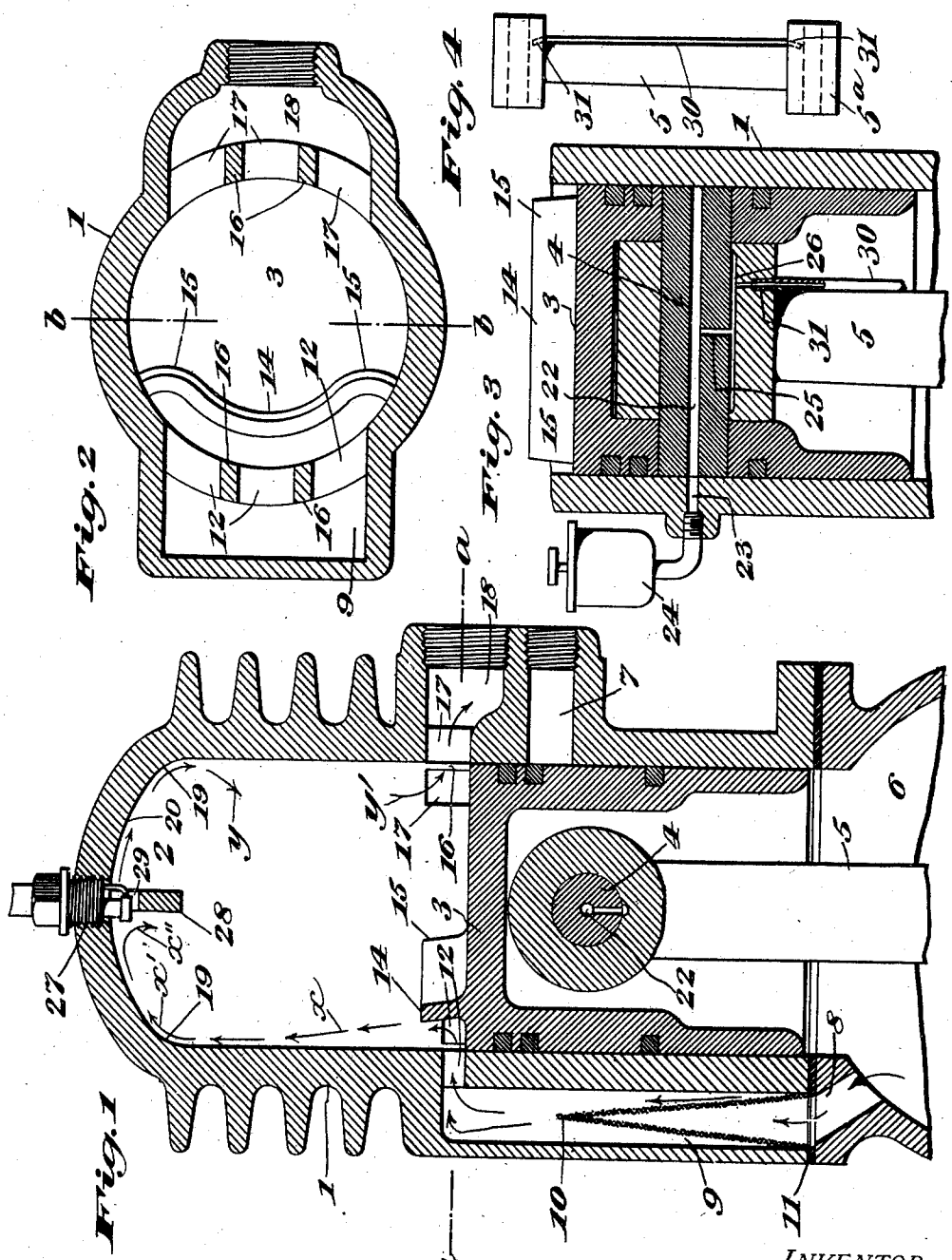
G. F. SWAIN.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED NOV. 28, 1905.

972,409. **Patented Oct. 11, 1910.**



WITNESSES:

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INTERNAL-COMBUSTION ENGINE.

972,409. Specification of Letters Patent. Patented Oct. 11, 1910.

Application filed November 28, 1905. Serial No. 289,396.

To all whom it may concern:

Be it known that I, GEORGE F. SWAIN, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to certain improvements in internal combustion engines and has for its object to provide an engine of this character of a simple and inexpensive nature and of a compact, strong and durable construction having improved means for the admission of the combustible charge whereby the same is prevented from admixture with the exhaust gases in the engine cylinder so that increased efficiency of the engine is attained.

The invention consists in an internal combustion engine the cylinder of which has oppositely arranged inlet and exhaust ports, a piston controlling said ports and a deflector carried by the piston and extended at an inclination to the direction of movement thereof to produce an inclined surface which, when the inlet port is opened is brought opposite thereto to deflect the entering charge lengthwise of the cylinder and also toward the side-wall thereof.

The invention consists also in certain novel features of the construction, combination and arrangement of the several parts of the improved engine, whereby certain important advantages are attained and the device is rendered simpler, cheaper and otherwise better adapted and more convenient for use, all as will be hereinafter fully set forth.

The novel features of the invention will be carefully defined in the claim.

In the accompanying drawings which serve to illustrate my invention Figure 1 is a sectional view taken axially through the cylinder and piston of an engine constructed according to my invention in the plane of the oppositely arranged inlet and exhaust ports of the cylinder. Fig. 2 is a transverse section taken through the cylinder of the engine in the plane indicated by the line *a*—*a* in Fig. 1, the arrangement of the opposite inlet and exhaust ports being shown in section and the piston being seen in end elevation, and Fig. 3 is a fragmentary axial section taken through the piston and cylinder in the plane indicated by line *b*—*b* in Fig. 2 and showing certain details of the means for lubricating the working parts. Fig. 4 is a view of the connecting rod on a small scale and showing the means for lubricating the crank connection thereof.

As shown in these views 1 represents the cylinder wall of the improved engine and 2 represents the bore thereof, while 3 indicates the piston playing in said bore and having a diametrical pin 4 which has pivotal connection in a well known way with the upper end of the connecting rod 5, the opposite end of which is adapted for connection with a crank (not shown) turning in the compression chamber 6 produced in a crank casing bolted or otherwise attached at the lower end of the engine cylinder.

7 represents the vapor inlet of the engine which is designed for drawing the explosive or combustible charge from a carbureter (not shown) or the like and which is produced in the side wall of the cylinder 1 at the lower part thereof in position to be uncovered by the piston when the latter has reached the limit of its up-stroke in the cylinder. On said up-stroke of the piston in the cylinder, a partial vacuum of the gases in the compression chamber 6 is produced in a well known way and by means which will be hereinafter explained, so that when the piston at the end of such up-stroke uncovers port 7, a charge of combustible gas will be drawn through said port and down through the lower part of the cylinder into the compression chamber 6. The supply of combustible gas or vapor thus drawn into chamber 6 will be compressed therein on the downstroke of the piston, port 7 being, of course, closed at the commencement of such downstroke.

8 is a passage at one side of the crank casing and leading from chamber 6 therein to the lower part of a charge chamber 9 produced in one side of the cylinder casting and herein shown opposite to port 7. Chamber 9 has imperforate walls and extends up the side of the cylinder with its upper end in communication with the inlet port 12 of the engine cylinder. The cylinder casting and crank casing are herein shown as provided with meeting flanges adapted to be bolted together, a compressible gasket being interposed in a well known way, and the lower end of chamber 9 is open at the underside of the flange of the cylinder casting, the interposed gasket being perforated opposite pas-

sage 8 for communication of said passage with said chamber.

10 is a foraminous diaphragm preferably formed of fine wire gauze in pyramidal form, with outwardly directed flanges 11 at its lower part, said flanges 11 being securely clamped between the under side of the flange of the cylinder casting and the top face of the interposed gasket, and the pyramidal body portion of said diaphragm 10 being extended up within the chamber 9 so that the charge entering said chamber 9 from passage 8 will be caused to pass through the meshes of the wire gauze diaphragm whereby back ignition from the combustion chamber of the engine through port 12 is effectively prevented. The cylinder inlet port 12 is so arranged as to be controlled by piston 3, being normally closed thereby and only opened when the piston reaches the end of its downstroke, as seen in Fig. 1, and since the gas in chamber 6 is compressed on the downstroke it is evident that on the opening of port 12 at the completion of such downstroke, the compressed gas in chamber 6 will be discharged under pressure from said chamber 6 through passage 8, chamber 9 and port 12 into the combustion chamber at the upper end of the cylinder.

The inclined sides of the pyramidal screen 10 in chamber 9 afford a maximum cross section for the flow of gas through the screen so that the mesh may be fine enough to prevent back ignition without undue retardation of the flow of gas when port 12 is opened. Being held in place by its flanges 11, there is no liability of displacement of the screen by suction of the engine.

The admission port 12 will preferably be of considerable width compared with the diameter of the cylinder and especially in small engines, and in order to prevent binding of the piston or of its packing on the edges of said port when thus widened, the port will be provided, as seen in the drawings, with vertical partitions or ribs 16, traversing it at intervals. Port 12 also has its lower side alined with the top surface of the piston when the same is in its lowermost position, so that there shall be no unnecessary obstruction to the free flow of the compressed gas from the port 12 into the combustion chamber of the engine when the piston reaches the end of its downstroke.

17 indicates the exhaust port of the cylinder which is also arranged, as herein shown, with its lower side alined with the top surface of the piston when in lowered position so that no unnecessary obstruction is offered to the free escape of the exhaust gases when the port 17 is opened. Said port 17 is, as herein shown, diametrically opposite the cylinder inlet port 12 and is likewise controlled by piston 3 and opened at the termination of the downstroke thereof, and said port 17 is also made widened and provided with guiding partitions or ribs 16, 16 similarly to the inlet port 12. The exhaust port is, however, extended up along the cylinder wall to a point above the upper side of the inlet port 12 so as to afford as large an opening as may be desirable for the escape of the products of combustion when said exhaust port is opened. The exhaust port is, as herein shown, located above the admission port 7 and communicates with a nipple 18 with which may be connected a pipe for conveying away the exhaust gases.

14 indicates a deflector carried upon the top surface of the piston 3 and extended across the same in position to stand opposite to the inlet port 12 when the piston is in lowered position. This deflector is curved along its length concentric with the cylinder wall and is suitably spaced therefrom as seen in Fig. 2, its extremities being provided with reversely curved portions, which are extended out as shown in said figure for close contact upon said cylinder walls at opposite sides of the port 12 so that all of the gas admitted to the cylinder through said port 12 is caused to strike upon the outer side of said deflector. The outer surface of the deflector 14 is also made inclined as clearly shown in Fig. 1 so as to be adapted to direct the gases striking upon it when discharged at the port 12 in an upward and lateral direction as indicated by the arrows at x in Fig. 1, whereby the entering charge admitted at port 12 is caused to flow along the side wall of the cylinder at which said port 12 is located and is prevented from being discharged directly upon the end wall of the cylinder.

Where the entering charge is discharged upon the end wall of the cylinder as is the case where vertically extended deflectors of the ordinary kind are employed, the charge is mixed to a greater or less degree with the exhaust gases remaining in the combustion chamber so that imperfect operation of the engine is caused, resulting in a greatly reduced power, and I have discovered that by the employment of the inclined deflector as herein shown, whereby the entering charge is caused to flow in a stream along the side wall of the cylinder, such mixture of the charge with the exhaust gases in the combustion chamber is prevented and a greatly increased power is developed by the engine.

The inclination of the deflector 14 is toward the junction of the inner wall of the cylinder head with the lateral cylinder wall at which the admission port is located, and is such that the entering charge is caused to flow evenly and uniformly along said lateral wall and across the inner wall of the cylinder head to sweep the spent gases out at the exhaust and is prevented from rebounding from said walls and becoming admixed with

the spent gases and thereby impairing the operation of the engine either through insufficient admission or escape of the charge at the cylinder exhaust. The course of the charge over said concaved surfaces is indicated by the arrows at x', and upon reaching the opposite wall of the cylinder it is evident that the charge will be deflected downward as seen at the arrow y so as to sweep the exhaust gases remaining in the combustion chamber down to and through the exhaust port 17.

27 represents the spark-plug, herein shown as set at the center of the cylinder head, and in order to still further guard against mixture of the entering charge with the exhaust gases in the cylinder, I provide a central deflector 28 in the form of a flat metal plate cast or otherwise secured to and depending from the cylinder head, being directed diametrically across the central part thereof in such a position that a portion of the entering charge flowing, as indicated by the arrows x across the concaved surfaces 19 and 20 is deflected downward as seen at x'' upon contact with said deflector plate 28 and is caused to sweep the exhaust gases remaining at the upper central part of the combustion chamber down toward and through the exhaust port 17. An opening is preferably formed in the plate 28 beneath the cylinder head or end wall as seen at 29 and said opening may be extended along any desired portion of the length of said plate 28 for the flow of that portion of the entering charge which passes in close proximity to the wall of said cylinder head.

22 is an axial oil-duct extended lengthwise in pin 4 with its ends open at opposite ends of said pin adjacent to the cylinder walls, one end thereof being adapted, in the travel of the piston, to come in co-incidence with an oil port 23 in the cylinder and to which oil is supplied from a suitable source as at 24 in Fig. 3. The oil thus supplied to duct 22 is discharged at the ends of the duct at opposite sides of the cylinder and is distributed around the circumference of the piston by the packing rings ordinarily carried thereby for effective lubrication of the piston in the cylinder.

25 is a passage downwardly extended from passage 22 at the center of pin 4 with its lower end communicating with the center of an oil duct 26 produced along the lower side of the bearing in connecting rod 5 in which pin 4 turns. Passages 25 and 26 are of less diameter than duct 22 so that part of the lubricant is conducted through passages 25 and 26 to lubricate the joint between pin 4 and connecting rod 5.

5^a in Fig. 4 is a bearing at the lower end of rod 5 for connection with the crank pin (not shown) in casing 6 and 30 represents a tube or duct extended along rod 5 with its upper and lower ends communicating respectively, with the duct or passage 26 in the bearing of pin 4 and with a similar passage (not shown) in the bearing 5^a for the crank pin. The openings in the bearings at the ends of rod 5 in which the ends of the tube 30 are engaged will be preferably slightly inclined as seen at 31 so that the tube may be sprung in place and retained by its own resilience.

The improved engine constructed according to my invention is of an extremely simple and inexpensive nature and is especially well adapted for use by reason of the greater power developed by the inclination of the piston deflector which, being fixedly held on the piston offers the least possible resistance to the inflowing charge while insuring the proper direction thereof against the side of the cylinder to prevent admixture of the entering charge with the exhaust gases. This result is increased by the rounding or concaving of the end surfaces of the cylinder walls and by the provision of the central diametrically extended deflector 28 upon the cylinder head. The inclined arrangement of the pyramidal screen 10 in the charge chamber also effectively prevents back ignition when the admission port 12 is opened and the arrangement of the oil-ducts at the piston connection with rod 5 and leading therefrom to the crank connection of said rod insures perfect lubrication of the working parts of the engine at all times. It will also be obvious from the above description that the improved engine is capable of considerable change without material departure from the principles and spirit of the invention and for this reason I do not desire to be understood as limiting myself to the precise form and arrangement of the several parts of the device as herein shown and described in carrying out my invention in practice.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

An internal combustion engine comprising a cylinder having a head provided with a concave inner surface, said cylinder having an admission and an exhaust port at diametrically opposite points and at a distance from the cylinder head, a piston movable in the cylinder and controlling said admission and exhaust ports, and a deflector extending across the face of the piston opposite said admission port, the base of said deflector being set in from the periphery of the piston at the portions opposite said port, said deflector being curved along its length concentric with the cylinder wall and having its ends curved backward to the circumferential edge of the piston in a direction opposite to the curvature of its middle portion and said deflector being inclined toward the wall above said admission port in such man-

ner that the edge of a vertical section of said deflector adjacent said admission port constitutes a straight line which if extended would intersect the cylinder wall at approximately the junction of the concave surface of said cylinder head with the side wall of the cylinder.

Signed at Chicago, Illinois, this 30th day of October, 1905, in the presence of two witnesses.

GEORGE F. SWAIN.

Witnesses:
W. F. MOORE,
J. D. CAPLINGER.