pressure upon the surface of the water, both inside and outside, is evenly balanced,. as the pressure upon the water exposed to the full atmosphere is 14½ lbs. upon each square inch of its surface, while that upon the same planes, but within the pipe, will sustain a column of water 2¼ feet high (weighing 1 lb.) and 13¼ lbs. pressure of air, making a total of 14½ lbs. If, in consequence of a second stroke of the pump, the air pressure in the pipe is reduced to 12½ lbs. per inch, the water will rise another 2¼ feet. This rule is uniform, and shows that the rise of a column of water within the pipe is equal in weight to the pressure of the air upon the surface of the water without.

The distance water can be lifted through a suction pipe varies with the height above sea level and also with the pressure of the atmosphere, which is constantly varying, the usual range of the barometer, at sea-level, being from 28½ in. to 30½ in. At this level the column of water which the atmosphere will support is about 33 feet in height, and a pump will "draw water," as it is called, this distance, but the force which sends the water into the pump at this height is so diminished as to be almost balanced by its own weight. For, although the atmosphere will support a column of water about 33 feet in height, it will only do so as long as the water in the pipe is stationary. If it is desired to keep the stream running, as in fire engine practice, the atmosphere has to perform two duties, one of them being to sustain the weight of the water, and the other to keep it moving.

Thus, taking the barometer at 28.5 inches, about the minimum ever reached in the ordinary way at sea level in this country, if the lift is only one foot, not more than 0.43 lbs. are required to counter-balance the weight of the water, and 13.57 lbs. are available to cause velocity. With a ten feet lift 4.34 lbs. are necessary to sustain the column of water, leaving 9.66 lbs. for velocity. With a 20 feet lift 8.67 lbs. are required to sustain the weight of water, and only 5.33 lbs. are left for velocity. At a little over 32 feet the atmosphere can only sustain the water stationary in the pipe, all its own weight being necessary to counterbalance that of the water.

The following table gives the velocity of flow through a suction pipe in feet per second with various heights. Barometer 30, thermometer 60 deg. Fahr.:—

Height of Pump in feet.	Velocity of Flow into Pump Chamber.	Height of Pump in feet.	Velocity of Flow into Pump Chamber.
	Feet per Second.		Feet per Second.
1	46 16	18	32.21
2	45.45	19	31.19
3	44 75	20	30.14
4	44 01	21	29 06
5	43.28	22	27.93
6	42 33	23	26.75
7	41 77	24	25.52
8	40.90	25	24 23
9	40 20	26	22.80
10	39 39	27	21.41
11	38.57	28	19.85
12	37.72	29	18 16
13	36.86	30	16.29
14	35 98	31	14.18
15	35.07	32	11.70
16	34.14	33	8.52
17	33.19	34	2 89

It will be seen that a pump will not raise water with a velocity which is of practical value at a greater depth than 24 to 25 feet, and this is about the extreme limit of a fire engine's or pump's efficiency. Such heavy duty as this cannot be done except under the most favorable conditions. There is, however, hardly any limit to the length of horizontal suction pipe through which a pump will draw, provided both the pump and the joints in the pipe are air-tight and the sizes are so proportioned as not to cause undue friction.

The following table is from practical tests. It shows the pressure on each square inch in pounds avoirdupois for each inch of the barometer, and the height of a column of water, stationary be it remembered, which the atmosphere at the pressures indicated will sustain:

Mercury in Inches	Pressure on each square inch in lbs. avoirdupois.	Corresponding columns of water in feet & decimals.	Mercury in inches.	Pressure on each square inch in lbs. avoirdupois.	Corresponding columns of water in feet & decimals.
1	.49	1.13	17	8 35	19.26
2	.98	2.27	18	8 84	20 39
3	1.47	3.40	19	9 33	21 53
4	1.96	4 53	20	9 82	22 66
5	2.46	5 67	21	10.31	23.79
6	2 95	6.80	22	10 81	24 93
7	3.44	7.93	23	11 30	26.06
8	3 93	9 06	24	11 79	27.19
9	4 42	10.20	25	11.28	28 33
10	4 91	11.33	26	12.77	29.46
11	5 40	12.46	27	13.26	30 59
12	5 81	13.60	28	13.75	31.72
13	6 39	14 73	29	14 24	32.86
14	6 38	15.86	30	14.74	33 99
15	7 37	17 00	31	15 23	35.13
16	7.86	18.13			

For use with deep lifts, a foot valve is usually provided. This is a valve to be fixed at the lower end of the suction, so hinged that the water can enter but cannot pass back. The effect, of course, is to keep the suction always full of water when it has been once filled.

I have pumps drawing water half a mile, 800 and 1,000 feet, with lifts of 23, 27 and 30 feet.

BERTRAM ENGINE WORKS CO.

The business formerly carried on under the name of "Doty Engine Works Co." and "The John Doty Engine Co., Ltd" will henceforth be known as "Bertram Engine Works Co." The new firm have made the following announcement in regard to their business:—

"Our Engine and Boiler Works are situated on Bathurst and Niagara streets, and the shipyard at the foot of Bathurst street, Toronto. Our facilities for work in our line are unsurpassed: the machine shop contains some of the heaviest machine tools to be found in the Dominion; the foundry is well equipped in every particular, and both are under charge of the same foremen who have for years past contributed to the established reputation which our machinery enjoys. The boiler shop is fitted up with tools thoroughly suited for the heaviest marine work, and with a reorganized force, is now under charge of J. J Fletcher, who, for the last ten years, has been with the Polson Iron Works Co.

"Owing to the extensive buildings and complete plant which we possess, we are in a position to turn out almost any kind of machinery; we will, however, devote special attention to the construction of Marine Engines, High Pressure, Compound and Triple Expansion, High-speed Engines for Electrical Work, Reynolds' Corliss Engines, all sizes; Hoisting and Vertical Engines; Gas Engines, 1 to 10 horse power; Marine, Stationary, and Portable Boilers, Roberts' Safety Water Tube Boilers, Mosher Water Tube Marine Boilers, Steel and Composite Yachts and Steamships, Mining Machinery, Ore Crushers, Stamp Mills, etc

"A Angstrom, who was chief engineer of the Cleveland Ship Building Co. for the last four years, and who came to us with the highest recommendations of the President of that company to accept the position of Manager of our works, will be able to give all our customers the benefit of his extended experience. It is our intention to leave nothing undone in the way of turning out first-class work at the lowest possible price, and giving satisfaction in every particular. We will be represented on the road by Mr. A. R. Milne, a practical engineer, having a thorough knowledge of general machinery."