A SUGGESTION IN CANAL BOAT PROPULSION.

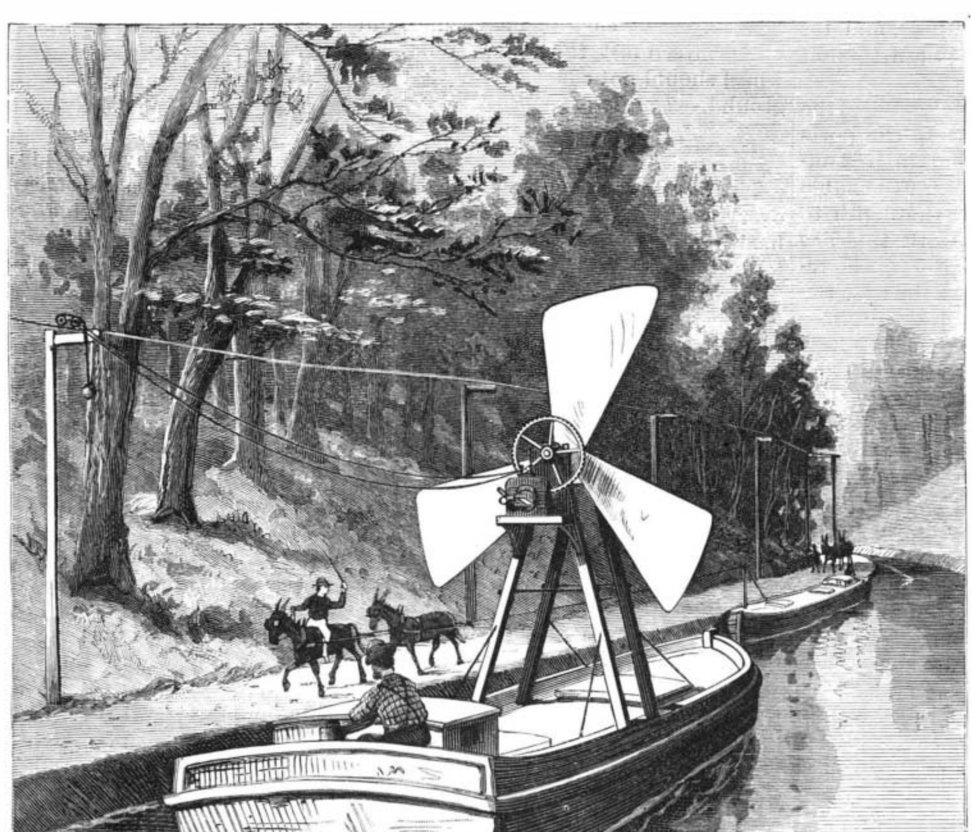
A paper which excited much attention was read at the last meeting of the British Association for the Advancement of Science, by H. C. Vogt. It is published in full in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 670. It was devoted to the subject of the propulsion of ships by air propellers. In it Mr. Vogt gave the summary and results of some very remarkable trials in navigation, executed at Copenhagen. A steam launch was fitted with a windmill with steel blades. It was carried on a frame above the deck, and formed an aerial propeller wheel. Steam machinery was provided for rotating this. With this as a propeller, it was proposed to drive the boat. At first sight the method would seem an extremely inefficient one as regards application of power to so unstable a medium as air. But when it is remembered that recent investigations of the marine propeller have established it as a true reaction engine, in which a large slip is not necessarily an accompaniment of inefficiency, it will appear clear that there is nothing wrong in the principle indicated by Mr. Vogt. An air propeller is a pure momentum or reaction machine. Practically, it was found that a twenty foot launch of five and one-half feet beam, with a propeller eight and one-half feet in diameter, could be driven at a speed of five knots per hour in calm weather and against a fresh breeze at four knots. The engine producing this effect indicated one and one-half horse power. For a single indicated horse power the thrust of the propeller was 36·7 pounds or about the same as that of a water propeller. It might be supposed that in a contrary wind this thrust would disappear, but, on the contrary, through seventy-five per cent of the horizon the thrust was found to be augmented by the wind.

With a larger launch, having a displacement of five tons, a speed of over six knots an hour was obtained against the wind. In some of the trials canvas-covered wings were used, but were found inferior to the steel ones.

We illustrate in the cut accompanying this article a suggestion in the direction of canal boat propulsion. A barge is provided with one of these aerial propellers carried well above the deck on standards. To actuate the propeller a dynamo is provided which is carried on the top of the frame and is connected by gearing with the propeller shaft. In this place frictional cone gearing might be advantageously adopted, so as to admit of a variation of speed. The blades of the propeller should be of steel accurately shaped and arranged to be turned at greater or less angles according to the direction of the wind. To drive the dynamo, a lead of an electric circuit is carried along the bank, upon which line runs a trolly. Wires extend from the trolly to the dynamo, or the circuit may be completed through the earth, the body of water in the canal offering the best possible facilities for grounding the motor circuit. Thus equipped, a canal boat could make her way with a speed exceeding that generally used, and with no greater proportionate expenditure of power than that existing in all cases where the trolly system of actuating electric motors is in use.

The advantages of the system are obvious. The hull of the vessel would be entirely clear of machinery, and the entire weight of the propelling apparatus carried by the boat need not greatly exceed that of an ordinary tow rope. No disturbance of the water of the canal would be produced, except such as would be due to the progressive motion of the hull of the vessel. It would seem as though in this suggestion might be found a solution of the mechanical driving of canal boats; one that from the points of view of simplicity, non-occupancy of the hull of the boat, and minimum disturbance of the water, would be nearly perfect.

The air propeller works with an entire absence of vibration. It requires ten or twelve times the area of the corresponding water screw. The blades may for the first reason be carried out to the tips of increasing width. As the thrust is a perfectly quiet one, and if due to the motion derived from a dynamo would be free from the jarring inseparable from the motions of a heavy reciprocating engine, and as it is cushioned in all its motions by the high elasticity and mobility of the air, a very light frame would suffice to carry the wheel. The thrust of seventy-five to one hundred and fifty pounds would be all that the frame would have to resist—a thrust which would always be brought upon it gradually and would be gradually released. In steam canal boats a very considerable portion of the hull is occupied by the engine, boiler, and coal bunkers, while the constant eddies and currents produced by the propeller are destructive in their effects on the sides and bottom. This is all done away with in the aerial propulsion. The establishment of a line of poles and wire would not represent the tithe of the cost of a fixed or traveling towing cable.

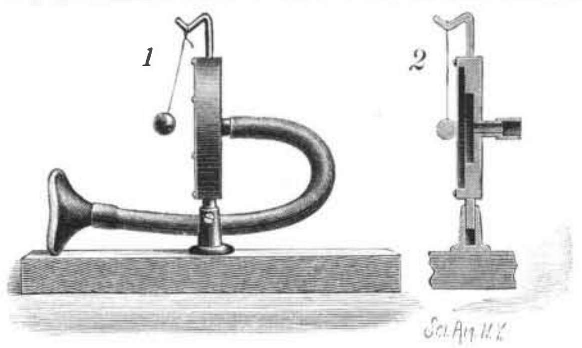


A SUGGESTION IN CANAL BOAT PROPULSION.

VIBRATIONS OF DIAPHRAGMS.

BY GEO. M. HOPKINS.

The telephone and phonograph show conclusively that the human voice is able to set certain bodies in



EXPERIMENT SHOWING THE VIBRATION OF A DIAPHRAGM.

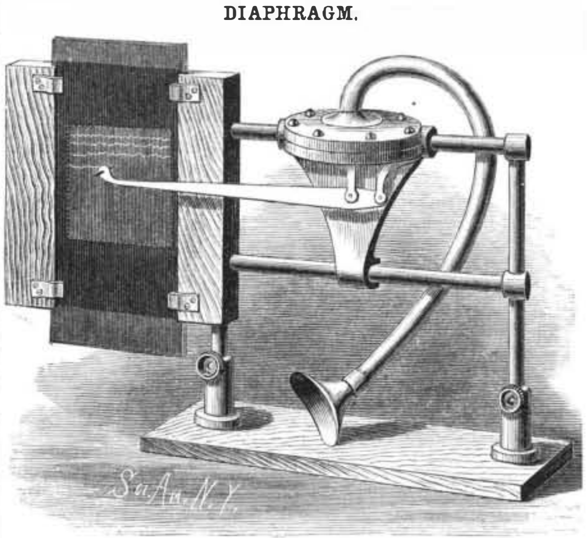


Fig. 3.—PHONOGRAPHIC RECORDER.

active vibration. These vibrations may be detected by touch, but they are not discernible by the unaided eye. It has been shown that the force which produces them is able to perform a considerable amount of work. A telephone diaphragm is able to vibrate sufficiently to transmit speech, even when heavily weighted. A diaphragm, when placed in a horizontal position and damped by a five pound weight suspended from its center, transmitted speech equally as well as one not so damped, the only difference being a considerable loss in the volume of sound.

Mr. Edison some years since devised a piece of apparatus known as the motophone, in which a diaphragm vibrated by the voice was made to rotate a wheel at a high velocity. In the phonograph the cutting stylus, which is moved by the diaphragm, exhibits, when in action, something of the power of the voice, and the engraving on the cylinder of the phonograph shows the complex character of the vibrations of the diaphragm, but on so small a scale as to be difficult of observation.

The use of the apparatus shown in the annexed engravings is, first, to show by means of the lantern that the telephone diaphragm vibrates, and, second, to exhibit by the same means the character of the vibrations.

In Fig. 1 is shown a telephone diaphragm arranged upon a standard and adapted for projection. This apparatus is shown in section in Fig. 2. To the top of the diaphragm cell is secured a hook which supports a small metallic ball opposite the center of the diaphragm by means of a fine silk thread. The ball hangs normally in contact with the diaphragm, but when sounds are uttered in the tube attached to the cell, the diaphragm is vibrated, its motion being made manifest by the repeated repulsion of the ball.

In Fig. 3 is shown an instrument for tracing upon a smoked glass a record of the movements of the diaphragm. A wooden frame is supported by a standard secured to the base board. The face of the wooden frame is grooved to receive the smoked glass plate, which is held in the groove by four spring clips, so that it may be moved up or down after each tracing, preparatory to making a new one. In one edge of the frame are inserted two parallel rods, which are further supported by a standard attached to the base. The standards are made adjustable to adapt the instrument to lanterns of different heights. The arm which supports the diaphragm cell is provided with a sleeve which slides freely on the upper rod, and it is furnished at its lower end with a fork which partly embraces the lower rod. By this arrangement, the diaphragm cell is truly guided while the tracing is being made, and at the same time the construction allows of tilting the cell whenever it is desirable to remove the tracing point from the surface of the glass. The diaphragm cell consists of two chambered recessed disks fastened together with screws, and clamping between them a thin iron diaphragm. The upper disk is apertured and provided with a flexible tube terminating in a mouthpiece. To the center of the diaphragm is attached a stud, which is pivoted to the tracing lever, the lever being fulcrumed in a rigid arm projecting downward from the cell. The free end of the tracing lever carries a fine cambric needle, which lightly touches the surface of the smoked glass when the cell is in the position shown. The tracing lever is made of a thin bar of aluminum, which can spring laterally, but which is very rigid in the direction of its motion.

When used, the apparatus is placed with reference to the lantern so that the opening of the wooden frame will come within the cone of light in front of the condenser. The smoked glass is focused on the screen, the diaphragm cell is placed near the wooden frame and held in one hand, while the mouthpiece at the end of the flexible tube is held at the mouth by the other hand. Now, while a sound is made in the mouthpiece, the diaphragm cell is quickly but steadily drawn along, so as to cause the tracing needle to traverse the smoked glass. A sinuous line will be formed upon the glass, which will be characteristic of the sound uttered, and this line will appear upon the screen as it is formed. By tilting the diaphragm cell, and moving the smoked glass, and then returning the cell to the point of starting, the operation may be repeated. It will thus be seen that, by means of this instrument, a sound may be produced and analyzed at the same moment.

MOSS MARBLE.—There has been discovered, four miles south of Rattlesnake Springs, Washington Territory, an extensive ledge of marble, in which beautiful trees or plants of moss are as frequent and as clearly defined as in the moss agate, though the marble is not translucent. The body of the stone is mostly white, with splotches of pink and blue between the bunches of moss.

Ship Channel between Quebec and Montreal.

The close of ocean navigation of the St. Lawrence was appropriately marked by the official opening of the new 27½ feet channel between Montreal and Quebec, the Montreal Harbor Commissioners, the Minister of Public Works, and their friends making the opening trip on the Allan steamer Sardinian on November 7. The great work has been in progress more or less rapidly for fifty years, for in the year 1838 it really commenced, and though in some years it has gone on slowly, it has never been wholly interrupted from that date. Previous to confederation, in 1867, the work of improving and deepening the channel, especially through the flats of Lake St. Peter, had been carried on partly by the government of the then Province of Canada, partly by commissioners appointed by the government, partly by commissioners acting as agents for the Public Works Department, and after 1851 by the Harbor Commissioners of Montreal.

In November of that year a channel was completed with a minimum depth of 14 feet, excepting in Lake St. Peter, where there was only 12 feet, their operations in five months having increased this latter 2 feet. In 1853 there was a channel entirely through these flats 150 feet wide and 16 feet deep, and by 1865 this was 20 feet deep and 300 feet wide, at which it remained for several years. In 1873 an act was passed in the Dominion Legislature authorizing the Department of Public Works to complete this channel to a depth of 22 feet at low water, and not less than 300 feet wide, the Harbor Commissioners acting under the authority of the Board of Works, the interest on the loan being paid out of the revenues of the port of Montreal. New plant was purchased and set to work in the spring of 1875, and was kept steadily at work until the close of 1878, when a minimum depth of 22 feet at ordinary low water had been attained. Up to this time the cost of the new dredging plant had amounted to $524,000, and the working expenses had been over $628,600, or together $1,152,600.

In view of the rapidly increasing size of Atlantic steamers it was then decided to deepen the ship channel to 25 feet at low water, which was completed in 1882, excepting for two short lengths. In the straight parts of the channel the dredging was 325 feet wide in Lake St. Peter, and elsewhere 300 feet wide, but in bends and at important points it is 450 feet wide or more. The quantity of dredging done in lowering the channel from 20 feet to 25 feet was: Shale rock, 289,600 cubic yards; earth of all sorts, including bowlders lifted by the dredges, 8,200,000 cubic yards; and large bowlders, lifted by stone-lifting barges, 16,700 yards; making in all 8,508,400 cubic yards. The total distance dredged for the 25 feet channel was 34·30 miles, besides five miles of lateral channels. The longest piece of continuous dredging is through Lake St. Peter, the flats of which are 17¼ miles in length, involving the removal since the beginning of dredging in the present channel in 1851 to 1882 of about 8,000,000 cubic yards. The outlay for the deepening from 20 feet to 25 feet was: For dredging plant, $534,809, and for working and other expenses, $1,245,321; or a total of $1,780,130.

No sooner was this depth of 25 feet obtained than the increased size of the steamers frequenting the ports made a further deepening necessary, and in 1883 authority was given for a further loan of $900,000 to enable the Harbor Commissioners to increase the depth to 27½ feet at low water, and this is the work that has just been brought to a successful completion. The returns for this year are not yet made out, but for the last fiscal year, ending June 30, 1887, the total number of cubic yards dredged was 1,341,486, as against 1,790,431 yards the year before. The quantity excavated in Lake St. Peter was 727,200 yards, costing the remarkably low price of 1·45d. per cubic yard. At Cape Charles, where the excavation is all through shale rock, where one dredge and a stone lifter were steadily at work, the cost was 16¾d. per yard for the dredge and 32d. per yard for the stone lifted. The plant employed in the works for the past three years has been seven elevator dredges, two spoon dredges, two stone lifters, nine screw tugs, and twenty-five barges. The following statement of the last date of sailing of the mail steamers from Montreal, their tonnage and draught, shows the gradual improvement:

		Tons.		Draught in feet.
1856	Canadian	1,045	Nov. 11	12·06
1858	Indian	1,154	" 13	16
1860	North American	1,137	" 20	18
1861	Nova Scotian	1,487	" 20	20
1865	Peruvian	1,899	" 15	17·02
1870	Moravian	1,527	" 20	18·09
1871	Scandinavian	1,811	" 21	18
1875	Sardinian	2,577	" 20	18·09
1877	Circassian	2,355	" 20	19·06
1880	Peruvian	1,854	" 22	22·03
1886	Parisian	3,445	" 19	21·08
1888	Pomeranian	3,211	" 23	23

A number of steamers have passed down the river during the last season drawing from 24 feet to 26 feet, and in no case this year has there been any accident or delay. The whole subject of the mail communication with Great Britain is now under the consideration of the government, and tenders are now being received for an accelerated mail service, which will bring to Montreal steamers of as good a class, as large in capacity, and as fleet in their passages as those now working from New York to England, for any of which there is now sufficient depth in the channel. The following statement shows the growth of the seagoing shipping trade from Montreal since the work of deepening from 20 feet at low water to 27½ feet was begun:

	1873. No.	1873. Tons.	1887. No.	1887. Tons.
Steamships	242	245,237	600	807,471
Ships	72	65,823	7	8,684
Barks	164	75,594	68	43,275
Brigs	18	4,660	2	1,118
Brigantines	59	8,581	7	2,031
Schooners	149	12,583	83	8,194
	704	412,478	767	870,773

The steamers have thus increased in average tonnage from 1,013 tons to 1,346 tons in fourteen years, while the proportion of steam tonnage compared with the total of all vessels has increased from 59 per cent to 93 per cent in the same time.—*Engineering.*

Wind Power for Flour Mills.

Although the question of employing the wind to drive flour mills is, in my opinion, a very important one, I have not seen any practical discussion of it in our milling journals. There are certain parts of this country where, as there is no available water power, while steam is too expensive, it would be not only possible but profitable to use wind power, but, so far as my observation goes, very few millers have any knowledge or appreciation of the fact. In other countries, European countries especially, wind-driven flour mills, and that of considerable capacity, are no uncommon sight. I know of one foreign firm operating two mills, one by steam and one by wind, who have assured me that the latter one was financially the more successful.

Of course, in advocating the use of wind power I do not pretend that it will compare favorably with such water powers as are found at Niagara Falls and many other points. I will say that in order to be successful and satisfactory, a windmill should be automatic in all its parts, and, further, should be so arranged that any department of its work can be carried on alone in case the power becomes at any time too small to operate the whole. This has been done in water mills with excellent results, and would be equally advantageous for a windmill. The air is hardly ever dead still, and a breeze that barely moved the leaves on the trees would give power enough to keep the grain elevating or cleaning machinery or corn and feed stone in operation.

Of course, it requires a very good man to run a windmill successfully, but there is no need of engineer, fireman, or fuel.

I would not advise anybody to build a windmill of small size, since no steady, uniform power can be obtained for it. The best work can be done in a mill of 150 or 200 barrels capacity, which should have a wind wheel at least 85 or 90 feet in diameter. No smaller wheel would be satisfactory. Furthermore, the wind is never steady close to the ground, but at a height of about fifteen feet it is more reliable. Therefore, the wheel should not come within that distance from the ground.—*The Roller Mill.*

Health Notes.

The *Sanitary News*, published at Chicago, contains every week sanitary notes, which every seeker of good health and long life will be wise in regarding. The following are from a recent issue:

DANGER IN WATER.—It is generally conceded by the medical profession that polluted drinking water produces more typhoid fever than any other cause, yet there is scarcely any one thing about which people are more careless and indifferent. The pollution commonly comes from the drainage of barnyards, privies, sink drains, stagnant pools, and the like into wells. The water from these nuisances being filtered through the soil, the pollution is seldom detected by the sight, taste, or smell. The board of health of one of the Eastern States, in a late annual report, gives an account of a well of water containing 49·2 grains of solids per gallon, yet the pollution could not be recognized by the senses, and several persons lost their lives by its use before the cause was discovered.

BAD AIR PRODUCES BAD HEALTH.—If you find frosted window panes, damp pillows and walls, and feel languid, with probably a slight headache when you wake on a cold morning, you can feel pretty sure that the ventilation is imperfect. At this time of year the air is frequently shut out to keep out the cold, and many suffer from the ill effects of an insufficient supply of oxygen and the breathing of air charged with carbonic acid and other deleterious substances thrown off by exhalation. The evidences of bad ventilation may not be decidedly marked, but the silent and insidious injury to health goes on. A family can be comfortable with less heat and more fresh air than is generally supposed, and in rooms heated by furnace or stoves and lighted by gas too much care regarding ventilation cannot be exercised.

SUNSHINE.—Equally important with pure air in living apartments is sunshine. It carries with it radiance and cheer and vigor and good health. It is a purifier, warding off mould, moisture, gloom, depression, and disease. It should be admitted to every apartment of the house, and made welcome at all times. It is a strong preventive to the disorders that visit shaded and musty places. It brings health and happiness that cannot be obtained from any other source. It is nature's own health-giving agent, and nothing can be substituted for it. It has no artificial counterpart. It does not only touch the physical body, but it reaches the mind and soul and purifies the whole existence of man. It may fade a carpet or upholstery, but it will bring color to the cheek, light to the eye, and elasticity to the step. The closed and shaded window may throw a richness of color upon the room, but it will bring paleness and feebleness to the occupants. This health agent is free to all, easily obtained, and one of the most economic health preservers we have, and ready to impart its efficacy at the rise of the curtain.

DANGER IN NEWLY BUILT HOUSES.—There is too great haste in occupying a house after its completion. In many places there is such demand for dwellings, and often business apartments, that, as soon as finished, they are occupied. This is especially true of small dwellings. There is more danger in this than is supposed. There is no health in dampness and mould under any circumstances, and in living apartments, where the tendency is toward poor ventilation, the dampness of newly finished houses contributes largely to ill-health. In the town of Basle, Switzerland, a regulation has been adopted which prevents newly built houses from being occupied until four months after completion. Under many circumstances, so long a time as above specified is not necessary, but it is often well to err on the side of safety. The size of the house, its location, surroundings, the material used, and the state of the weather enter into the consideration of the time necessary in which a building should become sufficiently dry for occupancy.

Population of the Sandwich Islands.

The following table of the proportion of nationalities in the kingdom of Hawaii, that is, the Sandwich Islands, is from the Honolulu Almanack and Directory:

Nationality.	Males.	Females.	Total.
Chinese	17,068	871	17,939
White natives	1,068	972	2,040
Americans	1,198	868	2,066
British	882	460	1,342
Germans	1,039	561	1,600
French	125	67	192
Portuguese	5,239	4,138	9,377
Japanese	98	18	116
Norwegians	262	100	362
Polynesians	667	289	956
Other nationalities	330	86	416
	27,976	8,430	36,406
Hawaiians and half-castes	23,623	20,609	44,232

Petroleum for Fuel.

In speaking of petroleum as used in the United States for fuel, *Engineering* says:

"America, which waited so long to be taught by Russia how to use liquid fuel on a large scale, has at length rushed into the business with ardor, and promises before another year to forge ahead of her rival. Why the United States should have lagged so long is capable of easy explanation. When the oil industry was originally developed, their fuel was everywhere cheap, and no necessity existed for a rival to wood and coal. Moreover, the American raw petroleum gave so large a yield of kerosene and lubricating oils that no particular balance of refuse was left inviting utilization. It was for this reason that the Americans looked coldly on the liquid fuel progress of Russia, and made no attempt to beat it. A few years ago, however, large quantities of oil were found in the State of Ohio not very well adapted for refining purposes, although many efforts were made to render the distillation of kerosene a paying operation. At length the Standard Oil Company, to prevent competition in the refining trade on the part of the Ohio refiners, bought the whole of them out, and then proceeded to utilize its monopoly by making arrangements to pipe the oil to Chicago for fuel purposes."

This line is 270 miles long, and the oil is supplied through an eight inch pipe. As the use of oil is far preferable to the use of coal in some industries, there was an immediate demand for the fuel as soon as it was offered at Chicago. Appliances for the consumption of oil were at once introduced, some of them copied from the Russian type and some modified and some original in construction, in order to meet the requirements of the local factories.

The three methods most generally employed for the combustion of the petroleum is the distilling the oil in a gas plant until it is reduced to a gas, after which it is burned under boilers similarly to natural gas. Another method is forcing the oil in a spray under the boiler by compressed air. Perhaps the most usual method, however, is spraying the oil into the furnace by an injector operated by a jet of steam, where it becomes vaporized and mingles with the air which is also thrown from the injector.