders. Thus a single water jacket and single head is provided for the several separate cylinders so that when the parts are assembled a rigid and stable construction of engine is provided notwithstanding that the water jacket and cylinders are made of sheet metal.

I also provide a pair of stamped plates 19 within the interior of the water jacket to strengthen the flat sides and shape these plates to conform to the curvature of the cylinders so as to produce substantially circular water chambers around each cylinder although all of them are in open communication for the circulation of water, and suitable openings 20 are provided in the cover plates 14 and 16 through which the water is free to pass into the water space in head 18. Where valves 21 are embodied in this head I may also mount a cam shaft 22 above the same, and drive the shaft by bevel gearing 23 from a counter shaft 24 operated by a bevel gear 25 upon crank shaft 2. In that case I provide a pressed sheet metal cap 26 adapted to inclose the cam shaft and its gear, and I may also inclose the counter shaft within a light metal tube 27 but of larger diameter than the shaft so as to provide an oil space or chamber which may have open communication at 28 with a similar oil space or chamber within the head and cap 26.

The upper crank case section 3 may be pressed into a circular form at the fly wheel end of the engine so as to inclose the fly wheel 29 and the end division plate 5′ opposite the fly wheel may be made to conform to the end of sections 3 and to the crank shaft so as to make an oil-tight closure at this end of the crank case. A water intake connection 30 is also provided for the water jacket, together with a water outlet 31 in the head 18. The fastening bolts 32 for securing the head to the upper end of the cylinders are also used to secure cap 26 in place.

What I claim is:

1. An engine for air machines constructed with separate cylinders drawn from sheet metal and a single water jacket for all said cylinders drawn from sheet metal having an integral bottom with flanged openings sleeved upon and permanently secured to said cylinders about their middle lower portion, a single plate having walled openings in sleeved engagement with the upper ends of said cylinders and with said jacket and a valve receiving and water circulating head removably mounted over said cylinders.

2. An engine of light weight and rigid construction comprising a plurality of drawn metal cylinders and a single water jacket of sheet metal and of elongated form inclosing said cylinders about their middle lower portion thereof and annularly reinforced over a portion of its longer sides and a top plate having walled openings engaged upon the upper ends of said cylinders.

3. An engine of light weight and rigid construction, comprising a plurality of cylinders having a separate sheet metal water jacket provided with separate internal reinforcing and spacing walls coextensive with the sides of said cylinders and provided with curves opposite the cylinders.

4. An engine of light weight and rigid construction, comprising a plurality of cylinders having a sheet-metal water jacket common to all said cylinders and separate curved reinforcing walls on opposite sides of said cylinders within said jacket.

5. An engine, comprising a crank casing having a plurality of cylinders mounted thereon, a sheet-metal jacket having flanged openings in permanently fixed sleeved engagement with the lower portions of said cylinders, and a cover plate for said jacket having flanged openings engaged with the upper ends of said cylinders and alining the cylinders relatively to each other, the said jacket being open alike to all said cylinders.

6. An engine, comprising a crank casing having a plurality of cylinders of drawn metal, a water jacket of pressed steel having flanged openings sleeved over said cylinders, a cover plate for said jacket having flanged openings sleeved over the upper ends of said cylinders, and a flanged plate supplementing said cover plate having openings corresponding to said cylinders, and reinforcing the union of said cover plate with said cylinders.

7. An engine, comprising a sectional crank casing made of pressed steel, a plurality of cylinders made of seamless drawn tubing affixed to the upper section of said casing, a water jacket made of pressed steel inclosing all said cylinders, and a cover plate for said water jacket having flanged openings permanently united with the upper ends of said cylinders.

8. An engine, comprising a crank casing consisting of upper and lower sections made of pressed steel having a plurality of cylinders affixed thereto, and transverse division walls in the upper section of the casing made of pressed steel bracing and reinforcing said casing between the ends thereof.

9. An engine, comprising a crank casing made of pressed steel having a plurality of drawn metal cylinders affixed thereto, crank hangers suspended from the upper side of said casing, and bracing plates of pressed metal transversely of said casing adjacent said hangers.

10. An engine, comprising a crank case

made of pressed metal having crank hangers suspended from the upper side thereof and provided with pressed metal plates transversely of said case on opposite sides of said hangers and engaging the walls of said case.

11. An engine, comprising a sectional crank case made of pressed sheet metal, one of the sections having a rounded enlargement at one end providing a fly-wheel chamber, and provided with transverse braces at intervals between the side and top walls thereof.

12. An engine, comprising a crank case section made of pressed sheet metal and provided with flanged openings in its upper side, crank hangers suspended centrally from the upper side of said section adjacent said openings, and separate brace members engaging said hangers and the walls of said crank case section.

13. An engine, comprising a crank case having a plurality of cylinders of drawn metal affixed thereto, a water jacket of pressed sheet metal having flanged bottom openings sleeved upon and directly united with said cylinders, and a water-circulating head surmounting said jacket and common to all said cylinders.

14. An engine, comprising a pressed sheet-metal crank case made in sections, a plurality of cylinders made of drawn sheet metal surmounting said crank case, a single water jacket made of drawn sheet metal having an integral bottom with openings and flanges sleeved and united with said cylinders, a cover plate of pressed sheet metal for said water jacket, and a head for said engine cylinders surmounting said cover plate.

15. An engine, comprising a pressed sheet metal crank case, cylinders made of drawn sheet-metal, a cylinder jacket of pressed sheet metal, a cover plate of pressed metal for said jacket, a second plate surmounting said cover plate and upper end of said jacket, a valved head covering each cylinder, valve operating mechanism surmounting said head, and a pressed sheet-metal cap for said mechanism.

16. An engine, comprising a pressed sheet-metal crank case having crank hangers therein, a crank shaft mounted in said hangers, drawn sheet-metal cylinders surmounting said crank case, a water-jacket of pressed sheet metal sleeved over and directly united at their lower ends with said cylinders, a head for said cylinders surmounting said crank case, a cap surmounting said crank case, a cap surmounting said head, a tubular connection between one end of said head and crank case, and valve operating parts within said cap and tubular connection.

Signed at Cleveland, in the county of Cuyahoga, and State of Ohio, this 1st day of February, 1919.

GEORGE B. FULLER.