locks now required between Lake Erie and the sea, this new canal system looks forward to but five." The promoters claim that with the new lock, an outline sketch of which is here given, they can get over difficulties that would require an outlay of $175,000,000 on the present system of locking. The inventor, describing his lock, says:

The peculiar utility of compressed air, as applied to lift ships in dry docks and locks, consists in that it gives an elastic support directly beneath the load, and consequently the structure is very simple and cheap, it makes the pressure independent of the height through which the lift operates, so that the pressures and strains are no greater in a lift of one hundred and sixty feet than in one of sixteen feet, and it flows with twenty-eight times the velocity of water, and thus makes it possible to operate high lifts in about the same time as low lifts.

The pneumatic lift has been developed until it is pronounced by the most eminent and experienced expert engineers to be scientifically and mechanically perfect. It is primarily a steel caisson, of tank structure, working up and down in a water well or pit formed in the lower level of the canal. Compressed air is the motive agent. In all the proposed works the pits will be sunk in rock. The tanks, or caissons, will be balanced in pairs, each caisson having an upper gated lock chamber adapted to retain the vessel to be locked and water to the stated depth (say twenty-seven feet), and a lower open bottom air chamber, containing compressed air, which is retained by a water seal formed by the immersion of the lower walls of the air chamber in the water of the pit, as in gas holders.

The compressed air is at such a pressure that its lifting effort is very much greater than the downward effort of the loaded lock, and therefore, when a lock is down, there is always an elastic cushion beneath its floor; and when it is elevated to its highest position the compressed air tends to expand and raise the lock still higher; and should any accident occur the lock cannot possibly fall, but will on the contrary rise and remain supported, with perfect safety to itself and contents, until the damage is repaired.

To stop and hold the locks at the proper height, to keep them level and to operate them with certainty, facility and security, they are equipped with a hydraulic auxiliary apparatus which levels, actuates and controls them during manipulation, and absorbs the unequal forces due to wind and wave action.

The air chamber in one lock is connected with its fellow by an air conduit controlled by a valve. In these locks the air conduits will be 21 feet in diameter; and the valve is so designed that it has no friction or wearing parts, and it can be opened or closed in one minute without shock.

The air charge is kept at a uniform working pressure above the atmosphere by a small weighted equalizing tank, which automatically takes care of the changes in the volume due to changes in the temperature and density of the adjacent atmosphere. The working pressure in a lock 26 to 28 feet draught is 14¼ pounds to the square inch.

The type of gate proposed to be used is a modification of the familiar pontoon gate used in dry docks. It is built of steel, very simple in construction, and is operated by a pinion and wheel, as draw-bridges are operated. All the gates are duplicates, and while so simple and strong as to be practically safe from damage, an injured gate can be removed and replaced in a very few minutes.

The principle on which the locks operate is the familiar one of weighing in a scale, the locks representing the scale pans and the compressed air replacing the scale beam. The motion is due to a small difference in the total weights of the water in the two locks, just as the motion of a scale is caused by a smaller difference between the weight and the object weighed. The locks move oppositely and synchronously, like scale pens, one ascending while the other is descending. The depressed lock contains the normal depth (26 feet) of water, and floats like a pontoon, its air connection being closed and its hydraulic system by-passed, to that end.

The elevated lock is firmly thrust and held up against its stops by the compressed air, and is connected with the equalizing tank to keep the air pressure constant. It contains a surcharge of water—that is to say, the water in it is 27½ feet deep, 1½ feet deeper than in the depressed lock, and it is correspondingly heavier. If, now, the lock gates be closed to retain the water in the locks during the transit, and if the operating valves be manipulated, the heavier, elevated lock will descend, and in descending will force the compressed air into the air chamber of the depressed lock and elevate it, reversing their relative positions.

Commenting on the effects of this canal on Canadian trade, C. R. Chisholm, of Montreal, writes THE CANADIAN ENGINEER as follows: "The building of this canal would enable the farmer in Manitoba to secure from 3 to 4 cents more per bushel for his wheat, which means on the working of 160 acres sown in wheat, with a yield of 30 bushels to the acre, a gain to each farmer of $144 per year. Take one commodity as return cargo, Manitoba will probably use 160,000 tons of coal per year.

They pay say $9 per ton, or per year		$1,440,000 00
Coal cost to mine, per ton	$1 25	
Freight by water, including commissions....	3 75	
	$5 00	
One hundred and sixty-thousand tons at $5		800,000 00
		$640,000 00
Add the saving on wheat crop		450,000 00
		$1,090,000 00

"This benefit would apply to Ontario, Quebec, Nova Scotia and New Brunswick, as they would all benefit by cheap freight rates by water.

"The freight movement in 1889 on all the lakes was estimated by the U. S. census report at 53,424,432 tons. The tonnage put afloat since then has increased this movement to 63,240,514 tons. Estimates only can be given, because at one point only on the lakes, Sault Ste. Marie, is there an official record made of tonnage movement. The movement through the Detroit River alone, in 1889, was estimated at 36,203,586 tons. The total entries and clearances, foreign and coastwise, for the port of London, England, that year (1889), were 19,245,417 tons; of Liverpool, 14,175,000 tons. The estimate of tonnage movement through the Detroit River, in 1889, was 3,000,000 tons above the combined foreign and coastwise nnage of the ports of London and Liverpool.

"The rapid growth, too, of steam transportation, and the competition of lake lines with the railways, have caused continued reductions in the cost of transportation. The cost per ton per mile of carrying freight, an average distance of eight hundred miles, was one and one half mill in 1889. The value of all the cargoes—27,500,000 tons—carried on the lakes during that year was over $315,000,000.

"Had this been carried at railway rates, the cost to the public would have been over $143,000,000; by the lake rates it was about $23,000,000 only; so that transportation on the lakes saved to the public about $120,000,000 in one year. But as to a large portion of this tonnage, any possible cost on wheels would not have permitted it to move at all. In such a case, its production at the point of origin would, of course, have been impossible.

"The U. S. Census Bureau estimates the ton mileage for the season 1889 by the lakes to be 15,518,360,000 tons miles. The aggregate ton mileage of railways for the year ending June 30, 1889, was 68,727,223,146, which shows the ton mileage of the lakes is nearly one-fourth of the total ton mileage of the railways in the United States. In no other way could the relative importance of lake commerce be more effectively shown."

With reference to this question, we hope to give at an early date some facts and estimates concerning a distinctively Canadian route for a deep canal connecting the upper lakes with the seaboard.