PUMPING ENGINES

—FOR THE—

WATER SUPPLY

—OF—

CITIES AND TOWNS.

H. P. M. BIRKINBINE,

ENGINEER FOR THE CONSTRUCTION OF WATER WORKS,

Office of the Birkinbine Fire Protection,

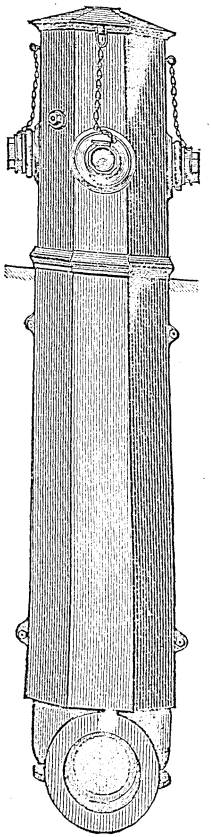
No. 152 S. FOURTH STREET,

PHILADELPHIA.

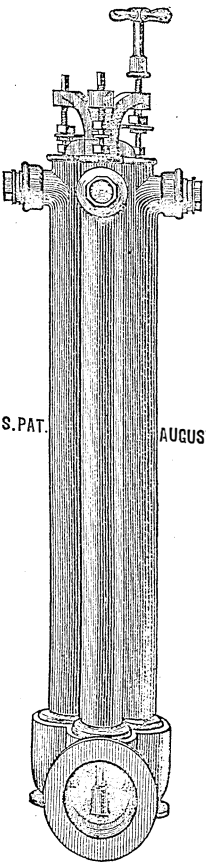
The Birkinbine Combined Fire Hydrant

IS ADAPTED TO THE REQUIREMENTS OF

Cities, Towns and Villages, Railroad Depots and Stations, Factories, Mills, Furnaces, Shops, etc., etc.



Hydrant in Case.



Hydrant.

It permits of the concentration of a number of independent fire streams, with a minimum amount of hose, and is the simplest and most substantial Fire Hydrant in the market. It consists of two or more separate and independent fire hydrants secured to a common base, all parts of which are interchangeable, and made to standard. One bolt holds the several hydrants securely to the base, and a single casting acts as a washer, and a nut for all the operating screws.

The several hydrants are constructed upon the most approved plan, which has satisfactorily stood the test of many years in a variety of water works. Any hydrant can be removed and another substituted for it in a few minutes without digging, it being only necessary to remove one nut on the top part of the case and one nut on the washer casting. All the proportions of the hydrant admit of ample water way; and the liability to defects or derangement is very slight. There are no inaccessible moving parts.

These hydrants are already in use in the water supplies of

SOUTH BEND, INDIANA; CHAMBERSBURG, PENNA.; MUSKEGON, MICHIGAN; LEBANON, PENNA.; MOUNT JOY, PENNA.;

And are also employed to protect the shops of the following establishments:

SINGER MANUFACTURING CO.; STUDEBAKER WAGON WORKS; SOUTH BEND IRON WORKS; WEIMER MACHINE WORKS; CUMBERLAND VALLEY RAILROAD COMPANY.

PUMPING ENGINES FOR WATER WORKS.

As there are but few cities or towns so favorably situated as to procure a supply of water by gravitation, it is generally necessary to pump the water to a proper elevation to secure the requisite pressure for town distribution. The character of the apparatus for pumping the water is a matter of much greater moment than it is generally considered; for the durability, efficiency, reliability, and the amount of fuel necessary to do the work required is but seldom taken into account; if the pumps will only perform the work, it is often all that is required; but experience or a little reflection will show that the character of a pumping apparatus is of the greatest importance. The city of Philadelphia has in its water-power works at Fairmount, in one mill house, six 18-inch pumps, 6 feet stroke, operated by three Jonval turbine wheels, each 9 feet diameter, 1,700 inches issue; and in another house there are six pumps, 22 inches diameter, 6 feet stroke, operated by three Jonval turbine wheels, each 10 feet 6 inches diameter, 2,250 inches issue. Both sets of machinery work under the same head and fall, and yet the former, smaller wheels and pumps, elevate more water into the reservoir than the larger ones, and with a saving of water-power corresponding to the relative size and issue of the wheels.

Simplicity and strength in construction, together with a proper arrangement and adaptation of the various parts, form the important elements in a pumping apparatus; complicated and delicate machinery is difficult and expensive to maintain, and is seldom economical in its operation; and where steam-power is employed, the question of efficiency becomes even more important than where water-power is used. The works originally built for supplying the portion of the city of Philadelphia lying west of the Schuylkill River, became in course of time too small for demands of that rapidly growing district; new works were constructed, and a different form of pumping engine used; but this change made it necessary for the city to purchase and consume 2,248 tons of anthracite coal in 1875, above what it would have required had engines like those in the old works been used, showing that the city is losing at least $12,000 per annum by the change in the character of the pumping apparatus.

HIGH PRESSURE PUMPING ENGINES

FOR

CHAMBERSBURG WATER WORKS.

The accompanying plates Nos. 1 and 2 are presented as illustrating an apparatus meeting the requirements of a town of moderate size, say 10,000 inhabitants, and represents the pumping engine constructed for the Chambersburg, Pennsylvania, Water Works. The ordinary capacity of the apparatus is 500,000 gallons per day, but it has been worked at the rate of over 1,000,000 gallons per day with perfect safety. Larger engines constructed upon a similar plan are now in operation, pumping at the rate of 5,000,000 gallons per day. This design of engine is presented as cheap, durable, reliable and efficient; there are as few parts as possible, and everything is made of abundant strength; the pump has but four double beat metallic valves fitted with Birkinbine's patent water-cushions, so arranged that at whatever speed the pump is operated the faces of the valves never come in violent contact; they are shown on Plate No. 2 in position.

In the Chambersburg Works, 25 horse-power is all that is required to supply the town through the reservoir; when working thus the steam is cut off at half-stroke, but in case of fire the steam is permitted to follow the piston the entire journey, and by increasing the pressure in the boiler the engine can then be worked up to 60 horse-power. The boiler used in these works is of the upright tubular fire-box kind, in which steam is raised and generated rapidly.

The engine and pump are secured upon a continuous bed-plate, and are horizontal; the piston-rod of the pump and steam cylinder is in one piece, having a cross-head secured to it; at either end of the cross-head the connecting-rods are attached, which take hold of the crank-pins in the fly-wheels placed on either side of the steam-cylinder. The steam-valve is operated by link motion, which permits of the steam being cut off at any desired point, or of the reversing and starting the engine. The entire weight of the apparatus is 35,000 pounds.

Engines without fly-wheels answer a good purpose in many positions, yet they cannot be made to perform as high duty as engines with fly-wheels, except the slow moving Cornish

pumping-engine; this form of engine, where a large amount of constant work is required, has not been excelled in actual duty.

It has been attempted to secure the same economical results as given by fly-wheel engines, by duplicating the parts, yet without success, and with the objection of double the working and wearing parts.

A pair of pumping-engines similar to Plates 1 and 2, illustrated, are now giving very satisfactory results; one is a high-pressure engine, 30 inches diameter of steam-cylinder, operating a 22-inch pump, 4 feet stroke; the other, a condensing engine, 54 inches diameter of steam cylinder, 22 inches diameter of pump, 4 feet stroke. They can be worked separately or together, and, when working together, the exhaust steam of the high-pressure engine furnishes the steam for the condensing engine.

The cost of coal when working combined is less than three-eighths of a cent per horse-power per hour, using anthracite pea coal at $2 75 per net ton. This is the ordinary operation of the engine, not experimental results.

These engines work against a constant pressure approximating 100 pounds per square inch, and can pump 5,000,000 gallons per day each, when working independently; or 8,000,000 gallons per day when operated combined as above described.

WATER POWER PUMPING APPARATUS,

AT FAIRMOUNT, PHILADELPHIA.

Plate No. 3 represents the pumping apparatus designed and constructed for the city of Philadelphia. Fig. 1 is a side elevation of one of the turbines and pump in position; Fig. 2 a front elevation with the lower part of the wheel in section so as to show the guide curves, wheel, draft tube and gate. The head and fall varies with the rise and fall of the tide, and is from eight to fourteen feet. To meet the peculiarities of this constantly changing power, I adopted plain Jonval turbine wheels. This was done after a thorough search into the various water motors then in use, and submitting a large number of turbines to actual test. The results of these tests were published at the time (1860).

The pumps were made to run at such speed as to absorb the power without the necessity of operating the gates. This was accomplished by the use of the water cushioned valve, which enabled the pumps to be run at a piston speed of from 120 to 250 feet per minute without any jar or concussion in closing the valves, of which there are but four, made of cast iron, in each pump. The isometrical view, Fig. 3, shows one of the valve houses in section with the valves in position. Fig. 4 is a section of one of the valves. Fig. 5 a plan. There are three wheels nine feet diameter with 1,700 inches issue, each wheel propelling two 18-inch pumps 6 feet stroke. These are all contained in one room; a substantial stone edifice with a flat roof surrounded with a balustrade which forms a promenade. These six pumps have forced twenty-four million gallons of water per day into the reservoirs.

CORNISH PUMPING ENGINE,

ROXBOROUGH WATER WORKS, PHILA.

Plate 4 represents a Cornish pumping engine constructed for the water works of the city of Philadelphia. The engine is built of unusual strength to sustain the heavy work it was required to perform of lifting water 365 feet through 4,660 feet of pipe. The engine is fitted with my equilibrium governor, shown by Fig. 3, which is a section of the lower valve house, containing the exhaust and equilibrium governor valves. This valve is so arranged that the equilibrium passage may be partially obstructed or entirely closed, and enables the starting of the engine when the reservoir and forcing main is empty, by controlling the steam in passing from one end of the cylinder to the other, and thus preventing the fall of the plunger. The pump is a plunger pump, and has but two valves made with water-cushions. This form of engine has proved itself the most economical in fuel and the most reliable, and is only approached in efficiency by the compound or Simpson engine, modifications of which are now doing good service in water works.

These illustrations represent a few of the pumping engines constructed from my designs and under my supervision. For large works, the engines should be specially arranged to meet the peculiarities of the service they are to perform. This is particularly the case where fuel is expensive.

HENRY P. M. BIRKINBINE.

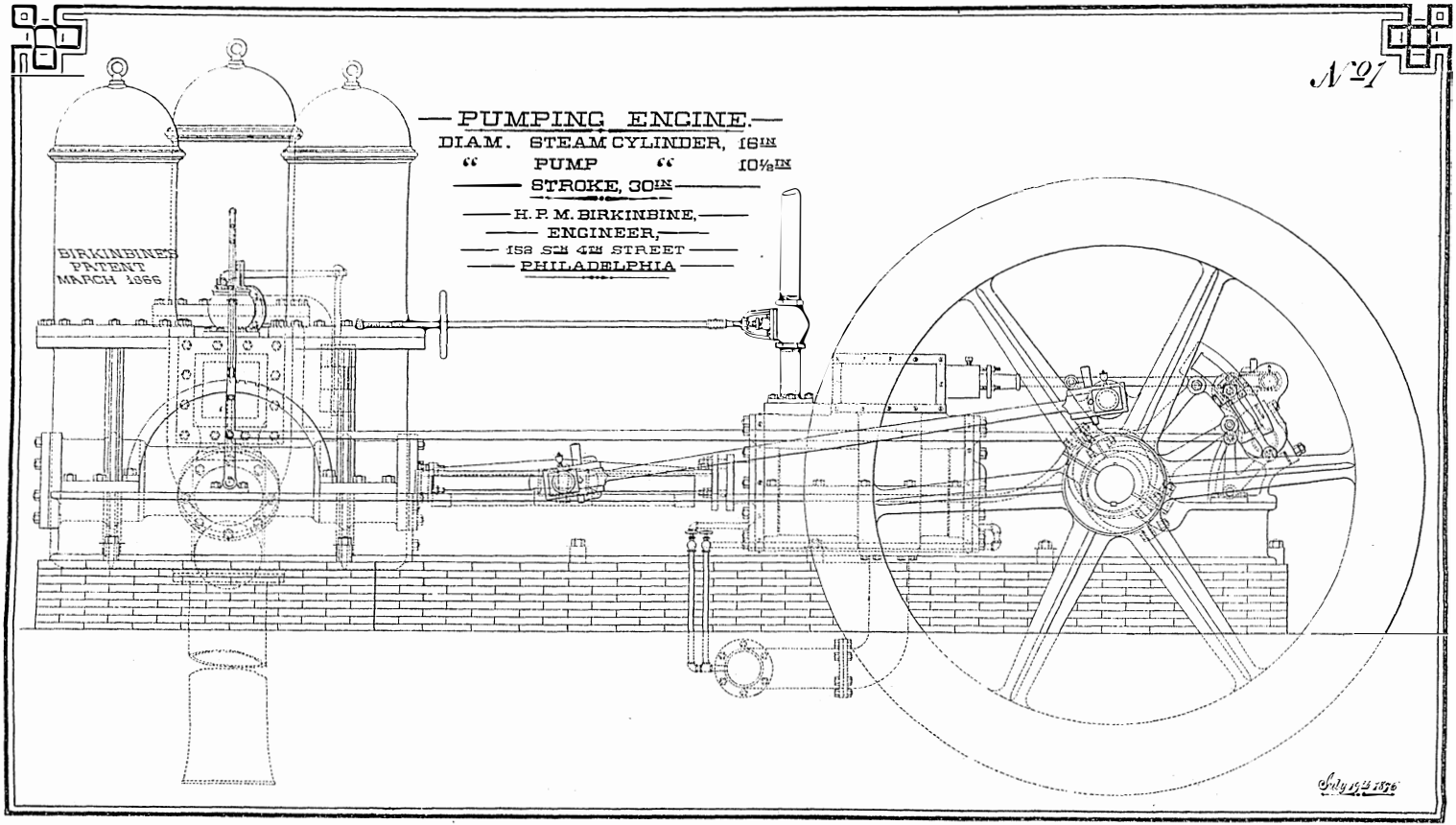
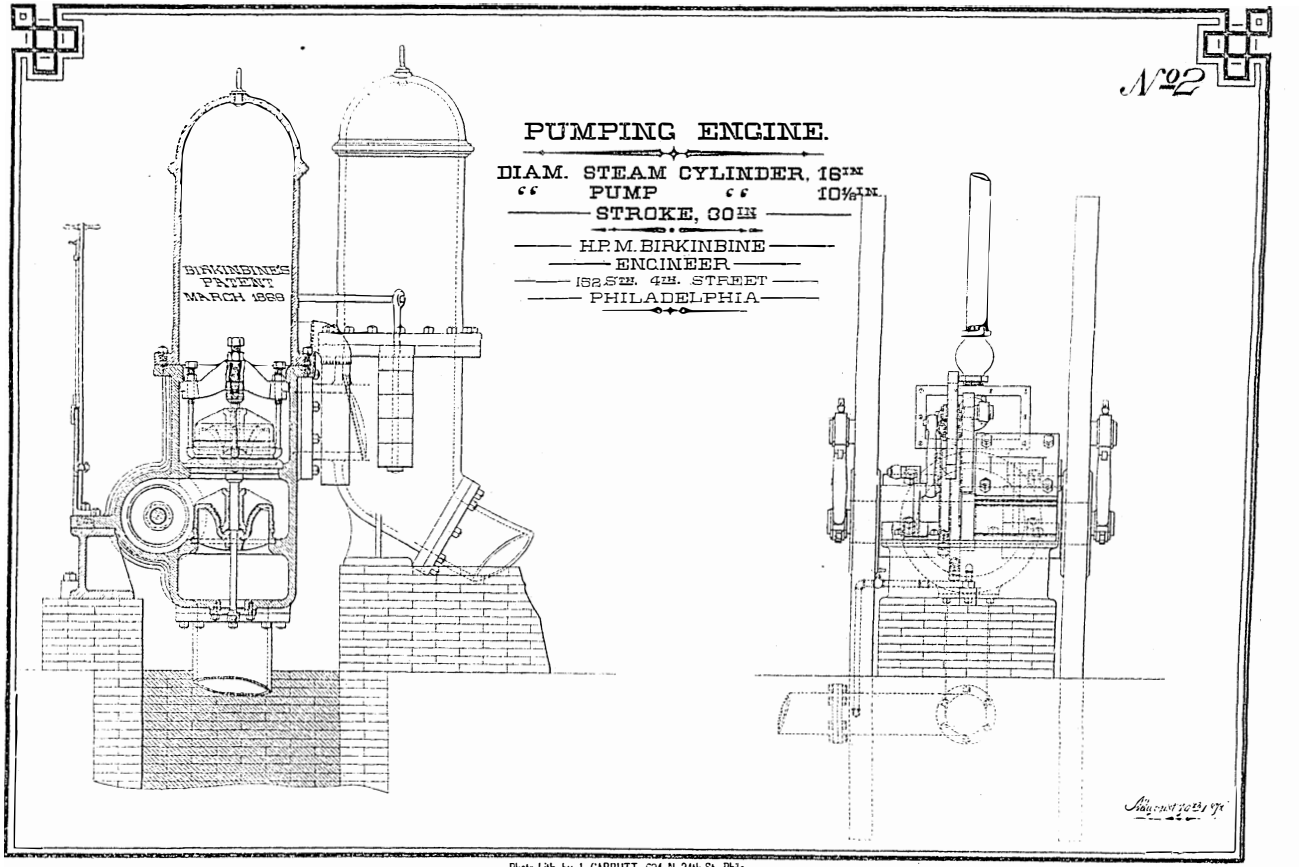


Photo-Lith. by J. CARBUTT, 624 N. 24th St., Phila.



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№ 3

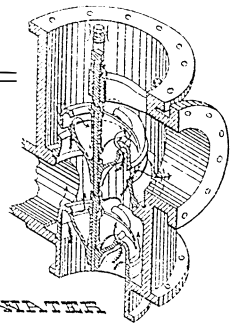


Fig. 3.

WATER CUSHIONED VALVE

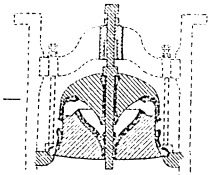


Fig. 4.

BIRKINBINE'S PATENT
MARCH 27TH 1866

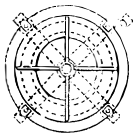


Fig. 5.

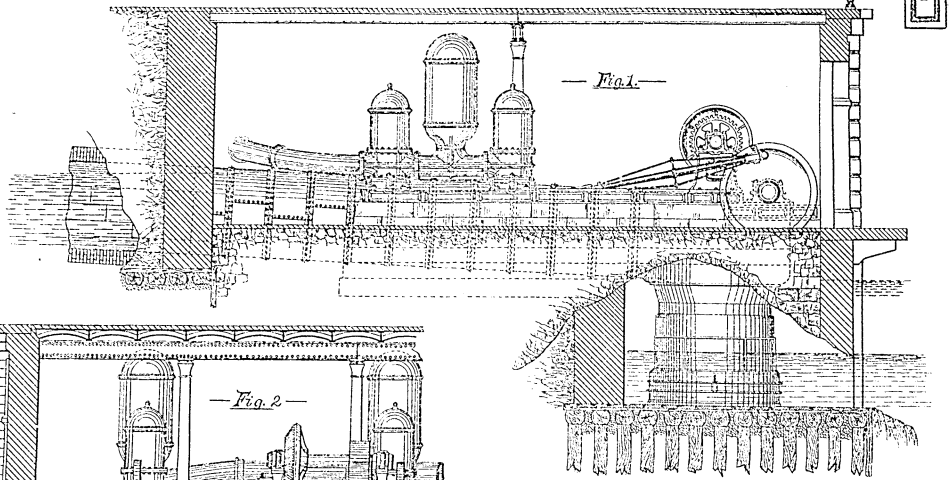


Fig. 1.

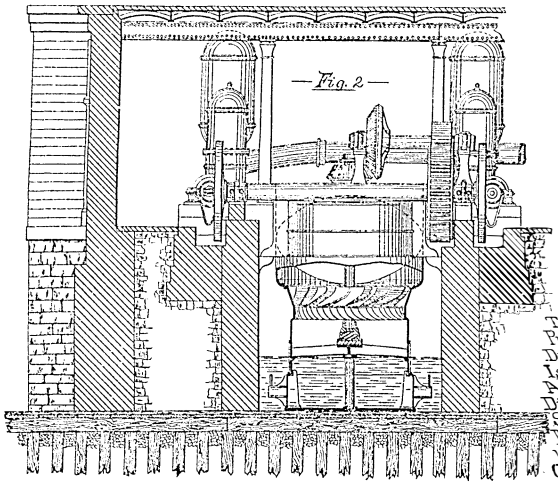


Fig. 2.

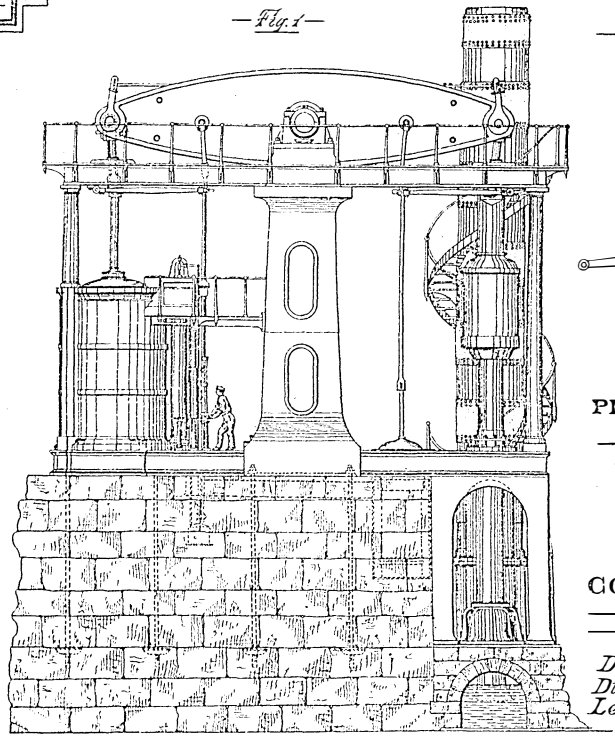
EXTENSION
OF THE
PHILADELPHIA WATER WORKS
BY
H.P.M. BIRKINBINE
CHIEF ENGINEER

Three Jonval Turbines, each driving two double acting Pumps.	
Diameter of Turbines outside of Buckets	9ft.
Issue of each Wheel	1100 cu.
Average height of water fall	11 ft.
Diameter of Pumps	18 in.
Stroke of Pistons	6ft.
Average number of double strokes of each Pump per minute	12 to 21
Capacity per day	22000000 gallons.
Height of surface of Reservoir	115 ft.

Photo-Lith. by J. CARBUTT, 624 N. 24th St., Phila.

No 4

Fig. 1



BIRKINBINE'S EQUILIBRIUM GOVERNOR

Fig. 3

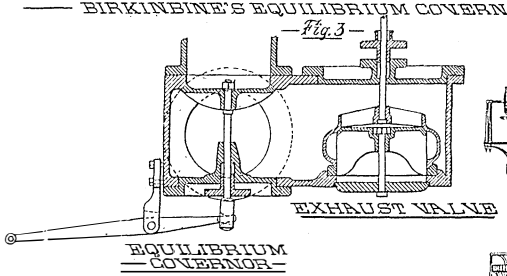
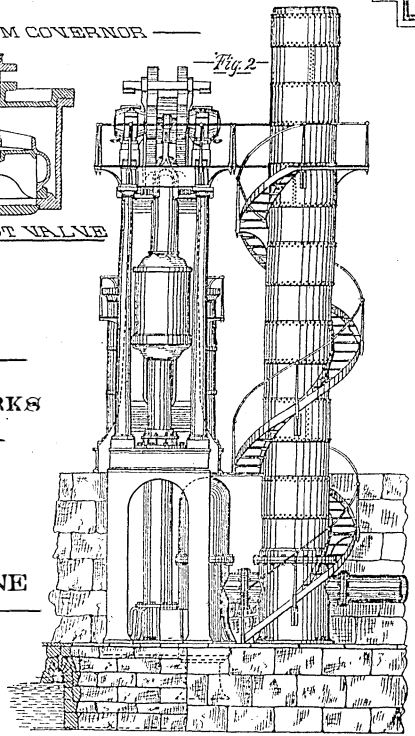


Fig. 2



EXTENSION
OF THE
PHILADELPHIA WATER WORKS
BY
H.P.M. BIRKINBINE
CHIEF ENGINEER

CORNISH PUMPING ENGINE
ROXBOROUGH WORKS

Diam. of Cylinder ..... 72 in.
Diam. of Plunger ..... 20½ in.
Length of Stroke ..... 10 ft.

Photo-Lith. by J. CARBUTT, 624 N. 24th St., Phila.

IMPROVED FIRE PROTECTION,

REISSUE

Patented Dec. 31, 1872; Jan. 11, 1876. Nov. 27, 1877.

H. P. M. BIRKINBINE, Engineer, No. 152 S. Fourth Street, Philadelphia.

Plate 1.

Town Plot with Water Works, Pipe Lines, and Fire Hydrants.

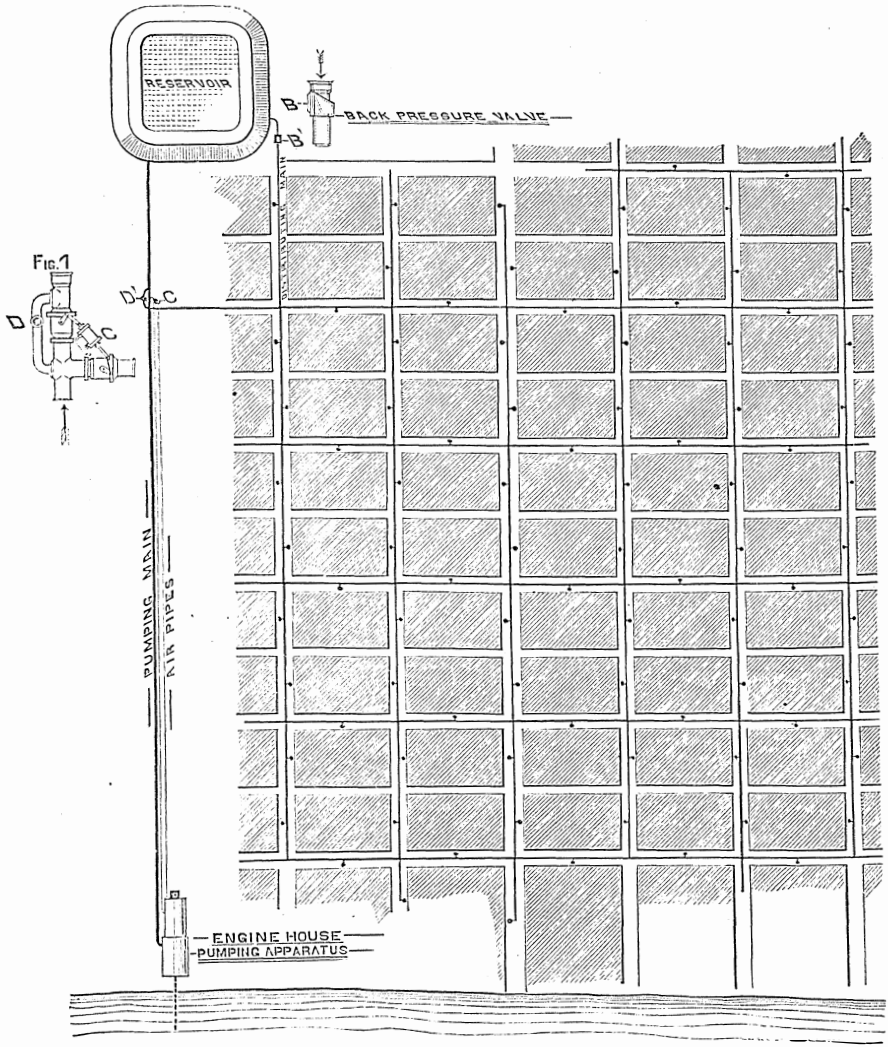


Fig. 1. Reversing Apparatus. B. Back Pressure Valve. C. Operating Cylinder.

—o Fire Hydrants. D. Safety Valve.

FIRE PROTECTION

FOR CITIES AND TOWNS.

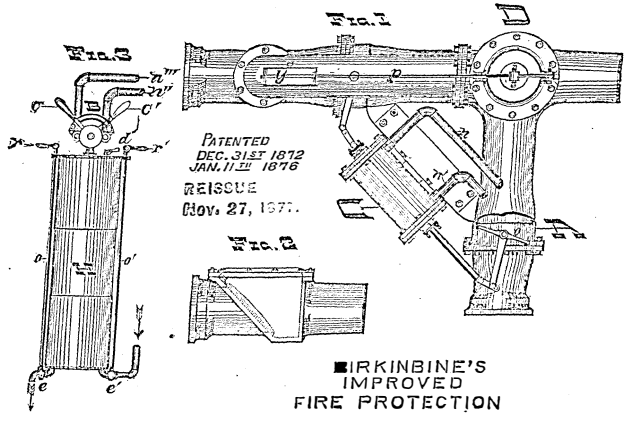


Fig. 1.
Valve Changing Apparatus.

Fig. 2.
Back Pressure Valve.

Fig. 3.
Air Compressor.

C Operating Cylinder. **D** Safety Valve. n, n', &c., Pipes connecting Compressor & Operating Cylinder.

The object of the apparatus illustrated above, and shown in position on the back of cover, is designed to obviate the necessity of fire-engines, by increasing the pressure and amount of water thrown from the street hydrants during the time of emergency; limited only by the strength and capacity of the pumping apparatus and pipes. When the fire is extinguished, the water is pumped into a reservoir in the ordinary manner.

The changes of the valves necessary to accomplish this, are made instantly by air under pressure, discharged from a compressor located in the engine-house, or other suitable point at any required distance from the valves. The compressor is operated by the ordinary reservoir pressure of water.

The reduction of insurance rates in towns where this apparatus forms a part of the water supply, is one of its best endorsements.

It can be readily applied to the protection of Manufactories, Furnaces, Depots, Shops, etc., supplied by their own pumping works.