GOODRICH

13

SMITH-VAILE

PUMPING MACHINERY

THE STILWELL-BIERCE & SMITH-VAILE CO.

DAYTON, OHIO, U.S.A.

GOODRICH

THE "SMITH-VAILE"

Steam Pumps, Pumping Engines,

AND

ARTESIAN WELL MACHINERY

OF EVERY DESCRIPTION
AND FOR EVERY PURPOSE

SALES DEPARTMENTS:

114 Liberty Street,
NEW YORK.

63 Canal Street,
CHICAGO.

40 W. Alabama Street,
ATLANTA, GA.

97 Queen Victoria Street,
LONDON, E. C. ENGLAND,

FACTORIES:

DAYTON, OHIO, U. S. A.

APRIL 1, 1896.

The Stilwell-Bierce & Smith-Vaile Co.

INDEX.

CIRCULAR.

In presenting this, our new catalogue for 1896, we beg to inform our old customers that we have withdrawn all exclusive agencies heretofore existing with general jobbing houses. We feel that the interest of both ourselves and our patrons can be best served by direct dealing with the manufacturer. While heretofore any inquiries coming to us from dealers in many cases had to be referred, we are now prepared to give them careful attention and immediate reply.

In addition to existing warehouses, we have opened a large sales department and warehouse in CHICAGO, where we will carry a complete line of goods, so that any order for our regular stock goods can be filled without delay.

In reply to a question often asked, we wish to say that *we also carry a full line of repair parts* and as all parts are made interchangeable in our machinery, we can provide immediately for any accidental breakage.

We also will have an able and competent force of consulting and erecting engineers at our sales department, and will, when desired, take contract for putting plant in operation, or attend to repair work.

We are in position to furnish Water Works contractors with full Steam Plant. To furnish Railroads with complete Water Stations. All kinds of Hydraulic and Mining Pumps. We particularly solicit the trade of the various Machinery Supply houses and offer them one of the largest lines of Pumping Machinery to select from. We call attention to a few points in regard to our Pumping Machinery, which is so widely known as to hardly need detail description.

We build both the Single and Duplex patterns, but in most cases, recommend the latter as simpler and more effective. We have made from time to time, any improvements possible, not being contented simply to manufacture a line that would sell, but we wish to make the best line. We adapt every machine to its particular kind of work, both in construction and material.

In addition to this catalogue, we issue special circulars on special lines, giving, where required, list of users, also detail description too voluminous for general catalogue. Every machine is fully tested before leaving our factory, both as to pressure and speed for which it is designed.

All our Machinery is fully Warranted by us.

PA
Box 543
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TO CUSTOMERS.

IT HAS BEEN OUR ENDEAVOR to make this Catalogue so complete that our customers would be able to select almost any machines necessary for their work from the following list. However, there will arise many cases where correspondence will be necessary. We have given detail descriptions as far as possible in the limited space allowed. Each and every type of machine will admit of many changes and modifications.

While we will continue to build all lines of single pumps, we recommend the duplex type as the most efficient and simple. Often in starting pumps much difficulty is experienced, in which case you should look for the trouble in your connections, and bear in mind that all pumps are thoroughly tested before leaving the factory, and tested under conditions much more severe than the regular work they are liable to be subjected to. We would briefly enumerate some of the points to avoid: An absolutely tight suction is necessary where the lift is long. A foot valve may be necessary, and a vacuum chamber on the suction pipe near the pump greatly assists.

When pumping against heavy pressure a pump may fail to work on account of full pressure resting on discharge valves. Under these conditions the air in pump cylinder is simply compressed and prevents water entering cylinder; so it is advisable to start pump and run until the air is expelled without any pressure. This can be done by suitable connections in pipe and a waste delivery. Where we are furnished a drawing of connections and given conditions, we will gladly plan setting of pumps.

We cordially invite correspondence, to which we will give a full and prompt reply.

THE STILWELL-BIERCE AND SMITH-VAILE CO.

April 1, 1896.

The Ohio Historical Society Library

TO CORRESPONDENTS.

Whenever possible refer to the FIGURE NO. of the machine about which you write, and in ordering a pump it is for the interest of the purchaser to fully inform us on the following questions:

1st. For what purpose is the pump to be used?
2d. What is the average pressure of steam carried?
3d. What is the maximum quantity to be pumped per minute or hour?
4th. To what height is the liquid to be lifted by suction? What is the length and diameter of suction pipe, and the number of elbows or bends?
5th. To what height is the liquid to be discharged, or against what pressure? What is the length and diameter of discharge pipe?
6th. What is the liquid to be pumped, hot or cold, clear or gritty, fresh, salt, alkaline, or acidulous?
7th. In ordering parts or describing details of sizes, give *shop* number stamped on steam cylinder.

DIRECTIONS FOR SETTING UP AND RUNNING PUMPS.

Never use pipes of smaller size than given in the tables. When long pipes are used it is necessary to increase the size to allow for the increased friction. Especially must this be observed in suction pipes.

Use as few elbows, T's and valves as possible, as they greatly increase friction. Use full round bends rather than elbows.

Care should be taken to guard against leaks in the suction pipe, as a very small leak destroys the effectiveness of the suction of a pump.

When hot water is to be pumped, the difficulty of lifting by suction increases by the temperature. It should therefore be arranged to flow into the pump, if so hot as to vaporize, when the pressure of the atmosphere is removed.

A large vacuum or suction chamber placed on the opposite side of the pump from where the suction enters or on the suction pipe near the pump, is always advantageous, and when the pump is run at a high speed it is a necessity.

Ordinary speed to run steam pumps is from 75 to 100 feet piston travel per minute. For continuous boiler feeding about one-half that speed is recommended.

Keep your pump clean, and stuffing boxes well packed.

P. E. Morrell & Son. 2/69

THE DAYTON "CAM" PUMP.

This Pump is simple in construction, positive in its action, has no "dead centers," and will successfully handle hot water.

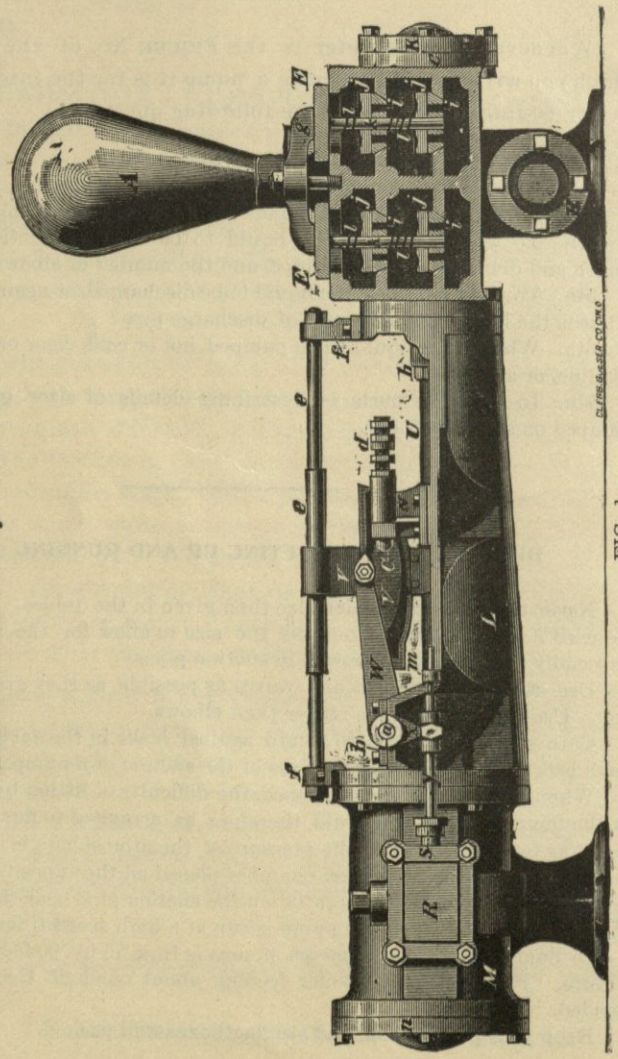

FIG. 1.

THE DAYTON "CAM" PUMP.

By reference to the Sectional View on opposite page, it will be seen that it is a Direct and Double-acting Piston Pump, having a plain slide valve similar to the ordinary "D" valve of an engine.

The valve is moved by two levers, *W X*, on a shaft *a*, being placed at right angles and forming a bell-lever.

Motion is imparted to these levers by a Cam *V*; also a fixed support or pocket, *N*, which holds a sliding V-shaped plunger, *C*, and spiral steel spring.

The operation of the valve movement is as follows: The Cam *V* near the termination of the stroke of the pump piston, brings the V-shaped or pointed lever *W* in contact with the V-shaped plunger, *C*, forcing it back in pocket *N*, and compressing the spiral spring contained in the pocket. The movement of the piston continues until the points have passed, when the forcible reaction of the spiral spring and the incline faces of the V-shaped points serve to move the lever *W*, and, through the small lever *X*, to throw the steam valve sufficiently to partially open the steam port for the return stroke.

The same operation is performed on the return stroke at its termination, only the lever *W* is thrown in the opposite direction.

By an inspection of the details of its moving mechanism, it will be found that it can *never* make a *short stroke*. Each stroke MUST be complete before the steam valve will open and permit a stroke in the opposite direction.

The Dayton Cam Pump has been found invaluable for pumping the condensation of steam heating coils back to the boiler, without the use of traps. The peculiar form of the Cam with its connections, as above described, causes the piston to make a slight pause at each end of the stroke, which allows the valves to seat securely before starting on its return stroke.

When using steam at a high pressure for heating purposes, this pump in connection with our Automatic Receiver, returns the water of condensation to boiler at a heat, due to pressure, but a few degrees below that in the boiler.

PRICES.

No.	Diameter of Steam Cylinder	Diameter of Water Cylinder	Length of Stroke.	Gallons for Single Stroke.	Size of Steam Supply Pipe.	Size of Exhaust Pipe.	Size of Suction.	Size of Discharge.	Length Over All.	Width Over All.	Height Over All.	Weight Boxed.
	Inch's	Inch's	Inch's		Inch's	Inch's	Inch's	Inch's	Ft. In.	Ft. In.	Ft. In.	Lbs.
2	4¾	3	4	.122	½	1	1¼	1	2 10	11	2	245
3	5	3⅛	6	.199	¾	1¼	1½	1¼	3 11	1 1	2 7	380
4	6⅜	4	7	.380	1	1¼	2	1½	3 11	1 1	2 7	420
5	7	4	10	.544	1	2	2½	2	5 6	1 3	3	680
6	9	5	10	.850	1¼	2½	3	2½	5 6	1 5	3 1	825
6½	11	7	10	1.66	1½	2½	4	3	5 6	1 5	3 1	1210

For continuous work, such as boiler feeding, we advise a piston speed of from twenty-five to thirty-five strokes per minute.

The pumps are arranged for feeding boilers at varying pressures, and can be run at the slowest speed without any danger of stopping.

Are arranged for either Hot or Cold Water, and capable of pumping not only *Hot*, but *Boiling* water under pressure.

THE SMITH-VAILE IMPROVED PUMPS.

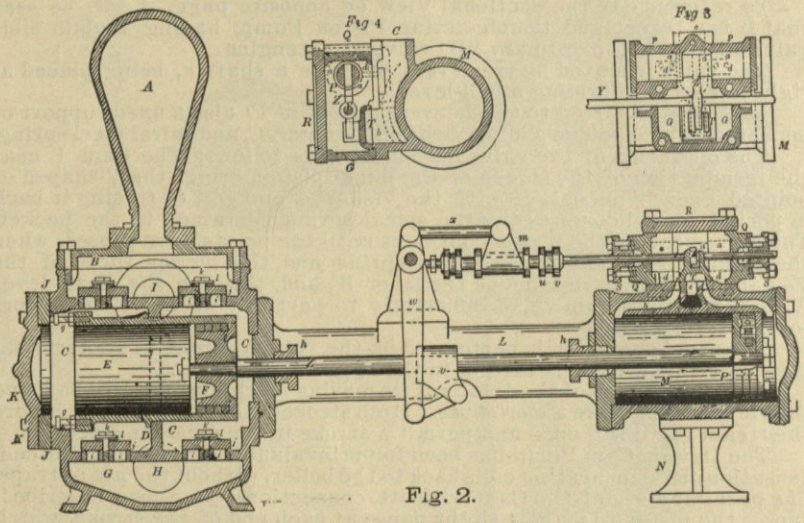

Fig. 2.

It is recognized by all Engineers of Hydraulics, that it is necessary to secure a steady and uniform motion to the steam valve.

As will be seen by reference to the sectional view given above, this is accomplished in the Smith-Vaile Co.'s Pumps, by means of crosshead *v*, lever *w*, link *x*, tappet head *m*, and adjusting nuts *u v*, thus making an easy adjustment of the pumps to suit different conditions and requirements, and placing it completely under control while in motion.

The lost motion is gradually taken up and when the piston has arrived almost at the end of its travel the main valve becomes closed while the plunger valve opens a small port and carries the main valve over, opening the port for reverse stroke.

By this means a full stroke is obtained without any possibility of failure, and at the same time these pumps can be run at a very slow speed without danger of stopping as long as there is steam enough to drive them.

The pump end contains a patent removable cylinder, which is securely fastened, but can be easily and quickly removed when desired, and other sizes inserted according to the duty required; and such change can be made without breaking any pipe connections.

The pumps are made of the best material to withstand the wear and corrosive action of the different liquids to be pumped. The removable cylinders are also made of various compositions, and in case the liquid is strongly acidulated, they may be lined with porcelain or brass.

Thus we have a pump simple in construction, easily managed, easily repaired, no dead center to stick on, also including all the latest improvements in construction, economical in the use of steam, and equal if not superior, to any pump found on the market.

THE SMITH & VAILE IMPROVED PUMPS.

As described upon the opposite page offer the following advantages:

They are direct acting steam pumps, with improvements which make them strictly positive in their action against any varying pressure. Also, while they are proportioned for regular duty as boiler feeding pumps they are suitable for any other duty requiring a uniform and steady stream.

Having a positive connection from piston rod to the steam valve, they can be regulated in speed so as to exactly supply the amount of water evaporated. They are the only pump with patented Removable Water Cylinder.

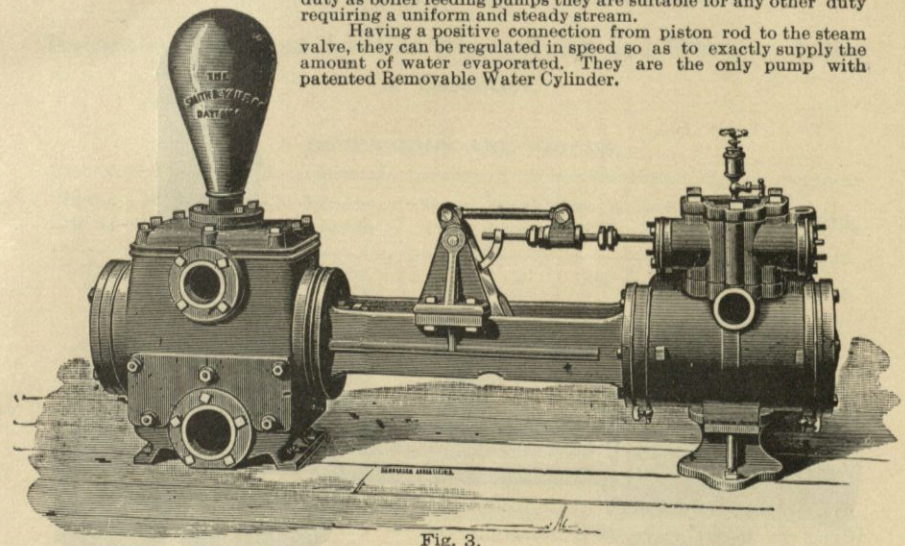

Fig. 3.

For Boiler Feeding and Heavy Pressure.

DIMENSIONS AND SIZES.

No.	Diameter of Steam Cylinder in Inches.	Diameter of Water Cylinder in Inches.	Length of Stroke in Inches.	Gallons per Single Stroke.	Steam Supply pipe.	Exhaust Pipe.	Suction Pipe.	Discharge Pipe.	Shipping Weight.
*	5½	3¼	7	.25	¾	1¼	2	1½	580
*	6½	3¼	7	.25	1	1½	2	1½	650
*	6½	4	7	.39	1	1½	2	1½	680
*	7½	4	10	.54	1	2	2½	2	1000
	7½	5	10	.85	1	2	3	2½	1015
	9½	5	10	.85	1¼	2½	3	2½	1180
	9½	6	10	1.22	1¼	2½	4	3	1200
	11	6½	14	2.01	1½	2½	4	3	2130
	11	7	14	2.32	1½	2½	5	4	2140
	13½	7½	14	2.68	2	3	5	4	2650

*Pumps so marked we put in solid water cylinders, unless very short suction is used, in which case removable cylinder pattern can be used.

These pumps are fitted with our Patented REMOVABLE WATER CYLINDERS, which can be changed or removed, without breaking any pipe connection; also fitted for hot or cold water, as occasion may require.

All pumps tested before leaving the factory.

SMITH-VAILE STANDARD RAILWAY AND GENERAL SERVICE PUMPS.

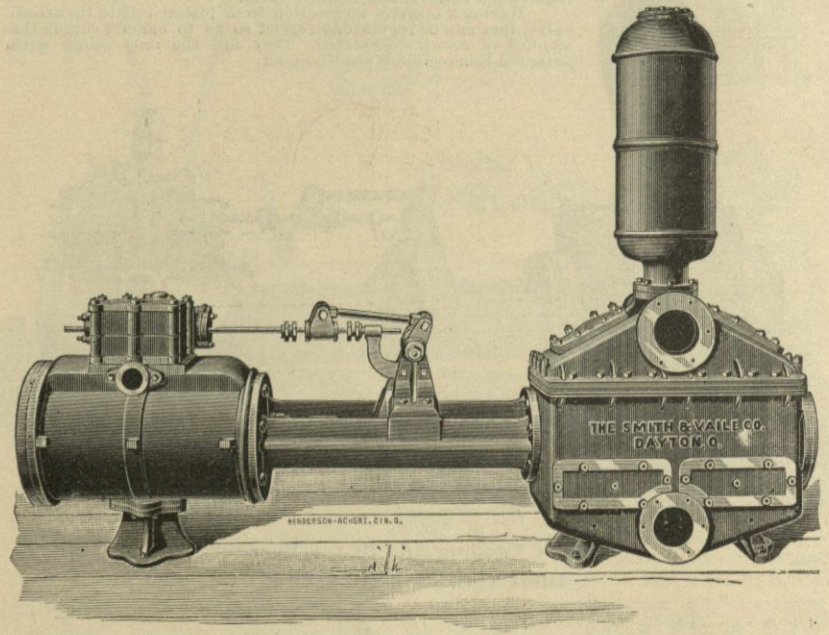

Fig. 4.

Above Cut Represents Railway Pump With 20-Inch Steam Cylinder, 12-Inch Water Cylinder, 30-Inch Stroke.

The Smith-Vaile Railway Pump will start instantly at any part of the stroke, and can be run at any speed desired, making it almost invaluable in case of sudden emergency.

Being constructed for this service with large water passages and of the best materials in every part, to withstand sudden strains, they can safely be depended upon in every instance.

Every Pump thoroughly tested at high speed against heavy pressure before leaving the factory.

Smith-Vaile Standard Railway and General Service Pumps.

WITH PATENTED REMOVABLE WATER CYLINDERS.

Particularly Adapted for Use Where Quick and Effective Action is Essential.

DIMENSIONS AND PRICES.

Steam Cyl'der	Water Cyl'der.	Length of Stroke.	Gallons per Stroke.	Steam Pipe.	Exh'st Pipe.	Suct'n Pipe.	Disch'g Pipe.	Shipping Weight.	PRICE.
* 7½	4	10	.54	1	2	2½	2	980	
7½	5	10	.85	1	2	3	2½	1000	
9½	5	10	.85	1¼	2½	3	2½	1180	
9½	6	10	1.22	1¼	2½	4	3	1200	
11	6½	14	2.01	1½	2½	4	3	2130	
11	7	14	2.32	1½	2½	5	4	2140	
13½	6½	14	2.01	2	3	4	4	2630	
13½	7½	14	3.68	2	3	5	4	2650	
16½	8	18	3.92	2½	4	6	6	3490	
16½	9	18	4.95	2½	4	6	6	3638	
16½	10	18	6.12	2½	4	6	6	3838	
16½	10	24	8.16	2½	4	8	6	5900	
18	10	18	6.12	3	4	6	6	4300	
18	12	18	8.81	3	4	8	6	6280	
18	10	24	8.16	3	4	8	6	6400	
18	12	30	14.06	3	4	8	8	7250	
20	10	24	8.16	3	4	8	6	6800	
20	12	24	11.74	3	4	8	8	7400	
20	14	24	16.40	3	4	10	8	7600	
20	10	30	10.20	3	4	8	6	7100	
20	12	30	14.06	3	4	8	8	7235	
20	14	30	20.15	3	4	10	8	7752	

*Solid water cylinder, unless for very light suction, when removable water cylinders can be used.

The above list is made out on a basis of about 150 feet piston travel per minute. But in case of emergencies this speed can be increased.

The simple and positive connection to the main slide valve makes these Pumps very effective for any duty.

Having made a specialty of these Pumps for a number of years, we feel warranted in saying that for quick work and effectiveness they are not excelled.

When desired we can furnish in connection with the Smith-Vaile Railway Pump a safe and quick steaming boiler, the two making a most admirable combination.

SMITH-VAILE IMPROVED PISTON MINING PUMPS.

With Removable Water Cylinders.

Where limited space or other circumstances prohibit the use of more extensive machinery, a Piston Pump is found very advantageous; and in order to secure the greatest degree of economy and durability of all wearing parts in this class of pumps, we have arranged to have each part easily accessible, and made of the best materials to withstand the wear or corrosive action of the liquid to be pumped.

DIMENSIONS AND PRICES.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Capacity for Single Stroke.	Size of Pipes for Sh'rt Lengt's to be incre'sed.					PRICE.
				Steam Pipe.	Exhaust Pipe.	Suct'n Pipe.	Disch'g Pipe.	Shipping Weight.	
* 7½	4	10	.54	1	2	2½	2	980	
7½	5	10	.85	1	2	3	2½	1000	
9½	5	10	.85	1¼	2½	3	2½	1180	
9½	6	10	1.22	1¼	2½	4	3	1200	
9½	6½	14	2.01	1¼	2½	4	3	1360	
9½	7½	14	2.68	1¼	2½	5	4	1400	
11	6½	10	1.43	1½	2½	4	3	1500	
11	7½	10	1.96	1½	2½	4	4	1500	
11	6½	14	2.01	1½	2½	4	3	2130	
11	7½	14	2.68	1½	2½	5	4	2150	
13½	6½	14	2,01	2	3	4	3	2630	
13½	7½	14	2.68	2	3	5	4	2650	
13½	8	14	3.85	2	3	6	5	2700	
13½	8	18	3.92	2	3	6	6	3000	
13½	9	24	6.61	2	3	6	6	3278	
16½	8	18	3.92	2½	4	6	6	3490	
16½	9	18	4.95	2½	4	6	6	3638	
16½	10	18	6.12	2½	4	6	6	3838	
16½	10	24	8.16	2½	4	6	6	5900	
16½	10	30	10.20	2½	4	6	6	6100	
18	9	18	4.95	3	4	6	6	4200	
18	10	18	6.12	3	4	6	6	4300	
18	10	24	8.16	3	4	6	6	6400	
18	12	30	14.06	3	4	8	8	7220	
18	14	30	20.05	3	4	10	8	7572	

*Solid water box is used unless suction lift is very small.

This list is based on a piston speed of 100 feet per minute. For regular duty a speed of 75 to 100 feet is recommended, although in extreme cases it can be doubled. Full water end made of best composition or gun metal when ordered, at the additional cost only of the metal used. See cut page 8.

STRONG, RELIABLE AND DURABLE.

SMITH-VAILE PATENT LOW SERVICE PUMPS.

WITH PATENTED REMOVABLE WATER CYLINDERS.

For Wrecking, Circulating, Tank Purposes, etc.

Steam Cyl'nd'r.	Water Cyl'nd'r.	Length of Stroke.	Capacity Single Stroke.	Num'r of Str'k's.	Size of Pipes for Short Lengths, to be increased as length increases.				Shipping Weight.	PRICE.
					Steam Pipe.	Exh'st Pipe.	Suct'n Pipe.	Disch'g Pipe.		
*5½	4	7	.39	170	¾	1¼	2	1½	580	
5½	5½	7	.72	170	¾	1¼	3	2½	654	
6½	5	7	.60	170	1	1¼	3	2½	660	
6½	5½	7	.72	170	1	1¼	3	2½	680	
7½	6	10	1.22	120	1	2	4	3	1030	
7½	7½	10	1.99	120	1	2	4	3	1095	
9½	7½	10	1.99	120	1¼	2½	4	3	1254	
9½	8	14	3.05	85	1¼	2½	5	4	1950	
9½	10	18	6.12	65	1¼	2½	6	6	2467	
9½	10	24	8.16	50	1¼	2½	8	8	4542	
9½	12	30	14.68	40	1¼	2½	8	8	4632	
11	8	14	3.05	85	1½	2½	5	4	2150	
11	10	18	6.12	65	1½	2½	6	6	2652	
11	12	24	11.75	50	1½	2½	8	8	4832	
11	14	24	16.40	50	1½	2½	10	8	5320	
13½	12	18	8.81	65	2	3	8	8	5000	
13½	16	24	20.80	50	2	3	12	10	8342	
13½	20	24	32.64	50	2	3	12	10	8842	
16½	12	18	8.81	65	2½	4	8	8	5600	
16½	14	24	16.40	50	2½	4	10	8	6567	
16½	16	24	20.80	50	2½	4	12	10	9200	
16½	20	30	40.80	40	2½	4	12	12	9752	
18	16	24	20.80	50	3	4	12	10	9600	
18	20	30	40.80	40	3	4	12	12	10500	
20	18	30	33.00	40	3	4	12	12	10600	
20	20	30	40.80	40	3	4	12	12	10660	

*Solid water cylinders, unless for very light suction, when removable water cylinders can be used.

Other proportion of Steam and Water Cylinders made for special duties, as required.

THEY ARE VERY COMPACT.

They are easily operated, having large piston and valve areas, and the Patented Smith-Vaile Movement, *the simplest form in use.* Every pump fully tested before leaving factory and guaranteed.

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SMITH-VAILE DOUBLE-ACTING PLUNGER PUMPS.

For Mining Purposes.

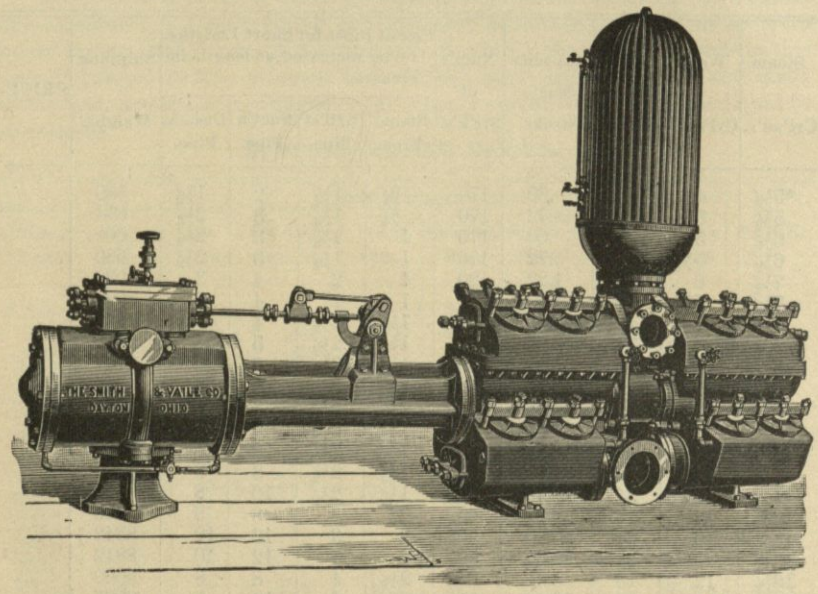


Fig. 5.

The above illustration shows an inside connected Double-Acting Plunger-Pump of simple design, having each water valve easily accessible, suction and discharge openings on either side. No inside packing.

The plunger is packed near the center as shown, by two stuffing boxes, which can be adjusted while the pump is in motion.

When required outside connections will be made to order, and of material suitable for the purpose.

Sewerage Pumps made to order and fully guaranteed, either Double-Acting Plunger or Piston pattern. Prices given on application.

SMITH-VAILE IMPROVED DOUBLE-ACTING PLUNGER-PUMP.

For Boiler Feeding and Heavy Pressure

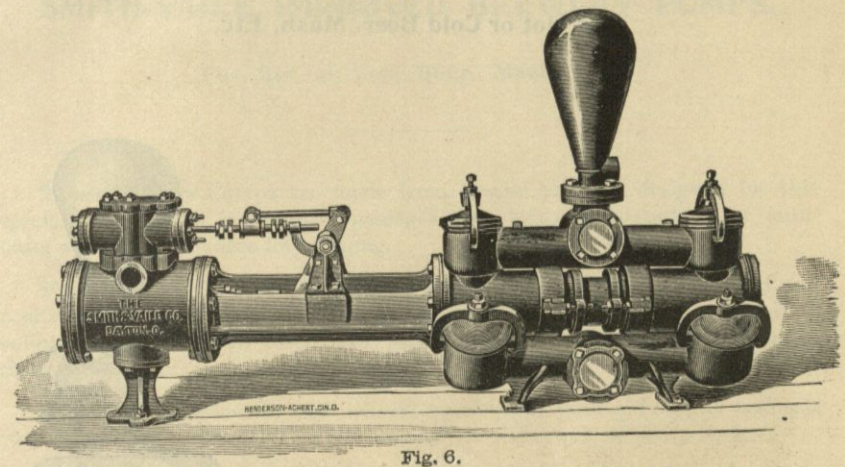


Fig. 6.

Above cut shows the Double-Acting Plunger Pump of the smaller sizes of the following list.

DIMENSIONS AND PRICES.

No.	Steam Cylinder.	Water Cylinder.	Stroke.	Gallons per Stroke.	Steam Pipe.	Exhaust Pipe.	Suction Pipe.	Discharge Pipe.	Shipping W'ght.	Price.
	4¾	3	4	.122	½	1	1¼	1	300	
3	5½	3¼	7	.25	¾	1¼	2	1½	670	
4	6½	4	7	.39	1	1¼	2	1½	760	
5	7½	4	10	.54	1	2	2½	2	1200	
6	8½	5	10	.85	1	2	3	2½	1340	
6½	9½	6	10	1.22	1¼	2½	4	3	1605	
7	11	7	14	2.32	1½	2½	5	4	2645	
8	13½	8	14	3.05	2	3	6	5	3300	
9	16½	10	18	6.12	2½	4	8	6	4800	
10	16½	10	24	8.16	2½	4	8	8	6550	

*Cam valve motion is used on this (No. 2) size.

Longer strokes or different proportions of cylinders to order.

These pumps are designed to be used for boiler feeding where high pressure of steam is carried, or any place where muddy or gritty water is to be pumped, being a simple double-acting plunger pump with outside packing glands. The water valves are of large area, and are easily accessible by loosening the nut on the yoke, on the suction and discharge pipe, on either side.

They are especially adapted for feeding boilers on river steamboats, rolling mills, blast furnaces, vaults, sewerage, etc. Arranged for hot or cold water by simply changing the valves. The Smith-Vaile Steam Valve is used, which can be regulated to any speed desired.

SMITH-VAILE IMPROVED BREWERY PUMPS.

For Hot or Cold Beer, Mash, Etc.

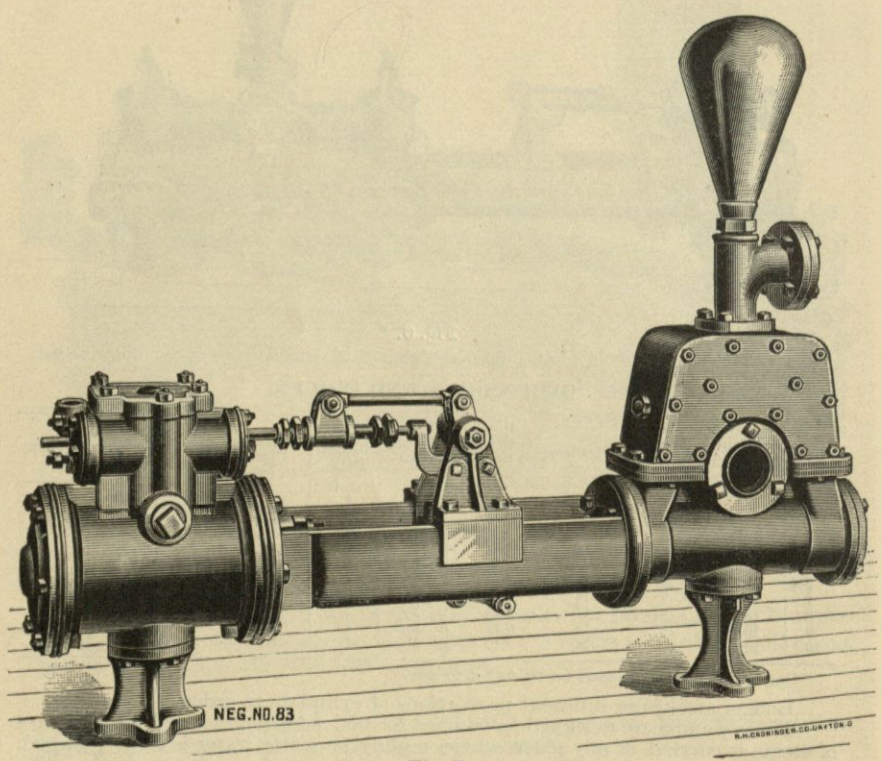


Fig. 7.

Cut Represents 7 1-2 Inch Steam Cylinder, 5 Inch Water Cylinder, 10 Inch Stroke.

SMITH-VAILE IMPROVED BREWERY PUMPS.

For Hot or Cold Beer, Mash, Etc.

These Brewery Pumps are made from special patterns designed for this special work, having large water passages, thus bringing friction to the minimum with slight chances for clogging.

For Hot or Cold Beer or Water, it has no equal as regards simplicity and positiveness of action, having few parts, and made of the best composition suitable for the special duty. All parts made to gauge and strictly interchangeable.

Each pump has suction and delivery openings on both sides; this makes it very convenient, as connections can be made on either side of pump desired.

DIMENSIONS AND SIZES.

Steam Cylinder.	Water Cylinder.	Stroke.	Gallons per Stroke.	Steam Pipe.	Exhaust Pipe.	Suction Pipe.	Discharge Pipe.	Shipping Weight.
5½	4	7	.39	¾	1¼	2½	2	589
5½	5½	7	.72	¾	1¼	3	2½	654
6½	4	7	.39	1	1¼	2½	2	680
6½	5½	7	.72	1	1¼	3	2½	680
7½	6	10	1.22	1	2	4	4	1030
7½	7½	10	1.99	1	2	4	4	1095
9½	7½	10	1.99	1¼	2½	4	4	1254
11	7½	10	1.99	1½	2½	4	4	1500
11	7½	14	2.68	1½	2½	4	4	2150
11	9	14	3.85	1½	2½	6	6	2200

Larger sizes or other combinations of cylinders to order.

Full composition water ends at extra cost of metal added; we recommend this for pumping acids or any liquids injurious to iron.

SMITH-VAILE IMPROVED BREWERY PUMPS.

For Hot or Cold Beer, Mash, Etc.

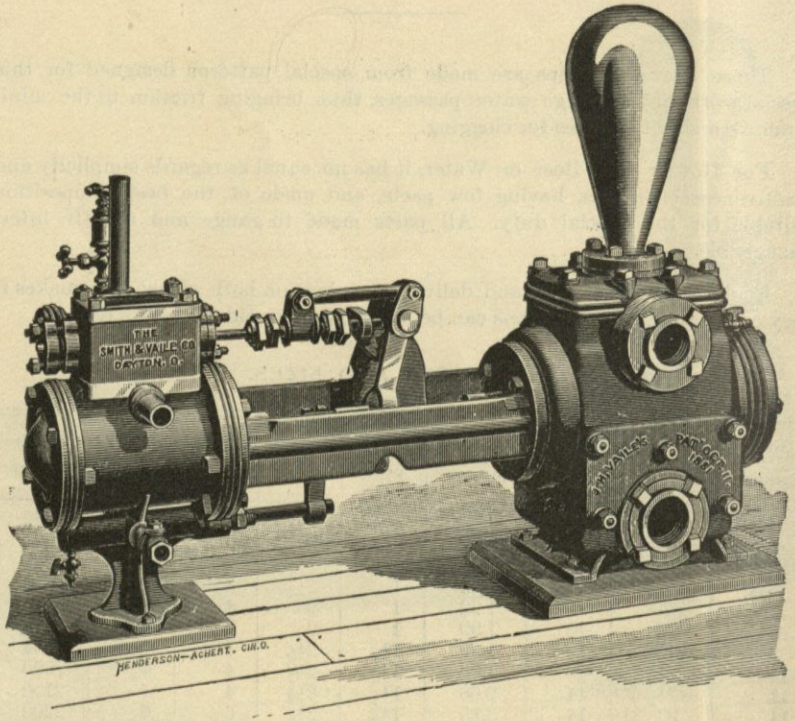


Fig. 8.

Cut Represents 6 1-2 Inch Steam Cylinder, 5 1-2 Inch Water Cylinder, 7 Inch Stroke.

See Page 15 for List of Sizes.

SMITH-VAILE BLOWING ENGINE.

For Oil Refineries, Blast Furnaces, Ventilating, Etc.

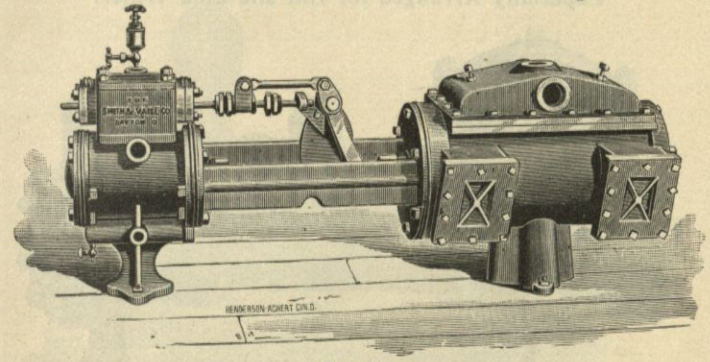


Fig. 9.

Cut Represents 7½ in. Steam Cylinder, 10 in. Air Cylinder, 10 in. Stroke.

For agitating oils, acids and chemical preparations, the Smith-Vaile Blowing Engines are unsurpassed in simplicity, strength and durability, and are capable of being run at any speed desired.

DIMENSIONS.

Steam Cylinder.	Air Cylinder.	Stroke.	Cubic Feet of Air Per Stroke.	Steam Pipe.	Exhaust Pipe.	Delivery Pipe.
5½	7	7	.12	1	1¼	As desired
5½	10	7	.24	1	1¼	
7½	7	7	.12	1	2	
7½	10	10	.34	1	2	
7½	15	10	1.10	1	2	
9½	10	10	.34	1¼	2½	
9½	15	10	1.60	1¼	2½	
9½	15	24	2.64	1¼	2½	
11	15	24	2.64	1½	2½	
11	16	24	2.8	1½	2½	
11	18	24	3.82	1½	2½	
13½	22	24	5.28	2	3	
13½	30	36	14.72	2	3	
16½	30	36	14.72	2½	4	

Larger sizes or other combination of cylinders made to order.

OIL REFINERY PUMPS, FOR NAPHTHA, CRUDE OR REFINED OIL, ETC.

Special reference is made in these pumps to the work to be performed, both in material and design, and are made either single or duplex, as the duty may require. Prices same as regular pumps of same size.

THE SMITH-VAILE DUPLEX BOILER FEED PUMP

Especially Arranged for Hot and Cold Water.

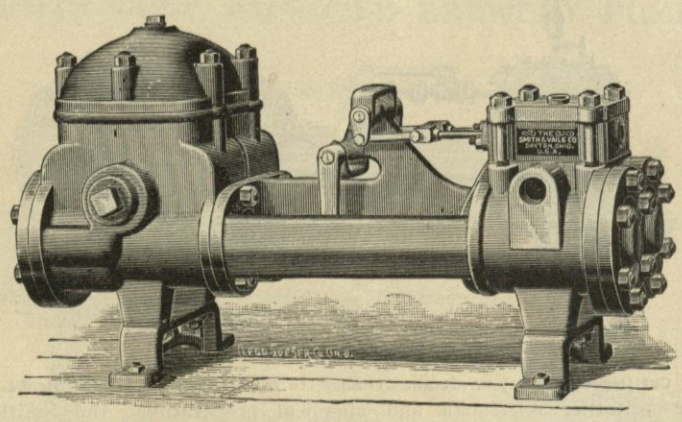


Fig. 10.

Boiler Feeder, Size 4½x3x4.

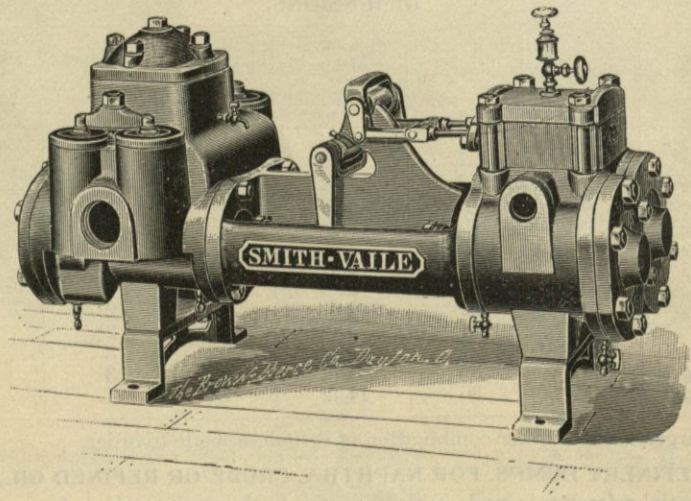


Fig. 11.

Boiler Feeder, Size 6x4x6.

THE SMITH-VAILE DUPLEX BOILER FEED PUMP.

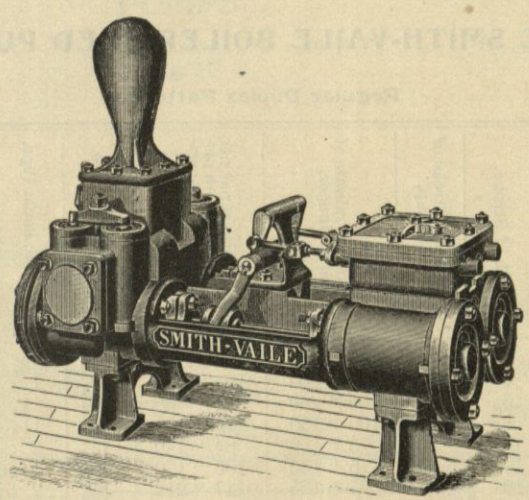


Fig. 12.

A constant and regular flow of water is the great requisite for the successful feeding of Steam Boilers, and the greatest economy is secured by using a Pump that can be set at any speed so that, by constant running, a regular height of water is maintained in the boilers.

The Smith-Vaile Duplex Boiler Feed Pump is especially adapted for this work, as it can be run at any speed required, and all working parts are easily accessible. The steam valve is of the plain slide valve pattern, with no auxiliaries, and each one is controlled by the movement of the opposite piston-rod, therefore there is no dead center. The water valves are of material suitable to the water pumped, whether hot or cold.

The water pistons have adjustable packing that can easily be kept tight.

The Smith-Vaile Patented Removable Water Cylinders are used, which can be taken out to be re-bored or otherwise, without breaking any pipe connections.

The construction shown in Fig. 11 and Fig. 12 makes very easy access to suction valves; by simply removing the one nut and yoke, the suction valves are exposed, a feature greatly appreciated by engineers.

For dimensions and sizes see page 20.

THE SMITH-VAILE BOILER FEED PUMP.

Regular Duplex Pattern.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons per Stroke of One Pump.	Strokes per minute of Each Plunger.	Gallons delivered per minute by both pistons at speed specified.	Size of Steam Pipe.	Size of Exhaust Pipe.	Size of Suction.	Size of Discharge.
3	2	4	.05	100 to 250	10 to 25	½	¾	1¼	1
4½	3	4	.12	100 " 200	24 " 48	¾	1	2	1½
5¼	3½	5	.20	100 " 200	40 " 80	¾	1¼	2½	1½
6	4	6	.33	100 " 150	70 " 100	1	1½	3	2
7	4	10	.56	75 " 150	84 " 140	1¼	2	4	3
7	4½	10	.69	75 " 150	100 " 170	1¼	2	4	3
7	5	10	.85	75 " 125	147 " 212	1¼	2	4	3
8	5	10	.85	75 " 125	180 " 300	1½	2	4	3
8	6	10	1.22	75 " 125	245 " 410	1½	2	5	4
10	6	12	1.46	60 " 120	175 " 350	2	2½	5	4

Every pump built and sold by us is thoroughly tested before leaving the works, and is fully guaranteed.

Heavy Pressure Patterns.—Outside Packed Plunger.

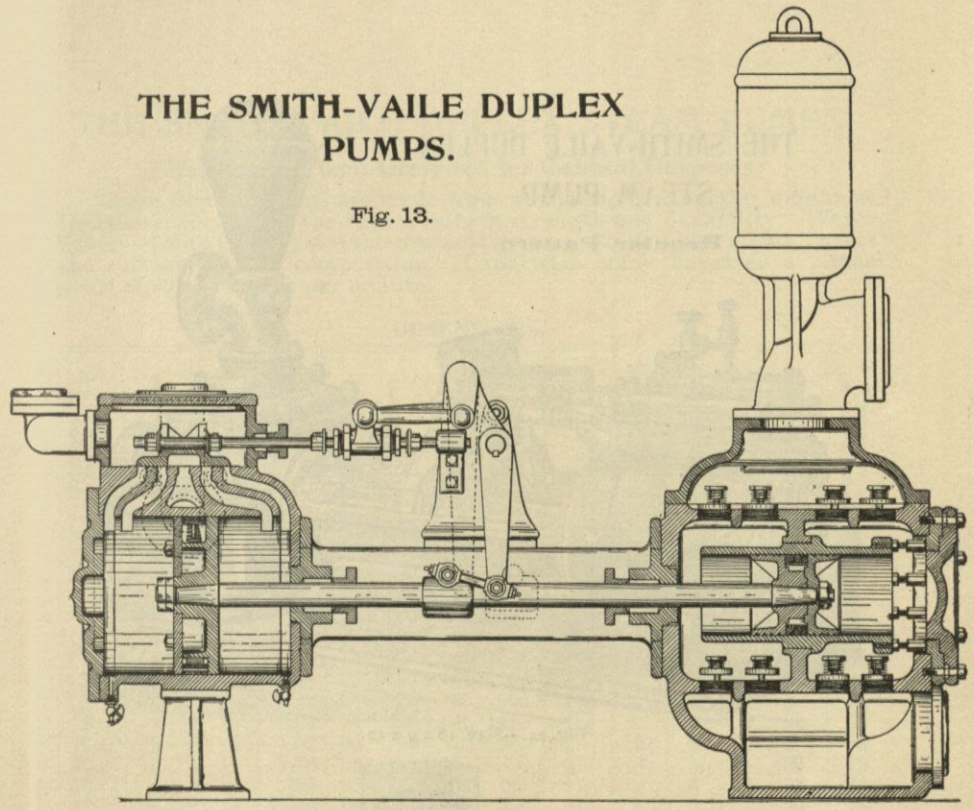
4½	3	4	.12	¾	1	2	1½
6	4	6	.33	1	1½	3	2
7	4½	10	.69	1¼	2	4	3
8	5	10	.85	1½	2	4	3
10	6	12	1.22	2	2½	5	4

The heavy pressure patterns are designed for cases where parties desire to carry 150 lb. boiler pressure. They are outside packed. Valves very accessible, being directly below plate held by yoke or studs.

See half tone engraving on page 94.

THE SMITH-VAILE DUPLEX PUMPS.

Fig. 13.



The above cut is a sectional view showing the working parts of one side of the Smith-Vaile Improved Duplex Steam Pumps of ordinary construction. It being two steam pumps, placed side by side, the moving of the piston of one pump imparts, through the vibrating arms, the required motion for the valve of the other. By this means a steady motion is given to each pump, and a uniform pressure maintained, as one piston starts on its stroke before the other has finished.

The steam valve of either engine is of the common slide or "D" pattern, which has stood the test of years, and still maintains the foremost position for durability and economy.

In the pump or water end we use the piston pattern with improved packing, which by tightening a nut, sets out the packing. The ease with which it is set out or repacked when worn is a desirable feature, as the engineer can keep it in perfect working order without being obliged to send out for repairs. The working barrel or water cylinder is removable, and made of any metal best suited to the work. It is held in position by a number of steel screws, the heads of which press against a ring at one end of the water box. The center partition of the water box is bored to gauge and faced on one side. The removable cylinder is turned to fit with a projecting shoulder. By tightening the screws the projecting shoulder is firmly held against the partition, making a perfect joint. By releasing these screws the cylinder can be taken out for reboring, or other sizes can be inserted, if at any time it should be desirable by reason of a change in the work to be done.

THE SMITH-VAILE DUPLEX STEAM PUMP.

Regular Pattern.

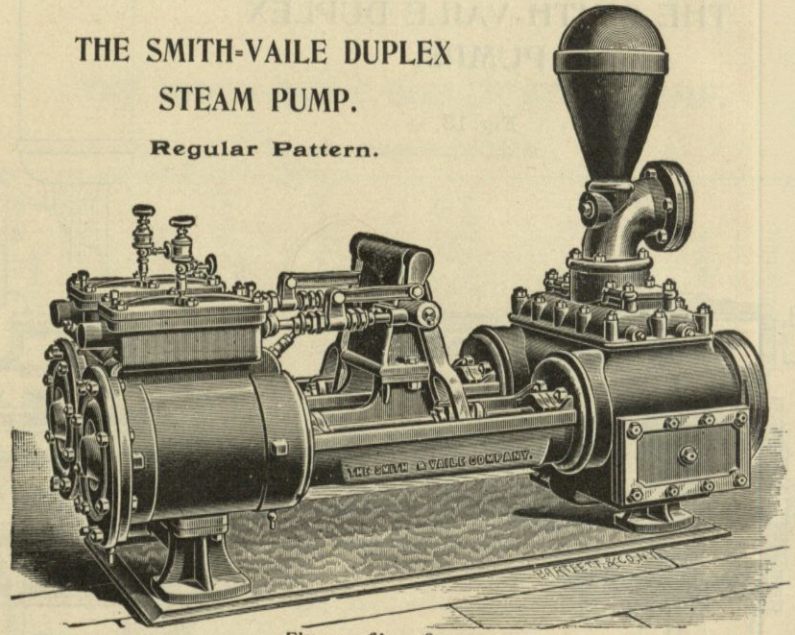


Fig. 14.—Size, 18 x 9 x 12.

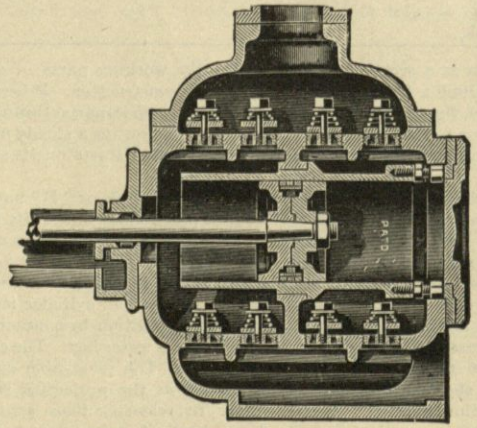


Fig. 15.—Section of Water Box.

THE SMITH-VAILE DUPLEX STEAM PUMPS.

Regular Pattern Designed for General Purposes.

These Duplex Pumps are made from new designs, and the weight so distributed as to give the best results in strength and durability. Water Valves of soft rubber, suitable for cold water. Valve seats, stems, covers and springs of best composition. Capacities below based on a piston speed of 50 to 100 feet per minute.

DIMENSIONS.

Diameter of Steam Cylinder in inches.	Diameter of Water Cylinder in inches.	Length of Stroke in inches.	Gallons per Stroke of one Pump.	Strokes per Minute of Each Plunger.	Gallons Delivered per Minute by both Pistons at Speeds Specified.	Size of Steam Supply Pipe in inches.	Size of Exhaust Pipe in inches.	Size of Su tion.	Size of Discharge.	Width over all in inches.	Length over all in inches.
3	2	4	.05	100 to 250	10 to 25	½	¾	1¼	1	10	33
4½	3	4	.12	100 " 200	24 " 48	¾	1	2	1½	16	38
5¼	3½	5	.20	100 " 200	40 " 80	¾	1¼	2½	1½		
6	4	6	.33	100 " 150	70 " 100	1	1½	3	2	22½	45
7	4	10	.56	75 " 150	84 " 140	1¼	2	4	3	23	58¼
7	4½	10	.69	75 " 150	100 " 170	1¼	2	4	3	23	58¼
8	5	10	.85	75 " 125	147 " 212	1½	2	4	3	30	61
8	6	10	1.22	75 " 125	180 " 300	1½	2	5	4	30	61
8	7	10	1.66	75 " 125	245 " 410	1½	2	6	5	30	62
10	5	12	1.02	60 " 120	122 " 244	2	2½	4	3	29½	75
10	6	12	1.46	60 " 120	175 " 350	2	2½	5	4	30	75
10	7	12	1.99	60 " 120	240 " 480	2	2½	6	5	31	75
12	6	12	1.46	60 " 120	175 " 350	2½	3	5	4	39	75
12	7	12	1.99	60 " 120	240 " 480	2½	3	6	5	39	75
12	8	12	2.61	60 " 120	313 " 625	2½	3	6	5	39	75
14	7	12	1.99	60 " 120	240 " 480	2½	3	6	5	39	75
14	8	12	2.61	60 " 120	313 " 626	2½	3	6	5	39	75
14	9	12	3.30	60 " 120	396 " 792	2½	3	7	6	39	78
14	10	12	4.08	60 " 120	490 " 980	2½	3	8	7	39	76
16	8	12	2.61	60 " 120	313 " 626	3	4	6	5	40	78
16	9	12	3.30	60 " 120	396 " 792	3	4	7	6	40	78
16	10	12	4.08	60 " 120	490 " 980	3	4	8	7	40	78
16	12	12	5.87	60 " 120	704 " 1408	3	4	10	8	48	85
18	8	12	2.61	60 " 120	313 " 626	3	4	6	5	46	78
18	10	12	4.08	60 " 120	490 " 980	3	4	8	7	46	78
18	12	12	5.87	60 " 120	704 " 1408	3	4	10	8	48	85
20	12	15	7.34	50 " 100	749 " 1478	4	6	10	8	52	120
20	15	15	11.47	50 " 100	1147 " 2294	4	6	14	12	58	124
20	12	12	5.87			4	6	10	8		
20	14	12	8.00			4	6	12	10		

Small additional charge for brass-covered piston rod, brass lining and plunger.

In addition to above list large number of combinations made adapted to any service.

THE SMITH-VAILE DUPLEX "LOW SERVICE" PUMPS.

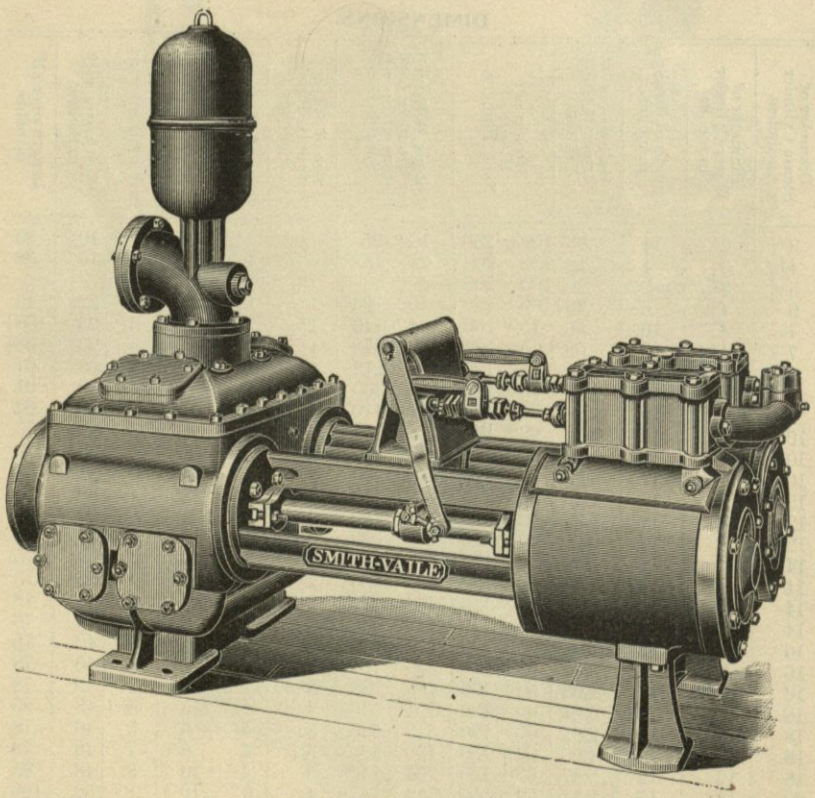


Fig. 16.—Size, 14 x 12 x 12.

THE SMITH-VAILE DUPLEX LOW SERVICE PUMPS

Arranged for Railway Water Stations, Quarries, Tanks, Etc.

Or any place where the liquid is to be elevated to a limited height with ordinary steam pressure. They have large pumping capacity in proportion to the size of the steam cylinder, and each part is made of the metal best suited to withstand wear or any corrosive influence of the liquid to be pumped.

SIZES AND DIMENSIONS.

Diameter of Steam Cylinder in Inches.	Diameter of Water Cylinder in Inches.	Length of Stroke in Inches.	Gallons per Stroke of One Pump.	Stroke per Minute of Each Piston.	Gallons Delivered per Minute by both Pistons at Speed Specified.	Steam Pipe in Inches.	Exhaust Pipe in Inches.	Suction Pipe in Inches.	Discharge Pipe in Inches.	Width Over All in Inches.	Length Over All in Inches.
6	5	6	.51	75 to 125	75 to 150	1	1½	4	3	27	55
7	6	10	1.22	75 " 125	180 " 300	1¼	2	5	4	30	61
8	7	10	1.66	75 " 125	245 " 410	1½	2	6	5	30	61
7	7	10	1.66	75 " 125	245 " 410	1½	2	6	5	30	61
7	8	10	2.17	75 " 125	320 " 545	1½	2	6	5	30	61
8	8	10	2.17	75 " 125	320 " 595	1½	2	6	5	30	61
10	7	12	1.99	75 " 125	298 " 445	2	2½	6	5	30	75
10	8	12	2.61	75 " 125	490 " 650	2	2½	6	5	30	75
12	9	12	3.30	75 " 125	495 " 825	2½	3	7	6	32	78
12	10	12	4.08	75 " 125	670 " 1020	2½	3	8	7	32	78
10	10	12	4.08	75 " 125	670 " 1020	2	2½	8	7	32	78
14	11	12	4.93	75 " 125	740 " 1230	2¼	3	10	8	48	85
14	12	12	5.87	50 " 100	587 " 1174	2½	3	10	8	48	85
10	12	12	5.87	50 " 100	587 " 1174	2	2½	10	8	48	85
8	12	12	5.87	50 " 100	587 " 1174	1½	2	10	8	48	85
16	12	12	5.87	50 " 100	587 " 1174	3	4	10	8	48	85
8	14	12	7.99	50 " 100	799 " 1598	1½	2	12	10		
18	14	15	9.99	50 " 80	1000 " 1600	3	4	12	10	58	105
20	15	15	11.47	50 " 80	1145 " 1835	4	6	14	12	58	120

Duplex Pumps fitted complete with suitable Boilers and fixtures adapted for Railway Water Stations, Quarries, etc. See page 76.

PRICES OF PRIMING PIPES AND STRAINERS FOR DUPLEX PUMPS.

Size of Pump in Inches.	4 x 6	5 x 10	6 x 10	7 x 12	8 x 12	9 x 12	10x12	11x12	12x12	14x12	12x15	15x15
Water End Diameter of Suction Pipe in Inches.	2½	3	4	5	6	7	7	7	8	10	12	12
Price of Priming Pipe and Strainer.	$13.00	$14.00	$15.00	$16.00	$18.00	$19.00	$20.00	$25.00	$30.00	$35.00	$40.00	$50.00

THE SMITH-VAILE DUPLEX BREWERY PUMP.

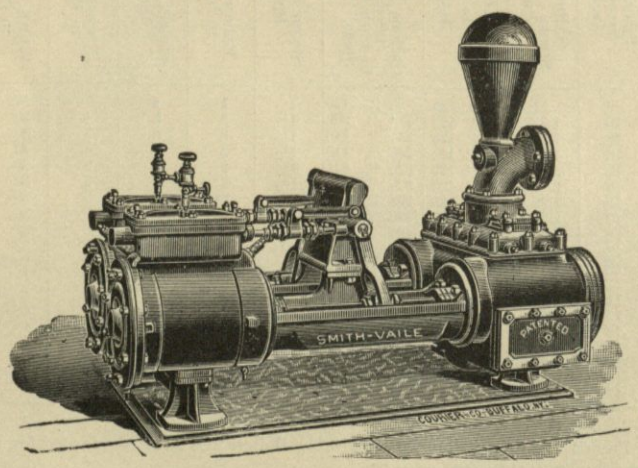


Fig. 17.—Size, 10 x 7 x 12.

SMITH-VAILE DUPLEX BREWERY PUMPS.

These pumps are designed for pumping beer, either hot or cold, and are made with special large openings and with the view to quick and easy access to valves, or for purpose of repairs.

They are usually fitted with brass covered pistons, composition lining and metal valves.

We will quote on all composition water end when so desired.

For Single Brewery Pumps, see Pages 14, 15 and 16.

SIZES AND DIMENSIONS.

Diameter of Steam Cylinder in inches.	Diameter of Water Cylinder in inches.	Length of Stroke in inches.	Gallons per Stroke of one Pump.	Strokes per minute of each Piston.	Gallons delivered per minute by both pistons at speed specified.	Steam Pipe in Inches.	Exhaust Pipe in Inches.	Suction Pipe in Inches.	Discharge Pipe in Inches.	Width over all in Inches.	Length over all in Inches.
4½	3	4	.12	100 to 200	24 to 48	¾	1	2	1½	15	38
6	4	6	.33	100 " 150	70 " 100	1	1½	3	2	27	55
7	5	10	.85	75 " 125	127 " 212	1¼	2	4	3	30	61
8	7	10	1.66	75 " 125	245 " 410	1½	2	6	5	30	61
8	8	10	2.17	60 " 120	250 " 500	1½	2	6	5	30	61
10	7	12	1.66	60 " 120	240 " 480	2	2½	6	5	30	65
10	8	12	2.17	60 " 120	313 " 626	2	2½	6	5	30	65
12	9	12	2.75	60 " 120	396 " 792	2½	3	7	6	39	65
12	10	12	3.40	60 " 120	490 " 980	2½	3	8	7	39	65
14	11	12	4.27	60 " 120	612 " 1224	2½	3	8	7	43	67
14	12	12	4.90	60 " 120	704 " 1408	2½	3	10	8	43	67
16	12	12	4.90	60 " 120	704 " 1408	3	4	10	8	43	67

The above list only includes a small number of sizes we make.

THE SMITH-VAILE IMPROVED CRANK AND FLY WHEEL DUPLEX AIR PUMP.

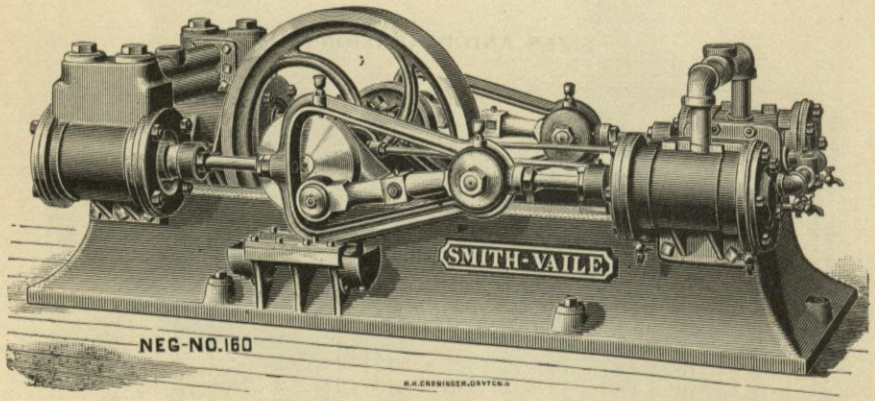


Fig. 18.—With Regulating Valve.

THE SMITH-VAILE IMPROVED DUPLEX CRANK AND FLY WHEEL AIR PUMP.

For Brewers Use in Racking Off Beer.

This pump is built with all the new improvements and especially constructed for the purpose of moving beer or other liquids from place to place.

It is a duplex pump of the crank and fly wheel pattern; the cranks are set at right angles, which insures it against having any dead centre, and gives it a perfectly positive motion. The pumps can be started and stopped at will. All pumps are fitted with an automatic regulator, that slows pump down as pressure increases, stopping it when the desired pressure is obtained, and restarting it automatically as soon as pressure in air receiver falls below the point at which gauge is set.

Steam Cylinders Inches.	Air Cylinders Inches.	Stroke Inches.	Cubic Feet Air per One Revolution of Crank. At atmospheric pressure.	Steam Pipe.	Exhaust Pipe.	Suction Pipe.	Delivery Pipe.
5	6	6	.39	1½	2	As desired.	As desired.
6⅜	7	7	.48	2	2½		
7	8	10	1.16	2	2½		
9	10	10	1.36	2½	3		

THE SMITH-VAILE IMPROVED DUPLEX PUMP.

With Long Stroke.

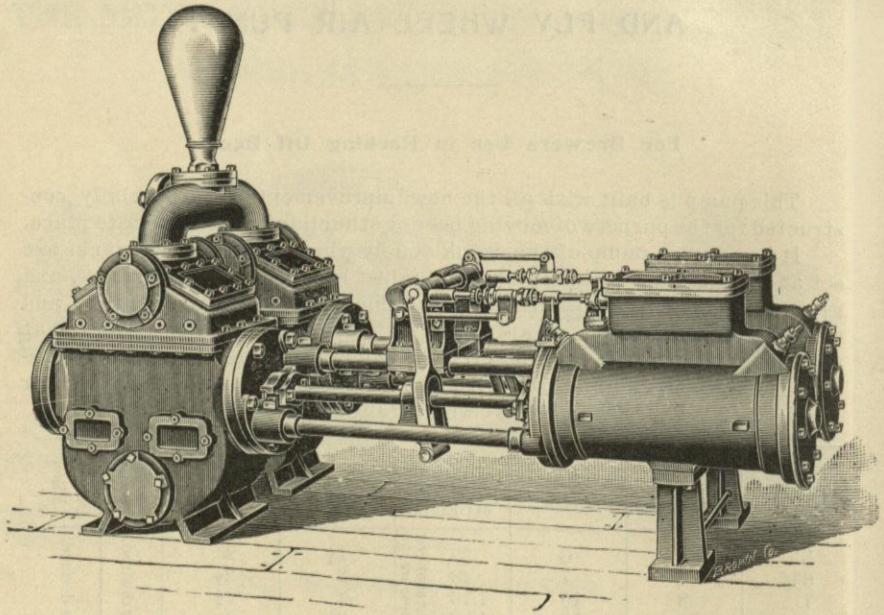


Fig. 19.—Size, 10 x 8 20.

THE SMITH-VAILE IMPROVED DUPLEX PUMPS.

With Long Stroke.

Where large quantities of water are desired in a short space of time, against either high or low pressures, these long stroke pumps will be found very efficient. Are especially adapted to Water Works, Hydraulic Elevators, etc.

PRICES AND DETAILS ON APPLICATION.

Size of Steam Cylinders in Inches.	Size of Wat'r Cylinder in Inches.	Length of Stroke in Inches.	Size of Pipes.	Size of Steam Cylinder in Inches.	Size of Wat'r Cylinder in Inches.	Length of Stroke in Inches.	Size of Pipes.
10	6	15	Adapted for work to be performed. Also capacity varies with duty required.	18	9	15	Adapted for work to be performed. Also capacity varies with duty required.
10	7	15		18	10	15	
10	8	15		18	12	15	
12	8	15		18	14	15	
12	9	15		14	10	20	
12	10	15		14	12	20	
12	12	15		14	13	20	
14	9	15		14	14	20	
14	10	15		14	15	20	
14	12	15		14	16	20	
16	7	15		20	10	20	
16	8	15		20	12	20	
16	9	15		20	13	20	
16	10	15		20	14	20	
16	12	15		20	15	20	
16	14	15		20	16	20	
18	8	15					

Above only only gives a partial list of the many combinations we make.

THE SMITH-VAILE STANDARD FIRE PUMP.

With Same Attachments as the Underwriters.

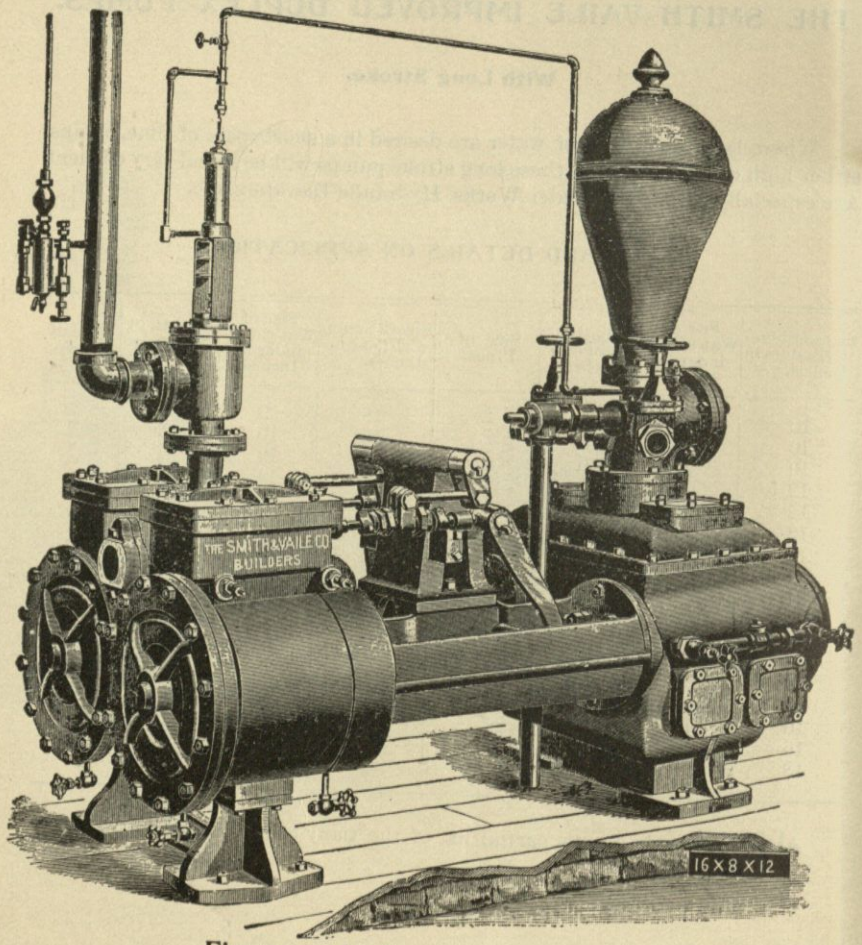


Fig. 20.—16 x 8 x 12 FIRE PUMP.

THE SMITH-VAILE STANDARD FIRE PUMP.

The cut on the opposite page illustrates our regular Standard Fire Pump, for general fire protection in factories, etc., where the more expensive Underwriters Fire Pump is not specified or required by terms of insurance. It is shown with all extra attachments as Priming Pipe, Relief Valve, Hose Connections and Governor.

These pumps are especially designed and made as quick working Fire Pumps, with water valves and passages of large areas, every part of the best material for the work required. For steady work, such as supplying water for Hydraulic Elevators, it has no equal, as it works smoothly, is compact, and the easiest kept in repair.

The Smith-Vaile Fire Pumps, as in all other styles, are fitted with water pistons. The packing is of square canvas rubber backed. The piston has two or more rings which are easily removed without removing the piston, as they are held in place by a follower plate, and by tightening a nut and lock-nut it sets out the packing. This manner of packing enables the pump to take suction very quickly and hold it.

We also furnish, at no extra charge, the metal packing rings, but do not advise for water, for after a short time running they become worn from various causes and the slippage is very great, the water churning from one end of the cylinder to the other when pumping against a pressure, as in case of fire.

SIZES AND DIMENSIONS.

Diameter of Steam Cylinders.	Diameter of Water Cylinders.	Length of Stroke.	Capacity per Single Stroke of One Pump.	Steam Pipe in Inches.	Exhaust Pipe in Inches.	Suction Pipe in Inches.	Disch'g Pipe in Inches.	Width Over all in Inches.	Length Over all in Inches.
7	4½	10	.69	1¼	2	4	4	30	61
8	5	10	.85	1½	2	5	5	30	61
10	5	12	1.02	2	2½	5	5	30	75
10	6	12	1.46	2	2½	6	5	30	75
12	5	12	1.02	2½	3	5	5	32	75
12	6	12	1.46	2½	3	6	5	32	75
12	7	12	1.99	2½	3	6	6	40	75
14	6	12	1.46	2½	3	6	5	40	80
14	7	12	1.99	2½	3	6	6	40	80
14	8	12	2.61	2½	3	8	6	40	80
16	7	12	1.99	3	4	6	6	40	80
16	8	12	2.61	3	4	8	6	40	80
16	9	12	3.30	3	4	8	7	44	80
18	8	12	2.61	3	4	8	6	44	100
18	10	12	4.08	3	4	10	8	44	100
20	12	20	9.79	4	6	12	10	52	121

All the attachments furnished if desired, extra, at lowest prices.

THE SMITH-VAILE UNDERWRITER PUMP.

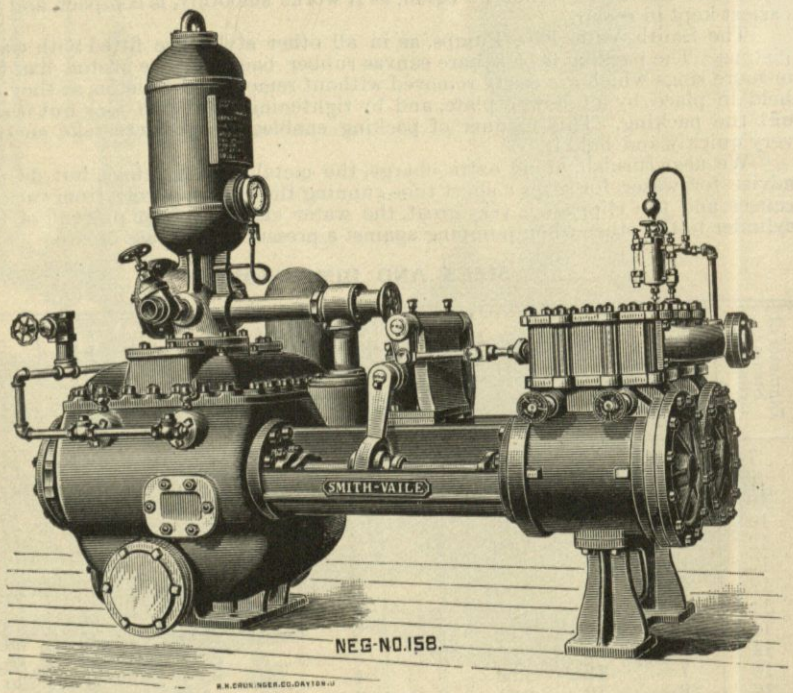


Fig. 21.—Size 14 x 7 x 12.

THE SMITH-VAILE UNDERWRITER FIRE PUMP.

The Underwriter Fire Pump, so-called from the fact that the Associated Factory Mutuals specified a certain design of Pump to be built for all cases where they assumed risks. No better explanation or description can be given than to quote direct from their circular:

SEPTEMBER, 1894.
ASSOCIATED FACTORY MUTUAL FIRE INSURANCE COMPANIES.

"We advise that all contracts call for strict conformity to the Underwriter Steam Fire Pump specifications of the Associated Factory Mutual Insurance Co.'s dated SEPTEMBER, 1894."

STEAM FIRE PUMPS.

"**THE UNDERWRITER PUMP** is merely a pump of the well-known "duplex" type, built in a very substantial manner, and with certain improvements suggested by the experience which our insurance inspectors have had with Fire Pumps.

The Reason for the changes is that a great many fire pumps have been found in a partly disabled or deteriorated condition, or incapable of delivering the rated volume of water without violent water hammer when suddenly called on for test by our inspectors.

The principal points of difference between the Underwriter Pump and the ordinary commercial pump are:—

1st. Its steam ports and water passages and air chamber are made much larger than in common trade pumps, so that a larger volume of water can be delivered in an emergency without water hammer.

2d. It is "rust proofed," that it may start instantly after disuse, by making its piston rods of Tobin Bronze, instead of steel; its water pistons, stuffing boxes and rock-shaft bearings of brass, instead of cast iron. Its valve levers are made of wrought iron forgings, instead of castings.

3d. The following necessary attachments (which are charged for as extras with common trade pumps, and which we find often get left off) are all included in the price of the "Underwriter," viz.—a vacuum chamber, two pressure gauges, a safety valve, a set of brass priming pipes, 2 to 6 hose valves, a stroke gauge, a capacity plate, a sight feed lubricator, and a cast-iron relief valve discharge cone.

By reason of the larger ports, passage ways and pipes, and the added attachments, an "Underwriter" pump costs more than a common trade fire pump, but the cost per gallon which these pumps can **deliver in an emergency** by reason of their large passage ways, etc., is believed to be no greater than for the old style of fire pump, and, in the opinion of the large majority of our insurance officers and inspectors, it is well worth this extra cost.

Finally, we remind you that these specifications cover only the outlines of the design, and that all pumps built under them are not of equal merit, and that the responsibility for first-class workmanship and strength of materials rests on the pump manufacturers, and not on the Insurance Companies."

Diameter Steam Cylinders.	Diameter of Water Cylinders.	Length of Stroke.	Nominal Capacity Gallons per Minute full Speed per Underwriters Table.	Exact Capacity Underwriters rating, allowing 10 per cent. for Slip.	Number of Standard 1⅛ Inches Fire Streams Each 250 Gallons per Minute.	Size of Pipes for Short Lengths.			
						Steam.	Exhaust.	Suction.	Discharge.
10	5	12	246	246	1	2½	3	6	5
12	6	12	320	359	1	2½	3	6	5
14	7	12	500	484	2	3	4	8	6
16	9	12	750	807	3	3½	4	10	7
18	10	12	1000	1007	4	4	5	12	8
20	10	12	1000	1007	4	4	5	12	8

THE SMITH-VAILE COMPOUND DUPLEX PUMPING ENGINES.

In the construction of Compound Pumping Engines for water works, we are prepared to offer machinery of the most modern design, and we propose to lead in the matter of strictly up-to-date patterns. We are prepared to furnish these engines with the high pressure cylinders directly following and nearest the water cylinders, connection being made by stretcher rods upon which the cylinder heads slide, thus giving access to both high and low pressure steam cylinders without detaching and taking down as in the case of the "overhanging type." The lower stretcher rod also serves as a guide and support for the crossheads, thus relieving the piston rod of this weight. The advantages of this construction are apparent.

We have patterns for the crosshead type of engine—sometimes desirable owing to lack of space. All the working parts of our engines are made to templates and are interchangeable. We employ a noiseless connection between the crosshead and rocker shaft, which is adjustable. Our valve motion is adjustable from the outside, an important feature for the operator in charge. Our stuffing boxes are deep and removable, and our type of water box is the most improved, combining strength, accessability, valve area, finish and durability. With our patent valve for the admission of live steam direct into the low pressure steam cylinders at boiler pressure and by the operation of one valve, we offer to towns a pumping engine combining the features of a high pressure pump for use in case of fire with those of an engine using steam expansively for economy of fuel bills.

We are prepared to lag the steam cylinders in black walnut or with Russia iron, or can supply a cabinet lagging for the entire steam end when required.

THE SMITH-VAILE COMPOUND DUPLEX PUMP.

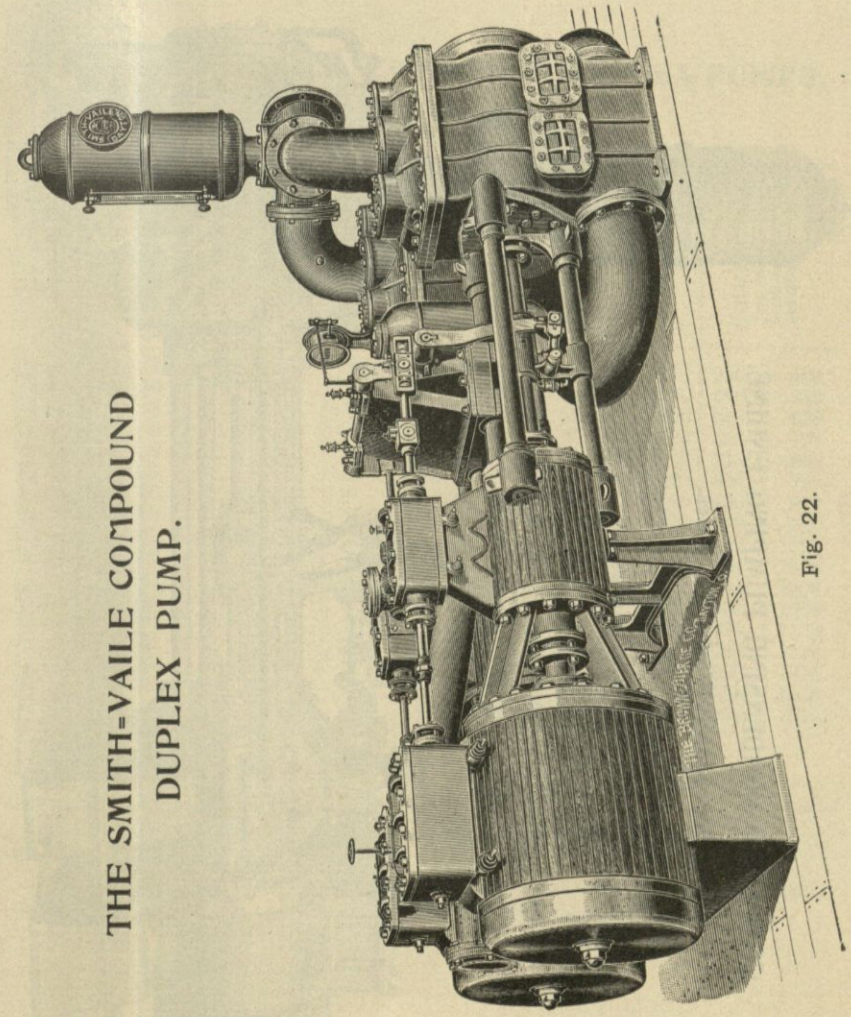


Fig. 22.

COMPOUND CONDENSING PUMPING ENGINE.

For Water-Works Purposes.

Capacity from One to Five Million Gallons per Twenty-four Hours.

1,500,000 GALLON PUMPING ENGINES.

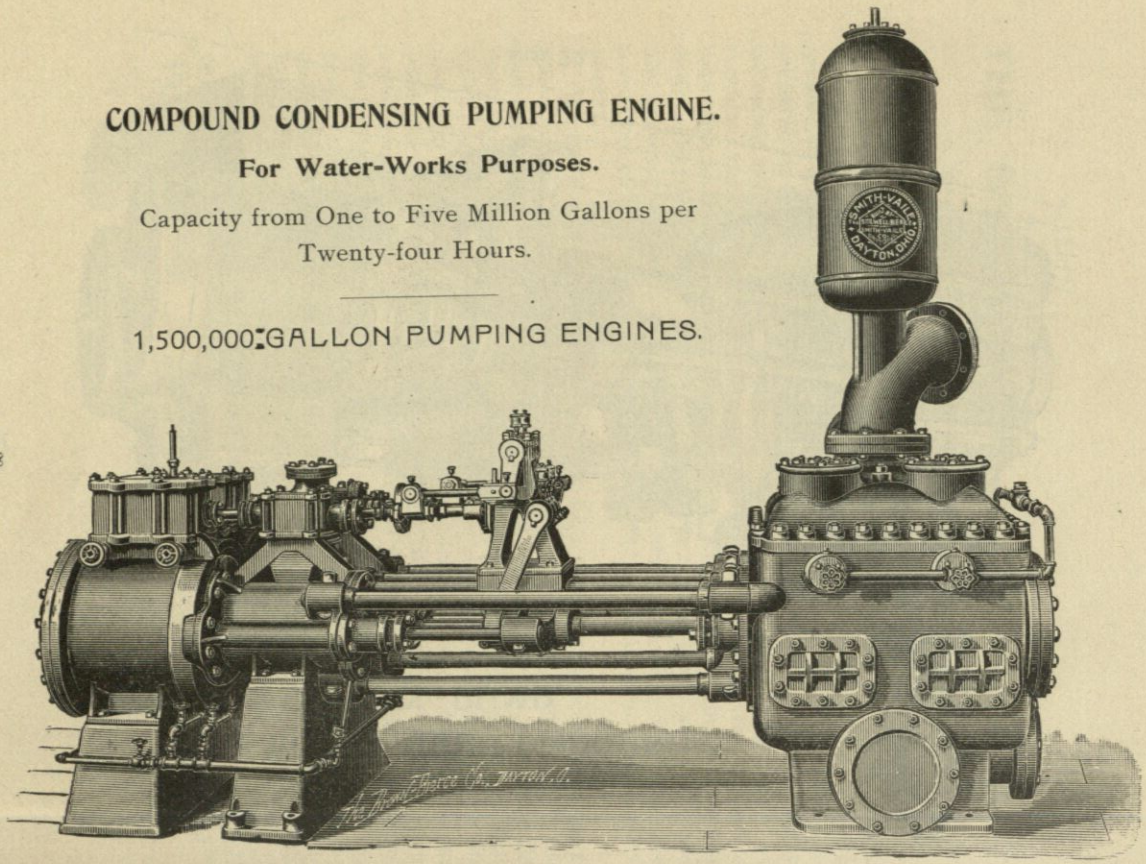


Fig. 23.

THE SMITH-VAILE COMPOUND DUPLEX PUMPS.

LIST OF SIZES AND DIMENSIONS.

Diameter of Steam Cylinder in Inches.	Diameter of Water Cylinder in Inches.	Length of Stroke in Inches.	Capacity per Stroke of one pump.	Steam Supply Pipe.	Steam Exhaust Pipe.	Suction Pipe.	Discharge Pipe.	Strokes per Minute of each Plunger.	Gallons delivered per minute by both pistons at speed specified.
8 and 12	7	12	1.99	1½	3	6	5	60 to 120	240 to 480
8 and 12	10	12	4.08	1½	3	8	7	60 " 120	490 " 980
8 and 12	8	12	2.61	1½	3	6	5	60 " 120	313 " 626
8 and 12	9	12	3.30	1½	3	7	6	60 " 120	396 " 792
10 and 16	8	12	2.61	2	4	6	5	60 " 120	313 " 625
10 and 16	9	12	3.30	2	4	7	6	60 " 120	396 " 792
10 and 16	10	12	4.08	2	4	8	7	60 " 120	490 " 980
12 and 18	10	12	4.08	2½	4	8	7	60 " 120	490 " 980
12 and 18	11	12	4.93	2½	4	10	8	60 " 120	612 " 1224
12 and 18	12	12	5.87	2½	4	10	8	60 " 120	704 " 1408
14 and 20	12	12	5.87	2½	6	10	8	60 " 120	704 " 1408
14 and 20	14	12	8.	2½	6	12	10	60 " 120	960 " 1920
14 and 20	10	15	5.75	2½	6	10	8	50 " 100	575 " 1150
14 and 20	12	15	7.85	2½	6	12	10	50 " 100	785 " 1570
14 and 20	11	20	8.54	2½	6	12	10	40 " 80	686 " 1374
16 and 24	12	20	9.80	2½	6	12	10	40 " 80	784 " 1568
16 and 24	14	15	9.56	3	7	14	12	50 " 100	956 " 1912
18 and 30	15	18		3	8				
18 and 30	16	18		3	8				

Other sizes and proportions of steam and water cylinders made as the duty may require.

If desired any of the above sizes will be made double plunger, either inside or outside connections, and with outside adjustable packing glands.

THE SMITH-VAILE IMPROVED
DUPLEX GEARED
POWER PUMP.

Separate Water Boxes.

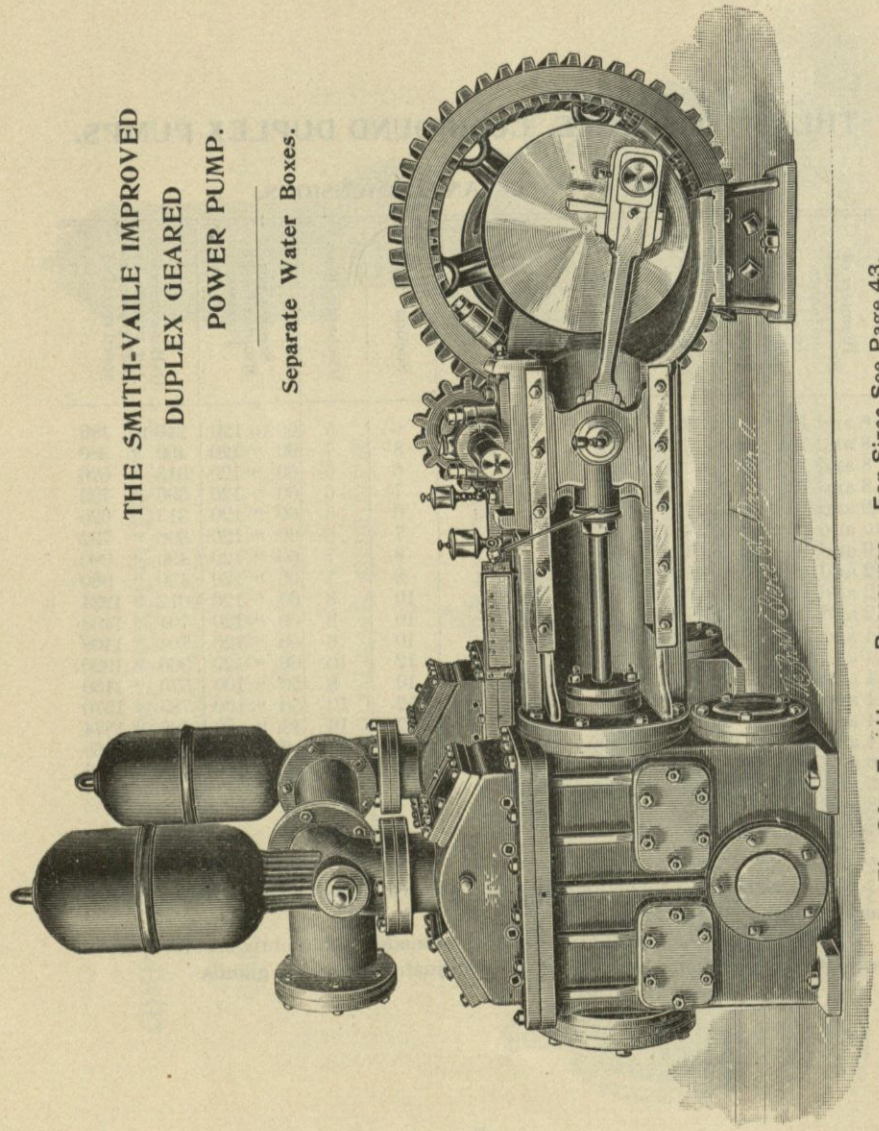


Fig. 24.—For Heavy Pressures. For Sizes See Page 43.

THE SMITH-VAILE DUPLEX GEARED POWER PUMP.

Single and Separate Water Boxes. Also Single Geared Power Pump.

We have a large line of power and geared pumps, thus enabling us us at all times to furnish a pump best suited to the duty to be performed. In the Duplex pattern, the water end consists of the regular Duplex pump, connected to cranks or shafts in such a manner as to work on quarters, the shaft to be driven by gearing or belt. As this style of pump does not have the elasticity of a steam end to receive any shock or jar, but must receive it direct, it is necessarily built very strong and durable.

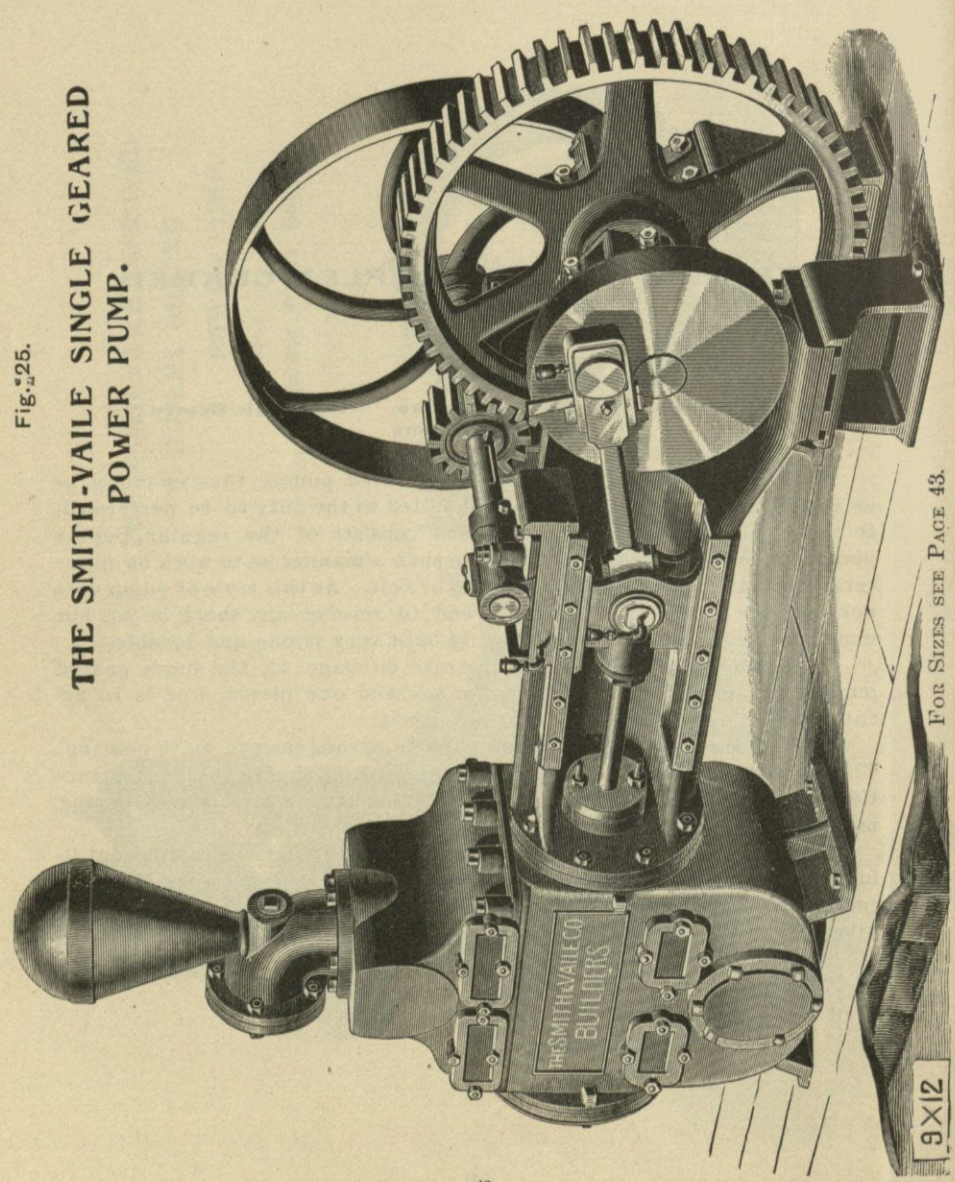
In addition to the duplex we illustrate on page 42, the single geared pump. This merely has the one water box and one piston, and is so arranged to be driven by either gearing or belt.

The Duplex patterns admit of various arrangements as to gearing. They can be driven at the side, with large gear on shaft, which construction is used with the solid water box: with separate water boxes gearing may be placed in centre if so desired.

On page 43, we give list with the various modifications of different illustrations. In asking for prices on power pumps, the pressure they are required to work against is a very important item and should always be given.

Fig. 25.

THE SMITH-VAILE SINGLE GEARED POWER PUMP.



For Sizes see Page 43.

THE SMITH-VAILE POWER AND GEARED PUMPS.

The prices when quoted on pumps listed does not include gearing or pulleys: these we make to suit the work to be performed and charge extra.

SIZES AND LIST OF IMPROVED DUPLEX POWER PUMP FOR HEAVY PRESSURES.

Diameter of Cylinder.	Stroke.	Gallons per Revolution of Crank Shaft.	Suction.	Discharge.	Speed under 75 to 100 lbs. Pressure.
8	12	10.44	6	5	15 to 20 revolutions of crank shaft per minute.
10	12	16.32	8	7	
12	15	29.36	12	10	
14	18	49.2	14	12	
16	18	62.4	14	12	
18	24	105.6	16	14	

The larger sizes of above Duplex Pumps are built with separate water boxes, forged straight shafts and crank plates, cast iron frames and stretcher rods. See cut page 40.

LIST AND SIZES SINGLE POWER PUMPS.

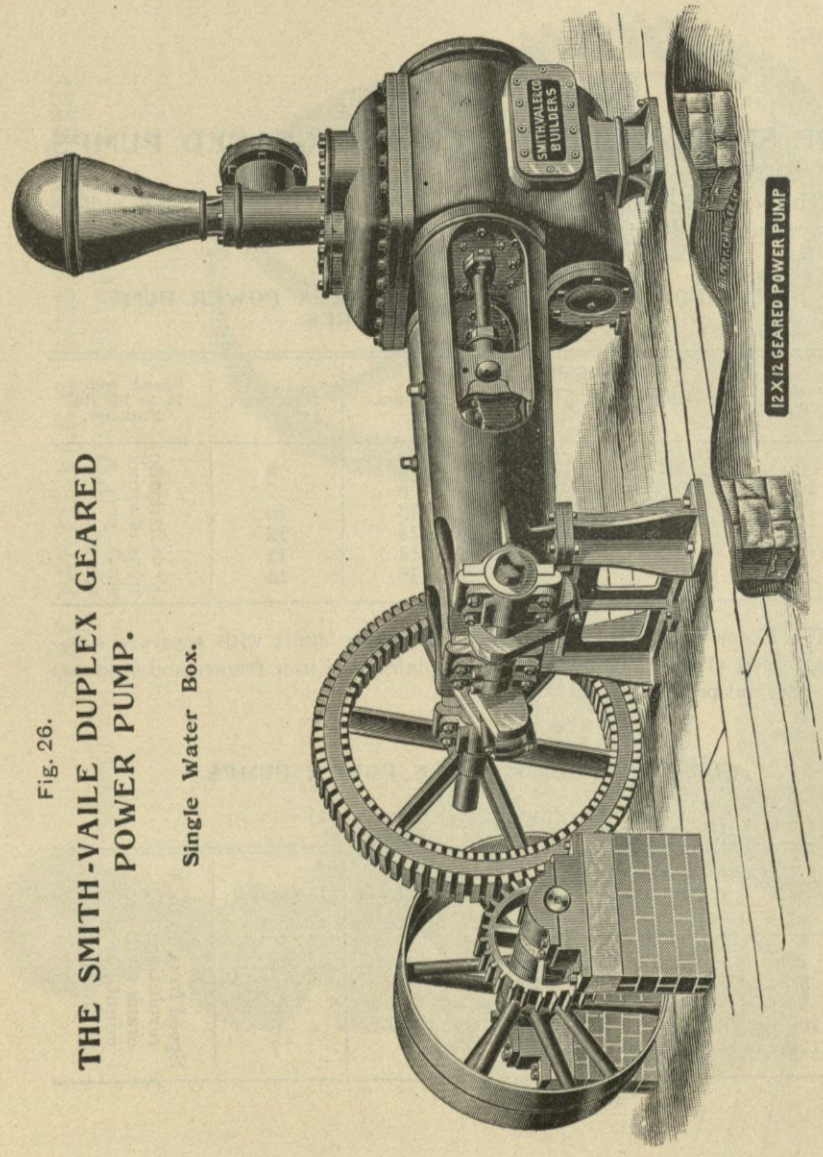
(See Illustrations on page 42.)

Diameter of Cylinder.	Stroke.	Gallons per Revolution of Crank Shaft.	Suction.	Discharge.	Speed from 15 to 30 revolutions of crank shaft per minute, according to pressure.
7	12	3.98	5	4	
8	12	5.22	6	5	
9	12	6.6	6	6	
10	12	8.16	7	6	
12	15	15.78	8	7	

Fig. 26.

THE SMITH-VAILE DUPLEX GEARED POWER PUMP.

Single Water Box.



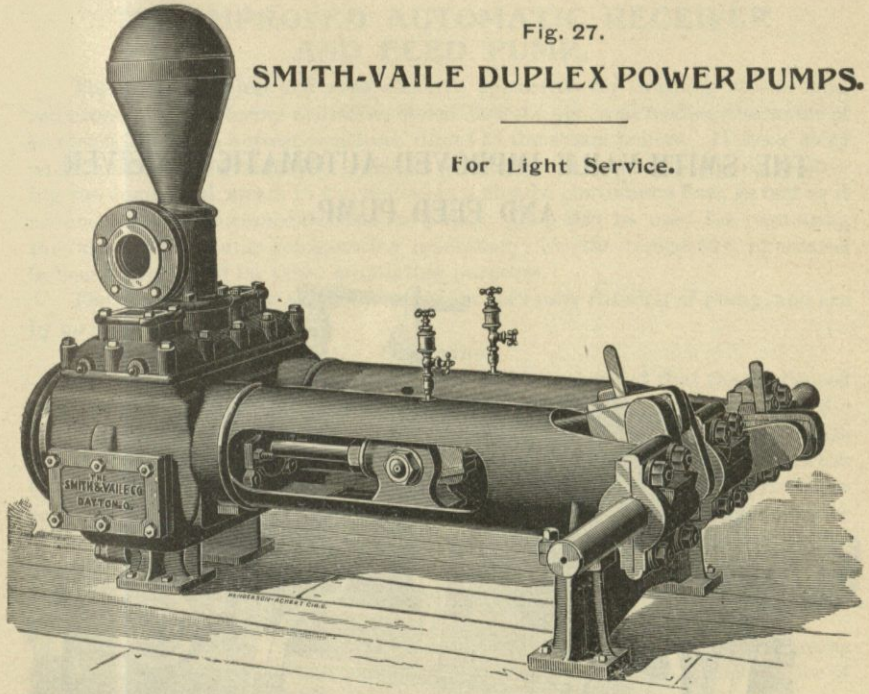
For Light Pressures.

For Capacities and Sizes see page opposite, same as the Duplex Power Pump; Gearing and Pulleys extra and to suit conditions.

Fig. 27.

SMITH-VAILE DUPLEX POWER PUMPS.

For Light Service.



These pumps are designed for *light service only*, such as elevating water in buildings, pumping into tanks, etc., where steam is not available, but where power can be obtained from a shaft or belt.

The water end is made from our regular patterns, having all our latest improvements, including the Patented Removable Water Cylinder. The water passages are large and direct, with large valve areas, which in a great measure tend to the efficient working of the pump. The Cranks are set at right angles, which brings one pump at center of stroke, while the other is at the end, thus assuring a steady and constant discharge of water at all times without any jar. The frame is heavy and in good proportion to withstand any strains.

SIZES AND DIMENSIONS.

Diameter of Water Cylinder.	Length of Stroke.	Gallons per Revolution of Crank Shaft.	Revolutions per Minute.	Capacity at Given Speed.
4	6	1.32	From 20 to 30 according to duty.	39 Gal.
4½	6	1.65		49 "
5	6	2.04		61 "
5	10	3.4		121 "
6	10	4.88		146 "
7	12	7.97		198 "
8	12	10.41		260 "

This pump is used in most cases where an electric dynamo is the power employed.

THE SMITH-VAILE IMPROVED AUTOMATIC RECEIVER AND FEED PUMP.

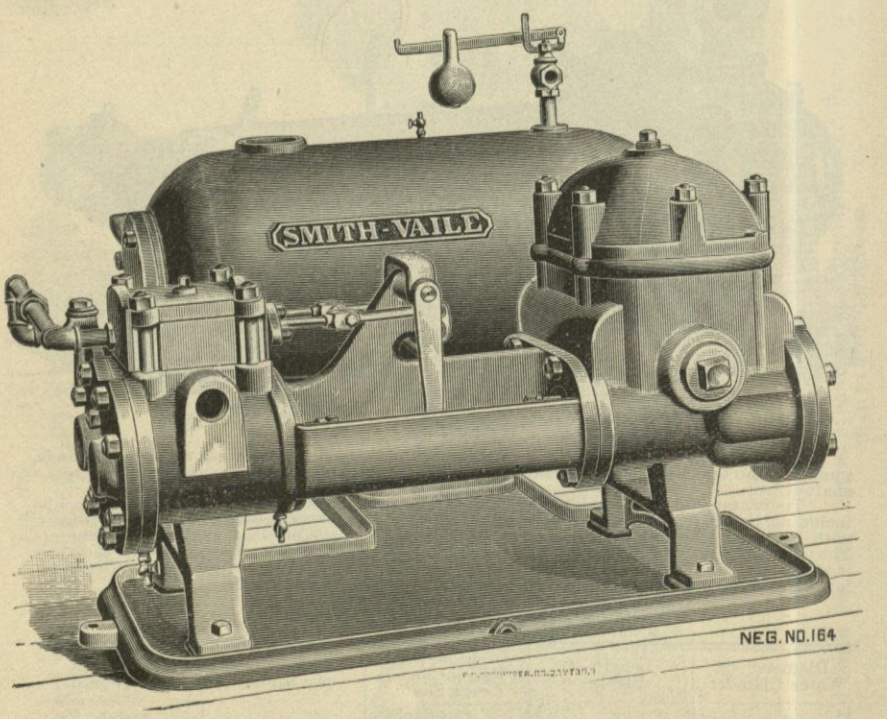


Fig. 28.—Size B, 6 x 4 x 6.

THE IMPROVED AUTOMATIC RECEIVER AND FEED PUMP.

This is the simplest and most effective apparatus for draining steam coils, radiators, heaters, drying cylinders, steam jackets, etc., and feeding the water of condensation in its hottest condition direct to the steam boilers. It does away with the expense of traps and tanks; is perfectly reliable and automatic, returning the condensed steam to the boilers in a steady. continuous flow, as fast as it accumulates in the receiver above the pump. Can also be used for regulating the brine circulation in refrigerating machinery; for the temporator apparatus in beer cooling, and for other circulating purposes.

The capacities given below are based on very easy running of pump, and are by no means maximums.

Operation.

Referring to the view on opposite page, it will be noticed that the condensed steam enters by the inlet nozzle at the top, and gravitates to the bottom of the Receiver. This water can not accumulate in any quantity as in rising it lifts the float and the steam pump takes it immediately away and forces it to the boiler. The pump is operated by the hollow float by means of the intermediate connection and balanced steam throttle. When the float rises with the water in the Receiver, the pump is started and the speed is regulated according to the quantity of water flowing in—the larger the quantity of water the faster the pump moves. The pump slows down as the supply of water drops off and when it ceases the pump stops entirely.

The hollow copper float can not fill by "sweating" or by actual leakage, as it is drained from the bottom through the hollow arm and axis. The interior of the float is in communication with the outside atmosphere.

This Automatic Regulator, Receiver and Steam Pump is being successfully used in some of the largest factories and railroad shops to automatically return the water of condensation direct to the boiler at nearly its full temperature.

SIZES AND DIMENSIONS.

Size.	Capacity per Minute.	Square Feet of Heating Surface it will Drain.	Size Pump.
A1	12 Gallons.	5,000	3 x 2 x 4
A	20 "	10,000	4½ x 3 x 4
A2	35 "	20,000	5¼ x 3½ x 5
B	60 "	40.000	6 x 4 x 6
C	100 "	80,000	7 x 4½ x 10

The above include the Improved Smith-Vaile Duplex Pump, with the attached Receiver, also the Glass Water-Gauge, Drain Cock, Air Cock, Safety Valve and the Suction and Steam Pipe connections as shown in the engraving.

THE SMITH-VAILE DUPLEX HYDRAULIC PRESSURE PUMPS,

IMPROVED PATTERNS,

For Steel Works, Cotton and Tobacco Presses, Etc.

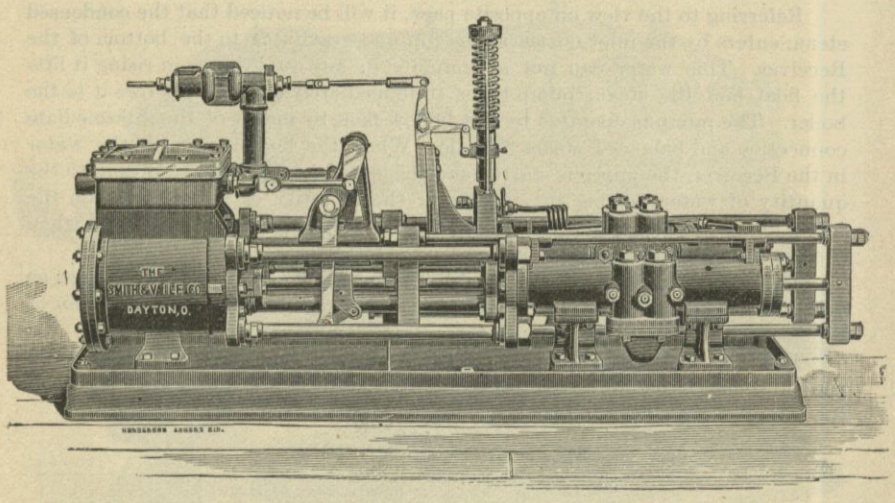


Fig. 29.—Size 12 x 1½ x 12.

With Automatic Regulator, Governor and Safety Valve.

THE SMITH-VAILE DUPLEX HYDRAULIC PRESSURE PUMP.

IMPROVED PATTERNS,

For Steel Works, Cotton and Tobacco Presses, Etc.

The utility of Direct Acting Hydraulic Pressure Pumps for working Oil Presses in lieu of Power Pumps, Cranks, Gears, Belts, Pulleys, etc., is now fully recognized by all intelligent Oil Mill Men. The old method of using power pumps at a pressure of from 1500 to 2000 pounds per square inch on the ram, is now a thing of the past. The exigencies of the oil business now demand more oil extracted per ton of seed, which can only be obtained by increased pressure, improved press boxes, rolls, heaters and methods of handling.

This pump has the improved Duplex valve connections, with outside connected double-acting plungers for the water end, external adjustable packing glands for the plungers which are readily renewed. The valve boxes are made of gun metal and plungers of steel.

It is a desirable form of steam pump for operating Hydraulic Presses for different purposes, as its action is positive at an increasing pressure or in maintaining an even pressure. When desired it is arranged to automatically maintain any required pressure, stopping when the limit is reached, and starting as soon as the pressure falls.

By its use the maximum working pressure and the accumulation of pressure is absolutely controllable by the manager or engineer.

Every machine is fully warranted.

SIZES AND DIMENSIONS.

Steam Cylinder. Inches.	Plungers. Inches.	Stroke. Inches.	Gallons Per Stroke.	Lbs. Pressure per Sq. In.	
				Steam at 60 Pounds.	Steam at 80 Pounds.
6	¾	6	.0114	3500	4500
7	⅞	6	.0156	"	"
8	1	10	.034	"	"
10	1¼	10	.053	"	"
12	1½	10	.076	"	"
14	1¾	10	.10	"	"
16	2	12	.16	"	"
18	2¼	12	.2	"	"
20	2½	15	.318	"	"
20	2½	20	.424	"	"

Any size made to order, and for any pressure from 500 to 10,000 pounds per square inch. Automatic Regulator, Governor and Safety Valve extra.

THE SMITH-VAILE DUPLEX HEAVY PRESSURE PUMPS.

DOUBLE PLUNGER PATTERN.

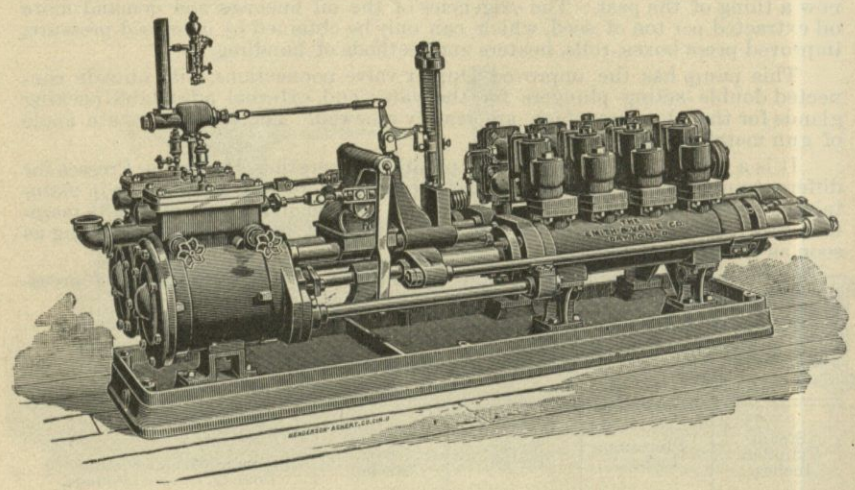


Fig. 30.—Size 12x4½x12.

With Automatic Regulator, Governor and Safety Valve.

THE SMITH-VAILE DUPLEX HEAVY PRESSURE PUMPS,

DOUBLE PLUNGER PATTERN.

Plunger Pumps are often more desirable for certain work, especially where the water is bad and the pressure is heavy; this is particularly true for mining purposes where the duty is heavy and the water likely to be impregnated with sulphur or acid. In such cases we construct the Pump of the hardest and closest grained iron it is possible to work. The Valves are made of Phosphor Bronze or Gun Metal, working on seats of the same material, and are almost indestructible in bad water. In the larger sizes these machines are mounted on a heavy bed plate of cast iron, which greatly increases their strength. No expense is spared either in material or workmanship to adapt them for the heavy duty for which they are designed. All parts are readily accessible. If emergencies require it, they will work under water. They are unequaled in the market by any Pump for continuous heavy work. All parts are strictly interchangeable.

LIST OF DIMENSIONS OF DUPLEX HEAVY PRESSURE PUMPS.

Double Plunger Pattern.

Steam Cylinder. Inches.	Water Plungers Inches.	Stroke. Inches.	Capacity per Stroke of One Pump.	Steam Pipe.	Exhaust Pipe.	Suction Pipe.	Discharge Pipe.
6	2	6	.08	1	1½	1½	1
6	2½	6	.127	1	1½	1½	1
7	2½	6	.127	1¼	2	1½	1
7	2½	10	.211	1¼	2	1½	1¼
7	3	10	.306	1¼	2	2	1½
8	3	10	.306	1½	2	2	1½
8	3½	10	.416	1½	2	2½	2
10	3	10	.306	2	2½	2	1½
10	3½	10	.416	2	2½	2½	2
10	4	12	.67	2	2½	3	2½
12	3½	12	.499	2½	3	2½	2
12	4	12	.67	2½	3	3	2½
12	4½	12	.826	2½	3	4	3
14	4½	12	.826	2½	3	4	3

In addition to the sizes given in the above list, a large number of other sizes and combinations can be supplied to meet the requirements of any particular service.

THE SMITH-VAILE OUTSIDE PACKED PLUNGER PUMPS.

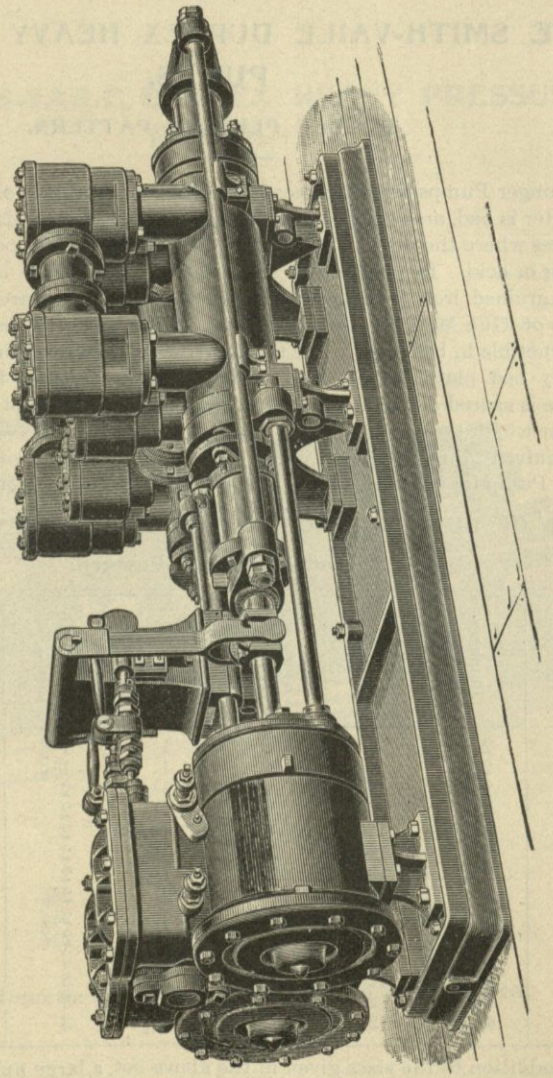


Fig. 31.

THE SMITH-VAILE IMPROVED DUPLEX OUTSIDE PACKED PLUNGER PUMP.

For all sizes, up to and including 10x6x12, see list for Heavy Pressure, Outside Packed Boiler Feeders.

This Pump is suitable for mining work or where it is necessary to work against heavy pressure; also where water is full of gritty foreign matter. The packing is adjustable from the outside and valves can be readily exposed for examination by removing cover. We mount these pumps on solid cast iron bases or wrought iron I beams as shown on opposite page. This insures perfect alignment under all conditions and pump can be quickly moved from one station to another, when necessary, without delay or preparation.

Steam Cylinder in Inches.	Water Cylinder in Inches.	Length of Stroke in Inches.	Gallons per Stroke of One Plunger.	Stroke per Minute of Each Plunger ordinary Speed.	Capacity of both Plungers at Speed stated, per Minute in Gallons.	Size of Steam Supply Pipe in Inches.	Exhaust Pipe in Inches.	Suction Pipe in Inches.	Discharge Pipe in Inches.
14	6	12	1.46	40 to 80	58 to 116	2½	3	5	4
14	8	12	2.61	40 " 80	94 " 188	2½	3	6	5
16	6	12	1.46	40 " 80	58 " 116	3	4	5	4
16	8	12	2.61	40 " 80	94 " 188	3	4	6	5
18	8	12	2.61	40 " 80	94 " 188	3	4	6	5
18	10	12	4.08	40 " 80	163 " 326	3	4	8	7
20	8	15	3.26	30 " 60	97 " 195	4	6	6	5
20	10	15	5.10	30 " 60	153 " 306	4	6	8	7
20	8	20	4.35	25 " 50	217 " 435	4	6	6	5
24	6	20	2.43	25 " 50	60 " 120			5	4
24	8	20	4.35	25 " 50	108 " 216			6	5
24	10	20	6.80	25 " 50	167 " 334			8	7

Other sizes made to order, mounted or not. See compounds.

For heavy and continuous service we especially recommend the long stroke as the most durable and satisfactory pump made.

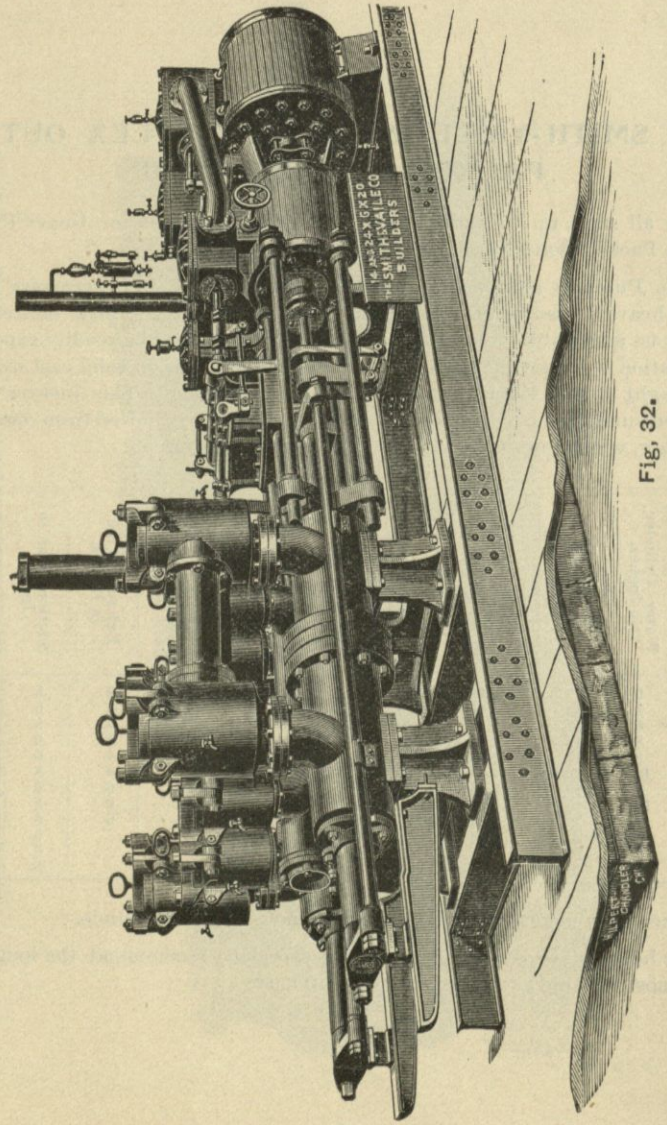


Fig. 32.

THE SMITH-VAILE COMPOUND HEAVY PRESSURE DUPLEX PUMP FOR MINES.

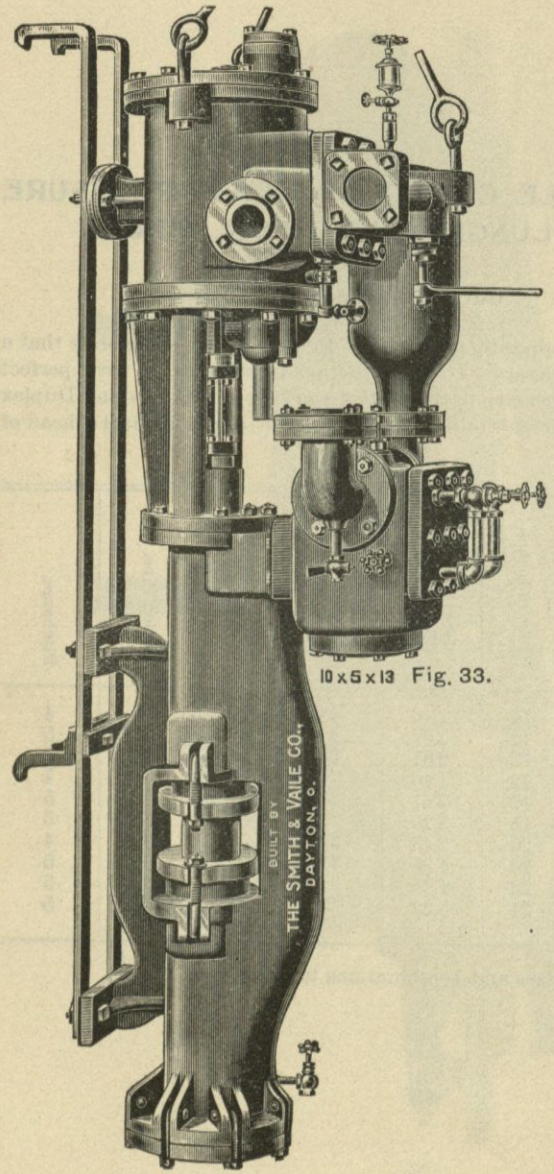
THE SMITH-VAILE COMPOUND HEAVY PRESSURE DOUBLE PLUNGER PUMP FOR MINES.

Outside Packed.

The illustration on opposite page shows this pump so completely that a description is hardly necessary. Its construction is such as to give perfect alignment, a feature so necessary to the perfect working of a Compound Duplex Pump. We have these pumps working successfully in mines against a head of 800 feet.

Diam. High Pressure Steam Cyl. in Inches.	Diam. Low Pressure Steam Cyl. in Inches.	Diam. of Plunger in Inches.	Stroke in Inches.	Gallons Delivered per Stroke of one Plunger.	Steam Supply Pipe.	Exhaust Pipe.	Suction Pipe.	Discharge.
8	14	6	12	1.46	1½	3	5	4
10	16	8	12	2.61	2	4	6	5
10	18	8	12	2.61	2	4	6	5
12	18	6	12	1.46	2½	4	5	4
12	20	8	12	2.61	2½	6	6	5
14	20	8	15	3.26	2½	6	6	5
14	24	6	20	2.43	2½	7	5	4
14	24	8	20	4.35	2½	7	6	5
16	24	8	20	4.35	3	7	6	5
18	30	8	24	5.22	3	8	6	5

Other sizes and combinations to order.



10x5x13 Fig. 33.

THE SMITH-VAILE VERTICAL MINING AND SINKING PUMP.

THE SMITH-VAILE VERTICAL MINING AND SINKING PUMP.

Double Plunger Pattern.

This form of pump is a necessity. In many cases in sinking a shaft where a considerable flow of water is encountered, it is impossible to lower the regular horizontal pump from station to station in time. This pump is suspended in the shaft, being lowered or raised at will by means of cable or rope. It is so arranged that it can be bolted to shaft timbers, although it works equally well when hanging by the tackle or when placed at an angle, being vertical it requires little room. It is very strongly built and none of the working parts exposed, in fact it is particularly designed for the rough usage of mine work. This pump has the advantage over all piston patterns in handling gritty or dirty water, it is also much heavier and stronger.

Special Features of Advantage Over Other Pumps.

The Packing can be tightened around Plunger when running.

The Pump can be entirely repacked without disturbing any of the connections. All parts necessary to remove in over-hauling are hinged to Pump, so there is no chance of losing bolts, nuts or any parts in shaft.

It is perfectly positive in its action and very simple.

Size.	Dimensions.	Capacity in Galls. per Stk.	Steam Pipe in Inches.	Exhaust Pipe.	Suction Pipe.	Discharge Pipe.
A	7x3½x12	.5	¾	1¼	2½	2
B	10x5 x13	.65	1¼	2	4	3
C	14x7 x13	2.16	2	3	5	4
D	16x8 x16	3.48	2½	4	6	5

If desired a base plate can be attached and pump used as a stationary pump at any time.

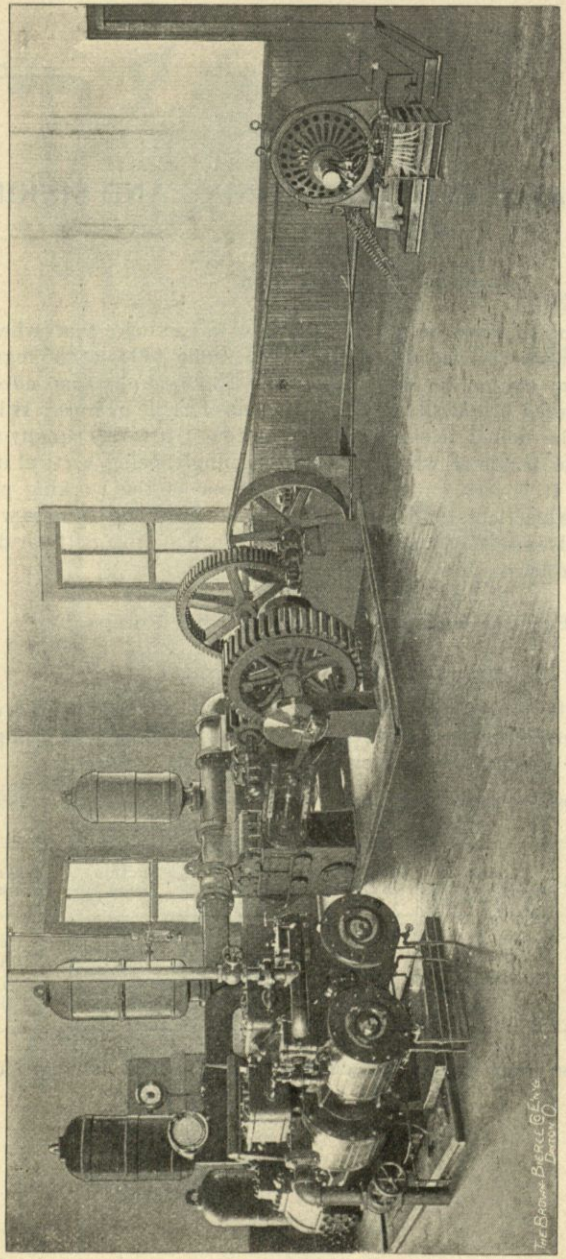


Fig. 34. The above illustration shows two Smith-Vaile pumping engines at the Anderson, S. C., Water Works. Particular attention is directed to the electrically-driven power pump, which is operated by a 30 H. P. two-phase motor, with a current of 50 volts, generated at a point on Rocky River, six miles distant from Anderson. With the more general adoption of long distance transmission of power by means of electricity, the demand for pumping machinery of this character is steadily increasing, and we have equipped a number of plants in this way with most satisfactory results. Such an arrangement possesses many advantages, and where the first cost of electricity is comparatively small, as in this case, is obviously preferable to a steam plant. The steam pump shown at the left of the engraving is only used as a reserve pump in case of an emergency.

We shall be glad to correspond with parties contemplating the installation of pumping machinery to be operated in this way.

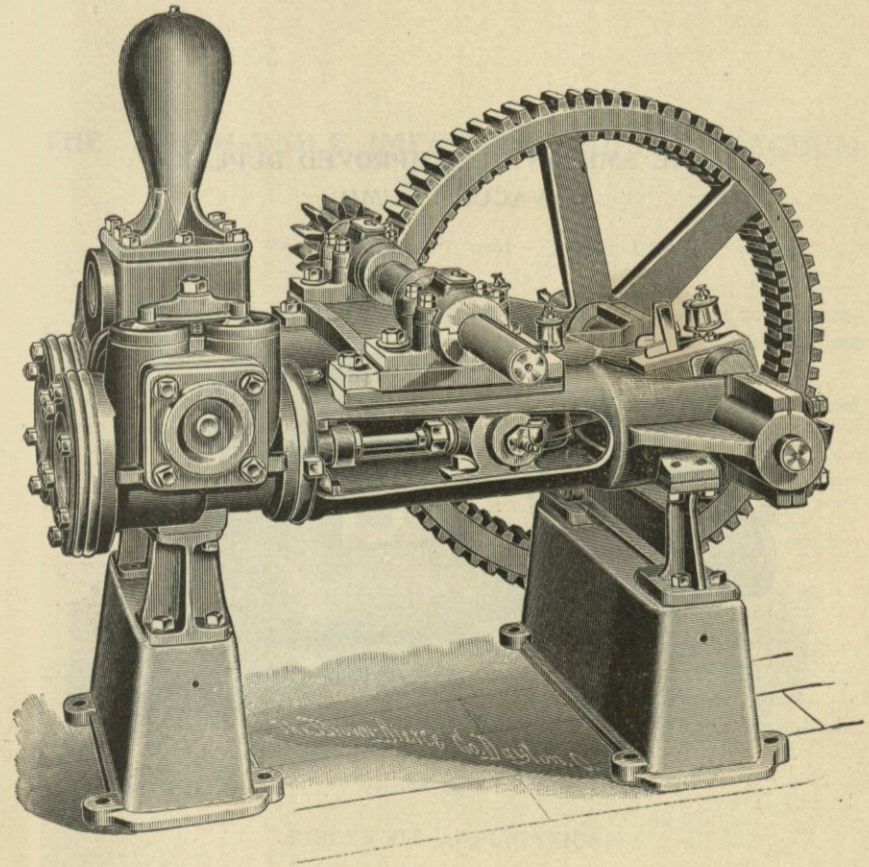


Fig. 35.

Fig. 35 illustrates a 4½x6 "Smith-Vaile" Power Pump arranged for attachment direct to an electric motor. It is frequently found desirable to make direct connection in this way, especially where the pump is small, or when the floor space is limited. When so arranged, this makes a very efficient combination, and being very compact it occupies but little room.

For a general line of power pumps, see pages 40 to 45 inclusive.

THE SMITH-VAILE IMPROVED DUPLEX VACUUM PUMP.

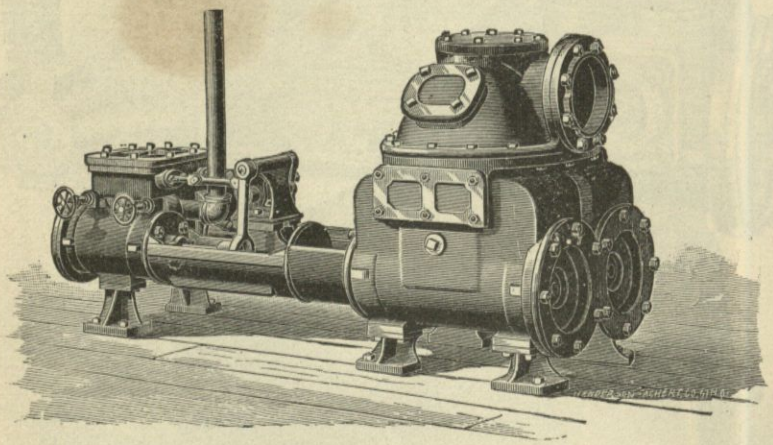


Fig. 36.

WE ALSO BUILD THIS PUMP AS A COMBINED VACUUM AND WATER PUMP.

THE SMITH-VAILE IMPROVED DUPLEX VACUUM PUMP.

For Vacuum Pans. "Double" and Triple Effects," Etc,

The vacuum that can be obtained by these pumps is superior to that produced by the best crank and fly-wheel pumps, while they are less costly, less liable to derangement, and more efficient and economical.

These pumps do not include any independent condenser, but when desired we can furnish with a jet or surface condenser bolted on above air pump.

Size of Steam Cylinders in Inches.	Size of Air Cylinders in Inches.	Length of Stroke in Inches.	Size of Steam Cylinders in Inches.	Size of Air Cylinders in Inches.	Length of Stroke in Inches.
4½	5	4	10	12	12
6	8	6	10	14	12
7	9	10	12	16	12
8	10	10	12	16	15

All steam, exhaust, suction and delivery pipes arranged for work to be performed.

We can also furnish larger sizes and other combinations.

PRICES ON APPLICATION.

Brass covered Piston Rods and Brass Cylinders always extra.

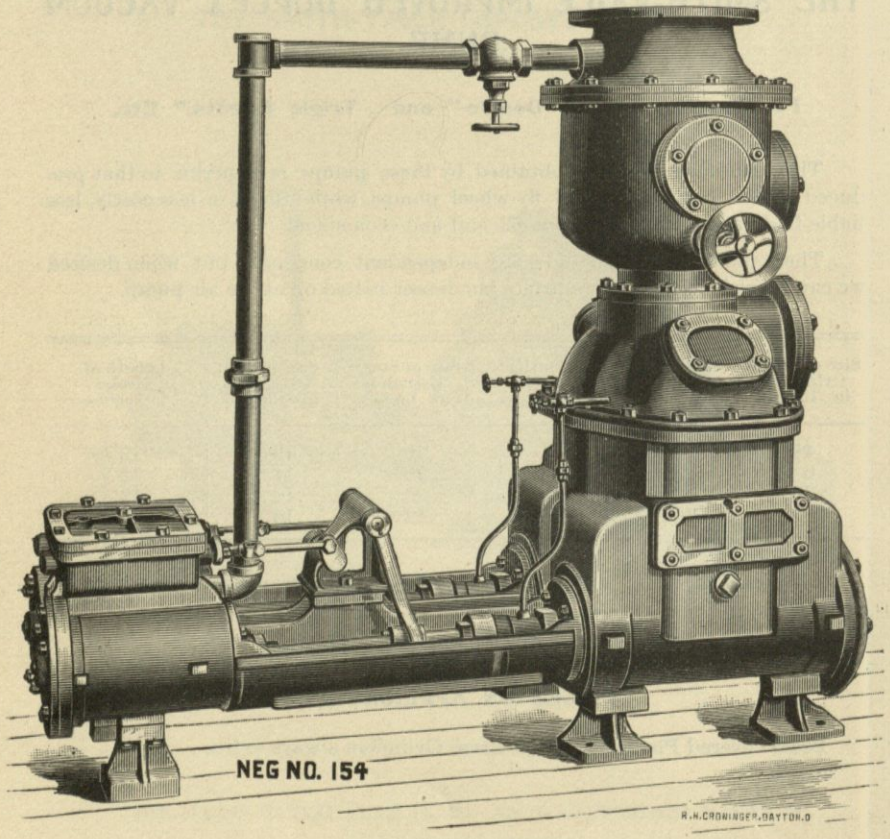


Fig. 37.

THE SMITH-VAILE INDEPENDENT DUPLEX AIR PUMPS AND CONDENSERS.

The Independent Air Pump and Condenser can be attached to any of our Pumps, and by its operation will effect a saving in fuel of 20 to 30 per cent. according to circumstances. The quantity of injection water required for condensing varies with its temperature; ordinarily it will take from 1 to 1½ gallons per minute, for each horse-power developed by the pump to which the condenser is attached. The condenser does not require any expensive foundation, and occupies very little floor space. Being independent, it can be started and a vacuum formed before the pump is started. It does not require an additional pump for the injection water, as the air pump will lift the water from any point within the limit of suction. We recommend attaching a condenser to any of our compound pumps where the service is to be continuous or nearly so, and where plenty of water can be had for operating it.

LIST OF DUPLEX AIR PUMPS AND CONDENSERS.

Steam Cylinders. Inches.	Air Cylinders. Inches.	Stroke. Inches.	Gallons per Stroke of One Pump.	Gallons Injection Water Per Minute.
5	6	6	.732	100 to 150
6	7	10	1.66	200 to 250
7	7½	10	1.99	250 to 300
7	9	10	2.75	300 to 450
8	10½	10	3.74	500 to 600
10	12	12	5.87	600 to 700
12	14	15	10.	700 to 900

Also patterns for larger sizes and other combination of cylinders.

PRICES ON APPLICATION.

COMPOUND DUPLEX PUMPING ENGINE.

With Independent Air Pump and Condenser Attached.

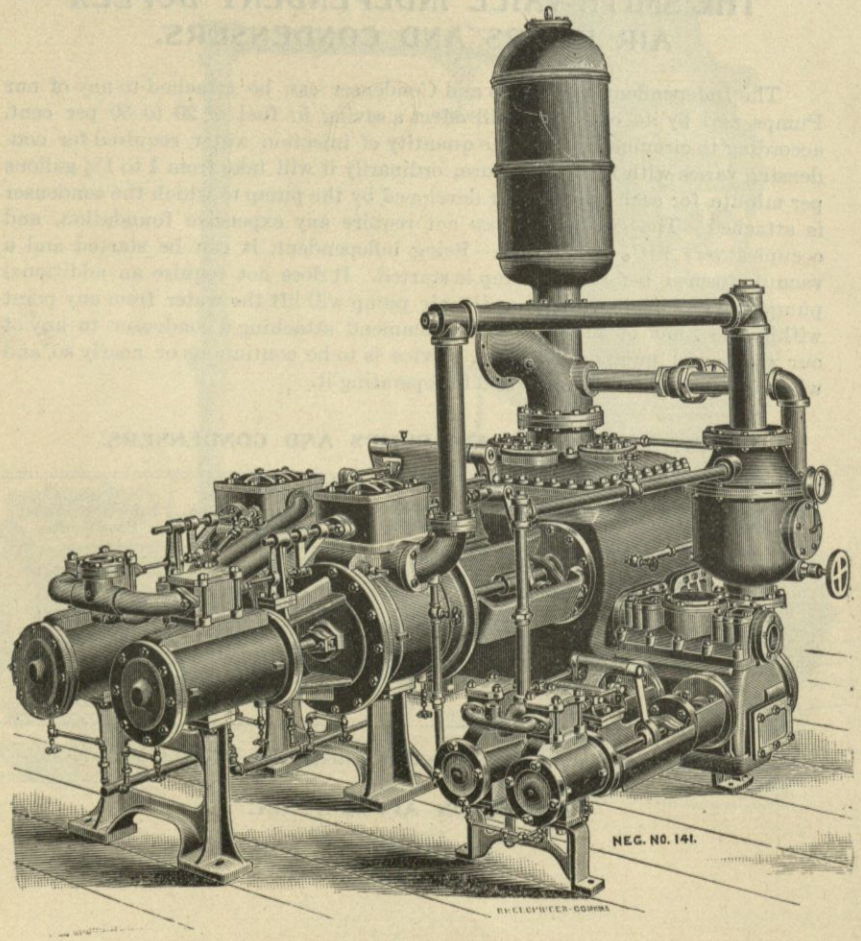


Fig. 38.

THE SMITH-VAILE INDEPENDENT AIR PUMP AND CONDENSER.

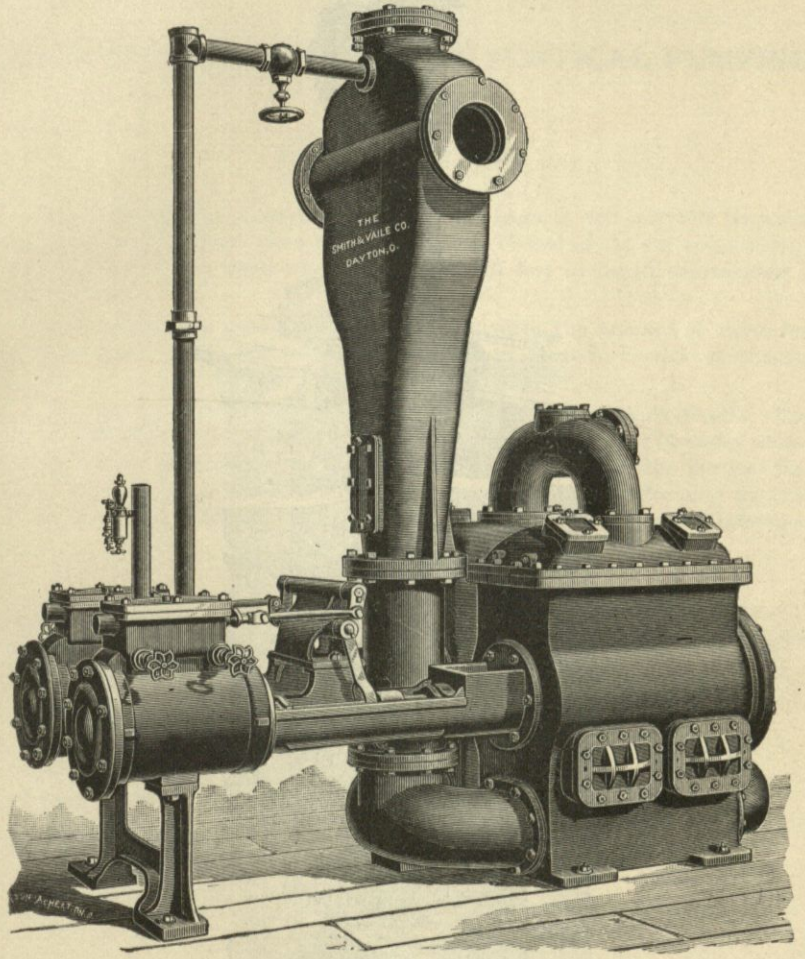


Fig. 39.—Duplex, Size 12 x 12 x 15.

THE SMITH-VAILE IMPROVED VERTICAL PUMPING ENGINE.

PLUNGER PATTERN.

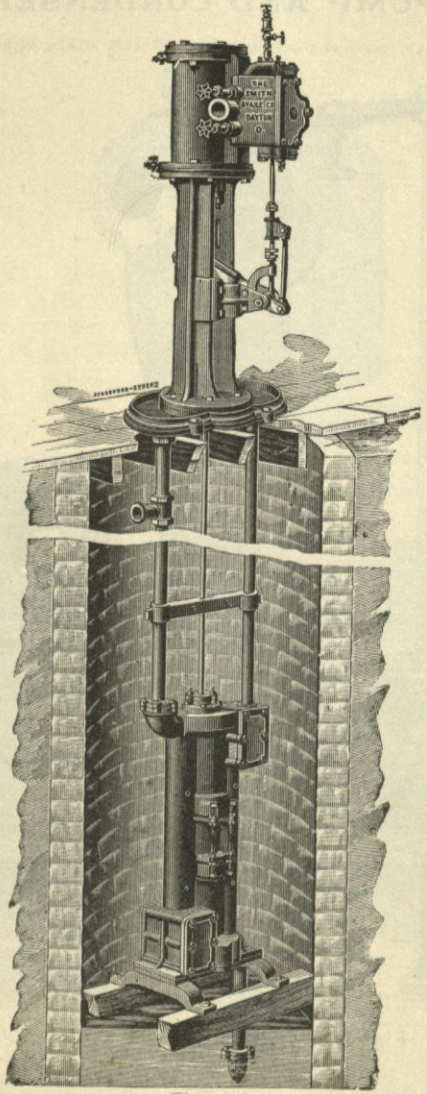


Fig. 40.

THE SMITH-VAILE IMPROVED VERTICAL PUMPING ENGINE.

PLUNGER PATTERN.

This Vertical Engine, as shown on opposite page, is well adapted for wells or shafts when the water does not rise to within 30 feet of the surface, and will successfully raise the water when the well is 150 feet in depth, discharging a steady stream.

By an adjustable connection in the steam valve, the amount of steam for the up or down stroke can be regulated so as to be uniform without causing any jar.

The Pump is a double-acting plunger with adjustable packing glands. The water valves have large areas, and placed in such a position as to be easily accessible. The two pipes extending from the Pump to the base of the Vertical Engine, maintain the relative positions of pump and engine, also forming a guide for the connecting rod by the use of suitable cross pieces at frequent intervals.

DIMENSIONS AND SIZES.

Diameter Steam Cylinder.	Diameter Water Cylinder.	Length of Stroke.	Capacity Single Stroke.	Steam Pipe.	Exhaust Pipe.	Suction Pipe.	Discharge Pipe.
7½	5	10	.85	1	2	3	2½
7½	6	14	1.71	1	2	4	3
9½	6	14	1.71	1¼	2½	4	3
9½	6	18	2.20	1¼	2½	4	3
11	6	18	2.20	1½	2½	4	3
13½	8	18	2.98	2	3	5	4

Estimates made for larger sizes for any depth of well.

THE SMITH-VAILE IMPROVED VERTICAL PUMPING ENGINE.

FOR DEEP WELLS.

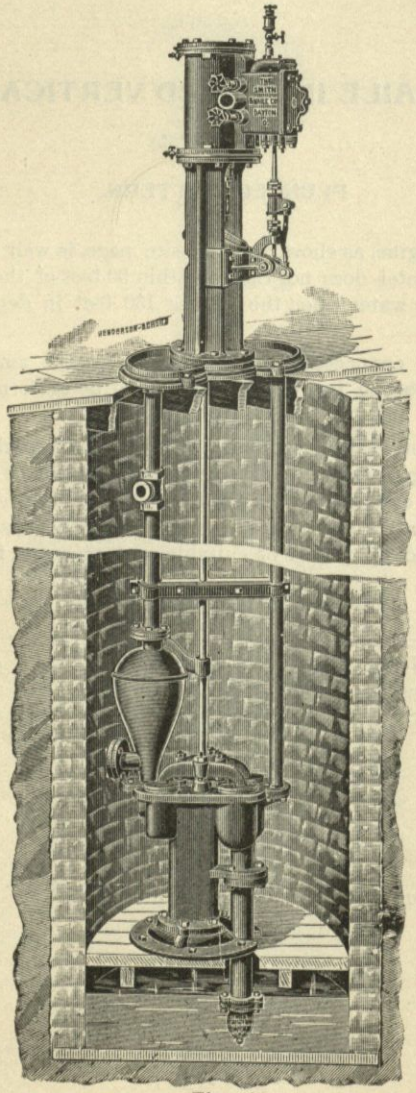


Fig. 41.

THE SMITH-VAILE IMPROVED VERTICAL PUMPING ENGINE.

For Deep Wells—Piston Pattern.

The engine is placed directly over the shaft or well, with the base firmly bolted to suitable cross timbers.

The Smith-Vaile steam valve attachment is arranged so that a uniform and steady motion is given to the piston on either up or down stroke.

The pump is a piston pattern, and placed near the water in the well, securely bolted to timbers which give a firm bearing.

One of the stay pipes is used as a discharge for the pump.

The pump is double-acting, and will discharge a steady and continuous stream to any point desired.

DIMENSIONS AND SIZES.

Diameter Steam Cylinder.	Diameter Water Cylinder.	Length of Stroke.	Capacity Single Stroke.	Steam Pipe.	Exhaust Pipe.	Suction.	Discharge.
7½	4	10	.54	1	2	3	2½
7½	5	10	.85	1	2	3	2½
9½	5	10	.85	1¼	2½	3	2½
9½	6	14	1.71	1¼	2½	4	3
9½	6	18	2.20	1¼	2½	4	3
11	6	18	2.20	1½	2½	4	3
13½	7	18	2.98	2	3	5	4

Other sizes to order as required.

THE SMITH-VAILE VERTICAL "ARTESIAN" WELL ENGINE.

ECONOMICAL, DURABLE, BEST.

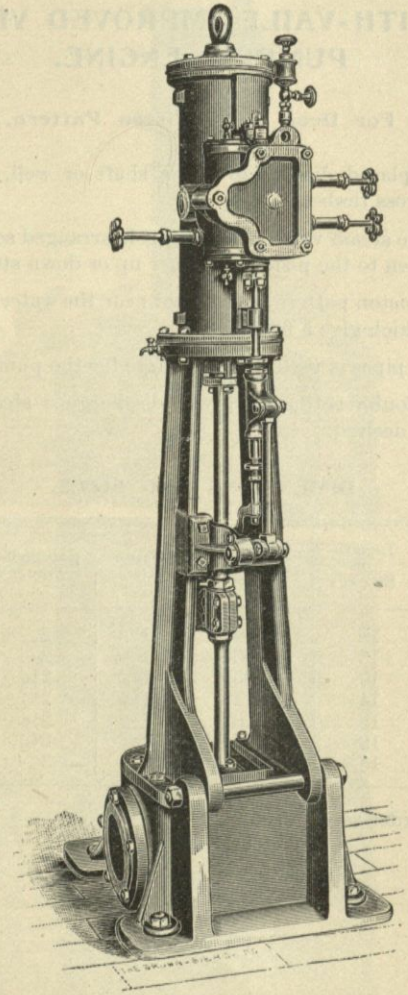


Fig. 42.

Also made to deliver part of water on down stroke by addition of plunger working through stuffing box.

THE SMITH-VAILE VERTICAL ARTESIAN WELL ENGINE.

Arranged to Operate the Pump on Pipe or Bored Wells.

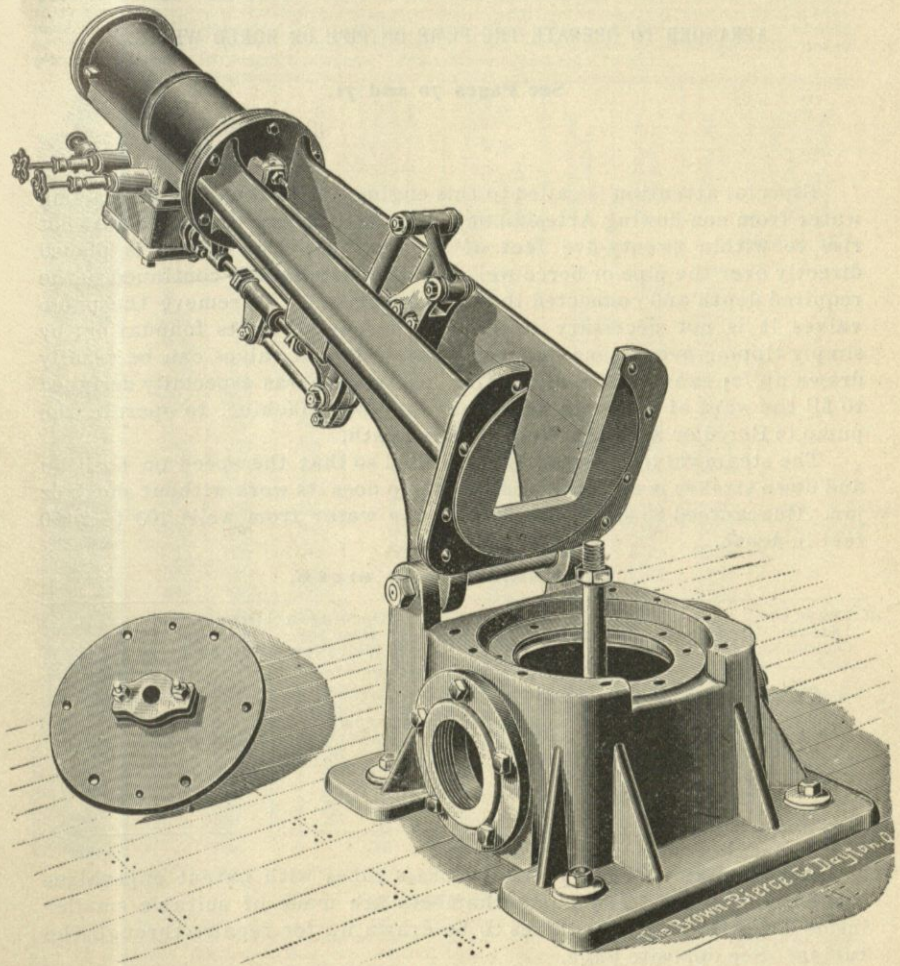


Fig. 43.

Above cut shows the steam cylinder tipped over on its side, giving free access to the Well for the withdrawal of the Pump Rods and Valves. Cut on opposite page shows the *Engine* when in position for work.

Dimensions on next page.

THE SMITH-VAILE ARTESIAN WELL ENGINE.

ARRANGED TO OPERATE THE PUMP ON PIPE OR BORED WELLS.

See Pages 70 and 71.

Especial attention is called to this engine. It is designed for raising water from non-flowing Artesian or Bored Wells where the water does not rise to within twenty-five feet of the surface. The engine is placed directly over the pipe or bored well, and the piston rod is continued to the required depth and connected to the pump bucket. To remove the pump valves it is not necessary to disturb the engine or its foundation; by simply tipping over to one side, the pump rods and valves can be readily drawn up for examination or repair. The engine was especially designed to fill the want of a simple and easily handled machine, to operate the pump in Bored or Artesian Wells of any depth.

The steam valve is perfectly controlled so that the speed on both up and down strokes is uniform, and the pump does its work without shock or jar. Guaranteed to successfully raise the water from wells 100 to 2,000 feet in depth.

DIMENSIONS AND SIZES.

Diam. of Steam Cylinder.	Stroke.	Steam Pipe.	Exhaust Pipe.	Opening in Base for Well Pipe.	Opening in Base for Discharge.	Diameter of Rod.
6½	18	1	1¼	4¾	4	1¼
6	24	1	1¼	4¾	4	1¼
7½	24	1	2	7¾	6	1½
7½	30	1	2	7¾	6	1½
9½	30	1¼	2½	7¾	6	1½
9½	36	1¼	2½	7¾	6	1½
11	30	1½	2½	7¾	6	1¾
11	36	1½	2½	7¾	6	1¾
13	36	2	3	7¾	6	2⅛

Artesian Well Pumps of heavy brass tubes with patent cup valves furnished to order. The pump chambers are made of suitable smaller inside diameter to enable valves to be drawn up for repairs through the tubing. See opposite page.

THE SMITH-VAILE ARTESIAN WELL CYLINDER.

The cylinder shell or body is of seamless drawn brass tube, of medium weight; the plunger (packed with leather cups) and lower valve of bronze metal, are removable, while perfectly finished brass balls complete each.

The cylinder is of smaller diameter than the pipe, which admits of plunger and lower valve being drawn up without disturbing pipe connections; while its area, lessened by displacement of rod, is still equal to cylinder, thus providing for unobstructed flow of water. A strainer or drive well point may be placed at bottom of lower valve, while we recommend the use of wood sucker rods with forged couplings. ***This cylinder is hung in the well.***

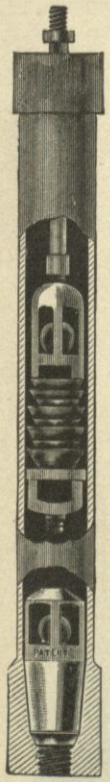


Fig. 44.

Inside Diameter Pump Cylinder.	Maximum Stroke.	Length of Pump Cylinder.	Inside Diameter of Pipe that is connected to the Cylinder above	Inside Diameter of Well, or Well Casing to be used in.	Strokes per Minute.	Gallons per Stroke.	Gallons per Hour.	Price Brass Cylinder and Valves, Bronzed Metal Balls.
2¾	24	40	3	4½	40	.61	1464	
3	24	44	3¼	5⅛	40	.73	1752	
3¼	24	44	3½	5⅛	40	.86	2064	
3¾	24	48	4	5⅝	40	1.15	2760	
4¼	24	48	4½	6¼	40	1.47	3528	
4¾	24	48	5	6⅝	40	1.84	4416	
2¾	30	46	3	4½	40	.77	1848	
3	30	50	3¼	5⅛	40	.92	2208	
3¼	30	50	3½	5⅛	40	1.06	2544	
3¾	30	54	4	5⅝	40	1.44	3456	
4¼	30	54	4½	6¼	40	1.84	4416	
4¾	30	54	5	6⅝	40	2.30	5520	
5¾	30	54	6	8¼	40	3.26	7824	
3¼	36	56	3½	5⅛	40	1.30	3120	
3¾	36	60	4	5⅝	40	1.72	4128	
4¼	36	60	4½	6¼	40	2.21	5304	
4¾	36	60	5	6⅝	40	2.76	6624	
5¾	36	60	6	8¼	40	3.90	9360	

SIZES IN CAST BRASS.

Inside Diameter Pump Cylinder.	Maximum Stroke.	Inside Diameter of Pipe that is connected to the Cylinder above and below.	Price Brass Cylinder and Valves, Bronzed Metal Balls.
6¾	36	7	
7¾	36	8	
8¾	36	9	
9½	36	11	
11½	36	12	

PLUNGER RODS.

There is but one kind of rod suitable for connecting the plunger valve with working or Steamhead, namely: a straight grain octagon ash rod with long wrought iron couplings at each end, so designed that when they are screwed tightly together they shoulder one against the other and take all strain from the threads. A connection made of pipe soon gives way at the coupling as the vibration and strain on the threads cause it to let go. These ash rods are from 16 to 22 feet long and made in three sizes—1¾ Inches, 8c. per foot; 2¼ Inches, 27c. per foot; 3½ Inches, 63c. per foot including coupling.

THE SMITH-VAILE PATENT STEAM PUMP.

With Vertical Tubular Boiler and Fittings Complete, Ready for Use.

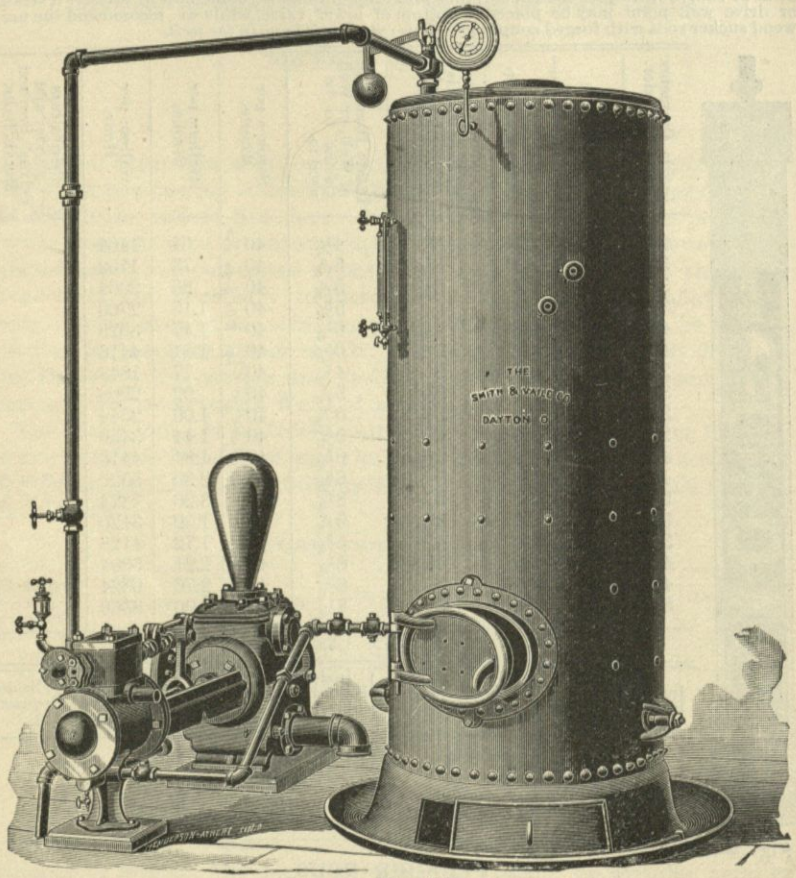


Fig. 45.

The above cut shows the No. 19 Steam Pump with Submerged Tubular or plain vertical Boiler, 30 inches diameter and 60 inches high; including boiler base, grates, doors, safety valve, steam gauge, glass water gauge, try cocks, blow-off cock, steam pipe and throttle, side pump with valves and pipe, or inspirator for feeding boiler, oil cup and the necessary pet-cocks, plugs and wrenches.

Each Pump and Boiler fully tested before leaving the factory.

THE SMITH-VAILE COMBINED PUMP AND BOILER.

With All Necessary Fittings, Complete for Railway Water Stations, Quarries, Coffer-Dams, Etc.

DIMENSIONS.

No.	Steam Cylinder.	Water Cylinder.	Stroke.	Gallons per Stroke.	Steam Pipe.	Exhaust Pipe.	Suction.	Discharge.	Dimen. of Boilers: Diameter of Shell.	Dimen. of Boilers: Height of Shell.	Dimen. of Boilers: Number of 2 inch Tubes.	Shipping Weight.	Price of Pump.	Price Complete.
*15	5½	3¼	7	.25	¾	1¼	2	1½	24	60	31	1690		
*16	5½	4	7	.39	¾	1¼	2	1½	24	60	31	1700		
17	5½	5½	7	.72	¾	1¼	3	2½	24	60	31	1764		
*18	6½	4	7	.39	1	1¼	2	1½	30	60	54	2335		
19	6½	5½	7	.72	1	1¼	3	2½	30	60	54	2335		
20	7½	4	10	.54	1	2	2½	2	30	72	54	2900		
21	7½	5	10	.85	1	2	3	2½	30	72	54	2925		
23	7½	6	10	1.22	1	2	4	3	30	72	54	2940		
25	7½	7	10	1.66	1	2	4	3	30	72	54	2960		
26	7½	7½	10	1.99	1	2	4	4	30	72	54	3000		
27	9½	5	10	.85	1¼	2½	3	2½	30	84	54	3380		
29	9½	6	10	1.22	1¼	2½	4	3	30	84	54	3400		
31	9½	7	10	1.66	1¼	2½	4	3	30	84	54	3430		
32	9½	7½	10	1.99	1¼	2½	4	3	30	84	54	3450		
33	11	7	14	2.32	1½	2½	5	5	36	84	60	5000		
34	11	8	14	3.05	1½	2½	6	5	36	84	60	5010		
35	11	9	14	3 85	1½	2½	6	6	36	84	60	5060		
37	13½	8	14	3.05	2	3	6	6						
38	13½	9	14	3.85	2	3	6	6						
39	13½	10	18	8.12	2	3	8	7						
40	13½	12	18	6.81	2	3	8	8						

*On numbers 15, 16 and 18 we put solid water boxes, unless the suction is very light, when removable water cylinder pattern can be used.

By the use of the Patented Removable Water Cylinder, railway companies are enabled to arrange their pumps at the different water stations, where the water is raised to different heights, in such a manner as to secure the full duty of the steam cylinder, and still have each pump duplicate in every part with others. At stations where the water is to be elevated less than fifty feet, use a removable cylinder about equal in diameter to the steam cylinder. Decrease the diameter of the water cylinder in proportion as the height water is to be elevated, exceeds fifty feet.

By this system the carrying of repairs for many sizes of pumps is avoided.

THE SMITH-VAILE DUPLEX PUMPS.

With Vertical Tubular Boiler and Fittings Complete, Ready for Use.

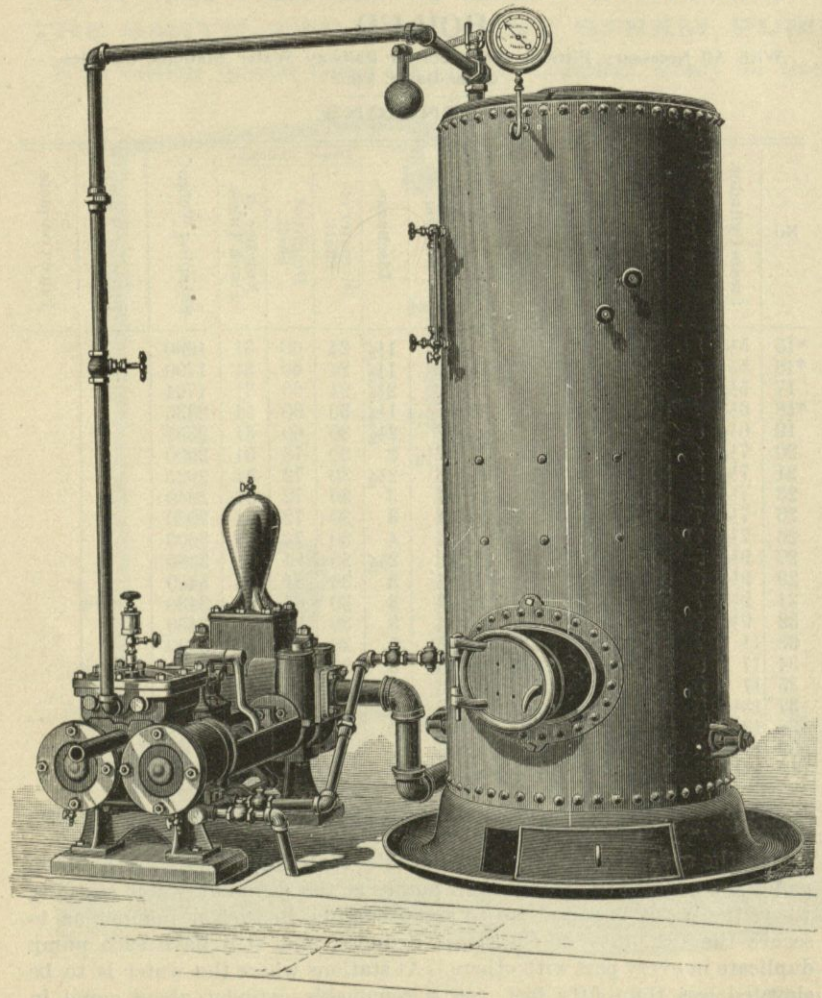


Fig. 46.

The above cut shows the No. 53 Duplex Pump with Submerged Tubular or Plain Vertical Boiler, 30 inches diameter and 72 inches high; including boiler base, grates, doors, safety valve, steam gauge, glass water gauge, try cocks, blow-off cock, steam pipe and throttle, side pump with valves and pipe, or Inspirator for feeding boiler, oil cup and the necessary pet-cocks, plugs and wrenches.

THE SMITH-VAILE DUPLEX PUMP.

With Submerged Tubular Boiler and Fittings Complete and Ready For Use.

This combination of the Smith-Vaile Duplex Pump, with Vertical Boiler, and complete in itself, with Auxiliary Boiler Feed Pump. Boiler Base, Smoke Box Extension, Grate Bars, Steam Gauge, Water Gauge, Gauge Cocks, Blow-off Cock, Safety Valve, Boiler Feed Connections, Steam Pipe and necessary fittings, etc., is the safest, most compact and serviceable machine of its kind for supplying water for Railroad Water Stations, Hotels, and Public Buildings, and for use in quarries, irrigating land, etc. It is light, compact and strong, and can be placed at the point of supply and the water forced to any distance and height required. It is easily understood, and does not need a skilled mechanic to operate it.

No.	Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Galls. per stroke of one Pump.	Steam Pipe.	Exhaust Pipe.	Suction.	Discharge	Dimensions of Boiler.		
									Diameter of Shell.	Height of Shell.	No. of 2-inch Tubes.
50	3	2	4	.05	½	¾	1¼	1	24	60	31
51	4½	3	4	.12	¾	1	2	1½	24	60	31
52	6	4	6	.33	1	1½	3	2	30	72	54
53	6	5	6	.51	1	1½	3	2	30	72	54
54	7	4	10	.56	1¼	2	4	3	30	84	54
55	7	5	10	.85	1¼	2	4	3	30	84	54
56	7	6	10	1.22	1¼	2	5	4	30	84	54
57	8	5	10	.85	1½	2	4	3	36	84	70
58	8	6	10	1.22	1½	2	5	4	36	84	70
59	8	7	10	1.66	1½	2	6	5	36	84	70
60	8	8	10	2.17	1½	2	6	5	36	84	70
61	10	6	12	1.46	2	2½	5	4	36	96	70
62	10	7	12	1.97	2	2½	6	5	36	96	70
63	10	8	12	2.61	2	2½	6	5	36	96	70

The Boilers are made of 60,000 lbs. test steel, with Fire Box Flange Iron in the Furnace and Heads.

Stacks extra to order when desired.

TRIPLEX POWER PUMP,

Brewery, Tank and Elevator Pumps, Etc., Etc.

For Use in Connection with Electric Motors.

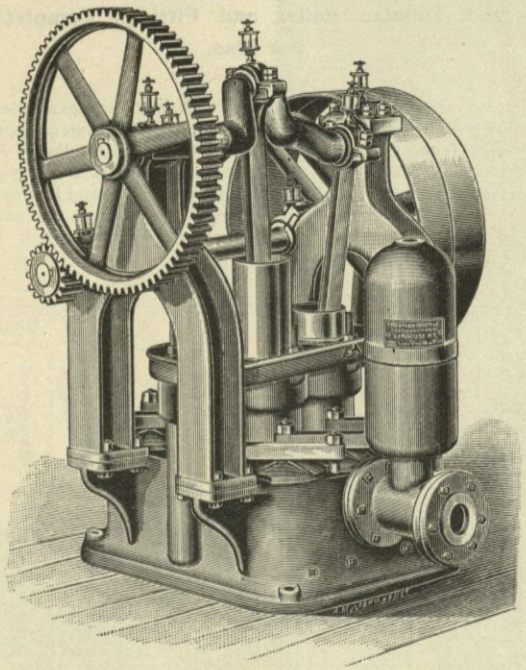


Fig. 47.

These pumps are especially adapted for Paper Makers' use as Stuff Pumps, Suction Pumps connected to suction boxes or Paper Machines. Fitted with ball valves and Bronze Plunger, Stuffing Boxes and Cylinders lined with bronze.

For Draining Dryers of Paper Machines, and Heating Coils.
For Tank Pump.
Pulp Mills—Tank Pumps.
For Maintaining Hydraulic Pressure on Wood Pulp Grinders.
Breweries and Distilleries—Tank Pumps, Mash Pumps, Cellar Pumps, Etc.
For Hydraulic Elevators.
Irrigation.

These pumps are constructed with three independent cylinders with suction valves on one side and discharge valves on the opposite all in one base. At the end of the pump to carry the shafts is securely bolted a heavy standard to which are fitted the journal boxes for carrying the shafts.

The shaft is a heavy steel casting with three cranks set at an angle of 120 degrees. The plungers are hollow trunk pattern fitting the cylinders through which they work and at the upper end of cylinders are long stuffing boxes which are easily accessible with an ordinary wrench.

The crank is operated by the large spur gear which engages a small pinion which receives its power from large pulleys. The style of valve used depends upon the work which the pump is required to do.

The pump is especially designed with a view of having all parts easily accessible without the use of any special appliances or special wrenches.

The gears used in all standard pumps are accurately cut gears. In cases where high speed is necessary rawhide pinion will be used if desired.

These pumps give the highest efficiency for the reason that when a column of water is once started in motion its velocity is maintained and the flow is continuous and smooth as one or more of the plungers are continually forcing water all the while, hence the loss of power occasioned by the the starting and stopping of the column of water at the end of every stroke in the ordinary single and duplex pumps is saved by the triplex pump.

Diameter of Cylinders.	Stroke.	Suction.	Discharge.	Gallons per Revolution.	Revolution per Minute.	Gallons per Minute.	Tight and Loose Pulleys.	Ratio of Gearing.	Weight Complete.	Over all.		
										Height.	Width.	Depth.
1¼″	2″	1″	¾″	.0319	60	1.914	12 x 2½	5 to 1	164	19½″	16⅜″	12 5/16″
1¾″	2½″	1¼″	1″	.0732	60	4.392	12 x 2½	5 to 1	373	27″	23½″	15½″
2″	3″	1¼″	1″	.1224	50	6.120	12 x 2½	5 to 1	370	27″	23½″	15½″
2½″	4″	1¼″	1″	.2550	50	12.75	15 x 3	5 to 1	400	29″	31⅜″	23″
3″	4″	2″	1½″	.3673	45	16.53	15 x 3	5 to 1	675	29″	31⅜″	23″
4″	4″	3″	2″	.6528	45	29.37	20 x 3	5 to 1	738	39⅜″	38¼″	28¼″
4″	6″	3″	2″	.9787	40	39.15	20 x 3	5 to 1	1228	39⅜″	38¼″	28¼″
5″	6″	4″	3″	1.530	40	61.20	26 x 4	5 to 1	1689	48½″	46⅜″	34⅜″
5″	8″	4″	3″	2 040	40	81 60	30 x 5	5 to 1	1840	48½″	48⅜″	36⅜″
6½″	8″	5″	4″	3 448	40	137.92	30 x 6	5 to 1	3648	59″	62¾″	42½″
8″	8″	6″	5″	5.222	40	208.88	36 x 6	5 to 1	5500	62″	70¾″	49½″
8″	10″	6″	5″	6.520	40	260.8	40 x 6	5 to 1	6725	65″	74½″	51½″

These pumps fitted with valves for hot or cold water as desired. Or with ball valves for handling pulp, for breweries or distilleries use or muddy or gritty water.

Why Triplex Pumps are Preferable.

First—Their action produces a smooth, even and continuous flow of water without the intermittent hammer so objectionable in single or duplex pumps, hence can be operated with considerably less power than those styles.

Second—These pumps are constructed with large valve areas. The valve lift is low and consequently less wear upon valves and valve seats.

Third—The valves and all working parts are easily accessible.

Fourth—There are but few joints, hence easily kept tight.

CENTRIFUGAL PUMPS.

PLAIN HORIZONTAL PATTERN.

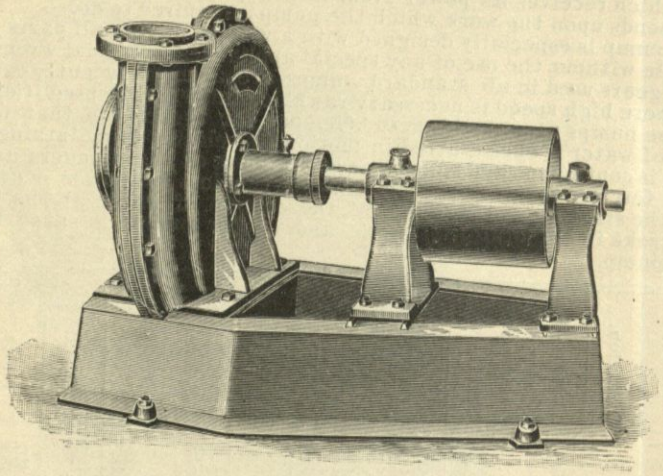


Fig. 49.

The above cut represents our Improved Horizontal pump, which is the Vertical Pump resting on its edge, securely fastened to an iron bed by flanges cast on each shell. Upon what would be the bottom of Vertical, but back shell of Horizontal, is cast a short pipe with flange to bolt to side of junk or flume, or to induction pipe. The shaft runs horizontally with bearing at either end of pulley. This must be set so that water will flow into it, unless a Foot Valve is used in bottom of induction pipe, in which case it may be set to not exceed twenty-eight feet above the water. In construction the Pumps are all alike, being cast in two halves or shells with flanges, which are bolted together. The piston revolves between these two shells secured to shaft.

This Pump with foot valve at bottom of suction pipe is chiefly used for Irrigating and Draining.

Pumps built to run Right or Left-handed as desired. In ordering, state whether Pump should run Right or Left-handed. Pump shown in Cut runs Right-handed.

CENTRIFUGAL PUMPS

Are Particularly Well Adapted for Contractor's Use in Emptying Cofferdams, Clearing Sewers, Etc.

They Are Largely Used in Tanneries, Bleacheries, Quarries and Dry Docks, and For Sand Dredging, Pulp and Sulphite Mills and White Lead Works.

Their simplicity, durability and large capacity combine to make a pump well suited to the requirements of irrigation companies, or, in fact, any parties who desire to handle a large amount of water in a short time.

These Pumps are furnished with special reference to the work they are to do, and the material they are to handle, so that in naming prices we must know fully what these requirements are, and the conditions under which the machine will operate. For instance, a pump which is to handle acids or chemicals must be built of some material that will best withstand the corrosive action of that particular acid, and the cost, of course, would be somewhat greater than that of a regular iron pump.

If you contemplate the purchase of this type of pump, please write us as fully as possible, and we will give you an estimate on a machine adapted for the conditions given.

DIFFERENTIAL POWER WORKING HEAD.

For Operating Deep Well Pumps.

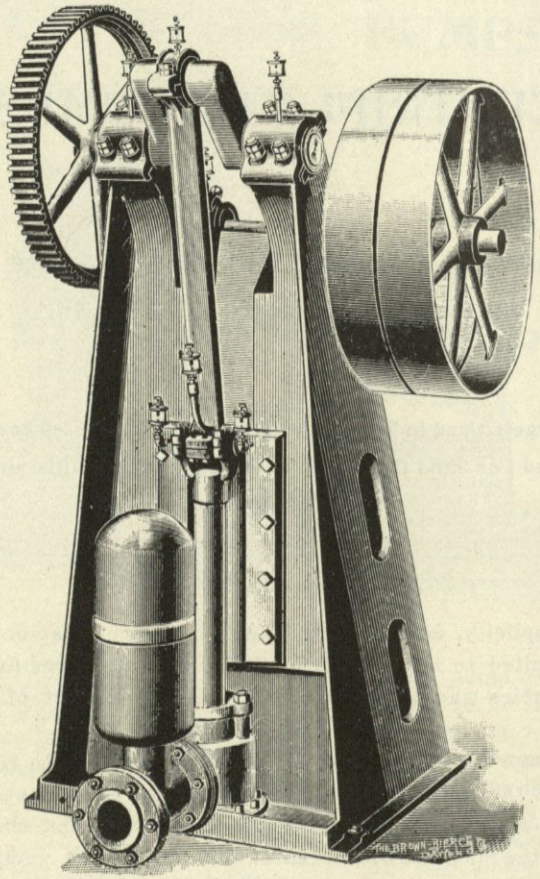


Fig. 48.

DIFFERENTIAL POWER WORKING HEADS.

Stroke in Inches.	Stroke per Minute.	Geared.	Pulleys Tight and Loose.	Maximum Dia. of Pipe in Inches.	
				Suction.	Discharge.
12	20 to 40	5 to 1	24x4	6	2
14	20 to 40	5 to 1	26x4	6	2½
16	20 to 35	5 to 1	26x5	6	3
18	15 to 30	5 to 1	26x6	8	3
20	15 to 25	5 to 1	30x4	8	4
22	10 to 20	5 to 1	30x5	8	4
24	10 to 20	5 to 1	30x6	8	5

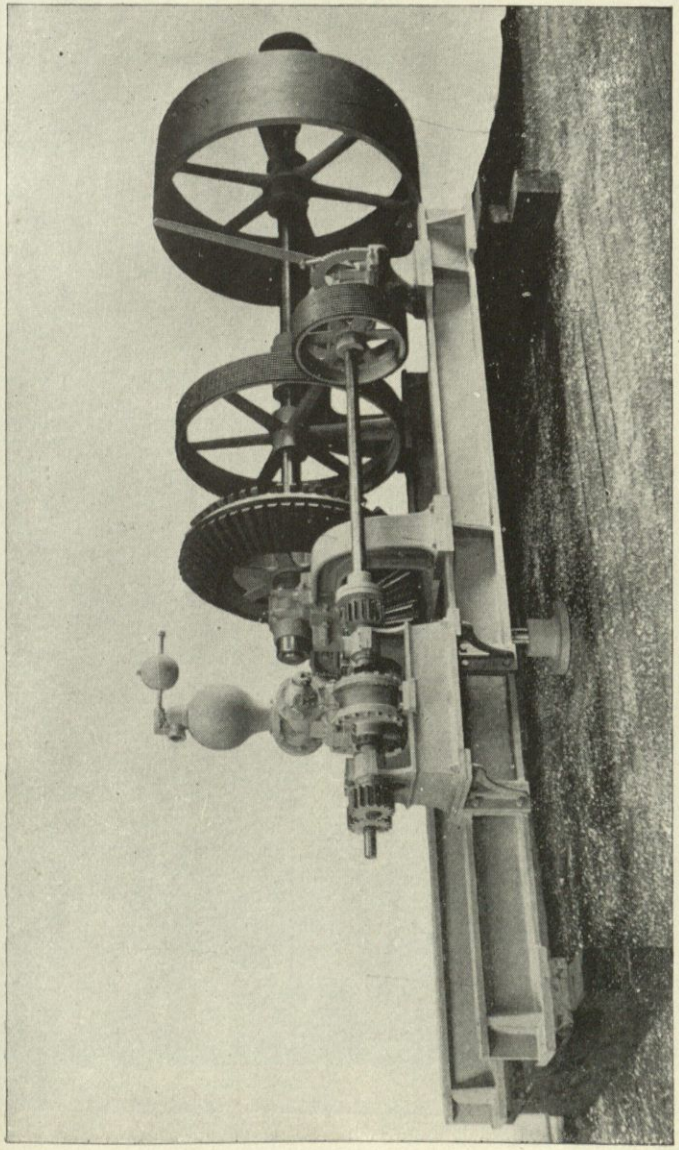


FIG. 50.—ROTARY FIRE PUMP.

We illustrate herewith a Rotary Fire Pump, with power connections, which we furnished with a Victor Turbine to the Pelham Manufacturing Company Cotton Mill, Pelham, S. C., and which fairly represents our work in that line. The pump is driven direct from the Jack Shaft by V Friction Gears, which can be instantly thrown into or out of gear by the hand lever. The entire arrangement is compact, simple, substantial and efficient, and is highly commended by the Associated Factory Mutual Insurance Companies.

Similar outfits have been furnished by us to a large number of corporations for use in cotton mills, woolen mills, etc.

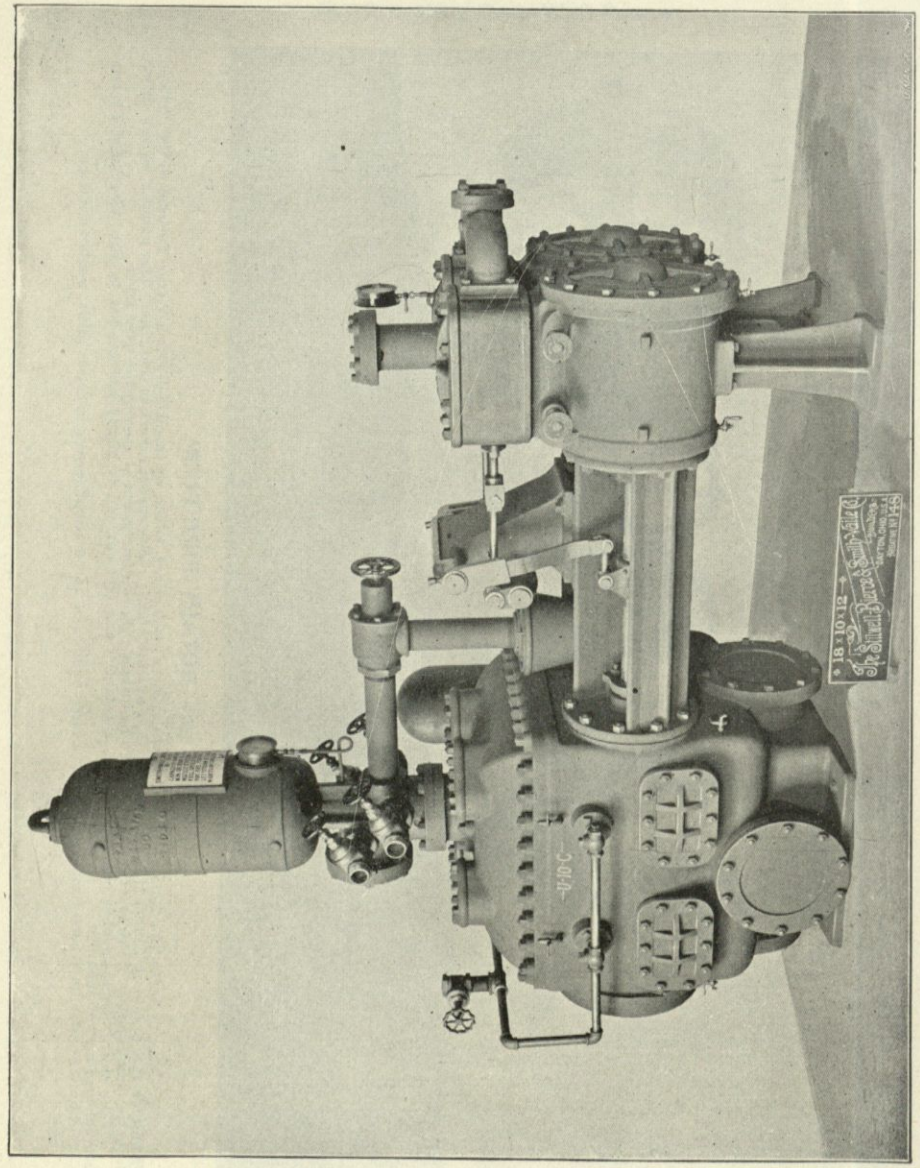


Fig. 51.—Smith-Vaile "Underwriter" Fire Pump, built strictly under the specifications of J. R. Freeman, Chief Engineer of the Associated Factory Mutual Insurance Companies. (See also pages 34 and 35.)

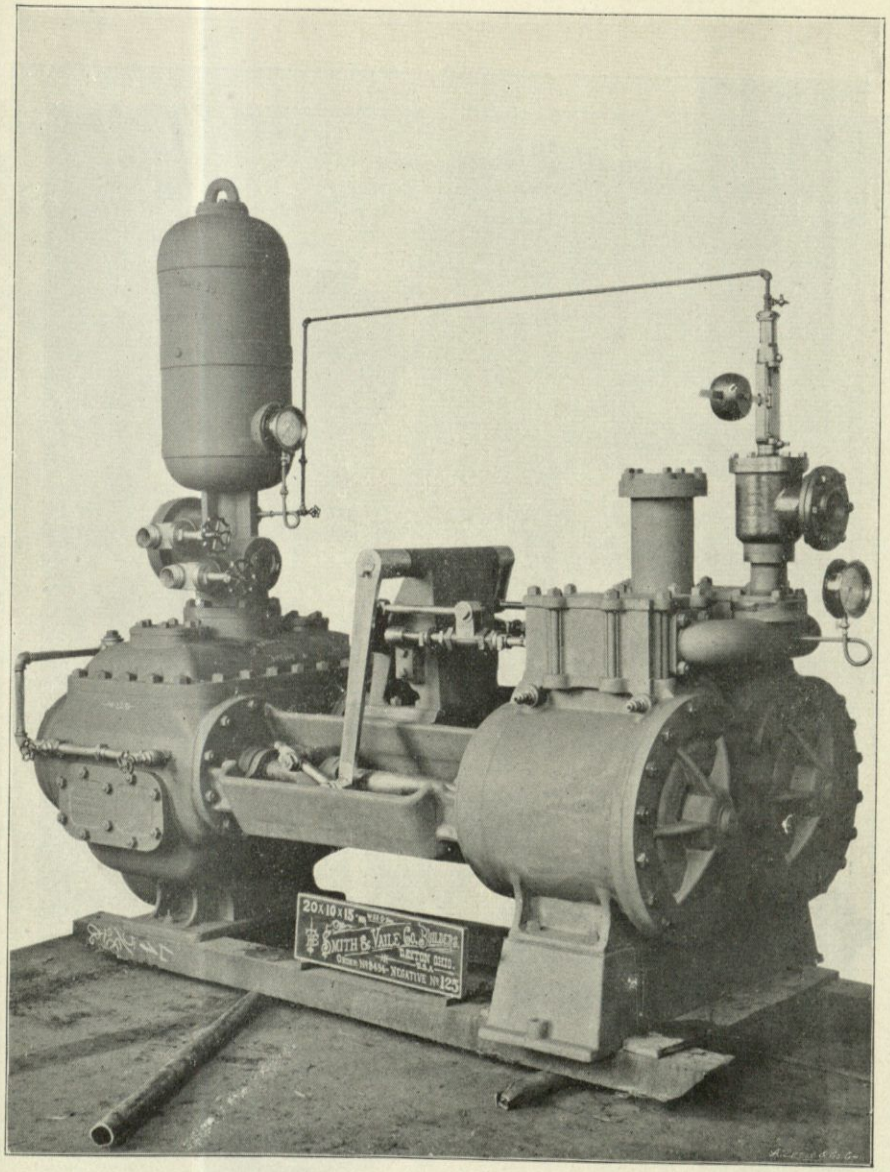


Fig. 52. The Smith-Vaile Standard Fire Pump, designed to meet the requirements of the Jardine Specifications; also for general fire protection in factories, etc., where the more expensive Underwriters' Fire Pump is not specified by terms of insurance. It is shown with all extra attachments. These pumps are made with large water passages and valve areas.

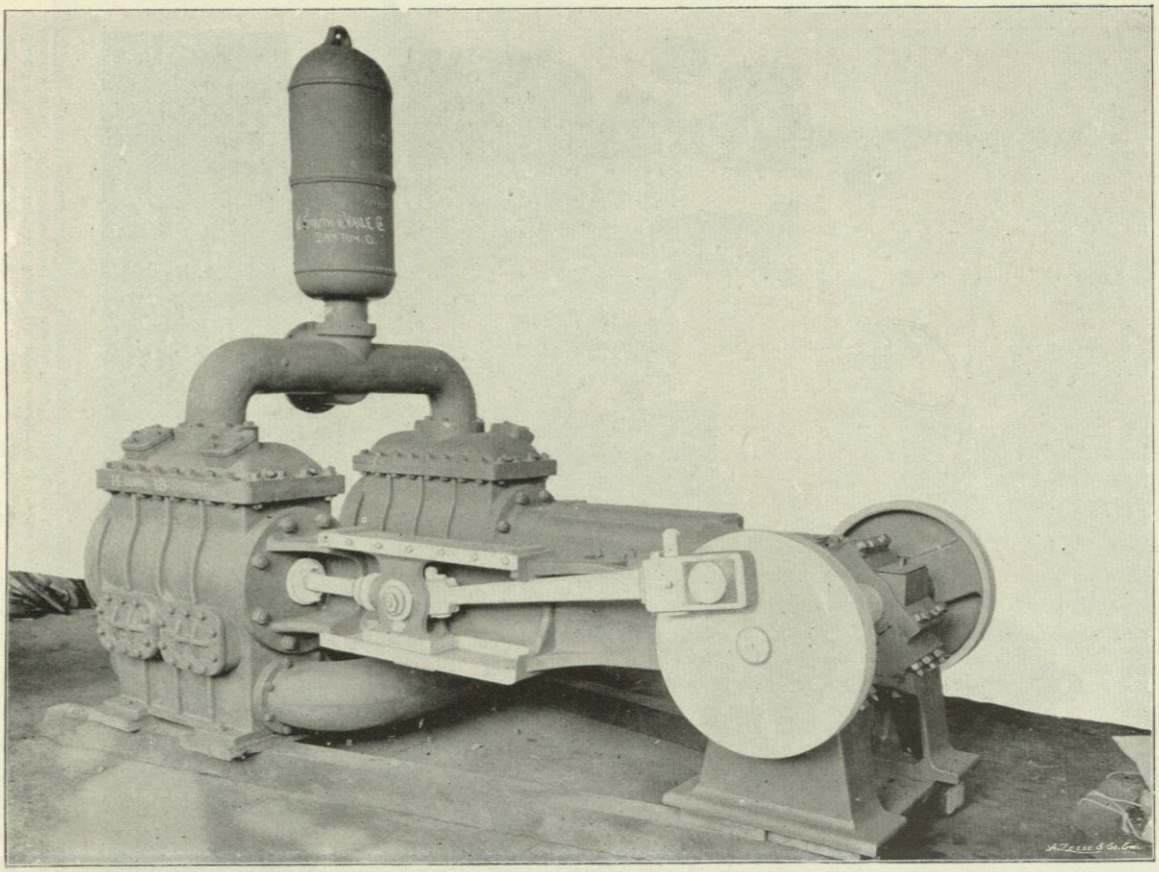


Fig. 53. The Smith-Vaile Duplex Power Pump, with separate water boxes, connected to cranks to work on quartering. The crank shaft to be driven by belts or gearing. For heavy service.

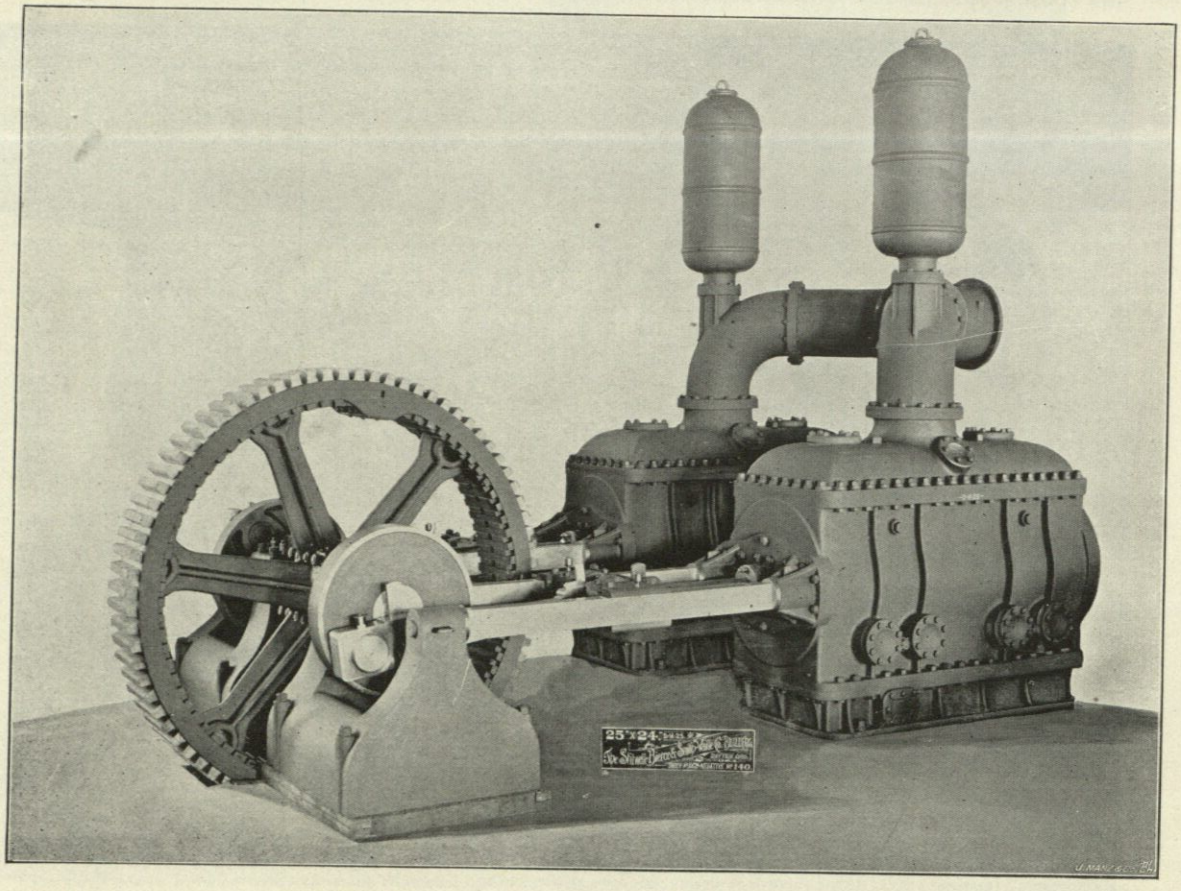


Fig. 54. Smith-Vaile Duplex Power Pump, for irrigating purposes. Capacity 5,000 gallons per minute. Two of these pumps, with two Victor Turbine Water Wheels, furnished The Prosser Falls Irrigating Co., of Prosser, Wash.

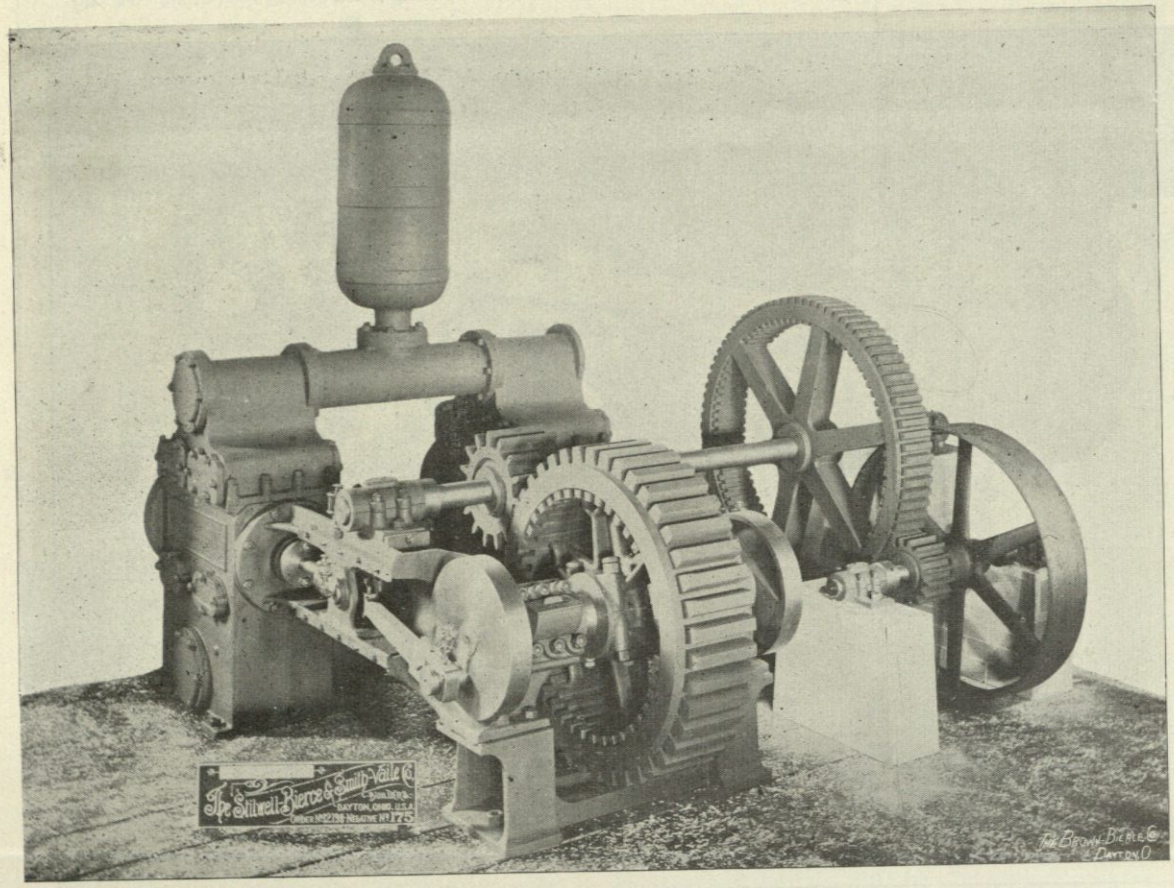
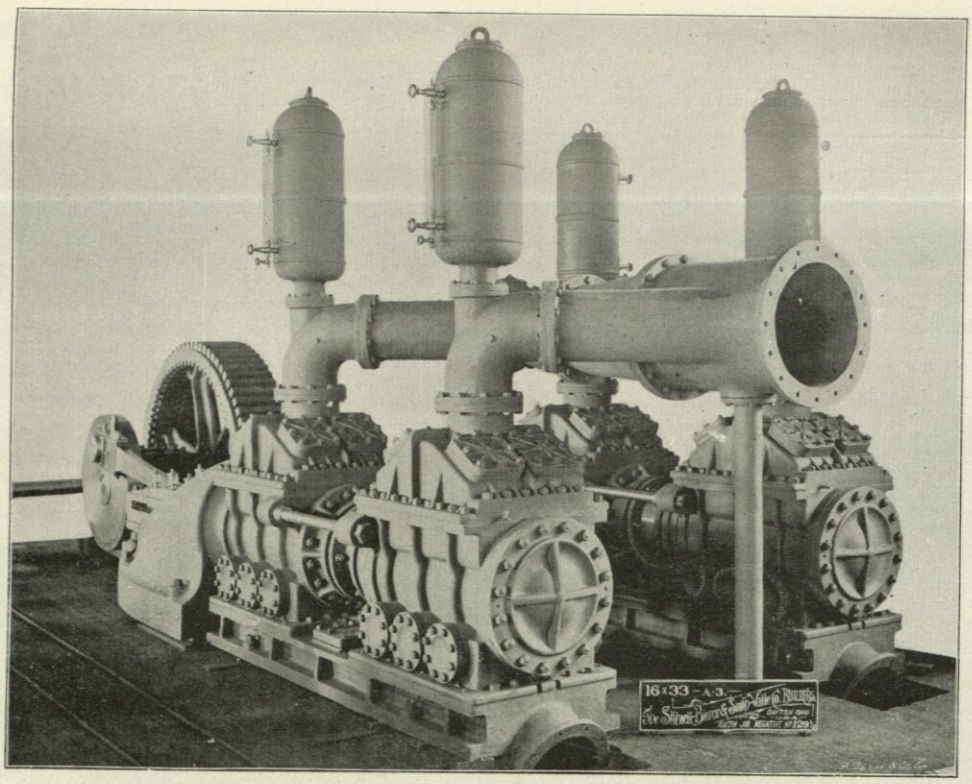


Fig. 55.—Smith-Vaile Duplex Power Pump with separate water boxes, arranged with special reducing gear to be driven by high speed electric motor.



No. 56.—These Pumping Engines consist of two Duplex Double Plunger Power Pumps, each having a capacity of four million gallons per 24 hours, delivered into the reservoir under a dynamic head of 165 pounds. The engines are very heavily constructed, the diameter of the water cylinder being 16¼ inches and the length of the stroke being 33 inches. The valve area of both the suction and discharge valve decks is 55 per cent. of the area of the plungers. The engine beds are of the Tangye type, very heavy, with cast steel cross heads, adjustable slides, and very heavy connecting rods and stub ends. The shafts are of hammered steel, 11½ inches in diameter. The pumps are driven by mortise spur gears with 18-inch face. The weight of each pumping engine is upward of 60 tons. Each water cylinder takes its supply through a 16-inch suction pipe from the forebay, having a head of about ten feet of water on the suction valve, and discharges through two 18-inch discharge pipes into one 24-inch main, which leads to the reservoir. Each discharge box is provided with a large air chamber, and the whole pumping engine is provided with all the necessary appurtenances and trimmings required for its complete operation. There are two in use at Austin, Texas.

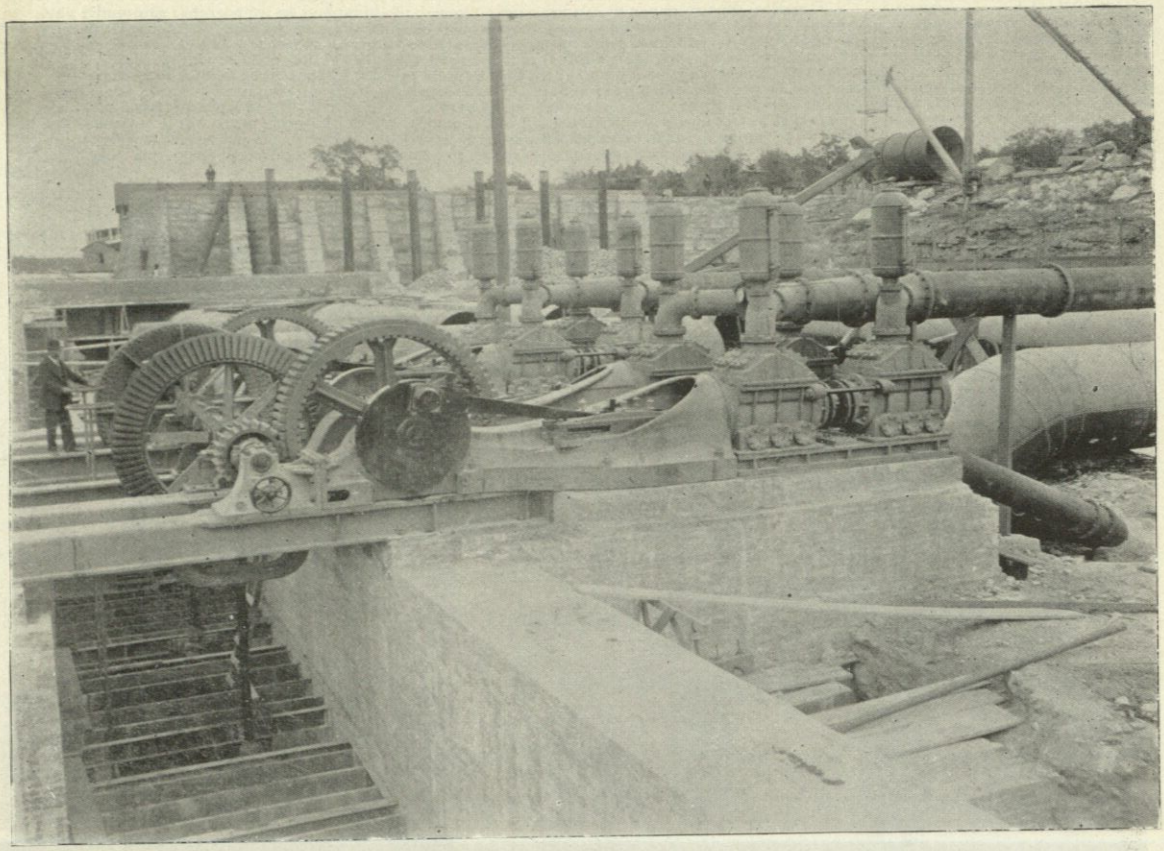


Fig. 57.—The above illustration is made from a photograph of the Power Pumping Engines referred to in the descriptive matter under Fig 56, after they had been placed in position, but before the completion of the Pumping Station.

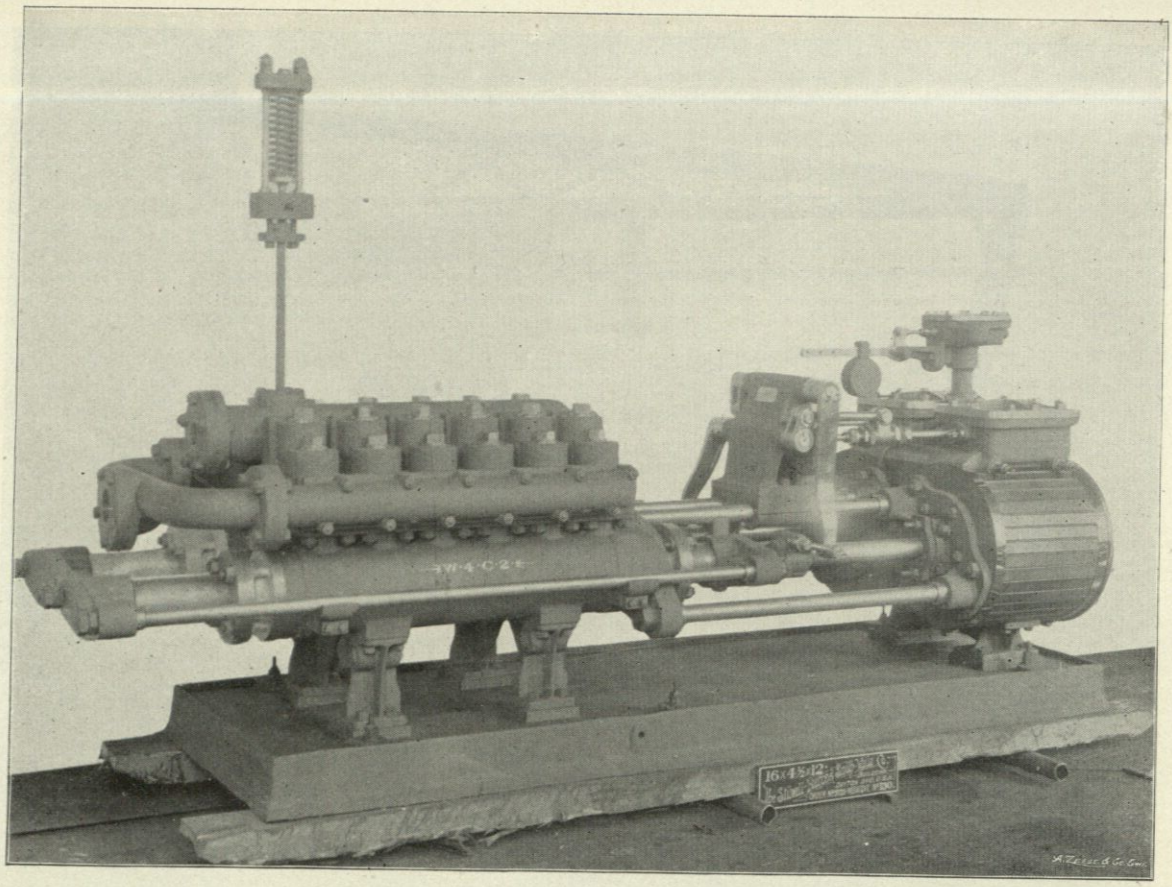


Fig. 59.—Smith-Vaile Heavy Pressure Duplex Plunger Pump. Outside packed for accumulator service. Built to run Hydraulic Crane in Machinery Hall, World's Fair, Chicago, Ill.

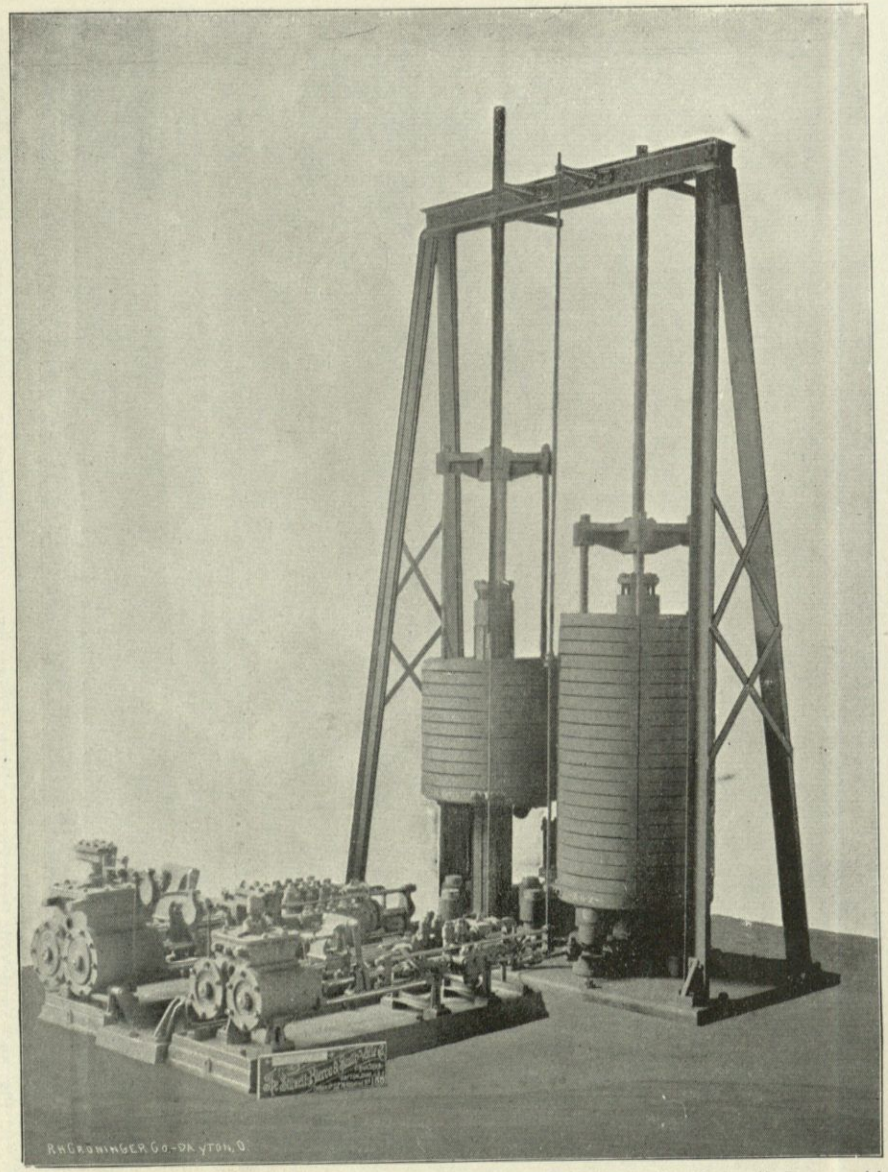


Fig. 60. High and Low Pressure Accumulators and Smith-Vaile Duplex Hydraulic Pumps, with Automatic Regulators, furnished the American Glucose Co., Peoria, Ill.

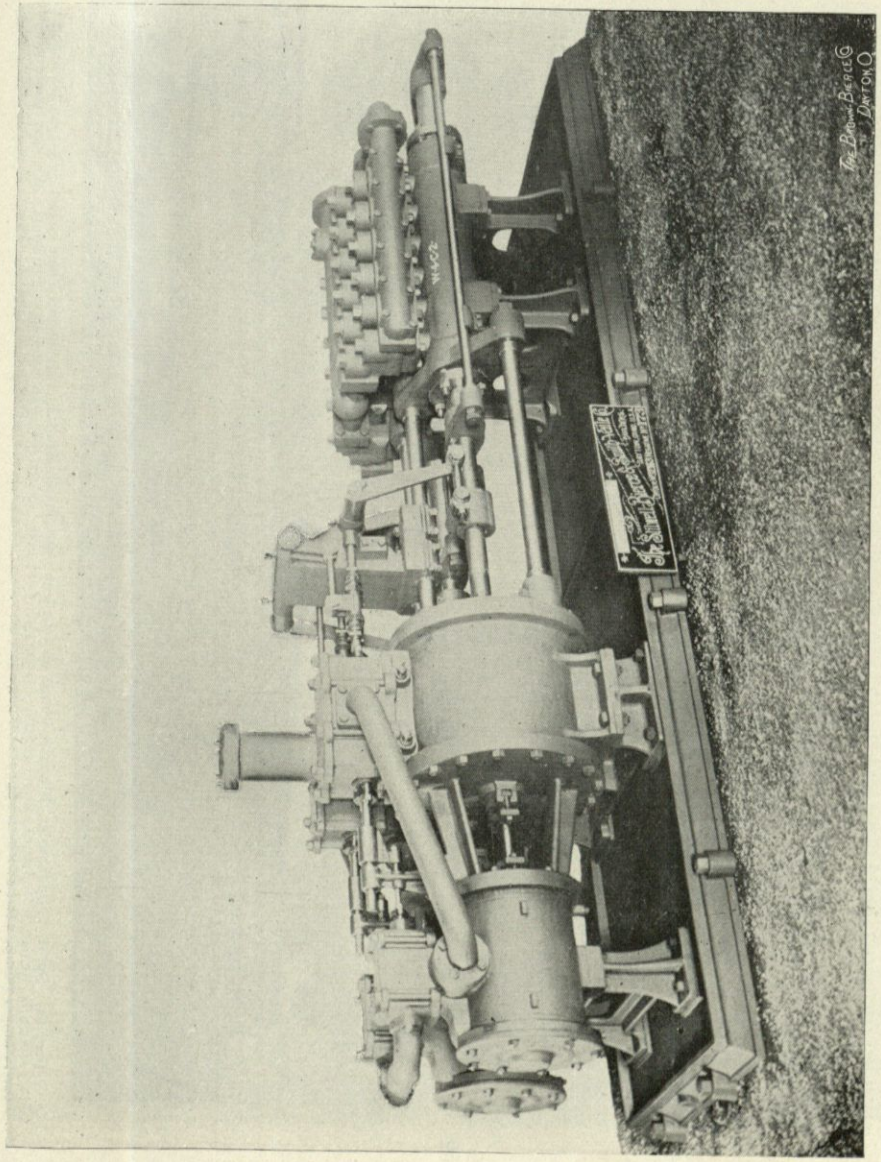


Fig. 64. Smith-Vaile Compound High Pressure Pump, for elevator service.

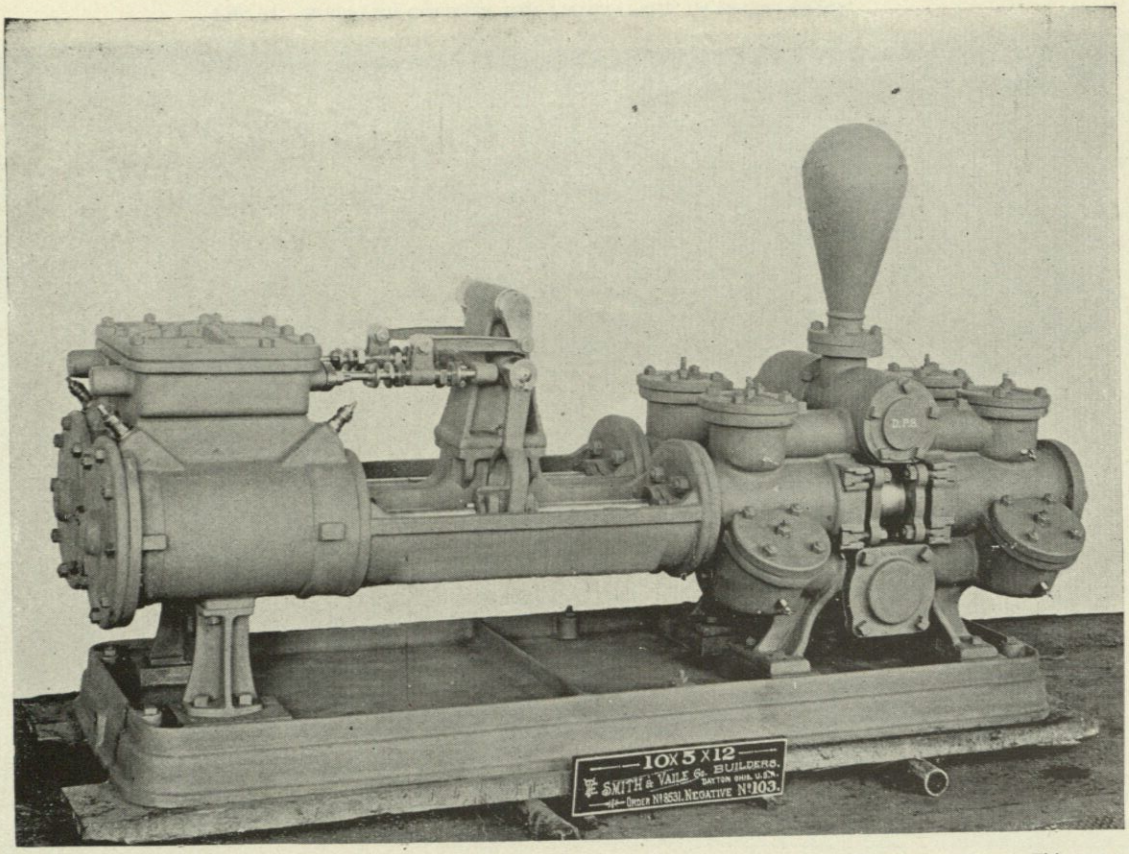


Fig. 61. Smith-Vaile Duplex Plunger Pump, on cast iron base, fitted with ball valves and large water passages. This pump is especially designed to handle heavy matter—sewerage, peat, etc. Also for heavy pressure filtration. We also make a boiler feed plunger pump, a list of which appears on page 20.

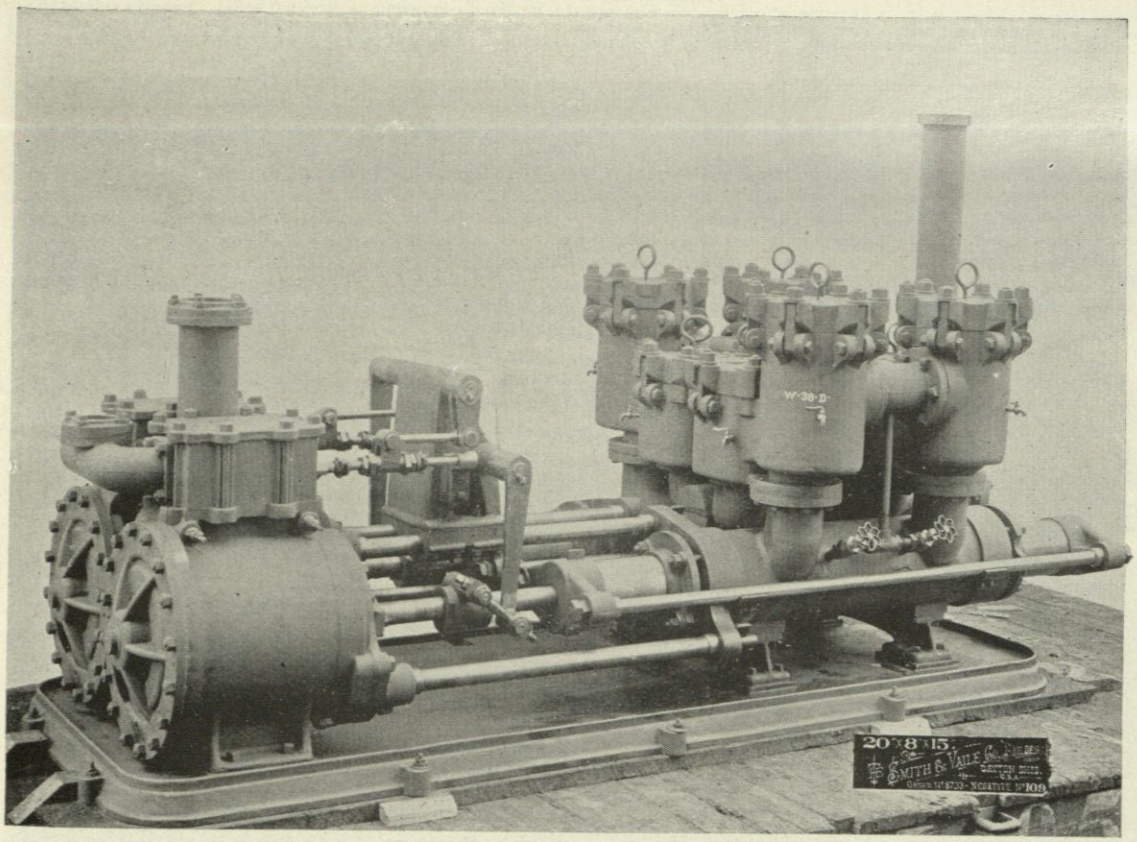


Fig. 62. This Pump is suitable for mining work where it is necessary to pump against heavy pressure; also where water is gritty or muddy. The packing is adjustable from the outside, and valves can be readily exposed for examination by removing covers. We mount this pump on cast-iron base. This insures perfect alignment under all conditions. Largely used in the Lake Superior Copper and Iron Mines.

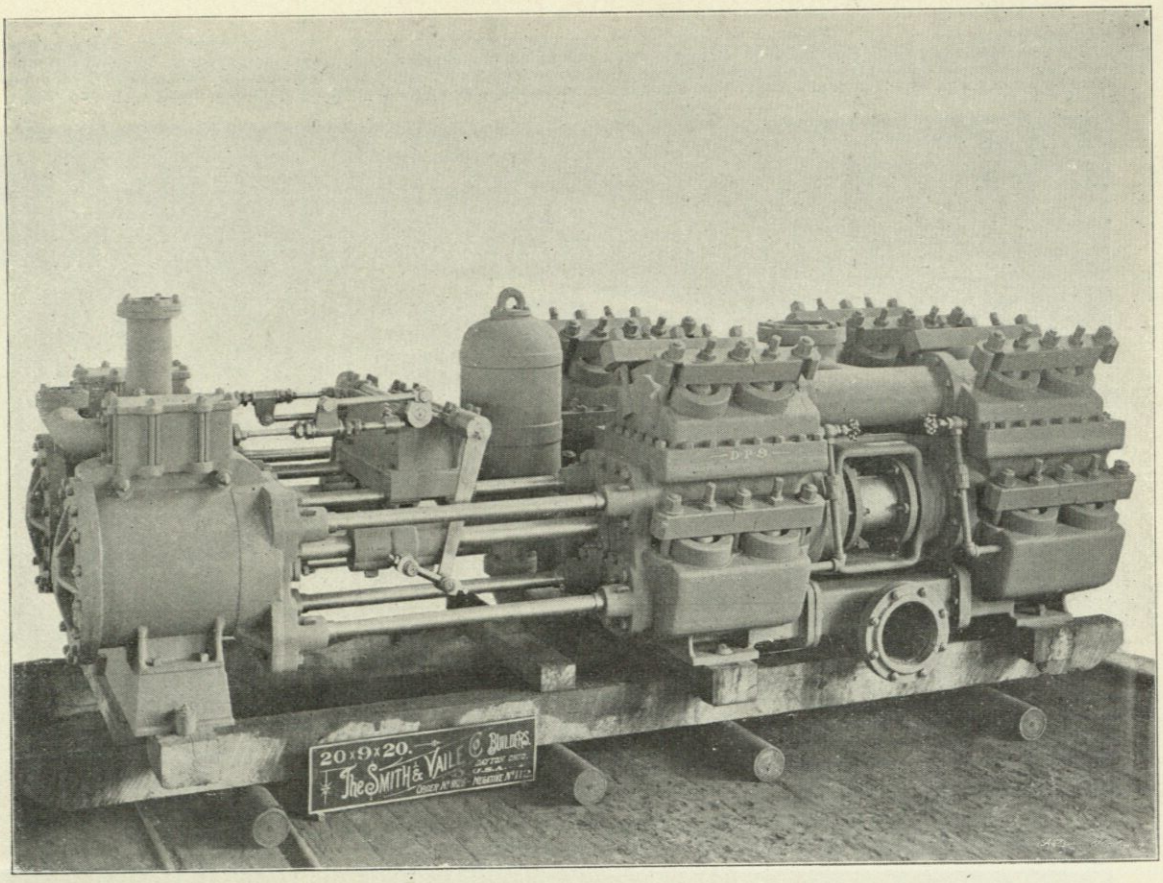


Fig. 63. Smith-Vaile Duplex Emergency Pump, Plunger Pattern. This special mining pump is constructed to run at very high speeds and against light or heavy pressure; also where water is very gritty. The packing is adjustable from the outside, and valves can be readily exposed. When required we mount this pump on cast iron base or wrought iron I beams. This insures perfect alignment under all conditions, and pumps can be moved quickly from one station to another.

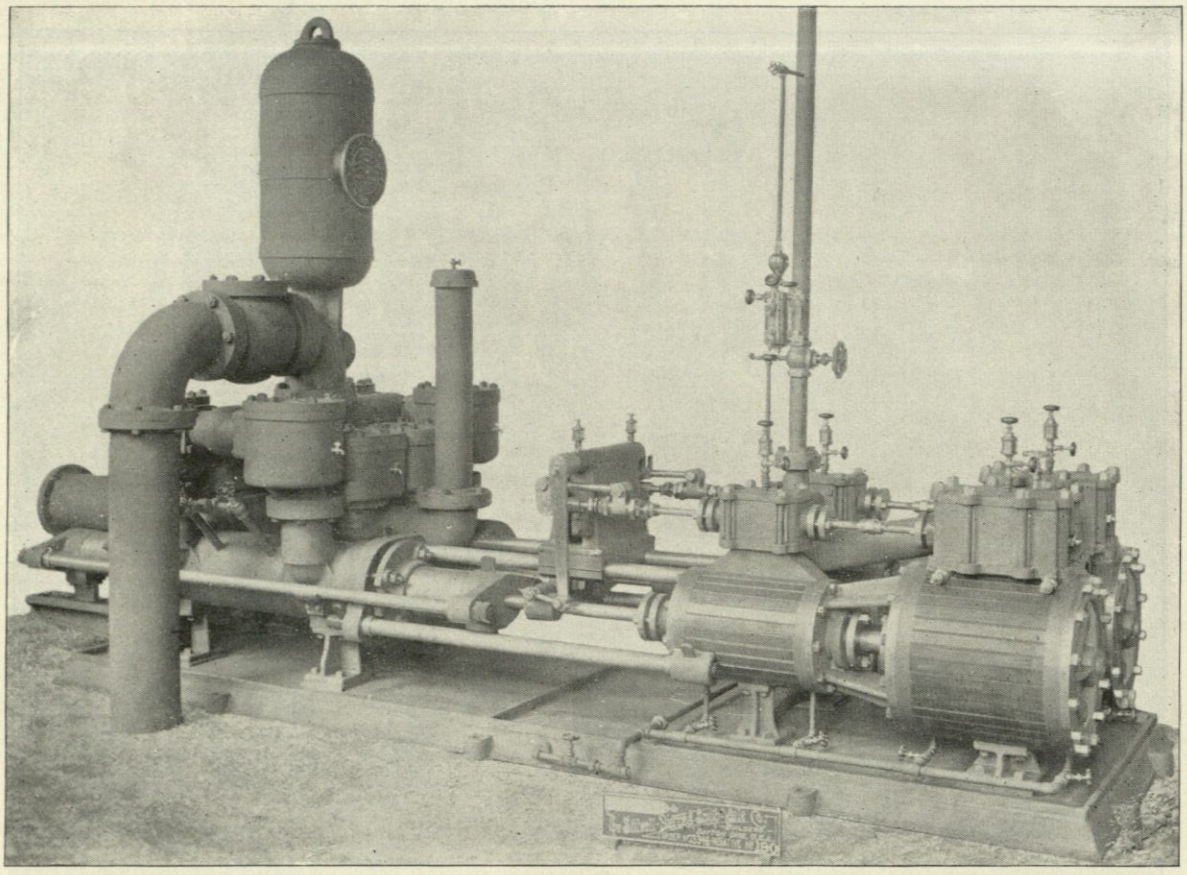


Fig. 65. Smith-Vaile Compound Duplex Pumping Engine, with the high pressure cylinders inboard and with outside packed plungers It is especially adapted for heavy pressures.

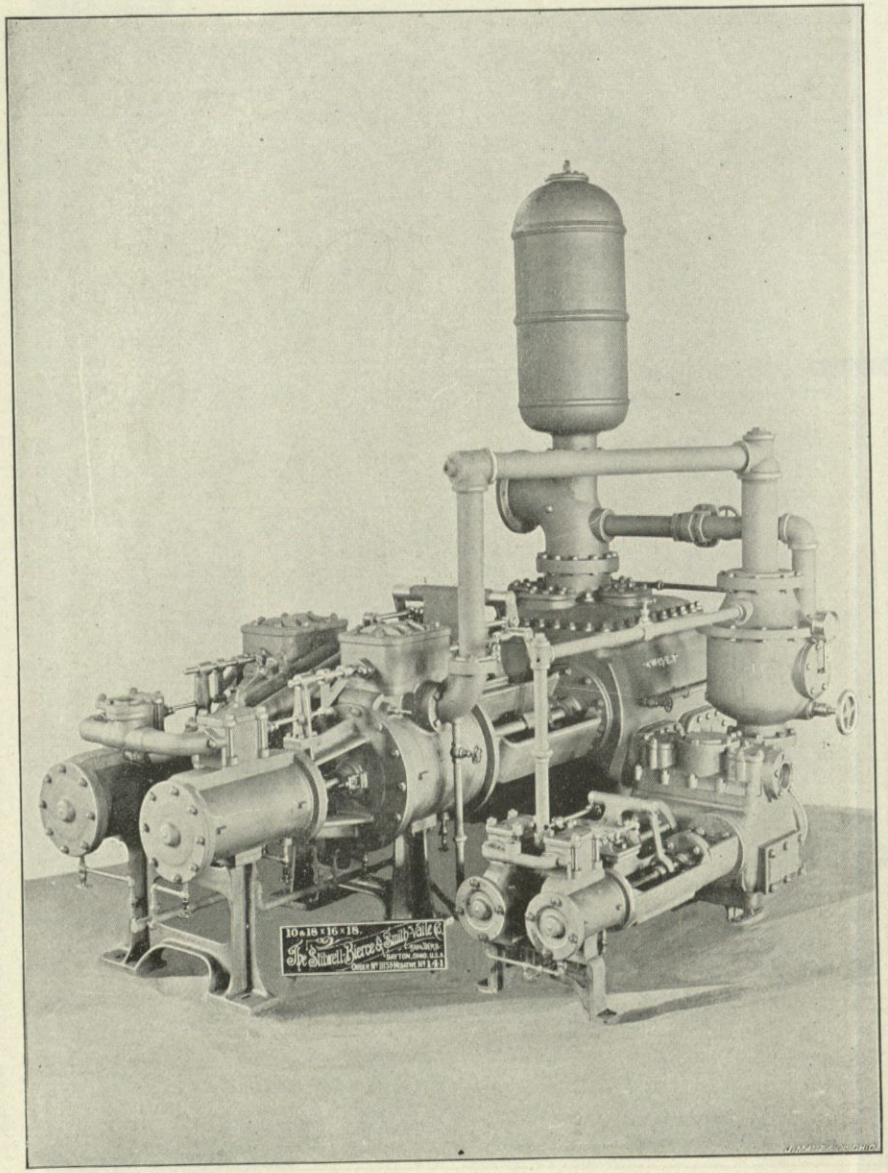


Fig. 66.—Smith-Vaile Compound Duplex Pumping Engine, with Independent Air Pump and Condenser, complete

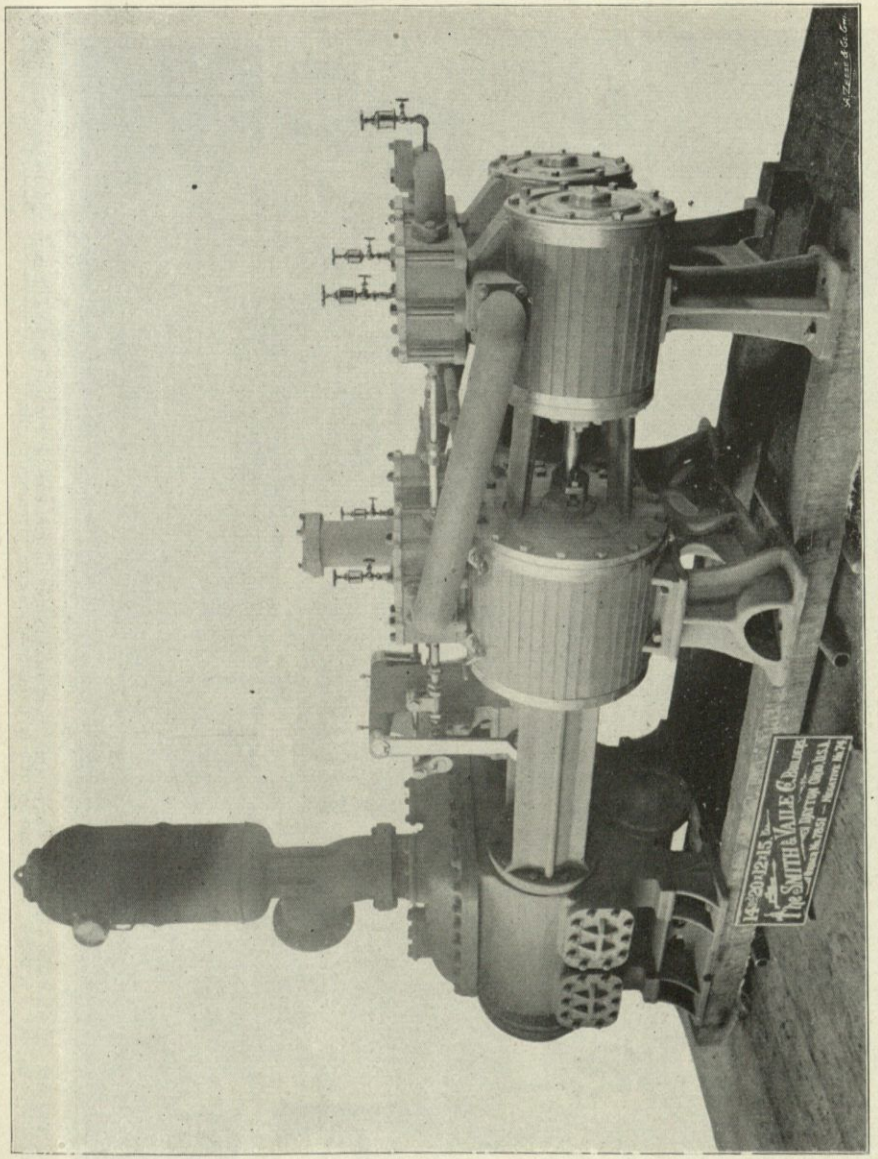


Fig. 67.—The Smith-Vaile Compound Duplex Pumping Engine. This pump is most effective where nearly constant duty is required, such as Hydraulic Elevators, Water Supply for small cities, Asylums and large factories. An effective Fire Pump is secured by the use of our Improved High Pressure Steam Connection to the low pressure cylinder, to be used in case of emergency against increased pressure and speed. Capacity one and one-half million gallons per 24 hours.

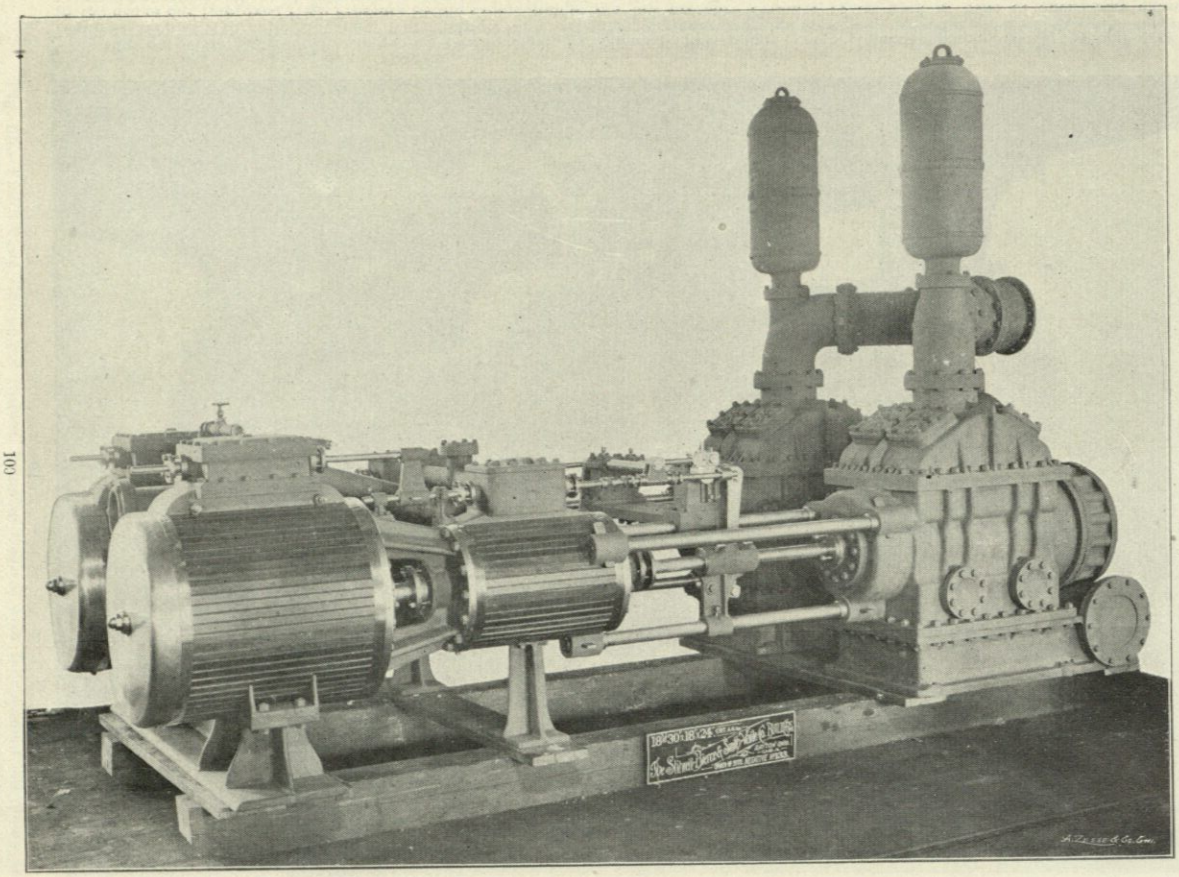


Fig. 68.—Smith-Vaile Compound Condensing Pumping Engine. Inside Packed Plunger Pattern of improved design. Capacity four million gallons in 24 hours. Two built for The St. Louis Stamping Co., Granite City, Ill.

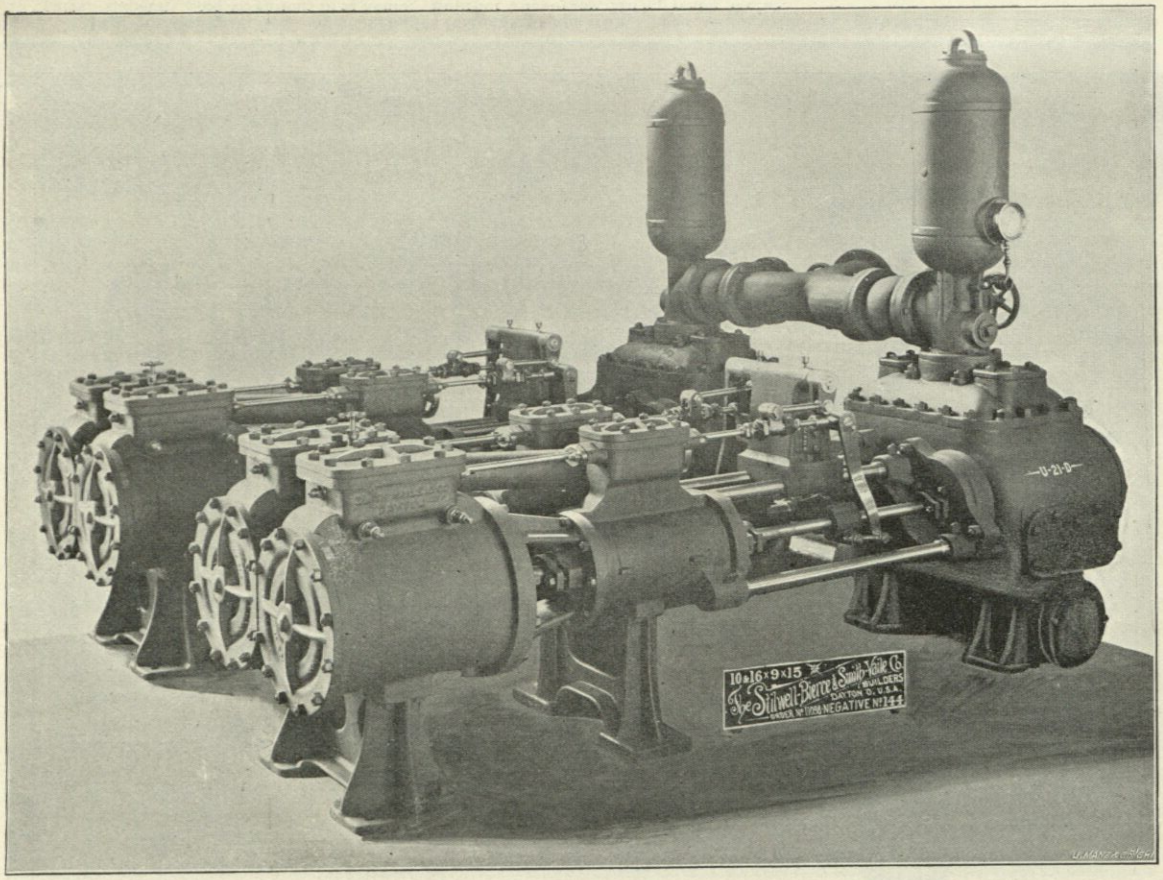


Fig. 69.—Smith-Vaile Compound Duplex Pumping Engines, built for Rochester, Ind., Water Works, and so arranged that either pump can be operated independent of the other. Combined capacity 1,500,000 gallons in 24 hours.

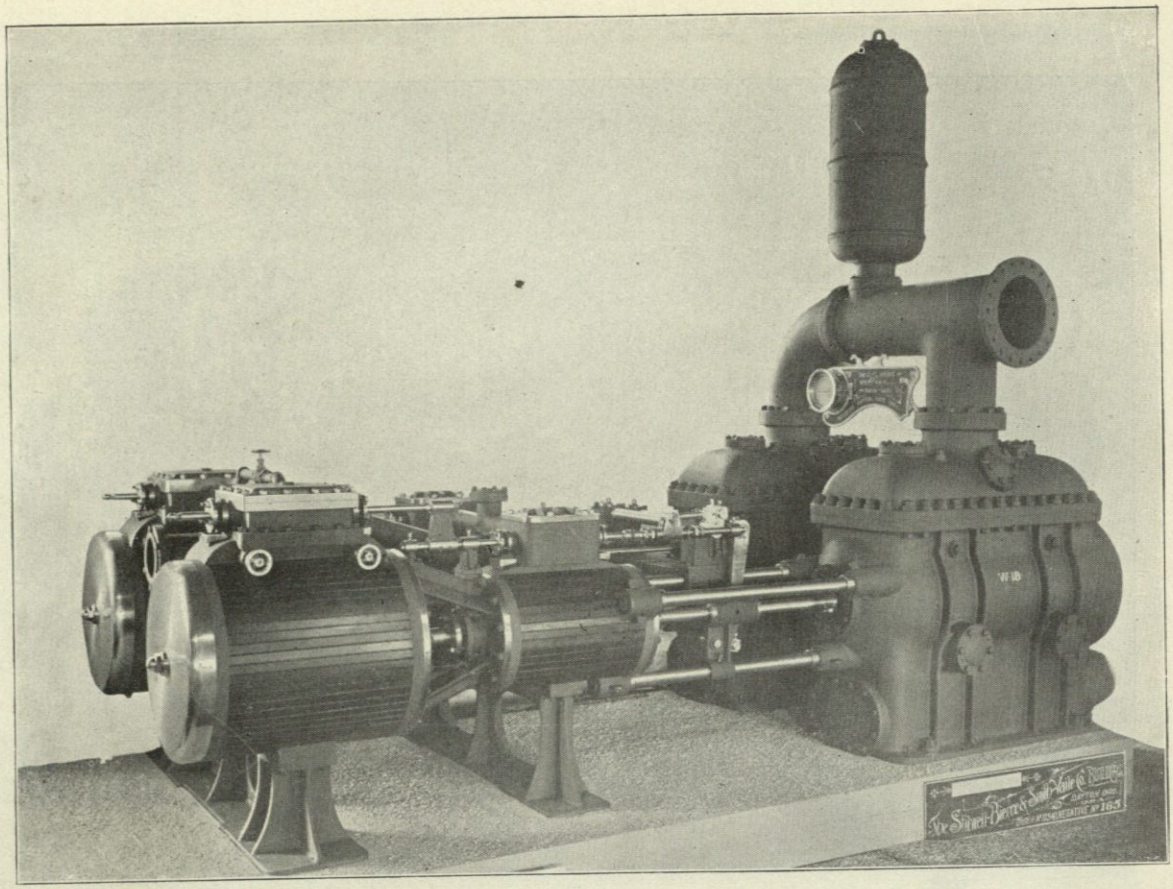


Fig. 70.—Smith-Vaile Compound Duplex Pumping Engine with lagged steam cylinders, polished cylinder heads and working parts. Capacity 4,000,000 gallons in 24 hours. Built for Cheboygan, Mich., Water Works.

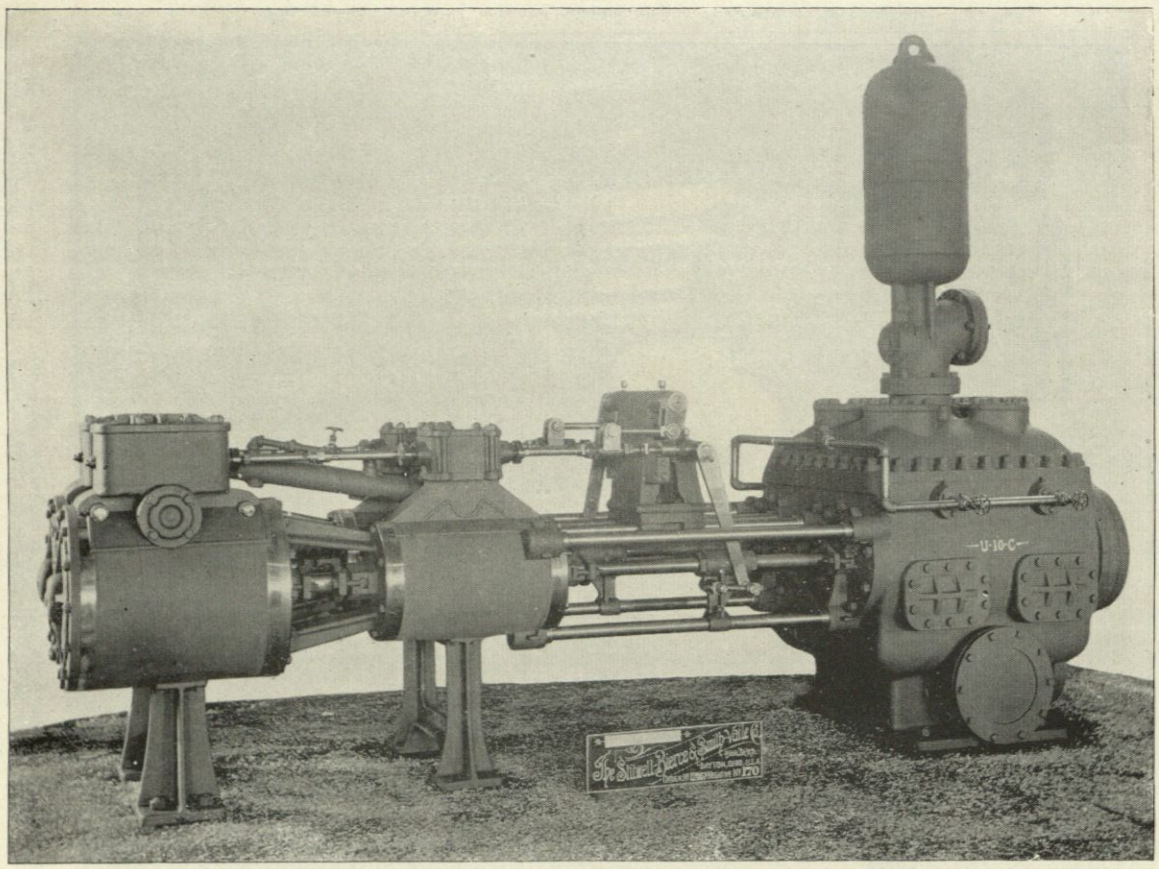


Fig. 71.—"Smith-Vaile" Direct Acting Compound Duplex Pump for Handling Brine.

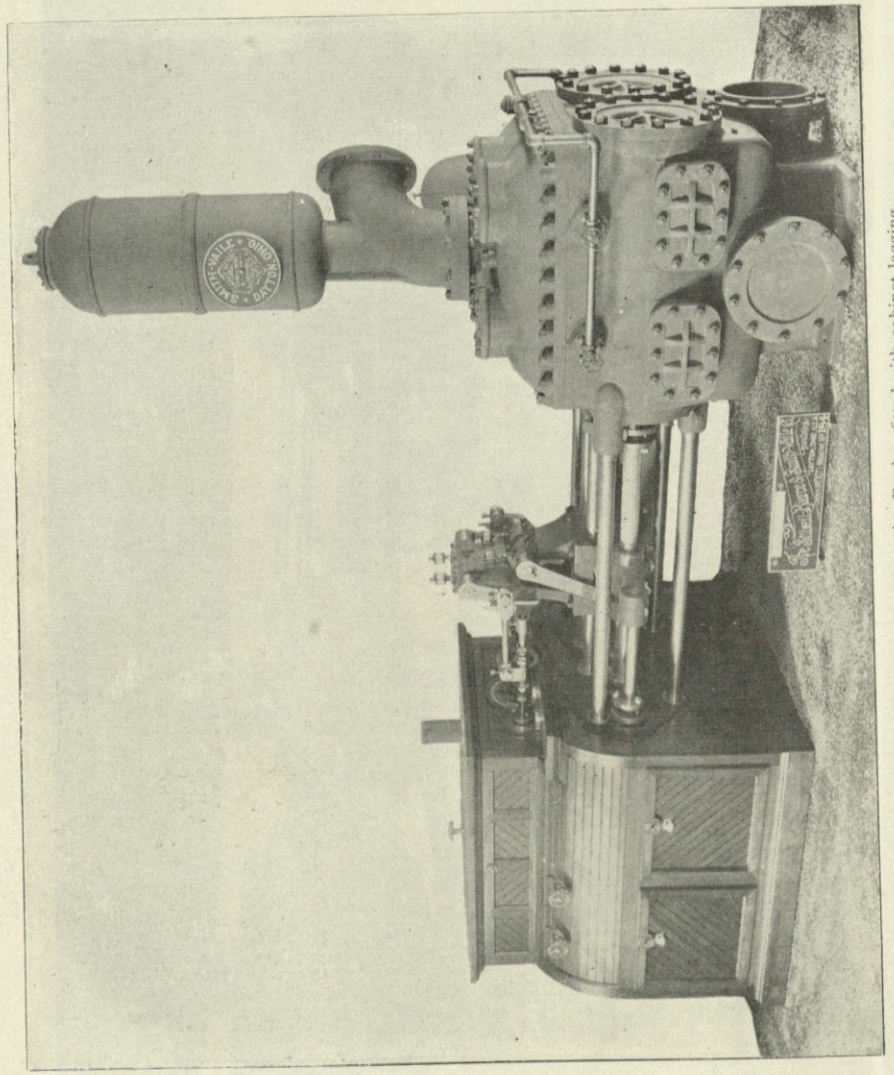


Fig. 72.—Smith-Vaile Compound Pumping Engine, fitted with cabinet lagging.

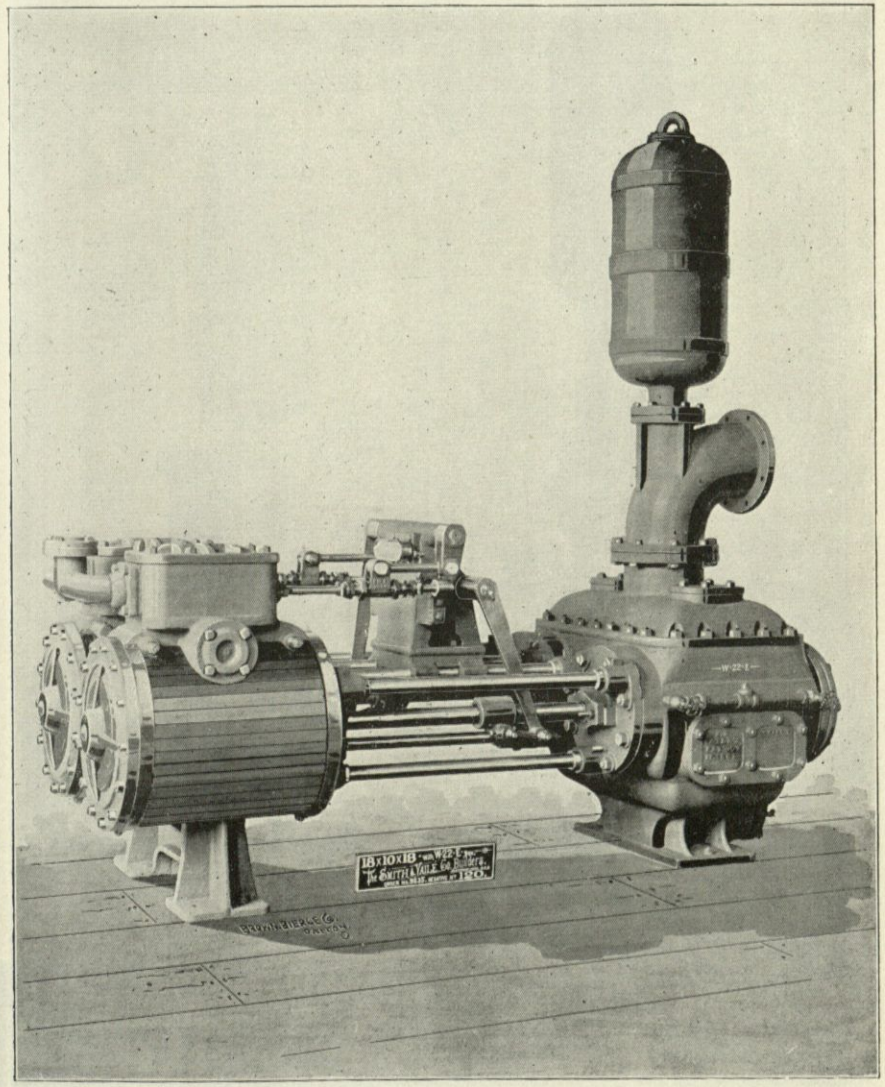


Fig. 73.—The Smith-Vaile Duplex Pumping Engine, with stretcher rods, walnut lagging and polished work. We build a great many of these pumps for water works service in towns and villages. They give excellent satisfaction.

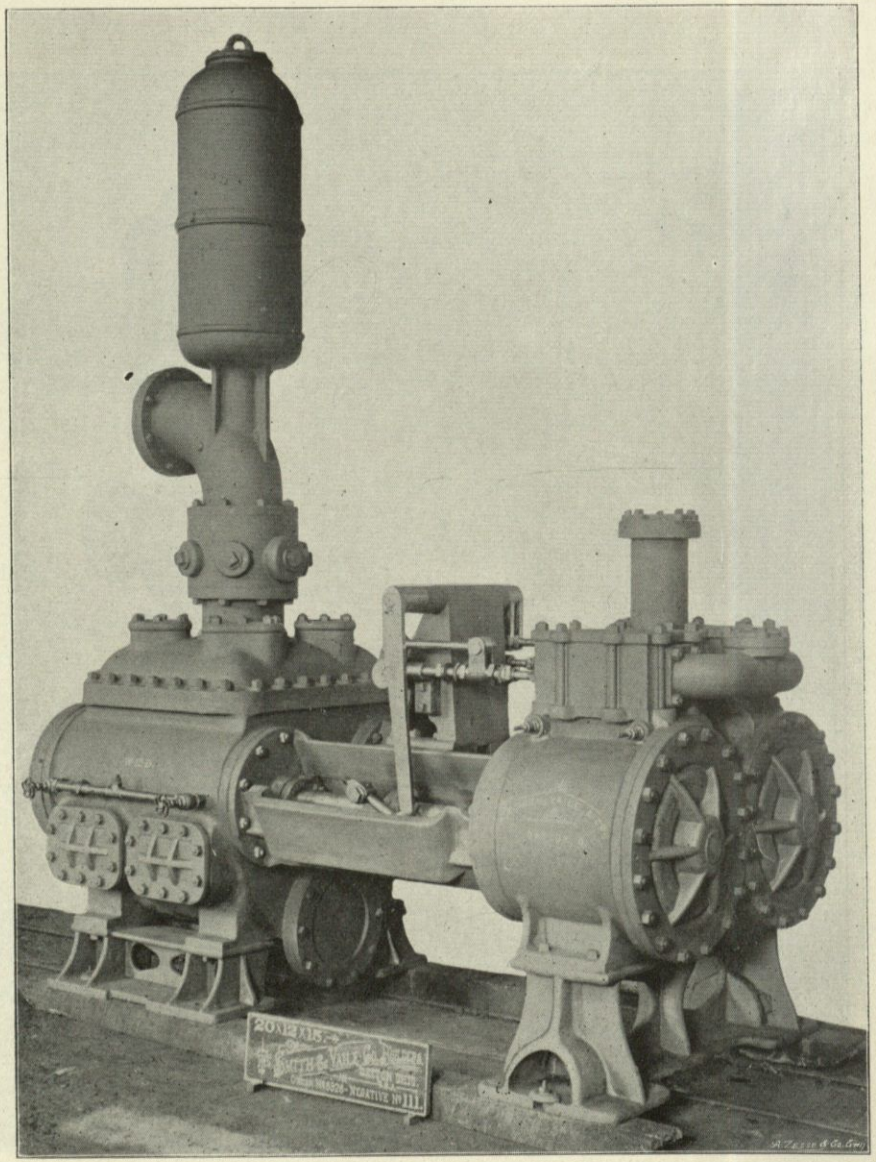


Fig. 74.—The Smith-Vaile Duplex Pumping Engine. Piston Pattern. Fitted with our Removable Water Cylinder and Steam Valve Motion, adjustable from the outside. Furnished to many small towns for water supply. Capacity 1,500,000 gallons per 24 hours.

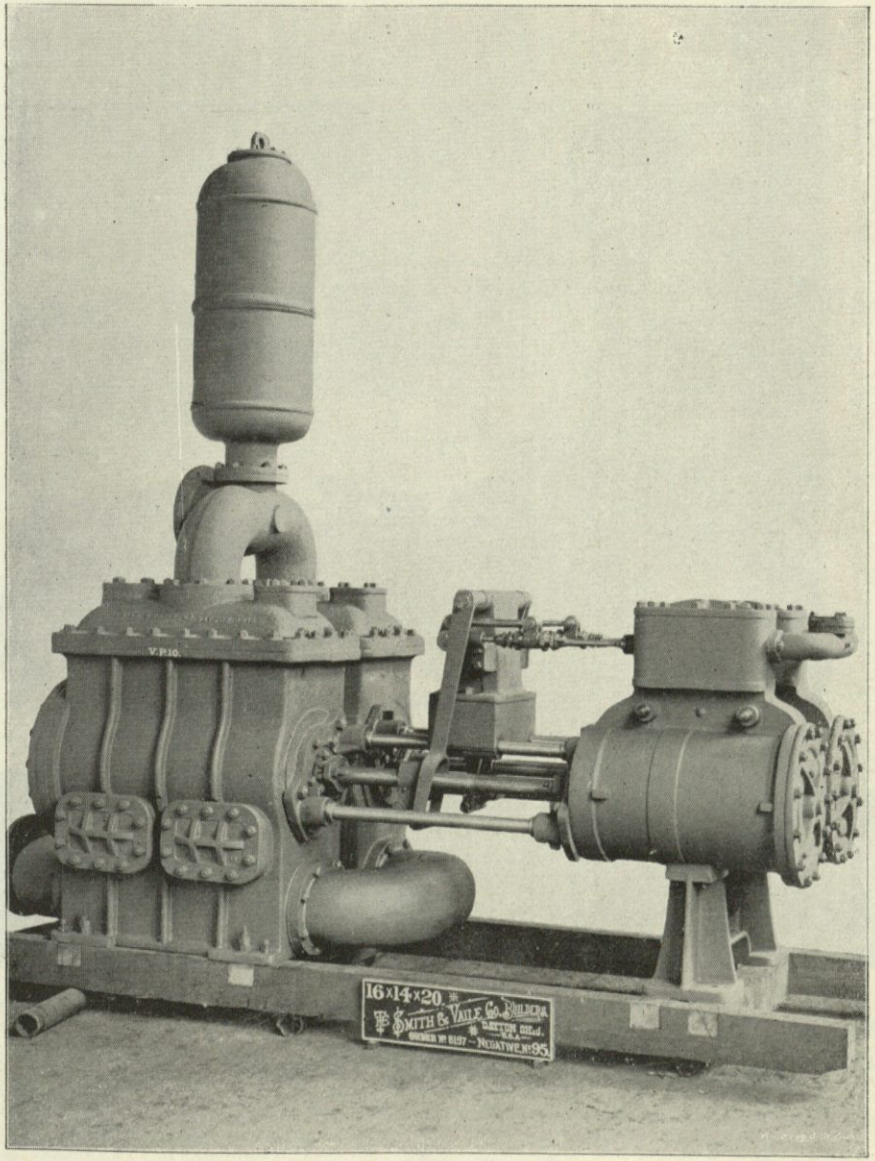


Fig. 75.—The Improved Smith-Vaile Duplex Pump, Piston Pattern. This pump is fitted with our Patent Removable Cylinder. For tank and reservoir. Capacity 2,000,000 gallons per 24 hours.

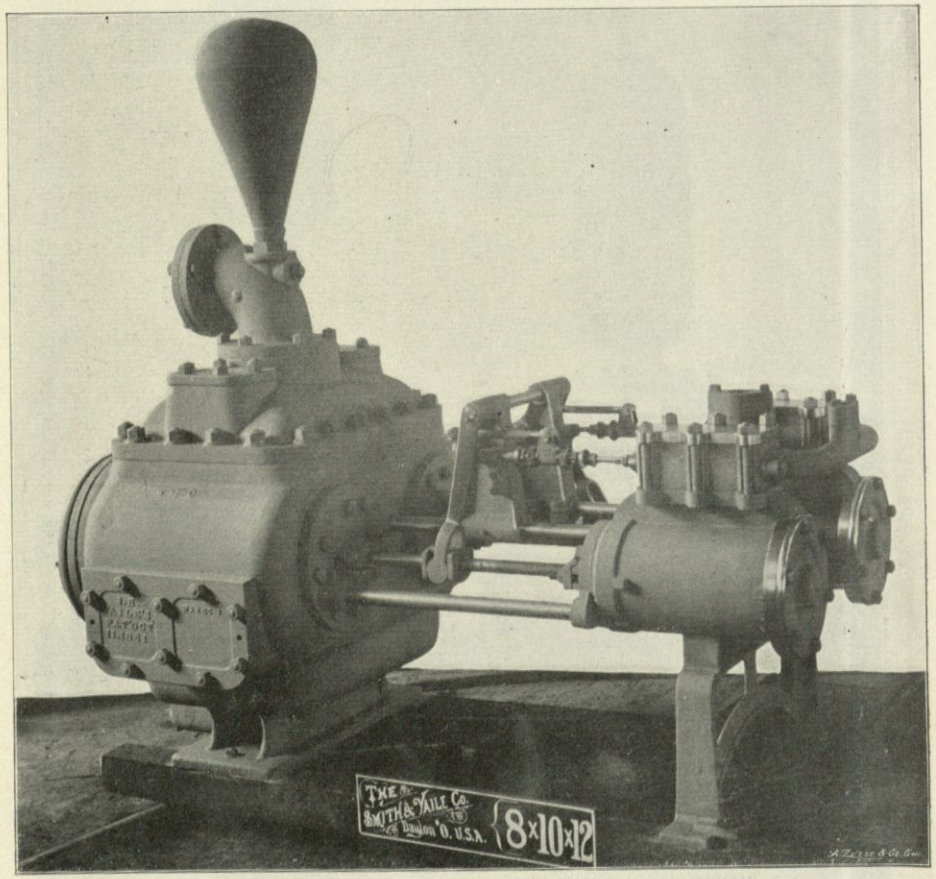


Fig. 76.—The Smith-Vaile Improved Duplex Low Service Pump. Arranged for Railway Water Stations, Quarries, Tanks, etc.

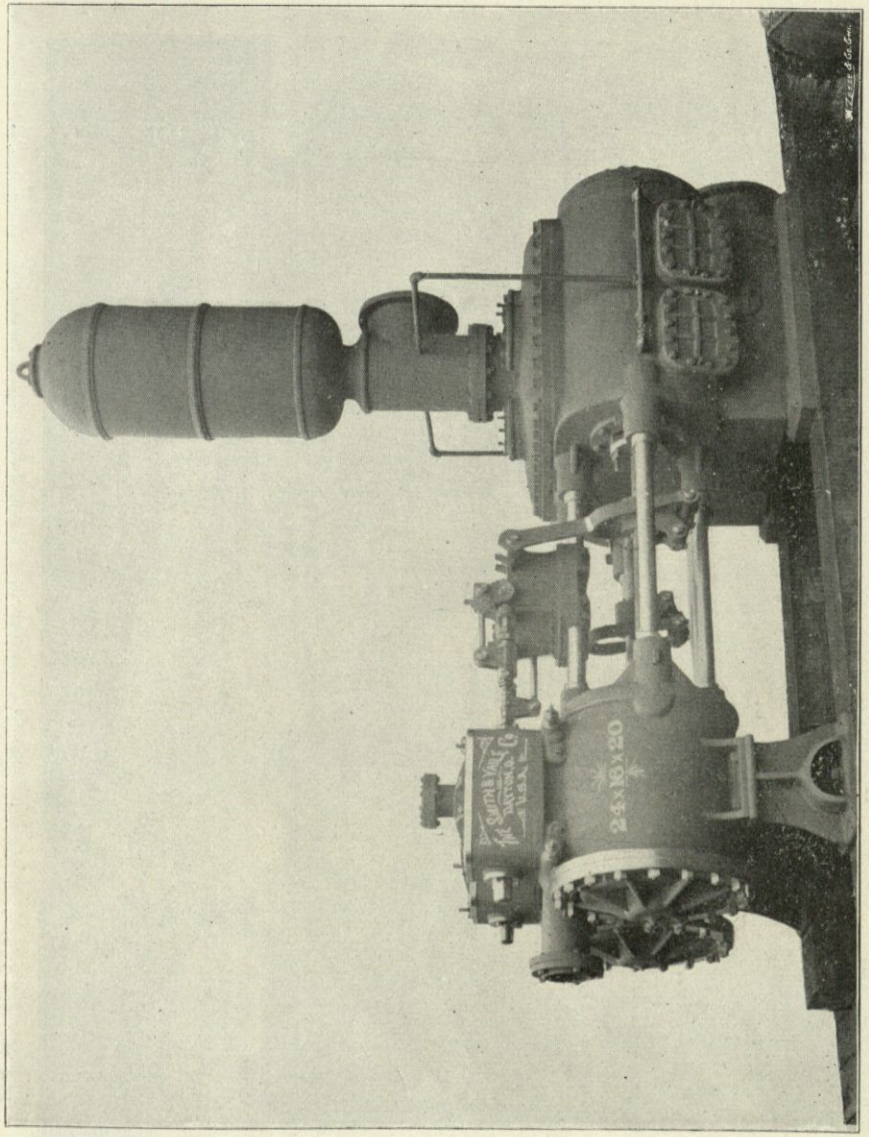


Fig. 77.—The Smith-Vaile Duplex Pump, with long stroke. Where large quantities of water are desired in a short space of time, against either high or low pressures, this pump is very efficient. Is especially adapted to Water Works, Hydraulic Elevators, etc.

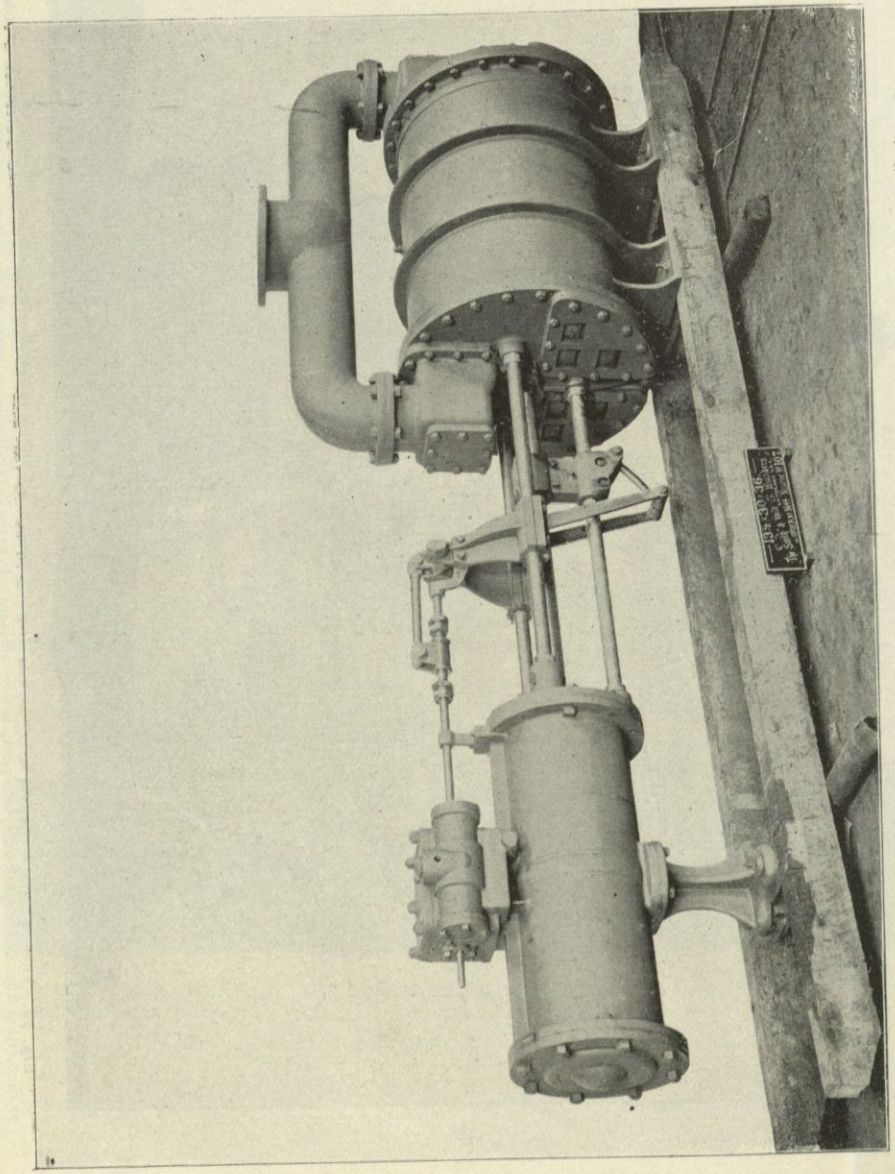


Fig. 78.—The Smith-Vaile Direct Acting Low Pressure Air Blower, for Oil Refineries, Blast Furnaces, ventilating, etc.

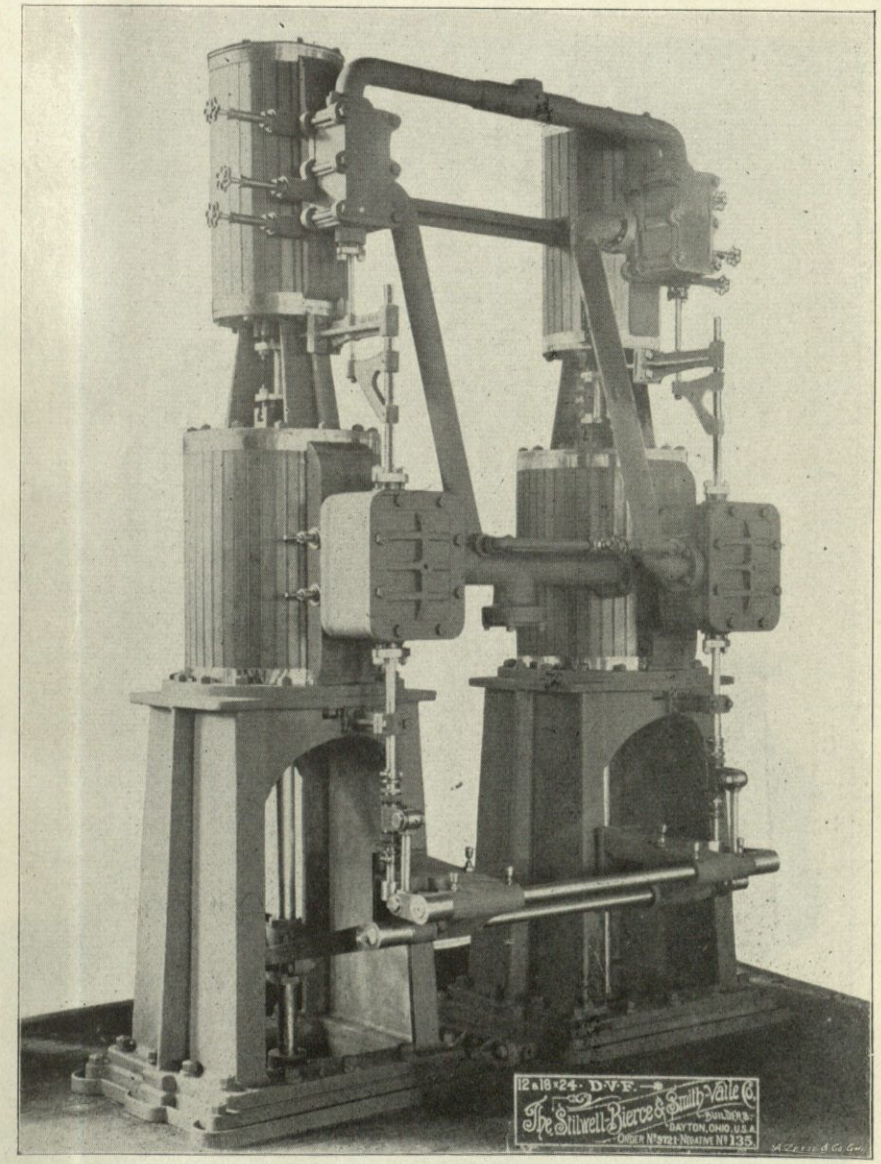


Fig. 79.—Smith-Vaile Vertical Compound Condensing Engine, connecting below the floor line to our Duplex Outside Packed Differential Plunger Pump.
Furnished to The St. Louis Stamping Co., Granite City, Ill.

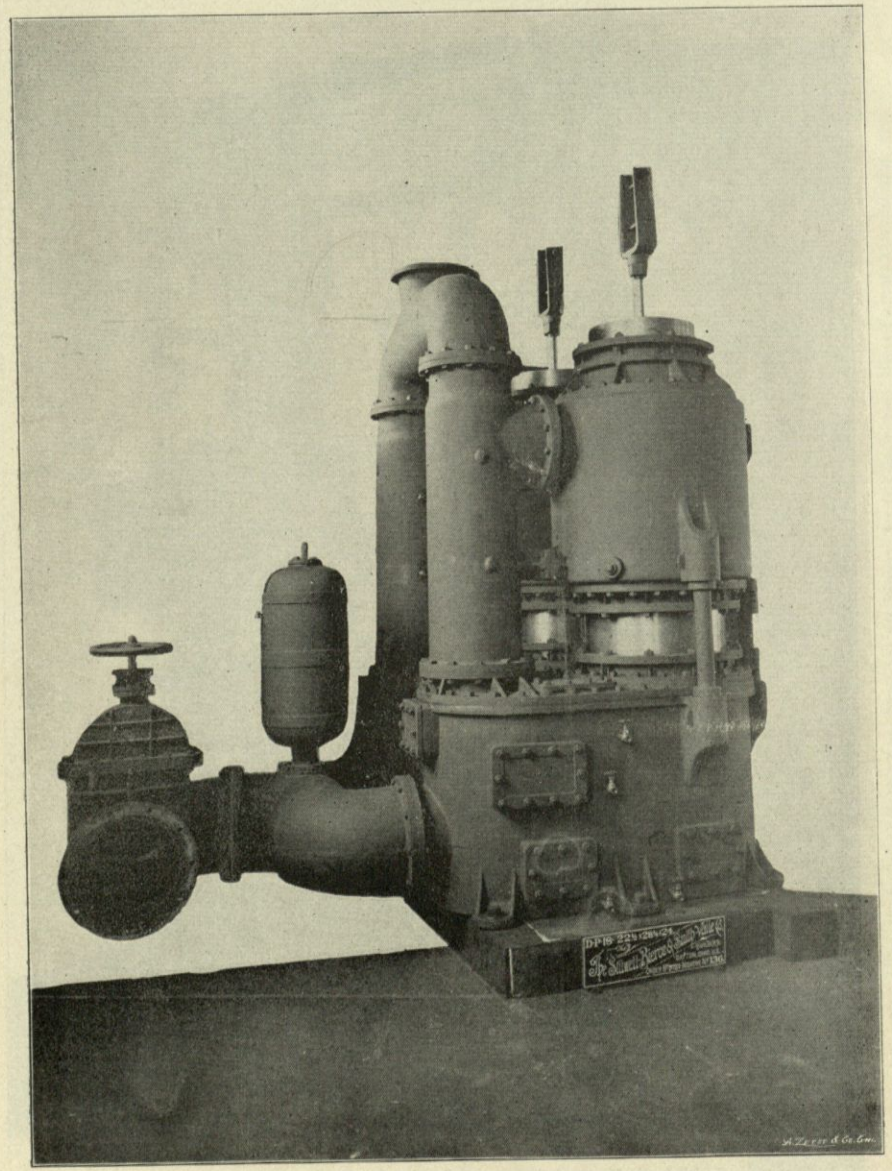


Fig. 80.—Smith-Vaile Vertical Duplex Outside Packed Differential Plunger Pump connecting to Compound Vertical Condensing Engine.
Furnished to The St. Louis Stamping Co., Granite City, Ill.

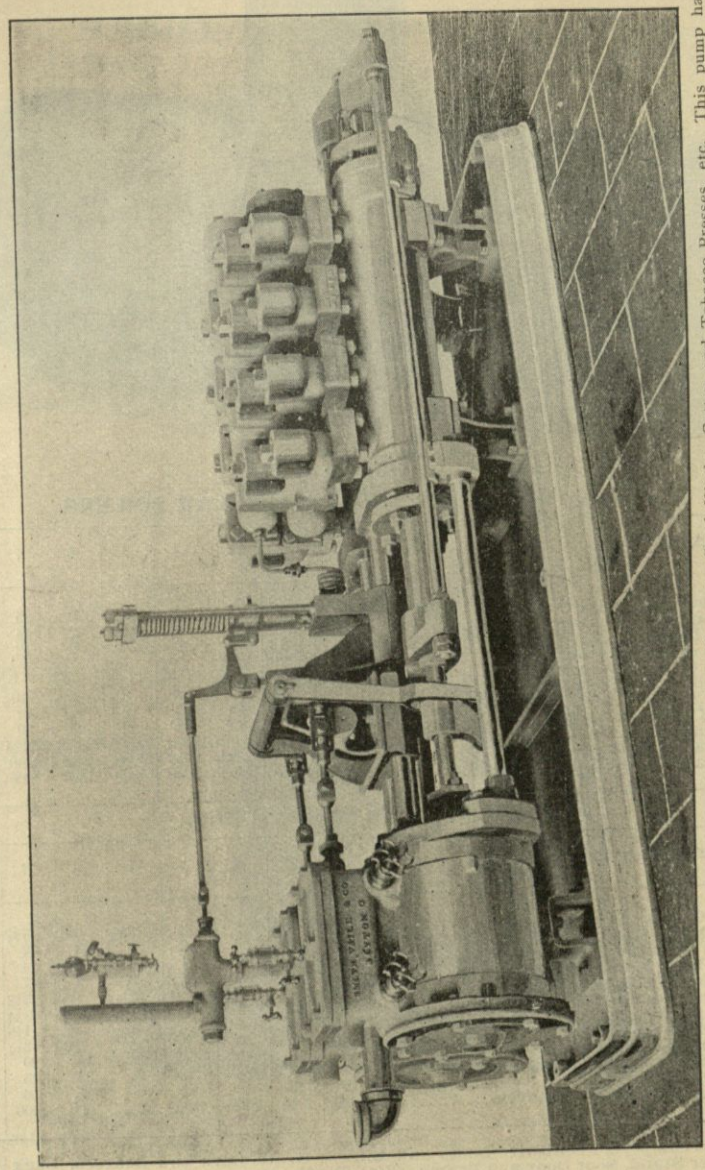


Fig. 81.—The Smith-Vaile Duplex Hydraulic Pressure Pump, for Steel Works, Cotton and Tobacco Presses, etc. This pump has Improved Valve Connections and Automatic Regulator, arranged to maintain any required pressure.
Furnished two of these pumps to the U. S. Dynamite Cruiser, "Vesuvius."

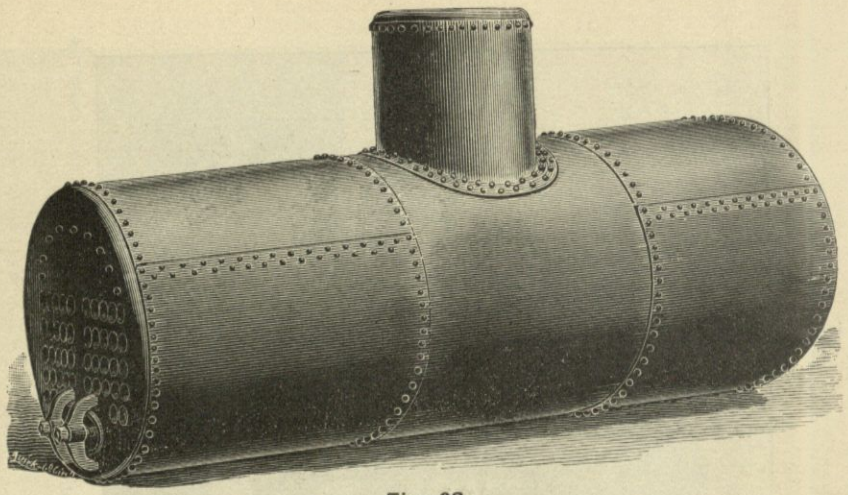


Fig. 82.

SPECIFICATIONS OF STANDARD TUBULAR BOILERS.

NUMBER OF SIZE	1	2	3	4	5	6	7	8
Horse-Power	10	12	15	20	25	30	35	40
Diameter in inches	32	34	36	36	40	42	44	44
Length in feet	8	8	8	10	10	12	12	14
Thickness of shells in inches	¼	¼	¼	¼	¼	¼	¼	¼
Thickness of Head in inches	⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜
Diameter of Tubes in inches	3	3	3	3	3	3½	3½	3½
Length of Tubes in feet	8	8	8	10	10	12	12	14
Number of Tubes	14	16	22	24	28	25	30	30
Size of Dome in inches	15x15	15x15	18x18	18x18	20x20	22x22	24x24	24x24
Approximate weight of Boiler	1940	2136	2388	2650	3200	4000	4450	5000
Approximate weight of Boiler and Fixtures	4250	4600	4765	5000	5800	7300	7900	8800

SPECIFICATIONS OF FIXTURES.

NUMBER OF SIZE OF BOILER	1	2	3	4	5	6	7	8
Length of Grates in feet	3	3	3	3	3½	3½	3½	4
Width of Grates in inches	30	36	36	36	36	42	42	42
Number of Wall Binding Bars	4	4	4	4	4	4	4	6
Length of Wall Binding Bars in feet	6	6	6	6	6	6	7	7
Size of Safety Valve in inches	1½	1½	2	2	2	2½	2½	3
Size of Check and Stop Valve in inches	1	1	1	1	1¼	1¼	1¼	1¼
Size of Blow-off Valve in inches	1¼	1¼	1¼	1¼	1½	1½	1½	1½
Size of Whistle in inches	3	3	3	3	3	3½	3½	3½
Diameter of Stack in inches	12	14	15	15	16	18	20	20
Length of Stack in feet	28	28	28	30	35	35	35	40
Number of Iron in Stack	16	16	16	16	16	16	16	16
Approximate Weight of Fixtures	2000	2000	2000	2000	2100	3500	3500	3500

Fixtures comprise Front with Doors and Liners, Grate Bars and Bearers, Back Wall Plate, Boiler Stand, Soot Door and Frame. Wall Binding Bars with Anchor Rods, Smoke Stack and Guy Rods (four times length of stack).

Fittings comprise Combination Gauge, Water Column with Steam Gauge, Glass Water Gauge and Gauge Cocks, Safety Valve, Check Valve, Stop Valve, Blow-off Cock, Whistle.

SUBMERGED TUBE VERTICAL BOILERS.

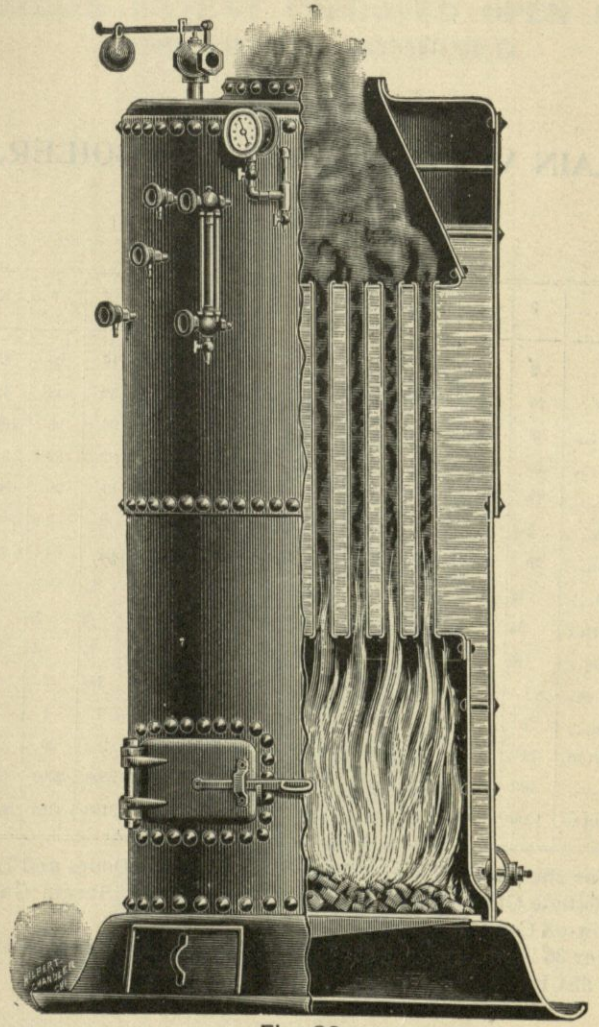


Fig. 83.

These Boilers are made of the "*Best Charcoal Hammered Iron*," No. 1, with fire box flange iron in the furnace and heads.

PLAIN VERTICAL TUBULAR BOILER,

Vertical Seams Double Riveted.

NUMBER.	0	1	2	3	4	5	6	7	8	9	10	11	12
Horse-Power	3	4	5	6	8	10	12	14	16	20	25	30	35
Diameter in inches	20	24	24	26	30	30	36	36	36	42	42	42	48
Height in inches	48	50	60	60	60	72	72	84	96	96	108	120	96
Height of Fire Box	23	25	25	25	25	25	25	28	32	32	32	34	34
Number of Tubes	18	31	31	37	49	49	61	61	61	79	85	91	138
Diam. of Tubes, in.	2	2	2	2	2	2	2	2	2	2	2	2	2
Length of Tubes, in.	25	25	35	35	35	47	47	56	64	64	76	86	
Thickness of Shell	¼	¼	¼	¼	¼	¼	¼	¼	¼	¼	¼	¼	¼
Thickness of Fire Box	¼	5/32	5/32	5/32	5/32	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16
Thickness of Heads	5/16	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	7/16	7/16	7/16	7/16
Size Safety Valve, in.	1	1	1¼	1¼	1½	1½	1½	1½	1½	2	2	2	2½
Size of Blow-off, in.	1	1	1	1	1	1	1	1	1	1	1	1¼	1½
Diameter of Stack, in.	11½	11½	11½	15½	15½	17	18	18	18	20	20	20	24
Weight of Boiler	700	800	1000	1100	1200	1400	1700	2000	2500	3200	3500	3800	4000
W't Boiler & Fixtures	1200	1300	1500	1600	1750	1900	2250	2650	3150	4100	4400	4700	5700

Fixtures for the above Boiler include Base, Grates, Doors and Hood.

Fittings include Glass Water Gauge, Gauge Cocks, Steam Gauge, Safety Valve and Blow-off Cock.

Boilers over 36 inches in diameter have shell extended 8 inches to form ash pit, and have flat bases.

STILWELL'S PATENT IMPROVED OPEN HEATER AND FILTER COMBINED.

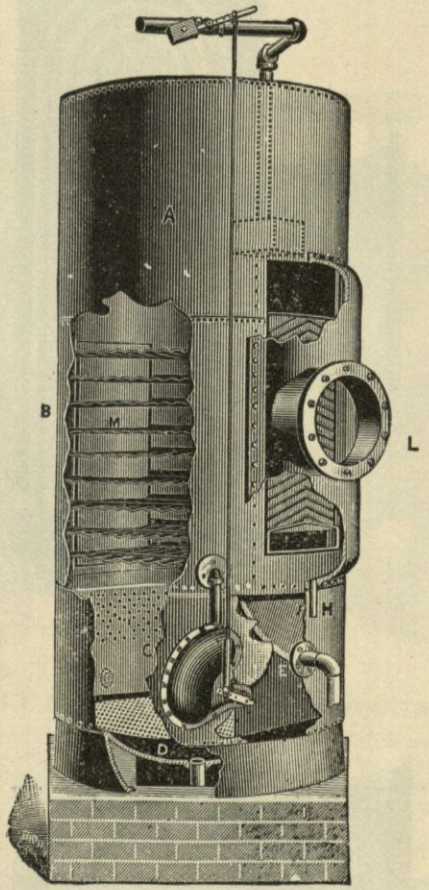


Fig. 84.—Patented April 29, 1890.

Extracts Lime and Magnesia. Separates Cylinder Oil from Exhaust Steam. Heats feed-water to boiling point. Indispensable to an Economical use of Steam. Illustrated Catalogue on application.

THE STILWELL-BIERCE & SMITH-VAILE CO.

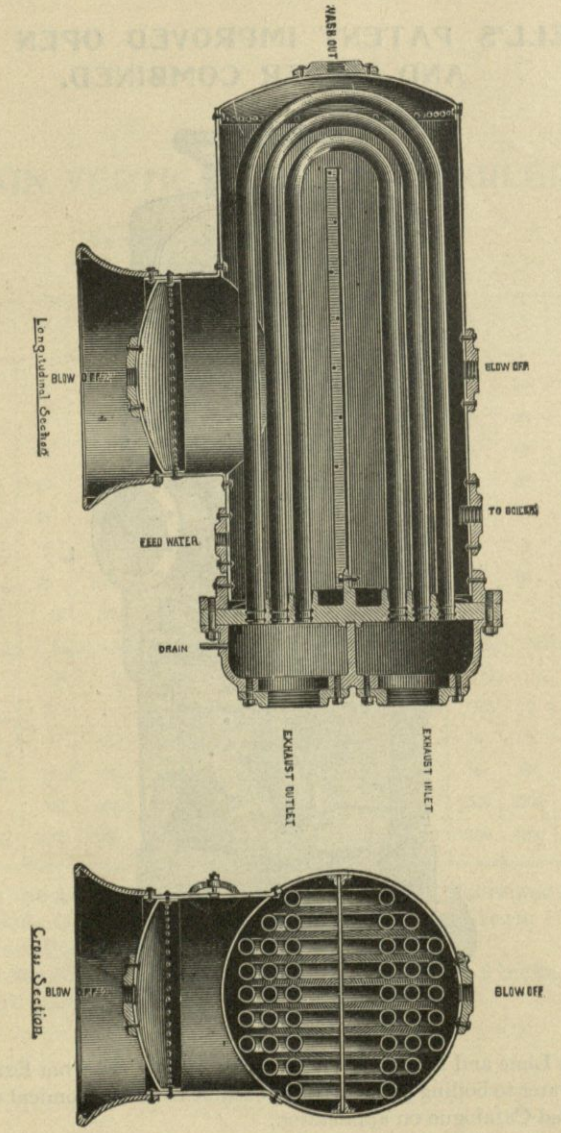


Fig. 85.

STILWELL'S PATENT CLOSE HEATER.

Patented May 31, 1892.

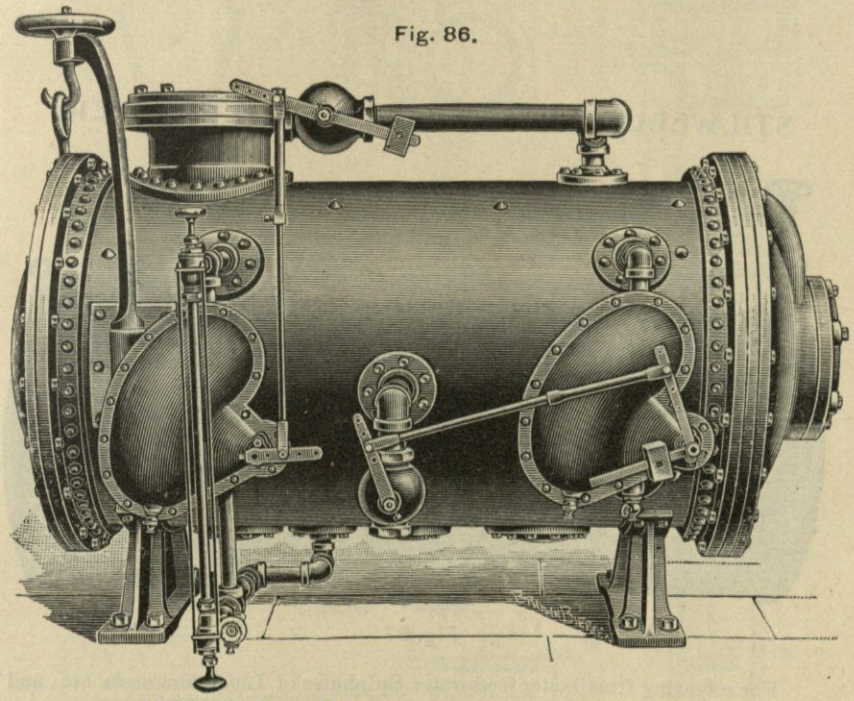
THE LATEST AND BEST OF ITS KIND.

MANUFACTURED BY

The Stilwell-Bierce & Smith-Vaile Co.

STILWELL'S PATENT FEED WATER HEATER, PURIFIER AND RECEIVING TANK COMBINED.

Fig. 86.



BRIEFLY STATED, ITS SUPERIOR POINTS ARE:

1. Large capacity within a small compass, which particularly adapts it for use in low basements or other places where head room is limited.
2. Separation of cylinder oils from the escape steam, thus preventing the Radiators or heating Pipes from becoming clogged with grease, a very important matter.
3. Can be more quickly and easily cleaned than any other device for similar use in the market.
4. The only Heater in the market provided with a Crane for handling the removable head; a patended feature which practical engineers will appreciate.
5. Automatic and reliable regulation of feed-water and returns from heating system.

Further particulars and prices will be furnished upon application, accompanied with such full particulars of the situation and its requirements, as will enable us to do so.

THE STILWELL-BIERCE & SMITH-VAILE CO.

STILWELL'S PATENT LIVE STEAM PURIFIER.

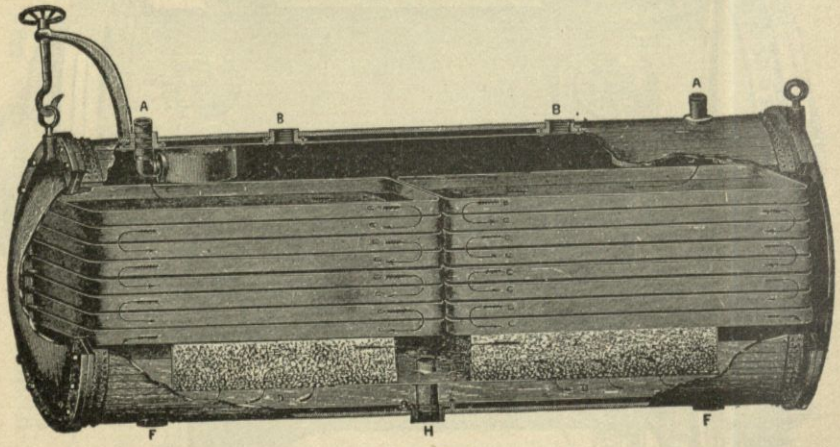


Fig. 87

For removing from boiler feed-water Sulphates of Lime, Magnesia, etc., and other scale producing impurities which require a much higher temperature than can be obtained with Escape Steam.

Full particulars on application to

THE STILWELL-BIERCE & SMITH-VAILE CO.

PRICE LIST OF REPAIRS FOR RAILROAD PUMPS.

Numbers 15 to 35 Inclusive.

APRIL 1, 1896.

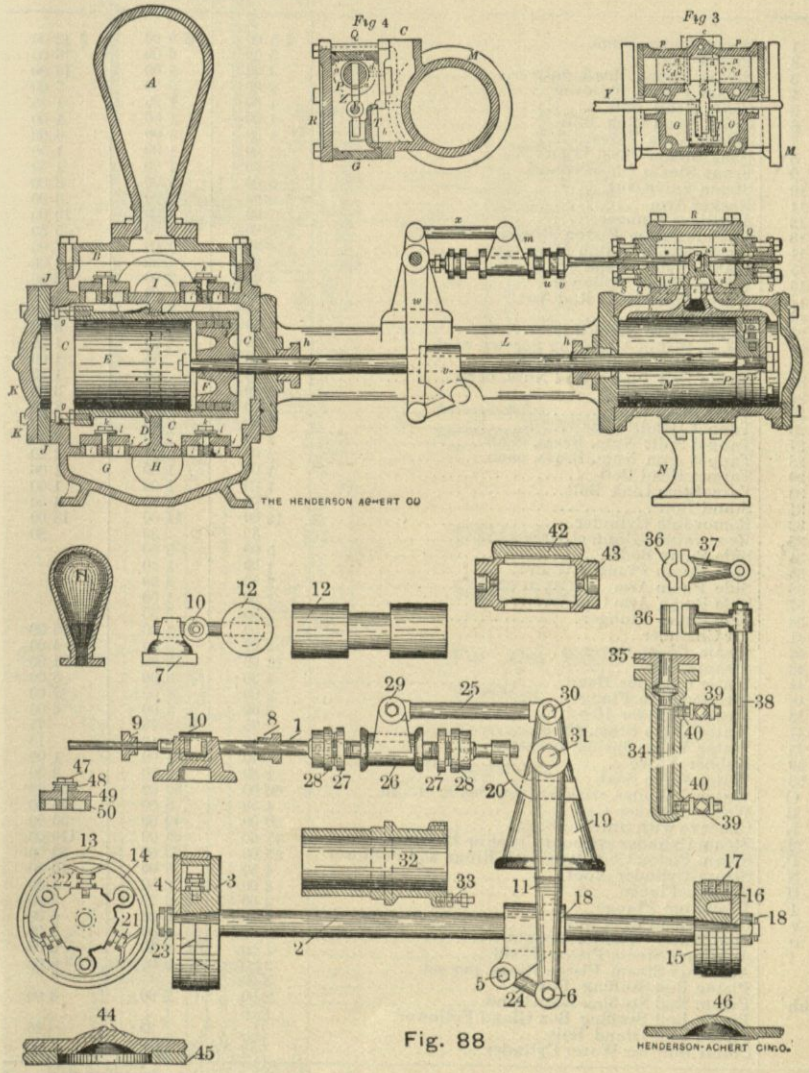


Fig. 88

Single Pump Tappet Mov ment Details.

REPAIRS FOR RAILROAD PUMPS.

No.		Nos. 15 to 19 H. Wt. Box	Nos. 20 to 32 G. Wt. Box	Nos. 33 to 35 F. Wt. Box
1	Steam Valve Stem	$ 5 00	$ 9 00	$ 12 00
2	Piston Rod	5 00	6 00	16 00
3	Steam Piston Head, only	4 00	5 00	10 00
4	Steam Piston Follower	2 00	3 00	5 00
5	Cross Head Bolt	1 00	1 25	1 25
6	Cross Head Link Bolt	1 00	1 00	1 00
7	Steam Slide Valve	4 00	5 00	6 00
8	Back Steam Chest Gland	1 00	1 00	1 50
9	Front Steam Chest Gland	1 00	1 00	1 50
10	Steam Valve Nut	5 00	5 00	6 00
11	Rocker Arm	5 00	6 00	8 00
12	Auxiliary Plunger	7 00	8 00	10 00
13	Outside Steam Piston Rings, each	2 00	4 00	5 50
14	Inside Steam Piston Ring	4 00	5 00	7 00
15	Water Piston Head	6 00	7 00	8 00
16	Water Piston Follower	2 00	3 00	3 50
18	Water End Piston Rod Nut	60	60	1 25
19	Rocker Stand		3 50	7 00
20	Steam Valve Stem Guide	2 50	2 75	3 00
21	Steam Piston Adjusting Screws, each	40	50	1 25
22	Steam Piston Springs, each	50	75	1 00
23	Steam End Piston Rod Nuts, each	60	60	1 25
24	Cross Head Link	2 00	2 00	3 00
25	Valve Stem Link	5 00	5 50	8 00
26	Tappet Head, Brass	4 00	6 50	7 50
27	Tappet Split Nuts, Brass, each	2 00	2 25	2 50
28	Tappet Jam Nuts, Brass, each	2 00	2 25	2 50
29	Tappet Head Bolt	1 00	1 00	1 00
30	Valve Stem Link Bolt	1 00	1 00	1 00
31	Stand Bolt	1 00	2 00	4 00
32	Removable Cylinder	12 00	14 00	18 00
33	Removable Cylinder Screws	80	80	80
34	Side Pump Body	5 00	5 00	
35	Side Pump Plunger Gland	1 50	1 50	
36	Side Pump Arm	2 50	2 50	
37	Side Pump Arm Cap	1 00	1 00	
38	Side Pump Plunger	2 50	2 50	
41	Air Chamber	7 00	8 00	25 00
42	Steam Chest Cover	2 00	3 00	4 00
43	Steam Chest	15 00	18 00	21 00
44	Water Cylinder Head	4 00	6 00	8 00
45	Intermediate Flange	3 00	4 00	7 00
46	Steam Cylinder Head	3 00	4 00	6 00
47	Water Valve Stem, Brass	75	75	75
48	Water Valve Spring, Brass	10	10	10
49	Rubber Valve	70	1 00	1 00
50	Water Valve Seat	1 80	2 00	2 00
C	Water Cylinder, with Valves, Seats, etc. in	60 00	80 00	150 00
B	Water Cylinder Cap	4 50	6 00	45 00
L	Concave with Stuffing Boxes	30 00	40 00	50 00
M	Steam Cylinder without Chest or Head	45 00	65 00	110 00
P	Steam Piston Complete, with Rings and Follower	15 00	23 00	33 00
N	Steam Cylinder Foot	4 50	6 00	10 00
H	Suction Flange	2 00	2 50	4 00
I	Discharge Flange	2 00	2 25	3 50
v	Cross Head with Key	4 00	5 00	6 00
o	Side Water Cylinder Bonnet	3 00	4 00	2 00
	Auxiliary Steam Piston Head	1 50	1 50	2 00
	Auxiliary Steam Piston Rings, per set	3 00	6 00	8 00
	Piston Rod Stuffing Box	5 00		
hh	Piston Rod Stuffing Box Gland	2 00	2 00	2 00
	Piston Rod Stuffing Box Gland Follower	1 00		
	Piston Rod Gland Bolt		25	25
	Collar Bolt for Water Cylinder	75	1 00	1 00

In ordering repairs, if possible give shop number of pump which will be found on flange of steam cylinder or on brass name-plate. Order parts by numbers as given above.

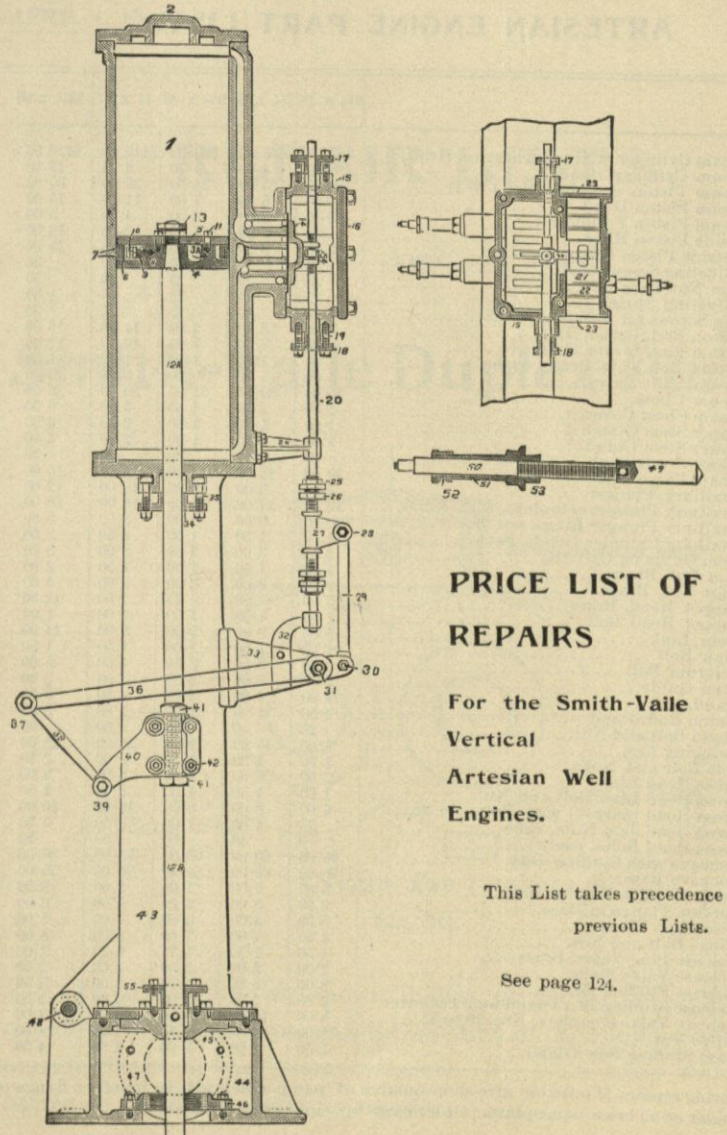


Fig. 89.

PRICE LIST OF REPAIRS

For the Smith-Vaile Vertical Artesian Well Engines.

This List takes precedence over all previous Lists.

See page 124.

ARTESIAN ENGINE PART LIST.

No.		6½ x 18	7½ x 30	9½ x 30	11 x 36	13½ x 36
1	Steam Cylinder without Chest or Head	$45 00	$65 00	$80 00	$115 00	$120 00
2	Steam Cylinder Head	3 00	4 00	4 50	6 75	13 50
3A	Steam Piston complete, See 4 to 11	20 00	25 00	28 00	35 00	50 00
4	Steam Piston Head	3 00	5 00	7 00	11 00	15 00
5	Steam Piston Follower	2 00	3 00	3 00	4 00	5 00
6	Inside Piston Ring	4 00	6 50	7 00	8 00	10 00
7	Outside Piston Rings, for the 2	6 00	8 50	9 00	10 00	15 00
8	Adjusting Screw, each	50	50	50	50	50
9	Jam Nut, each	25	25	25	30	50
10	Adjusting Spring	75	75	75	75	1 50
11	Cap Screws for Follower, each	20	20	25	25	30
12A	Piston Rod, Upper Half	5 00	8 00	9 00	14 00	16 00
12B	Piston Rod, Lower Half	4 00	7 00	7 00	10 00	12 00
13	Piston Rod Nuts, Brass, each	1 00	1 00	1 00	1 00	1 00
14	Steam Slide Valve	4 00	5 00	5 00	5 00	6 00
15	Steam Chest	15 00	20 00	21 00	30 00	36 00
16	Steam Chest Cover	2 00	3 50	4 50	5 00	6 00
17	Upper Stem Gland	1 00	1 00	1 00	2 00	3 00
18	Lower Stem Gland	1 00	1 00	1 00	2 00	3 00
19	Gland Studs, each	20	25	30	30	30
20	Steam Valve Stem	10 00	12 00	12 00	16 00	16 00
21	Auxiliary Plunger	7 00	8 00	10 00	10 00	12 00
	Auxiliary Plunger complete, with Rings	13 00	14 00	16 00	18 00	20 00
22	Auxiliary Plunger Rings, per Set	6 00	6 00	6 00	8 00	8 00
23	Auxiliary Cylinder Heads, each	1 50	1 50	1 50	2 50	2 50
24	Stem Guide on Cylinder	2 50	3 00	3 00	3 00	3 00
25	Jam Nut, Brass	1 50	1 50	1 50	1 50	2 00
26	Split Nut, Brass	2 00	2 00	2 00	2 00	5 00
27	Tappet Head, Brass	5 00	5 60	5 75	7 00	12 00
28	Tappet Head Bolt	1 00	1 00	1 00	1 00	1 00
29	Stem Link	5 00	9 00	9 00	9 00	14 00
30	Link Bolt	1 00	1 00	1 00	1 00	1 50
31	Fulcrum Bolt	2 50	3 00	3 50	4 00	5 00
32	Stem Guide	2 50	3 00	3 00	3 00	3 00
33	Stand	4 00	4 00	4 00	4 50	5 50
34	Piston Rod Gland	1 50	1 50	1 50	1 80	2 80
35	Gland Bolt and Nut	25	40	50	50	50
36	Swinging Arm	5 00	15 00	16 00	25 00	28 00
37	Arm Bolt and Nut	1 50	1 50	1 50	2 00	2 50
38	Cross Head Link	2 00	6 00	6 00	8 00	9 00
39	Cross Head Link Bolt and Nut	1 00	1 50	1 50	2 00	2 50
40	Cross Head (parted) with Bolts No. 42	6 00	8 00	9 00	16 00	20 00
41	Cross Head Jam Nuts, each	75	1 00	1 00	3 50	5 50
42	Cross Head Bolts, each	30	40	50	50	50
43	Concave with Stuffing Box	35 00	60 00	60 00	75 00	80 00
44	Concave Base	35 00	60 00	60 00	70 00	75 00
45	Loose Stuffing Box for Base	5 00	7 00	7 00	8 00	8 00
46	Suction Flange in Base	3 00	5 00	5 00	5 00	6 00
47	Discharge Flange	3 00	4 00	4 00	4 00	5 00
48	Hinge Bolt and Nut	4 50	7 00	7 00	8 00	8 00
49	Release Plug Valve, Brass	1 50	1 50	1 75	1 75	2 00
50	Release Valve Stem	2 00	2 00	2 00	2 00	2 50
51	Release Stuffing Box	3 00	3 50	5 00	5 00	5 50
52	Release Stuffing Box Gland and Follower	2 00	2 00	2 00	2 00	2 50
53	Release Valve complete, Nos. 49 to 52	8 00	10 00	10 00	10 00	12 00
54	Valve Nut	5 00	5 00	7 50	7 50	14 00
55	Base Stuffing Box Gland	1 50	2 00	2 00	2 00	4 50

In ordering repairs, if possible give shop number of pump which will be found on flange of steam cylinder or on brass name-plate. Order parts by numbers as given above.

REPAIR LISTS

FOR

Smith-Vaile Duplex Pumps

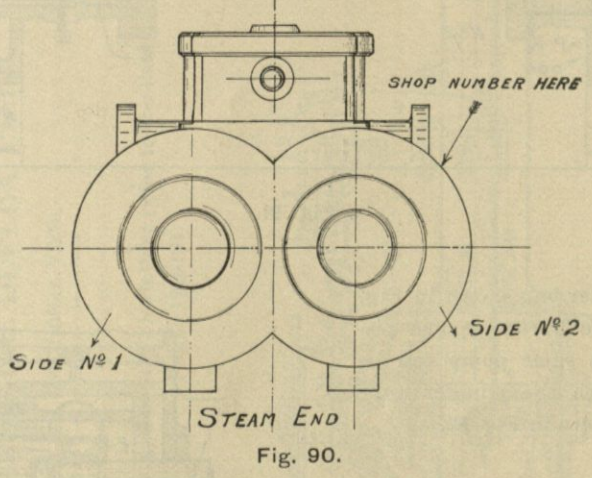


Fig. 90.

The outline drawing shown in Fig. 90 shows the steam end of one of our duplex pumps, and the location of the shop number on the outside flange of the steam cylinder. *We must know this number before we can fill an order for repairs.*

SMITH-VAILE DUPLEX PUMP.

Sectional View.

(See also Fig. 93).

The letters refer to the lists on pages 128–131.

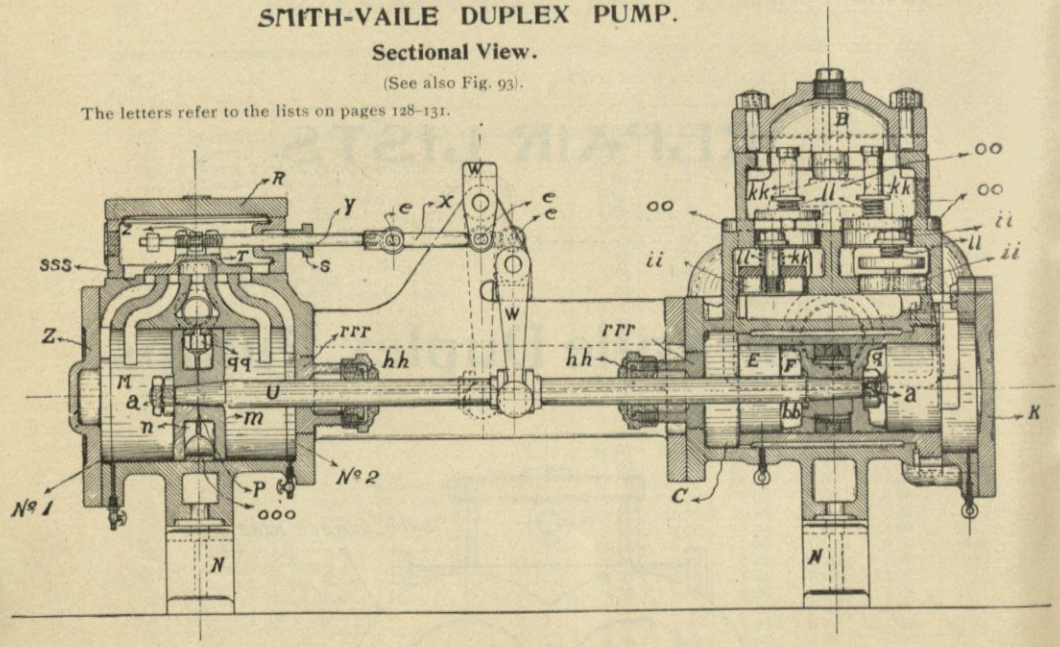


Fig. 91.

The water box shown in Fig. 91 has the fibrous-packed piston. This same pump can be fitted with the plunger type piston shown in Fig. 92.

Fig. 92 shows our plunger type water piston working in sleeve.

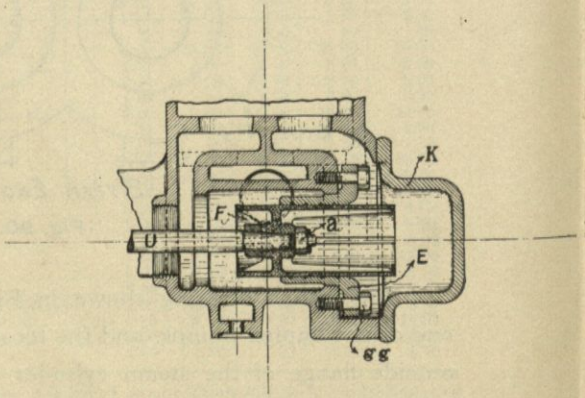


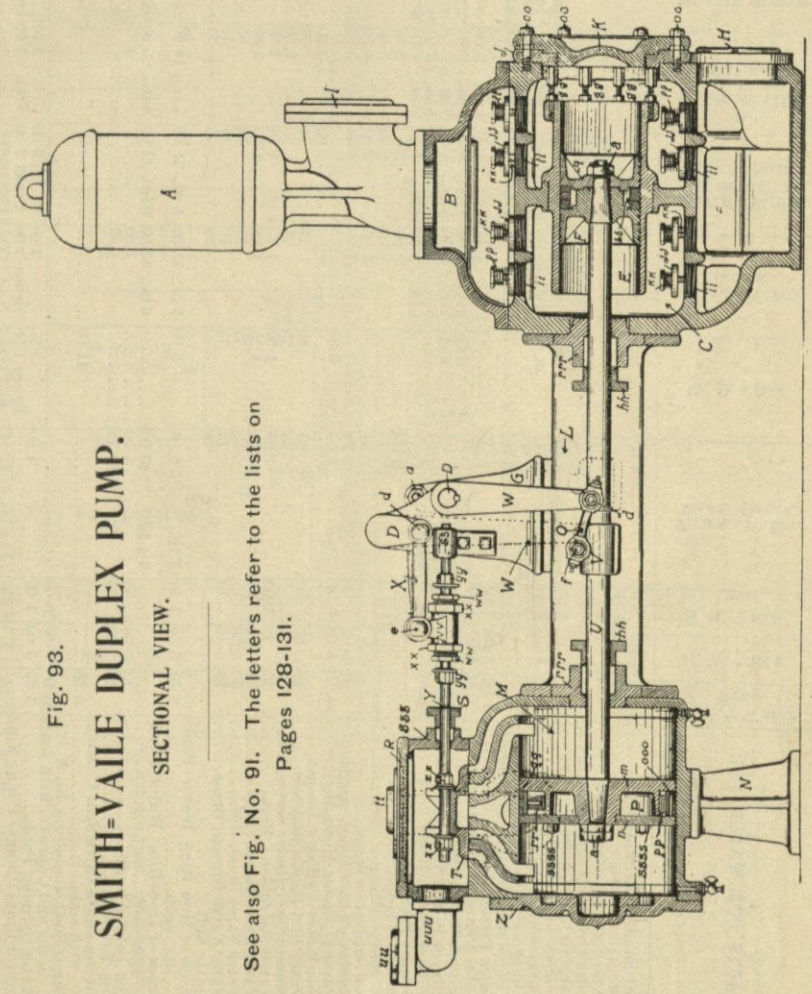
Fig. 92.

Fig. 93.

SMITH-VAILE DUPLEX PUMP.

SECTIONAL VIEW.

See also Fig. No. 91. The letters refer to the lists on Pages 128-131.



WATER END DUPLEX PUMP.

No.	PARTS FOR WATER END.	D. W. 2 Water Box.	D. W. 1 Box.	D. W. 3 Box.	W. 5 A., W. 5. 1. W. 5 2. Boxes.	W. B. 5 Box.	W. 6. 1. W. 6. 2. Boxes.	W. 6 B., W. 6 B. B., W. 6 C., W. 6 C. C. Boxes.	W. 8 B., W. 8 B. B., W. 8 C., W. 8 C. C., W. 8 D. Boxes	W. 10 B., W. 10 B. B., W. 10 C., W. 10 C. C., W. 10 D. Boxes.
A	Air Chamber, Regular style	$3 00	$3 00	.....	$ 6 00	.....	$10 50	$ 10 50	$ 21 50	$ 33 00
	Dome Air Chamber	3 00	3 00	$4 50	.....	$ 9 00	.....	.....	.....	.....
B	Water Cylinder Cap	.....	.....	.....	.....	.....	.....	15 00	22 50	27 50
	Water Cylinder Cap Bonnet	.....	.....	.....	.....	.....	.....	2 00	2 00	2 50
C	Water Cylinder, with Seats in	18 00	.....	.....	50 00	57 00	75 00	100 00	140 00	180 00
E	Removable Cylinder, Iron	.....	4 00	4 50	6 in. stroke, 5 00	5 00	5 in., 10 00	5 in., 12 00	7 in., 13 00	8 in., 16 00
E	Removable Cylinder, Brass-lined	.....	8 00	9 00	" " 10 00	10 00	5 in., 17 00	5 in., 24 00	7 in., 28 00	8 in., 31 00
E	Removable Cylinder, Iron	.....	.....	.....	10 in. " 8 00	.....	6 in., 10 00	6 in., 12 00	8 in., 13 00	9&10 in., 20 00
E	Removable Cylinder, Brass-lined	.....	.....	.....	" " 13 00	.....	6 in., 20 00	6 in., 26 00	8 in., 33 00	9&10 in., 55 00
F	Water Piston Head	1 00	2 00	3 00	3 50	.....	4 00	5 00	7 00	8 00
q	Water Piston Follower	50	1 00	1 00	1 50	.....	2 00	2 00	3 00	3 50
	Plunger Piston Head	.....	.....	.....	.....	3 00	5 in., 4 00	5 in., 5 00	7 in., 6 00	8 in., 6 40
	Plunger Piston Follower	.....	.....	.....	.....	3 00	5 in., 3 50	5 in., 4 00	7 in., 5 00	8 in., 5 50
	Plunger Piston Head	.....	.....	.....	.....	.....	6 in., 4 00	6 in., 5 00	8 in., 6 00	9&10 in., 7 50
	Plunger Piston Follower	.....	.....	.....	.....	.....	6 in., 3 50	6 in., 4 00	8 in., 5 00	9&10 in., 6 50
H	Suction Flange	.....	.....	.....	2 00	.....	2 00	2 0	3 50	5 50
I	Discharge Flange	.....	.....	.....	.....	.....	2 00	2 00	3 50	5 00
J	Intermediate Flange	.....	.....	.....	2 50	.....	3 00	3 00	4 50	8 00
K	Water Cylinder Head, single	50	2 00	.....	3 50	.....	4 00	4 50	5 50	12 00
	Water Cylinder Head, double	.....	4 00	6 50	7 00	6 00	.....	.....	.....	.....
Q	Side Water Cylinder Bonnet	.....	.....	.....	.....	.....	.....	3 00	5 50	6 00
a	Water End Piston Rod Nut	40	50	50	60	60	75	75	75	75
gg	Removable Cylinder Screw, Iron	.....	25	.....	75	75	75	75	1 00	1 00
ii	Water Valve Seat, Brass	75	75	1 00	1 00	1 00	1 25	1 25	1 25	1 25
jj	Water Valve Brass	75	75	75	75	1 25	1 25	1 50	1 05	1 50
kk	Water Valve Stem, Brass	50	50	75	75	75	75	75	75	75
ll	Water Valve Spring, Brass	10	10	10	10	15	10	15	15	15
oo	Collar Bolt	.....	.....	.....	75	.....	75	75	75	1 00
	Brass or Iron Ring Water Packing, each	5 00	6 50	7 40	4 in., 8 00	8 00	5 in., 11 00	5 in., 11 00	7 in., 14 00	8 in., 16 00
	Brass or Iron Ring Water Packing, each	.....	.....	.....	4½ in., 10 00	.....	6 in., 12 00	6 in., 12 00	8 in., 16 00	9&10 in., 20 00
	Top Valve Clamp	40	50	50	1 00	.....	1 00	.....	.....	.....
	Top Valve Cap	40	50	50	75	.....	75	.....	.....	.....
	Intermediate Valve Seat Casting, with seats	6 50	.....	.....	.....	11 00	.....	.....	.....	.....
	Pump Body, including St. & Wt. Cyls. and Concave, with seats	35 00	50 00	70 00	.....	.....	.....	.....	.....	.....
	Water Cylinder Foot	1 00	1 00	1 00	4 00	2 50	3 00	3 00	3 50	.....
bb	Iron or Brass Plunger P'k'ng Ring	.....	.....	.....	.....	Brass 1 50	Brass 3 00	Brass 3 00	Iron 2 60	Iron 2 75

NOTE—* Means that the parts mentioned are *not shown.*

WATER END DUPLEX PUMP.—Continued.

No.	PARTS FOR WATER END.	W. 12 B., W. 12 B. B., Boxes.	W. 12 D. Boxes.	W. 15 D., W. 15 E. Boxes.	W. 19 C., W. 19 C. C., Boxes,	W. 20 C. Box,	W. 21 C., W. 21 C. C. Boxes.	W. 22 D., W. 22 E. Boxes.
A	Air Chamber, regular style	$ 65 00	$100 00	.....	$ 20 00	$ 21 00	$ 35 00	$ 64 00
	Air Chamber Cap	4 00	5 00	.....	.....	.....	.....	4 00
B	Water Cylinder Cap	70 00	100 00	$105 00	29 00	34 00	42 50	51 00
	Water Cylinder Cap Bonnet	4 50	6 00	6 50	3 00	3 50	3 50	3 50
C	Water Cylinder, with seats in	380 00	510 00	760 00	150 00	230 00	285 00	335 00
E	Removable Cylinder, Iron	30 00	33 00	50 00	5 in., 12 00	7 in., 17 00	8 in., 18 00	10 in., 30 00
E	Removable Cylinder, Brass-lined	.....	.....	.....	5 in., 24 00	7 in., 33 00	8 in., 33 00	.....
E	Removable Cylinder, Iron	32 00	36 00	60 00	6 in., 12 00	8 in., 18 00	9 & 10 in., 20 00	.....
E	Removable Cylinder, Brass-lined	.....	.....	.....	6 in., 26 00	8 in., 41 00	9 & 10 in., 55 00	.....
F	Water Piston Head	14 00	16 00	.....	.....	.....	.....	.....
q	Water Piston Follower	7 00	8 00	.....	.....	.....	.....	.....
	Plunger Piston Head	13 00	14 00	20 00	5 in., 5 50	7 in., 6 50	8 in., 10 00	10 in., 10 50
	Plunger Piston Follower	11 00	12 00	16 00	5 in., 4 50	7 in., 5 50	8 in., 8 00	10 in., 9 50
	Plunger Piston Head	16 00	18 50	22 00	6 in., 5 50	8 in., 7 00	9 & 10 in., 11 00	.....
	Plunger Piston Follower	14 00	14 50	18 00	6 in., 4 50	8 in., 6 00	9 & 10 in., 9 00	.....
H	Suction Flange	7 50	8 50	8 50	4 50	4 50	7 00	7 50
I	Discharge Flange	6 00	.....	17 50	4 00	4 00	6 00	5 50
J	Intermediate Flange	12 00	14 00	20 00	3 50	6 00	9 00	9 00
K	Water Cylinder head, single	20 00	22 00	28 00	5 00	7 00	11 00	11 00
Q	Side Water Cylinder Bonnet	8 00	10 00	10 00	4 25	3 00	7 00	7 00
a	Water End Piston Rod Nut	1 00	1 00	1 50	75	75	75	1 00
gg	Removable Cylinder Screw, Iron	1 00	1 00	1 25	75	75	75	75
ii	Water Valve Seat, Brass	1 25	1 50	1 50	1 00	1 00	1 00	1 25
jj	Water Valve, Brass	1 50	2 00	2 00	1 00	1 00	1 00	1 50
kk	Water Vale Stem Brass	75	75	75	75	75	75	1 00
ll	Water Valve Spring, Brass	15	15	15	10	10	10	15
oo	Collar Bolt	1 00	1 00	1 00	75	75	75	75
	Brass or Iron Ring Water Packing, each	20 00	20 00	.....	5 in., 11 00	7 in., 14 00	8 in., 16 00	10 in., 20 00
	Brass or Iron Ring Water Packing, each	.....	.....	.....	6 in., 12 00	8 in., 16 00	9 & 10 in., 20 00	.....
	Water Cylinder Foot	15 00	31 00	31 00	.....	.....	.....	.....
bb	Iron or Brass Plunger Pack'g Ring	Iron 3 00	Iron 3 00	Iron 6 00	Brass 3 00	Iron 2 60	Iron 2 75	Iron 2 75

NOTE—* Means that the parts mentioned are *not shown.*

STEAM END DUPLEX PUMP.

	PARTS FOR STEAM END.	3-inch Steam Cylinder.	4½-in. Cylinder.	5¼-in. Cylinder.	Old Style 6-in. Cylinder.	New Style 6-in. Cylinder.	7-inch Cylinder.	8-inch Cylinder.	10-in. Cylinder.	12-in. Cylinder.	14-in. Cylinder.	16-in. Cylinder.	18-in. Cylinder.	20-in. Cylinder.
D	Rocker Shaft and Pin, Cast	.....	$ 2 50	.....	$ 2 50	.....	$ 3 00	$ 3 00	$ 4 00	$ 4 25	$ 5 50	$ 7 00	$ 9 50	.....
	Rocker Shaft, Wrought	$ 1 00	1 00	$ 1 00	.....	$ 1 00	.....	.....	.....	.....	.....	9 00	13 75	$13 75
	Rocker Shaft Head, only	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4 00	5 75	5 75
G	Rocker Stand	1 50	.....	.....	5 00	.....	7 00	8 00	12 00	16 00	20 00	20 00	37 00	37 00
L	Concave complete, with Stuffing Boxes	.....	.....	.....	9 00	.....	16 00	16 00	24 00	26 00	36 00	36 00	57 00	70 00
M	Steam Cylinders, cast together, without Chest	12 00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Steam Cylinders, cast together, with Chest	.....	.....	.....	40 00	.....	65 00	70 00	85 00	.....	.....	.....	.....	.....
	Steam Cylinders, cast single, without Chest	.....	.....	.....	.....	.....	.....	.....	48 00	60 00	70 00	.....	100 00	140 00
	Steam Cylinders, cast single, with Chest	.....	.....	.....	.....	.....	.....	.....	.....	65 00	.....	80 00	.....	.....
	Steam Cylinders, with Concaves attached	.....	.....	.....	.....	60 00	.....	.....	.....	.....	.....	.....	.....	.....
N	Steam Cylinder Foot	1 00	1 00	1 00	4 00	2 50	4 50	5 00	5 50	8 50	22 00	22 00	22 00	42 00
O	Cross Head Link, Iron	.....	1 00	.....	1 50	.....	1 50	1 50	1 75	1 75	2 75	2 75	5 25	7 00
O	Cross Head Link, Brass	.....	.....	.....	.....	.....	.....	.....	4 00	4 00	6 00	6 00	7 50	15 00
P	Steam Piston Complete, with Rings & Follower.	5 50	6 50	8 00	10 00	10 00	12 00	14 00	19 00	25 00	36 00	39 00	52 00	78 00
m	Steam Piston Head, only	2 00	2 25	3 00	3 50	3 50	4 00	4 50	6 50	8 50	14 00	15 00	20 00	27 00
n	Steam Piston Follower	75	75	1 00	1 50	1 50	2 00	2 50	3 00	4 00	6 00	6 50	8 00	15 00
ooo	Steam Piston Ring	1 50	2 00	2 50	3 00	3 00	3 75	4 00	5 50	7 00	9 75	9 75	20 00	32 00
pp	Steam Piston Spring	1 00	1 25	1 25	1 50	1 50	2 00	2 50	3 50	5 00	5 25	5 50	.....	.....
qq	Steam Piston Break-joint	50	60	60	80	80	80	1 00	1 00	1 25	2 25	2 60	.....	.....
rr	Steam Piston Break-joint Spring	10	10	10	10	10	50	10	15	15	15	20	.....	.....
sss	Steam Piston Spring Small	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	75	1 00
ssss	Steam Piston Head Screw	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40	40
SSS	Steam Chest	4 50	5 00	6 00	.....	6 00	.....	.....	19 00	12 00	14 00	.....	18 00	20 00
R	Steam Chest Bonnet	1 50	2 50	3 50	3 60	3 00	5 50	6 00	8 00	4 25	4 75	7 00	7 50	10 00
S	Steam Chest Stuffing Box Gland	50	60	60	60	60	80	80	1 00	1 00	1 25	1 50	1 50	1 50
T	Steam Slide Valve	2 00	3 00	3 00	3 50	3 50	4 00	4 50	5 50	6 00	10 00	10 00	12 00	12 00
U	Piston Rod, Steel	2 00	2 50	3 00	3 50	3 50	5 25	6 50	9 00	11 00	17 00	20 00	22 75	36 00
	Piston Rod, Brass	4 00	5 50	5 50	8 00	8 00	11 50	12 00	.....	.....	.....	.....	.....	.....
	Piston Rod, Brass Covered	.....	.....	.....	.....	.....	.....	.....	17 00	21 00	28 00	34 00	35 00	56 00
V	Cross Head and Pin	1 00	1 00	1 00	1 50	1 50	2 50	2 75	3 25	3 25	4 25	4 25	4 75	7 50
	Cross Head Key	.....	40	40	40	40	40	40	50	50	50	50	80	1 00
W	Rocker Arm and Pin	1 50	2 00	3 00	2 00	3 00	3 00	3 00	4 00	4 00	4 50	5 50	17 00	26 00
	Rocker Arm Key	.....	.....	.....	40	40	40	40	50	50	50	50	80	1 00
X	Valve Stem Link, Iron	75	1 00	1 00	1 00	1 00	1 25	1 50	1 75	1 75	2 75	2 75	11 00	11 00

NOTE—Means that the parts mentioned are *not shown*.

STEAM END DUPLEX PUMP.—Continued.

	PARTS FOR STEAM END.	3-inch Steam Cylinder.	4½-in. Cylinder.	5¼-in. Cylinder.	Old Style 6-in Cylinder.	New Style 6-in. Cylinder.	7-in. Cylinder.	8-in. Cylinder.	10-in. Cylinder.	12-in. Cylinder.	14-in. Cylinder.	16-in. Cylinder.	18-in. Cylinder.	20-in. Cylinder.
uuu	Steam Pipe	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Y	Steam Valve Stem with Fork	$ 1 50	$ 1 50	$ 1 75	$ 2 00	$ 2 00	$ 2 50	$ 2 50	$ 3 00	$ 3 50	$ 3 75	$ 3 75	$ 4 25	$ 4 25
*	Steam Valve Stem Nut	.....	75	75	.....	75	.....	.....	.....	.....	.....	.....	.....	.....
Z	Steam Cylinder Head, single	.....	1 00	2 00	2 50	.....	3 50	4 00	5 00	7 25	8 50	12 00	25 00	28 00
	Steam Cylinder Head, double	1 50	2 00	.....	5 00	5 00	.....	.....	.....	.....	.....	.....	.....	.....
a	Steam End Piston Rod Nut	40	50	50	60	60	60	60	60	75	75	1 00	1 00	1 25
*	Steam Valve Stem Fork	75	80	1 00	1 00	1 00	1 00	1 00	.....	.....	.....	.....	.....	.....
*	Steam Valve Stem Fork Bolt	75	1 00	1 00	1 00	1 00	1 00	1 00	.....	.....	.....	.....	.....	.....
d	Rocker Arm Bolt	1 00	.....	.....	1 00	.....	1 00	1 00	1 00	1 00	1 25	1 25	2 00	3 00
e	Steam Valve Stem Link Bolt	75	1 00	1 00	1 00	1 00	1 00	1 00	1 00	1 00	1 50	1 50	2 00	3 00
f	Cross Head Bolt	.....	.....	.....	.....	.....	1 00	1 00	1 00	1 00	1 50	1 50	2 00	3 00
hh	Piston Rod Stuffing Box Gland, Iron	50	.....	.....	1 00	.....	1 00	1 00	1 25	1 50	1 50	2 00	2 50	3 00
	Piston Rod Stuffing Box Gland, Brass	1 75	2 00	2 00	.....	2 75	.....	.....	.....	.....	.....	.....	.....	.....
	Piston Rod Stuffing Box Gland Follower	50	1 00	1 00	.....	1 00	.....	.....	.....	.....	.....	.....	.....	.....
	Piston Rod Stuffing Box Gland Bolt	.....	.....	.....	30	.....	30	30	40	40	50	50	60	60
rrr	Piston Rod Stuffing Box	2 50	2 50	2 50	.....	3 00	.....	.....	.....	.....	6 00	6 00	.....	.....
	Piston Rod Stuffing Box, old style	1 25	.....	.....	.....	.....	.....	.....	1 00	1 00	1 25	1 25	1 50	2 00
ss	Stem Guide on Stand	.....	.....	.....	.....	.....	.....	.....	.....	1 25	2 00	2 00	3 00	3 75
tt	Exhaust Flange	.....	.....	.....	.....	.....	.....	.....	.....	1 25	2 00	.....	2 50	2 75
uu	Steam Flange	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
vv	Tappet Head, Brass	.....	.....	.....	.....	.....	.....	.....	5 00	5 00	6 00	6 00	10 00	12 00
ww	Tappet Sleeve, Brass	.....	.....	.....	.....	.....	.....	.....	2 50	2 50	3 00	3 00	3 75	3 75
xx	Tappet Jam Nut, Brass	.....	.....	.....	.....	.....	.....	.....	1 00	1 00	1 50	1 50	1 75	1 75
yy	Tappet Clamp Nut, Brass	.....	.....	.....	.....	.....	.....	.....	1 25	1 25	1 60	1 60	2 00	2 00
zz	Valve Clamp Nut, Brass	.....	.....	.....	.....	.....	.....	.....	1 00	1 00	1 00	1 00	1 25	1 25
e	Tappet Head Bolt	.....	.....	.....	.....	.....	.....	.....	1 00	1 00	1 50	1 50	2 00	3 00
*	Release Valve Stem	.....	.....	.....	.....	.....	.....	.....	1 00	1 00	1 00	1 25	1 25	1 25
*	Release Valve Stuffing Box	.....	.....	.....	.....	.....	.....	.....	1 50	1 50	1 50	1 75	1 75	1 75
*	Release Valve Stuffing Box Gland	.....	.....	.....	.....	.....	.....	.....	75	75	75	75	75	75
*	Release Valve Stuffing Box Gland Follower	.....	.....	.....	.....	.....	.....	.....	25	25	25	25	25	25

WE TAKE pleasure in presenting herewith a partial list of the municipalities to whom we have furnished water works pumping machinery during the past few years. The general excellence of our work in this line has never been higher than it is at present, and we propose to fully maintain our good reputation as builders of high-class pumping engines.

Alma, Mich	one	Pumping Engine,	750,000 gallons capacity.
Aiken, S. C	one	Pumping Engine,	500,000 gallons capacity.
Atlantic City, N. J	three	Pumping Engines, each	1,500,000 gallons capacity.
Atlantic City, N. J	one	Pumping Engine,	2,000,000 gallons capacity.
Atlantic City, N. J	one	Pumping Engine,	1,000,000 gallons capacity.
Anderson, S. C	two	Pumping Engines, each	1,000,000 gallons capacity.
Alexandria, La	two	Pumping Engines, each	1,000,000 gallons capacity.
Attala, Ala	one	Pumping Engine,	750,000 gallons capacity.
Ashland, O	two	Pumping Engines, each	1,000,000 gallons capacity.
Austin, Texas	two	Pumping Engines, each	4,000,000 gallons capacity.
American Water Co., Denver, Col	one	Pumping Engine,	500,000 gallons capacity.
Alexandria. Ind	two	Pumping Engines, each	1,500,000 gallons capacity.
Bayfield, Wis	one	Pumping Engine,	1,000,000 gallons capacity.
Boonsville, Mo	two	Pumping Engines, each	1,000,000 gallons capacity.
Beloit, Wis	two	Pumping Engines, each	1,000,000 gallons capacity.
Beloit, Wis	one	Pumping Engine,	1,000,000 gallons capacity.
Blair, Neb	one	Pumping Engine,	1,000,000 gallons capacity.
Beloit, Kans	one	Pumping Engine,	1,000,000 gallons capacity.
Beaumont, Texas	one	Pumping Engine,	750,000 gallons capacity.
Breckenridge, Minn	one	Pumping Engine.	1,000,000 gallons capacity.
Breckenridge, Minn	one	Pumping Engine,	600,000 gallons capacity.
Bloomington, Ind	two	Pumping Engines, each	1,000,000 gallons capacity.
Barnesville, Ga	one	Pumping Engine,	1,750,000 gallons capacity.
Blue Earth, Minn	one	Pumping Engine,	500,000 gallons capacity.
Breckenridge, Minn	one	Pumping Engine,	500,000 gallons capacity.
Britt, Iowa	one	Pumping Engine,	750,000 gallons capacity.
Chicago Heights, Ills	two	Pumping Engines, each	1,000,000 gallons capacity.
Columbus, Neb	two	Pumping Engines, each	1,000,000 gallons capacity.
Crown Point, Ind	four	Pumping Engines, each	750,000 gallons capacity.

Calvert, Texas	one	Pumping Engine,	750,000 gallons capacity.
Carson City, Mich	one	Pumping Engine,	750,000 gallons capacity.
Culpepper, Va	one	Pumping Engine,	500,000 gallons capacity.
Cuero, Texas	two	Pumping Engines, each	750,000 gallons capacity.
Columbiana, O	two	Pumping Engines, each	750,000 gallons capa ity.
Creston, Iowa	two	Pumping Engines, each	1,500,000 gallons capacity.
Cuthbert, Ga	two	Pumping Engines, each	750,000 gallons capacity.
Cattlettsburg, Ky	two	Pumping Engines, each	750,000 gallons capacity.
Cheboygan, Mich	one	Pumping Engine,	4,000,000 gallons capacity.
Dodge City, Kans	two	Pumping Engines, each	750,000 gallons capacity.
Denison, Iowa	one	Pumping Engine,	500,000 gallons capacity.
Detroit, Minn	one	Pumping Engine,	750,000 gallons capacity.
El Paso, Texas	three	Pumping Engines, each	500,000 gallons capacity.
Elkhart, Ind	four	Pumping Engines, each	1,250,000 gallons capacity.
Eau Clare, Wis	two	Pumping Engines, each	2,000,000 gallons capacity.
East Chicago, Ind	two	Pumping Engines, each	1,000,000 gallons capacity.
Elizabethtown, Ky	two	Pumping Engines, each	500,000 gallons capaciry.
Eau Clare, Wis	one	Pumping Engine,	2,500,000 gallons capacity.
Etna, Pa	two	Pumping Engines, each	1,000,000 gallons capacity.
Ennis, Texas	one	Pumping Engine,	750,000 gallons capacity.
Elroy, Wis	two	Pumping Engines, each	500,000 gallons capacity.
El Reno, Ok. Ter	two	Pumping Engines, each	1,000,000 gallons capacity.
Fort Scott, Kans	two	Pumping Engines, each	750,000 gallons capacity.
Fort Smith, Ark	two	Pumping Engines, each	750,000 gallons capacity.
Fairmount, Neb	two	Pumping Engines, each	500,000 gallons capacity.
Fairbury, Ills	one	Pumping Engine,	500,000 gallons capacity.
Fort Wayne, Ind	one	Pumping Engine.	1,500,000 gallons capacity.
Fort Valley, Ga	one	Pumping Engine,	500,000 gallons capacity.
Fulton, Ills	one	Pumping Engine,	750,000 gallons capacity.
Frankfort, Mich	two	Pumping Engines, each	750,000 gallons capacity.
Fonda, Iowa	two	Pumping Engines, each	750,000 gallons capacity.
Fowler, Ind	four	Pumping Engines, each	750,000 gallons capacity.
Flanigan, Texas	one	Pumping Engine,	500,000 gallons capacity.
Farmville, Va	two	Pumping Engines, each	750,000 gallons capacity.
Fulda, Minn	one	Pumping Engine;	500,000 gallons capacity.
Grand Rapids, Mich	one	Pumping Engine,	2,500,000 gallons capacity.
Glenwood, Wis	two	Pumping Engines, each	500,000 gallons capacity.
Gainsville, Ga	one	Pumping Engine,	500,000 gallons capacity.
Genessee, Ills	one	Pumping Engine,	750,000 gallons capacity.
Glenwood, Minn	one	Pumping Engine,	750,000 gallons capacity.
Hinton, W. Va	two	Pumping Engines, each	750,000 gallons capacity.

Hagerstown, Md	one	Pumping Engine,	1,500,000 gallons capacity.
Hancock, Mich	one	Pumping Engine,	1,000,000 gallons capacity.
Harvard, Ills	one	Pumping Engine,	750,000 gallons capacity.
Harvard, Ills	one	Pumping Engine,	500,000 gallons capacity.
Harvey, Ills	one	Pumping Engine,	750,000 gallons capacity.
Harlem, Ills	one	Pumping Engine,	500,000 gallons capacity.
Iona, Mich	two	Pumping Engines, each	1,000,000 gallons capacity.
Independence, Mo	four	Pumping Engines, each	500,000 gallons capacity.
Independence, Kans	two	Pumping Engines, each	750,000 gallons capacity.
Iron Mountain, Mich	one	Pumping Engine,	1.000,000 gallons capacity.
Joplin, Mo	two	Pumping Engines, each	750,000 gallons capacity.
Johnson Creek, Wis	one	Pumping Engine,	500,000 gallons capacity.
Kilbourn City, Wis	one	Pumping Engine,	500,000 gallons capacity.
LaFayette, Ind	two	Pumping Engines, each	500,000 gallons capacity.
Lemont, Ills	two	Pumping Engines, each	300,000 gallons capacity.
Lancaster, Ohio	one	Pumping Engine,	750,000 gallons capacity.
Leechburg, Pa	one	Pumping Engne,	750,000 gallons capacity.
Lebanon, Ohio	two	Pumping Engines, each	1,000,000 gallons capacity.
Lansdowne, Pa	one	Pumping Engine,	750,000 gallons oapacity.
Lake Mills, Wis	one	Pumping Engine,	750,000 gallons capacity.
Litchfield, Minn	two	Pumping Engines, each	500,000 gallons capacity
Lowell, Mich	one	Pumping Engine,	800,000 gallons capacity.
Lamark, Ills	one	Pumping Engine,	500,000 gallons capacity.
Milford, Del	one	Pumping Engine,	1,000,000 gallons capacity.
Martinsville, Va	one	Pumping Engine,	750,000 gallons capacity.
Mattoon, Ills	two	Pumping Engines, each	1,000,000 gallons capacity.
Minerva, O	one	Pumping Engine,	750,000 gallons capacity.
Maryville, Mo	two	Pumping Engines, each	750,000 gallons capacity.
Middletown, O	two	Pumping Engines, each	1,500,000 gallons capacity.
Millersburg, O	one	Pumping Engine.	750,000 gallons capacity.
Mexia, Texas	one	Pumping Engine,	750,000 gallons capacity.
Marietta, Ga	one	Pumping Engine,	1,000,000 gallons capacity.
Mercer, Pa	two	Pumping Engines, each	750,000 gallons capacity.
Morristown, Tenn	two	Pumping Engines, each	750,000 gallons capacity.
Minonk, Ills	one	Pumping Engine,	500,000 gallons capacity.
Monroe, Wis	one	Pumping Engine,	500,000 gallons capacity.
Morea, Ills	two	Pumping Engines, each	500,000 gallons capacity.
Marengo, Ills	one	Pumping Engine,	750,000 gallons capacity.
Manning, Iowa	one	Pumping Engine,	500,000 gallons capacity.
Morgan Park, Ills	one	Pumping Engine,	750,000 gallons capacity.
Momence, Ills	two	Pumping Engines, each	750,000 gallons capacity.
Marva, Ills	one	Pumping Engine,	750,000 gallons capacity.

Napoleon, O	two	Pumping Engines, each	1,000,000 gallons capacity.
Newton, Ills	one	Pumping Engine,	750,000 gallons capacity.
Nat'l Soldiers' Home, Dayton, O.	two	Pumping Engines, each	1,500,000 gallons capacity.
Nat'l Soldiers' Home, Dayton, O.	one	Pumping Engine,	1,750,000 gallons capacity.
Navasota, Texas	one	Pumping Engine,	750,000 gallons capacity.
Newport, Ark	two	Pumping Engines, each	750,000 gallons capacity.
New Ulm, Minn	one	Pumping Engine,	1,000,000 gallons capacity.
New Hampton, Iowa	one	Pumping Engine,	500,000 gallons capacity.
Newberry, Mich	two	Pumping Engines, each	500,000 gallons capacity.
New Richmond, Wis	one	Pumping Engine,	1,000,000 gallons capacity.
Newnan, Ga	two	Pumping Engines, each	750,000 gallons capacity.
Orange, Texas	one	Pumping Engine,	750,000 gallons capacity.
Owatonna, Wis	one	Pumping Engine,	1,000,000 gallons capacity.
Orange City, Fla	one	Pumping Engine,	1,000,000 gallons capacity.
Oxford, Ohio	two	Pumping Engines, each	750,000 gallons capacity.
Parsons, Kans	two	Pumping Engines, each	750,000 gallons capacity.
Paris, Tenn	two	Pumping Engines, each	1,000,000 gallons capacity.
Presido Military Res., San Francisco, Cal	one	Pumping Engine,	1,000,000 gallons capacity.
Pinconning, Mich	two	Pumping Engines, each	500,000 gallons capacity.
Prosser Falls Irrigating Co., Prosser, Wash	two	Power Pumps, each	7,000,000 gallons capacity.
Pulaski, Tenn	one	Pumping Engine,	1,000,000 gallons capacity.
Quitman, Ga	one	Pumping Engine,	750,000 gallons capacity.
Red Oak, Iowa	one	Pumping Engine,	500,000 gallons capacity.
Rockport, Ind	one	Pumping Engine,	1,000,000 gallons capacity.
Raleigh, N. C	four	Pumping Engines, each	1,000,000 gallons capacity.
Raritan, N. J	two	Pumping Engines, each	1,000,000 gallons capacity.
Ravenna, Neb	one	Pumping Engine,	500,000 gallons capacity.
Rice Lake, Wis	two	Pumping Engines, each	1,000,000 gallons capacity.
Rennville, Minn	one	Pumping Engine,	500,000 gallons capacity.
Rochester, Ind	two	Pumping Engines, each	1,000 000 gallons capacity.
Rennville, Minn	one	Pumping Engine,	1,000,000 gallons capacity.
Springfield, Mo	two	Pumping Engines, each	1,000,000 gallons capacity.
Scotland, Dak	one	Pumping Engine,	1,000,000 gallons capacity.
Seymour, Ind	two	Pumping Engines, each	1,500,000 gallons capacity.
Salem, Ore	one	Pumping Engine,	2,000,000 gallons capacity.
Schuyler, Neb	two	Pumping Engines, each	750,000 gallons capacity.
St. Marys, Ohio	two	Pumping Engines, each	1,000,000 gallons capacity.
St. Charles, Minn	one	Pumping Engine,	500,000 gallons capacity.
Spring Lake, Mich	one	Pumping Engine,	750,000 gallons capacity.
St. Louis Stamping Co	two	Pumping Engines, each	3,000,000 gallons capacity.

St. Louis Stamping Co.	Two Vertical	Pumping Engines, each	3,000,000 gallons capacity.
St. Cloud, Minn.	one	Pumping Engine,	1,000,000 gallons capacity.
Sheldon, Iowa	one	Pumping Engine,	750,000 gallons capacity.
Troy, Ohio	two	Pumping Engines, each	1,000,000 gallons capacity.
Trenton, Mo.	one	Pumping Engine,	750,000 gallons capacity.
Thibodeaux, La.	two	Pumping Engines, each	500,000 gallons capacity.
Trenton, Mo.	one	Pumping Engine,	1,000,000 gallons capacity.
Tarentum, Pa.	one	Pumping Engine,	1,000,000 gallons capacity.
Two Harbors, Minn.	one	Pumping Engine,	1,000,000 gallons capacity.
Two Rivers, Wis.	one	Pumping Engine,	750,000 gallons capacity.
Tomahawk, Wis.	one	Pumping Engine,	1,000,000 gallons capacity.
Tomah, Wis.	two	Pumping Engines, each	750,000 gallons capacity.
Tracy, Minn.	two	Pumping Engines, each	1,000,000 gallons capacity.
Union City, Mich.	two	Pumping Engines, each	750,000 gallons capacity.
Vermillion, S. D.	two	Pumping Engines, each	750,000 gallons capacity.
Union Springs, Ala.	two	Pumping Engines, each	500,000 gallons capacity.
Wichita, Kans.	two	Pumping Engines, each	1,500,000 gallons capacity.
Watertown, Wis.	two	Pumping Engines, each	2,000,000 gallons capacity.
Wellington, Kans.	two	Pumping Engines, each	1,000,000 gallons capacity.
Winston, N. C.	two	Pumping Engines, each	750,000 gallons capacity.
Waynesburg, Pa.	one	Pumping Engine,	750,000 gallons capacity.
Waynesburg, Pa.	one	Pumping Engine,	500,000 gallons capacity.
Weir City, Kans.	one	Pumping Engine,	500,000 gallons capacity.
Water Valley, Miss.	two	Pumping Engines, each	500,000 gallons capacity.
West La Fayette, Ind.	two	Pumping Engines, each	750,000 gallons capacity.
Waverly, Iowa	one	Pumping Engine,	750,000 gallons capacity.
Waverly, Iowa	one	Pumping Engine,	1,500,000 gallons capacity.
Wilmar, Minn.	two	Pumping Engines, each	750,000 gallons capacity.
Worthington, Minn.	one	Pumping Engine,	750,000 gallons capacity.
Waterbury, Conn.	two	Pumping Engines, each	1,500,000 gallons capacity.
White Cloud, Mich.	one	Pumping Engine,	750,000 gallons capacity.
Worthington, Minn	one	Pumping Engine,	750,000 gallons capacity.
Washington Heights, Ill.	one	Pumping Engine,	750,000 gallons capacity.
Washington Heights, Ill.	one	Pumping Engine,	750,000 gallons capacity.
Yoakum, Texas.	one	Pumping Engine,	750,000 gallons capacity.
Yorkville, S. C.	one	Pumping Engine,	750,000 gallons capacity

TOTAL PUMPING CAPACITY FURNISHED 275,000,000 GALLONS.

IN ADDITION to the complete line of Steam and Power Pumping Machinery illustrated in this catalogue, we are extensively engaged in the manufacture of the Smith-Vaile Cottonseed, Linseed, and Castor Oil Machinery, Ice and Refrigerating Machinery, Filter Presses, and Special Hydraulic Work, Lifting Jacks, Water Columns, Gears, Pulleys, Shafting and all kinds of Power connections; Stilwell Feed Water Heaters and Purifiers, and the well-known "Victor" Turbines.

With our long experience in these several lines of manufacture and increased facilities in almost every department, we are prepared to fully maintain the high standard of our work in the past.

We invite the careful consideration of intending purchasers, to whom we shall be glad to send catalogues on application.

THE STILWELL-BIERCE & SMITH-VAILE CO.

GENERAL INFORMATION.

1. A gallon of fresh water weighs 8⅓ pounds, and contains 231 cubic inches.

2. A cubic foot of water weighs 62½ pounds, and contains 1,728 cubic inches, or 7½ gallons.

3. A "miner's inch" of water is approximately equal to a supply of 12 gallons per minute.

4. The friction of water in pipes increases with the square of its velocity.

5. The capacity of pipes increases with the square of their diameter, thus doubling the diameter increases the capacity four times.

6. To find the area of a piston, square the diameter and multiply by .7854.

7. In calculating horse-power of tubular boilers, 15 square feet of heating surface is equivalent to one nominal horse-power.

8. Each nominal horse-power of boilers will require about one cubic foot of water per hour.

9. The mean pressure of the atmosphere is usually estimated at 14.7 pounds per square inch, so that with a perfect vacuum it will sustain a column of mercury 20.9 inches, or a column of water 33.9 feet high.

10. To find the capacity of a cylinder in gallons: Multiply the area in inches by the stroke in inches will give the total number of cubic inches; divide this amount by 231 (which is the cubical contents of a gallon in inches), and the quotient is the capacity in gallons.

11. To find the pressure in pounds per square inch of a gallon of water multiply the height of the column in feet by .434. Approximately each foot elevation is called equal to one-half pound pressure per square inch.

12. To find the diameter of a pump cylinder to move a given quantity of water per minute at a piston travel of 100 feet per minute, divide the number of gallons by 4, then extract the square root and the result will be the diameter of the pump cylinder in inches.

13. To find the horse-power required to elevate water to a given height, multiply the total weight of the water in pounds by the height in feet and divide the product by 33,000. An allowance should be made of 25 per cent. for water friction; also about 25 per cent. for loss in steam pipe and cylinder.

14. The area of the steam piston, multiplied by the steam pressure, gives the total amount of pressure exerted. The area of the water piston multiplied by the pressure of water per square inch, gives the resistance. A margin of from 30 to 50 per cent. must be added to move the piston at the required speed.

SPLINES

SHAFT.	WIDTH.	DEPTH.
1 1/16	1/4	1/8
1 1/16	3/8	3/16
1 15/16	1/2	1/4
2 3/16	1/2	1/4
2 7/16	5/8	5/16
2 11/16	5/8	5/16
2 15/16	5/8	5/16
3 3/16	3/4	3/8
3 7/16	3/4	3/8
3 11/16	3/4	3/8
3 15/16	3/4	3/8
4 1/8	3/4	3/8
4 3/8	3/4	3/8
4 5/8	7/8	3/8
4 7/8	7/8	3/8
5 1/8	7/8	3/8
5 3/8	1	3/8
5 5/8	1	3/8
5 7/8	1	3/8
6 1/8	1 1/8	3/8
6 3/8	1 1/8	3/8
6 5/8	1 1/8	3/8
6 7/8	1 1/8	3/8
7	1 1/8	3/8
7 1/8	1 1/4	3/8
7 1/2	1 1/4	3/8
7 7/8	1 1/4	3/8
8	1 1/4	3/8
8 1/2	1 3/8	3/8
9	1 3/8	3/8
9 1/2	1 1/2	3/8
10 & 10 1/2	1 1/2	1/2

The Smith & Vaile Co. Dayton Ohio. May 7, 1891

PIPES.

feet of length in differ-
Water per minute.

R.

n	12 in	14 in	16 in	18 in
	....	.....	.....	.....
	....	.....	.....	.....
	....	.....	.....	.....
	....	.....	.....	.....
	....	.....	.....	.....
	....	.....	.....	.....
	....	.....	.....	.....
	....	.....	.....	.....
	....	.....	.....	.....
	....	.....	.....	.....
	....	.....	.....	.....
3	0.01	.....	.....	.....
4	....	.....	.....	.....
5	0.02	.....	.....	.....
6	....	.....	.....	.....
7	0.03	.....	.....	.....
9	0.04	0.017	0.009	0.005
8	0.08	.....	.....	.....
2	0.13	0.062	0.036	0.020
9	0.20	.....	.....	.....
0	0.29	0.135	0.071	0.040
5	0.38	.....	.....	.....
3	0.49	0.234	0.123	0.071
	0.63	.....	.....	.....
	0.77	0.362	0.188	0.107
	1.11	0.515	0.267	0.150

ough 100 feet of 2½-inch
)

Minute.	Horizontal Stream.	Verti l Stream.
	191	136
	203	146
	214	153
	224	158
	119	66
	148	86
	169	107
	186	126
	200	140
	213	150
	225	157
	236	161

GE

1. A gallon of fr
inches.

2. A cubic foot c
inches, or 7½ gallons.

3. A "miner's in
gallons per minute.

4. The friction
velocity.

5. The capacity
thus doubling the diar

6. To find the a
.7854.

7. In calculating
heating surface is equ

8. Each nominal
foot of water per hou

9. The mean pre
pounds per square in
column of mercury 20

10. To find the c
in inches by the stro
inches; divide this a
gallon in inches), an

11. To find the p
multiply the height of
elevation is called equ

12. To find the d
of water per minute
number of gallons by
the diameter of the p

13. To find the h
multiply the total wei
divide the product by
for water friction; a
cylinder.

14. The area of
gives the total amoun
multiplied by the pre
A margin of from 30
the required speed.

FRICTION OF WATER IN PIPES.

Friction loss in pounds pressure per square inch, for each 100 feet of length in different size clean Iron Pipes discharging given quantities of Water per minute.

Gals. per minute.	SIZES OF PIPES—INSIDE DIAMETER.														
	¾ in	1 in	1¼ in	1½ in	2 in	2½ in	3 in	4 in	6 in	8 in	10 in	12 in	14 in	16 in	18 in
5	3.3	0.84	0.31	0.12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	13.0	3.16	1.05	0.47	0.12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	28.7	6.98	2.38	0.97	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20	50.4	12.3	4.07	1.66	0.42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	78.0	19.0	6.40	2.62	.....	0.21	0.10	.....	.....	.....	.....	.....	.....	.....	.....
30	....	27.5	9.15	3.75	0.91	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
35	....	37.0	12 4	5.05	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
40	....	48.0	16.1	6.52	1.60	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
45	....	.....	20.2	8.15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
50	....	.....	24.9	10.0	2.44	0.81	0.35	0.09	.....	.....	.....	.....	.....	.....	.....
75	....	.....	56.1	22.4	5.32	1.80	0.74	.....	.....	.....	.....	.....	.....	.....	.....
100	....	.....	.....	39.0	9.46	3.20	1.31	0.33	0.05	.....	.....	.....	.....	.....	.....
125	....	.....	.....	.....	14.9	4.89	1.99	.....	.....	.....	.....	.....	.....	.....	.....
150	....	.....	.....	.....	21.2	7.0	2.85	0.69	0.10	.....	.....	.....	.....	.....	.....
175	....	.....	.....	.....	28.1	9.46	3.85	.....	.....	.....	.....	.....	.....	.....	.....
200	....	.....	.....	.....	37.5	12.47	5.02	1.22	0.17	.....	.....	.....	.....	.....	.....
250	....	.....	.....	.....	.....	19.66	7.76	1.89	0.26	0.07	0.03	0.01	.....	.....	.....
300	....	.....	.....	.....	.....	28.06	11.2	2 66	0.37	0.09	0.04	.....	.....	.....	.....
350	....	.....	.....	.....	.....	.....	15.2	3.65	0.50	0.12	0.05	0.02	.....	.....	.....
400	....	.....	.....	.....	.....	.....	19.5	4.73	0.65	0.16	0.06	.....	.....	.....	.....
450	....	.....	.....	.....	.....	.....	25.0	6.01	0.81	0.20	0.07	0.03	.....	.....	.....
500	....	.....	.....	.....	.....	.....	30.8	7.43	0.96	0.25	0.09	0.04	0.017	0.009	0.005
750	....	.....	.....	.....	.....	.....	.....	.....	2.21	0.53	0.18	0.08	.....	.....	.....
1000	....	.....	.....	.....	.....	.....	.....	.....	3.88	0.94	0.32	0.13	0.062	0.036	0.020
1250	....	.....	.....	.....	.....	.....	.....	.....	....	1.46	0.49	0.20	.....	.....	.....
1500	....	.....	.....	.....	.....	.....	.....	.....	....	2.09	0.70	0.29	0.135	0.071	0.040
1750	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.95	0.38	.....	.....	.....
2000	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.23	0.49	0.234	0.123	0.071
2250	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	0.63	.....	.....	.....
2500	....	.....	.....	.....	.....	.....	.....	.....	....	.....	....	0.77	0.362	0.188	0.107
3000	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.11	0.515	0.267	0.150

Table showing Gallons of Water Discharged in Fire Streams through 100 feet of 2½-inch Rubber Hose, with given Nozzles (smooth.)

Diam. of Nozzle.	Pressure at Nozzle.	Gallons per Minute.	Horizontal Stream.	Vertical Stream.	Diameter of Nozzle.	Pressure at Nozzle.	Gallons per Minute.	Horizontal Stream.	Vertical Stream.
1	30	161	109	63	1⅛	70	314	191	136
1	40	186	133	83	1⅛	80	336	203	146
1	50	208	152	101	1⅛	90	356	214	153
1	60	228	167	117	1⅛	100	376	224	158
1	70	246	179	130	1¼	30	256	119	66
1	80	263	189	140	1¼	40	296	148	86
1	90	279	197	147	1¼	50	331	169	107
1	100	295	205	152	1¼	60	363	186	126
1⅛	30	206	115	64	1¼	70	392	200	140
1⅛	40	238	142	84	1¼	80	419	213	150
1⅛	50	266	162	104	1¼	90	444	225	157
1⅛	60	291	178	122	1¼	100	468	236	161

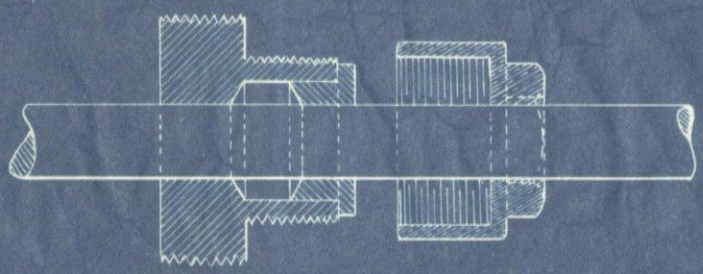
SIZE OF TANKS.

TABLE SHOWING THE NUMBER OF GALLONS IN CISTERNS AND TANKS.

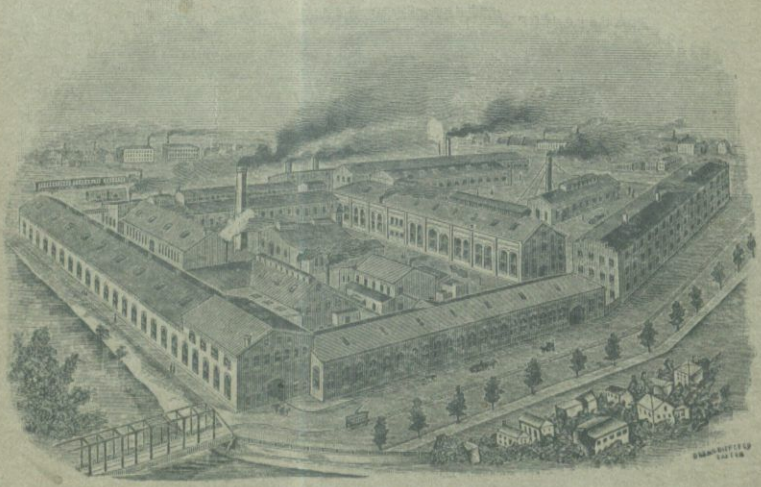
Depth in Feet.	DIAMETER IN FEET.																	Depth in Feet.
	5	6	7	8	9	10	11	12	13	14	15	16	18	20	22	24	25	
5	725	1060	1440	1875	2380	2925	3550	4237	4960	5765	6698	7520	9516	11750	14215	16918	18358	5
6	870	1270	1728	2250	2855	3510	4260	5084	5952	6918	8038	9024	11419	14100	17059	20302	22030	6
7	1015	1480	2016	2625	3330	4095	4970	5931	6944	8071	9378	10528	13322	16450	19902	23680	25701	7
8	1160	1690	2304	3000	3805	4680	5680	6778	7936	9224	10718	12032	15225	18800	22745	27070	29372	8
9	1305	1900	2592	3375	4280	5265	6390	7625	8928	10377	12058	13536	17128	21150	25588	30454	33043	9
10	1450	2110	2880	3750	4755	5850	7100	8472	9920	11530	13398	15040	19031	23500	28431	33838	36714	10
11	1595	2320	3168	4125	5230	6435	7810	9319	10912	12683	14738	16544	20934	25850	31274	37222	40385	11
12	1740	2530	3456	4500	5705	7020	8520	10166	11904	13836	16078	18048	22837	28200	34117	40606	44056	12
13	1885	2740	3744	4875	6180	7605	9230	11013	12896	14989	17418	19552	24740	30550	36960	43990	47727	13
14	2030	2950	4032	5250	6655	8190	9940	11860	13888	16142	18758	21056	26643	32900	39803	47374	51398	14
15	2175	3160	4320	5625	7130	8775	10650	12707	14880	17295	20098	22260	28546	35250	42646	50758	55069	15
16	2320	3370	4608	6000	7605	9360	11360	13554	15872	18448	21438	24064	30449	37600	45489	54142	58740	16
17	2465	3580	4896	6375	8080	9945	12070	14401	16864	19601	22778	25568	32352	39950	48332	57520	62411	17
18	2610	3790	5184	6750	8535	10530	12780	15248	17856	20754	24118	27072	34255	42300	51175	60910	66082	18
19	2755	4000	5472	7125	9010	11115	13490	16095	18848	21907	25458	28576	36158	44650	54018	64294	69753	19
20	2900	4210	5760	7500	9490	11700	14200	16942	19840	23060	26798	30080	38062	47000	56861	67678	73424	20

For Tanks that are tapering, measure the diameter four-tenths from the large end.

SMITH-VAILE STUFFING BOXES.



SYMBOL OF PUMP	DIAMETER OF ROD	STUFFING BOX TAP	THREADS	GLAND TAP	GLAND TAP THREADS	
#1 CAM	3/4"	2 5/8"	12	1 23/32"	10	
#2 "	7/8"	3 3/8"	12	2 1/16"	10	
#3 "	1 1/8"	3 5/8"	12	2 3/4"	10	
#4 "	1 1/8"	4 1/4"	12	2 3/4"	10	
#5 "	1 1/4"	3 5/8"	12	2 3/4"	10	
#6 "	1 1/4"	4 1/4"	12	2 3/4"	10	
#6 1/2 "	1 1/2"	4 1/4"	12	3 1/4	10	
#7 "	1 3/4"	3 7/8"	12	3 5/8"	7	
#8 "	1 3/4"	3 7/8"	12	3 5/8"	7	
#9 "	2 1/8"	3 7/8"	12	3 7/8"	7	
D.W.1	1	3 5/8"	12	2 3/4"	10	
D.B.6	1 1/8"	3 5/8"	12	2 3/4"	10	
D.W.3	1	3 5/8"	12	2 3/4"	10	
D.W.2	3/4"	2 5/8"	12	2 1/16"	10	



EAST SHOPS.