COLDER THAN MEDICINE HAT

Chief Seal Hunter Outclassed by Tripler's Liquid Air Feats.

FREEZES PURE ALCOHOL AND MERCURY

How a Drop of It Feels on a Man's Hand—Danger Is When Confined—Commercial Uses of the Product.

Only one substance in the world has not been frozen. When science has succeeded in producing a cold intense enough to freeze that single remaining gas, helium, a move else can be formed of what the world would be without heat.

Helium is the lightest of all known substances. It is lighter even than hydrogen and so evanescent that it was not until recent years that chemists knew of its existence. It is found in the deep crevices of the earth where it has been confined through all the ages. If it were permitted to escape into the outer atmosphere it would immediately fly away into space and disappear. Hydrogen gas, which is next in order of lightness, has recently been reduced from gas to a liquid substance by Prof. John Dewar of England—an achievement as remarkable in the realm of science as the discovery of the north pole would be in exploration.

Indeed, the effect to produce low temperatures is much like arctic exploration. Scientists have gone downward slowly, discovering method after method for getting nearer to the north pole of temperature. Continental experimenters have vied with Englishmen, and Englishmen have vied with Americans; but we can take pride in the fact that none of them has been as successful in the field as Charles E. Tripler of New York City, who is able to produce a greater degree of cold for a longer period of time than any other experimenter.

I visited Mr. Tripler's laboratory not long since and he explained to me for the first time his cold-producing machine, by means of which he reduces the ordinary air of his workroom, no matter how warm it may be, to a liquid that looks not unlike water, although it is not wet. This liquid is so cold that it actually burns like a redhot iron and it boils as violently when placed on a block of ice as water on a redhot stove. Mr. Tripler also showed me how he freezes this liquid air into air-ice, a curious, flinty substance somewhat resembling half crystallized syrup sugar.

Ice Made from Air.

Wonderful as it is to see ice that is made of air, it is not so wonderful as Mr. Tripler's story of the meaning of this phenomenon. He tells how, at some remote age in the future, all of the atmosphere which we now breathe will fall in drops of liquid, just such as he produces in his laboratory, and great lakes and oceans of air will form on the earth, much resembling the present lakes and oceans of water.

"When the earth grows so cold that the air is liquefied," Mr. Tripler continues, "of course all the water on the earth will long ago have been frozen solid. Indeed, it will be as hard as rock crystal and not unlike that substance in color and texture. After the air is all in the form of lakes or oceans the cold will continue to increase until they in turn are frozen hard. After that the hydrogen, helium and possibly some other very light gases, of which we may now have no knowledge, will fall in the form of rain and then the world will be absolutely dead and inert, frozen as hard as the moon."

The entire process of the universe is typified in Mr. Tripler's laboratory, where every degree of temperature from the heat of a steam boiler nearly down to the cold of interstellar space can be produced at any time.

Until a few years ago all scientists believed that there were what they called "permanent gases"—that is, gases which could not be liquefied. Some of the best experimenters had tried compressing the two gases which compose our air (oxygen and nitrogen) under thousands of pounds to the square inch, all to no result. They also tried heating them in reverberatory furnaces and cooling them to the greatest known depths of cold, but they still remained gases. Finally the idea of combining immense pressure with great cold occurred to a French savant and one day he astonished the entire world of science by exhibiting a few drops of a clear, transparent liquid—liquid oxygen. An English experimenter who followed him produced a whole wine glass full of liquid air, but it cost him about $3,000.

Now Mr. Tripler, the American inventor, has succeeded in building a machine which will produce liquid air in very large quantities at an expense so low that it may be said to cost nothing at all. From a mere laboratory curiosity this marvelous substance has suddenly given promise of almost unlimited commercial uses, so that those who know say it must soon rival electricity in the variety of its adaptations. Ships will run with it, guns will fire with it, it will be used as a motive power for operating locomotives and auto-mobiles and in driving great manufacturing concerns. Mr. Tripler even predicts that by the agency of liquid air practical aerial navigation is assured. The problem which has hitherto defeated the purposes of aerial navigators has been the difficulty of producing a propelling machine sufficiently light and yet strong enough to keep the propeller in motion. Liquid air requires no boilers nor fuel nor smoke stacks and the machinery necessary to its use will be a mere feather's weight compared with the ordinary steam engine.

Process of Liquefaction.

The principle of the liquefaction of air and all other gases is exceedingly simple. When a gas is compressed it gives out heat—that is a well known fact in physics. When this pressure is removed the gas must take up from somewhere the heat which it gave out. After a series of expensive experiments extending over eight years Mr. Tripler has at last evolved a wonderful machine for utilizing this principle. He has so arranged the liquefier portion of his apparatus that when the air, which has been highly compressed by his steam engine, is allowed to expand it takes up the heat from another pipe containing compressed air, thereby reducing the heat, or, in other words, producing cold in this pipe.

By means of this process he produces a cold so intense that the air finally drops down in liquid form and by the twist of a small valve it is allowed to run out. This epoch-making machine has only just been completed, and the patent office in Washington has declared it to be an original invention and has permitted Mr. Tripler to take out a patent on it. The liquid air as it comes from Mr. Tripler's liquefier is a grayish looking fluid substance which gives off a cold, heavy vapor which rolls out along the floor. If this vapor touches a man's leg or foot he at once feels the sensation of coolness.

Mr. Tripler keeps the liquid air in a double tin can, not unlike an ice cream freezer, which is insulated from the action of heat by means of a wrapping of felt. The top of the "freezer" is always left open except for a thin wad of felt around which the expanding vapor passes readily. Liquid air is very tender of its liberties, for every gallon of it contains 800 gallons of ordinary air, so that its expansive properties are something tremendous. A little of the substance confined in a tight iron pipe will blow it into atoms in two seconds. It is to be understood, however, that liquid air is not an explosive, that it can be handled as easily as water and with quite as much safety, and Mr. Tripler says there will never be any necessity of confining it to make it useful for commercial purposes.

Low Temperatures.

The cold necessary to liquefy air is 312 degrees below zero of our Fahrenheit thermometer. Some idea of the terrible intensity of this cold may be had by comparing it with the freezing point of mercury, which is 40 degrees below zero. Alcohol, which has been used for registering all the degrees of low temperature, freezes at 202 degrees below zero, so that air liquefies 110 degrees below the lowest limit which a spirit thermometer will register.

In one of Mr. Tripler's experiments he pours a little liquid air from a saucepan into a glass containing some pure alcohol. This he stirs with a glass rod. The alcohol boils vigorously and in a few minutes freezes until it resembles wet snow and if the stirring is continued the frozen alcohol can be lifted out of the glass as a hard lump. To freeze liquid air into air-ice, as Mr. Tripler is able to do without difficulty in his cold-producing machine, a temperature of 340 degrees below zero must be attained. Mr. Tripler is certain that he has gone even lower than this, although he has had no accurate means of measuring such inconceivable temperatures. It is certain that Prof. John Dewar of England, in liquefying hydrogen, produced a temperature at least 350 degrees below zero, which is probably the coldest cold ever obtained by artificial means. Scientists are now agreed that the absolute zero—that is, the cold of interstellar space, where there is absolutely no heat—is 461 degrees below zero. Therefore Mr. Tripler has reached a degree of cold only 111 degrees above the absolute cold and it may safely be predicted that some day science will go even further, perhaps discovering the real north pole of temperature.

To the human sense of touch a temperature of 312 degrees below zero is most extraordinary. Mr. Tripler dips his hand fearlessly into a pail of liquid air, but he is careful to withdraw it instantly. The reason that it does not freeze him at once is the same that enables a workman to dip his hand into molten lead, the moisture of the human flesh forming a little cushion of vapor which keeps away for a second the effect of the cold or the heat. A few drops held in my hand for an instant felt exactly like a red hot coal. It does not really burn, of course, but it kills, leaving a little red blister not unlike a burn. For this reason, one of its prospective uses will be for the purpose of cauterization in surgical cases. It is not only a good deal cheaper than the ordinary caustics, but is much more efficient, and its action can be absolutely controlled. Indeed, a well known surgeon has already performed a difficult operation on a cancer case with liquid air furnished by Mr. Tripler, and he has reported the case to be absolutely cured.

Mr. Tripler showed me some of the curious effects of intense cold by dipping a beefsteak and an egg into liquid air. The egg was frozen until it was as hard as a bit of quartz, and when I struck it with a hammer it cracked open and the inside was sharply crystallized. The beefsteak, when frozen, was as stiff and brittle as glass. Mr. Tripler crumbled it up in his hands like so much cracker, and a piece of it dropped to the floor shivered into a thousand pieces.

"Not long ago I was in Boston," said Mr. Tripler, "exhibiting some of my liquid air to a number of scientists. We were dining at the hotel and a waiter brought in a fine piece of beefsteak. I dipped it in the liquid air, froze it stiff, and returned it to the platter. Then we called the chef and asked him how it happened that he served such beefsteaks; then I proceeded to break it up into little bits with my fingers. You can appreciate his astonishment."

Freezing Iron and Mercury.

Liquid air freezes iron and steel just as rapidly as it freezes beefsteak. Mr. Tripler accidentally dropped one of the tin cups in which he had been ladeling out liquid air and it at once shivered like so much glass. It has, however, an exactly opposite effect on copper, gold and the other precious metals, all of which it renders tougher instead of more brittle. Mercury is frozen into a hard block. Mr. Tripler makes a little pasteboard box the size and shape of a hammer head, fills it with mercury, suspends an iron tube in it as a handle, and sets it down in a pan containing liquid air. In a few moments it is frozen hard, so that it can be lifted out and used for driving a nail into a hard wood block.

Not long ago Mr. Tripler took a can of liquid air to the Harlem river and poured it out on the water in order to see its effect. Small masses of it at once collected in little round balls on the surface of the river, and being so much colder than the water, they froze, little cups or boats of ice in which they began floating about swiftly and bumping up against one another like so many lively water bugs, finally boiling away and disappearing, leaving the miniature ice boats quite still. If a bit of the liquid air is placed in a tall jar of water, part of the nitrogen, which is lighter than water will evaporate first, then the liquid oxygen, which is slightly heavier than the water, will sink in beautiful silvery bubbles.

Mr. Tripler shows the terrific expansive power of liquid air by placing a little of it in the bottom of a copper jar, in the mouth of which he inserts a cork perforated by four glass tubes. The copper jar is then placed in a pan of ordinary water, the heat of which causes the liquid air to expand instantly and blow upward through the tubes a perfect geyser of fine vapor, like the exhaust of a steam engine.

It is a curious thing to see liquid air, placed in a teapot, boiling vigorously, on a block of ice, but it must be remembered that ice is as much warmer than liquid air as a stove is warmer than water, so that it makes liquid air boil just as the stove makes water boil. If this same teapot is placed over a gas flame a thick coating of ice will at once collect on the bottom between the kettle and the blaze and no amount of heat seems enough to melt it.

Burning Steel.

As I said before, when the liquid nitrogen boils away from liquid air it leaves behind almost pure liquid oxygen. Liquid oxygen is a most marvelous substance in the production of rapid combustion. Mr. Tripler places a little liquid oxygen in a tumbler made of ice and then thrusts into it a steel spring, having at the end a lighted match. The moment the steel strikes the oxygen it burns like a splinter of fat pine. This experiment shows a most astonishing range of temperature. Here is steel burning at 3,500 degrees above zero in an ice receptacle containing liquid air at 312 degrees below zero. In the same way, if liquid air is thrown on woolen felt, which under ordinary circumstances will not burn at all, it causes the felt, when ignited, to explode and burn with all of the violence of gunpowder. From the last named experiment Mr. Tripler indicates the use to which liquid air may be placed in making explosives.

The tremendous expansive power of liquid air, which is about 200 times that of steam, gives a convincing idea of the wonderful uses to which the substance may be placed for producing power for running all kinds of machinery. Moreover, liquid air boils and produces expansive vapor at the ordinary temperature of the atmosphere, requiring no coal or other substance for generating heat.

GUNS AND BELLS OF SPAIN.

Tons of Old Bronze from Cuba to New York.

A smelting firm in New York city has received from Cuba during the last two weeks fifty of the oldest Spanish cannon on the island, ranging in weight from 500 pounds to five tons, each one of solid bronze and each one with a history of its own. Fifty huge bells of bronze, all containing a considerable proportion of gold and silver, have also been received, and unless some one wants some of the pieces as curiosities the whole lot will be run into the smelting pots before another month has passed.

In this lot are many cannon and bells over 200 years old, relates the New York Sun. Nearly all are floridly decorated and inscribed. They bear the arms of Spain some running back to the time of King Philip V. The stroke of an ordinary lead pencil on either cannon or bell brings forth a clear metallic ring most agreeable to the ear, an ample evidence of the character of the metal of which they are made. For many years before the last insurrection these cannon were the pride of the Spanish villages and towns in Cuba. They stood in the square and before the official residences. Some were used by the Spaniards during the ten years' war, but the greater part of those which have now come to New York were too antiquated even at that date to be of any use in warfare.

The bells range in weight from half a ton to two tons. Some come from sets of chimes in churches in the larger towns, others hung alone in the steeples of churches in the smaller villages of the island. The general policy of both Spaniards and Cubans in burning and ravage everything on the island outside of the fortified cities resulted in bringing to the ground hundreds of these church bells and dismounting the historic old cannon. They have been lying for years neglected as long as a state of disorder prevailed on the island and there they would doubtless be lying still but for the approach of the Yankee with the business eye and the gold in his pocket to pay for what he wanted. The Spaniard may rave when he hears about the vulgar end of his bronze cannon and silver chimes, but it is a significant fact that all of these relics, now hovering on the brink of the smelting pot, were sold to American speculators by Spanish officers for good American gold.

The cannon were brought here on Ward line steamers and are now stored in the warehouse of the Terminal Warehouse company at Thirteenth avenue and Twenty-eighth street. All of them are of the smooth-bore, muzzle-loading pattern, and some look as though they had seen service. Others look more as if they had been made for ornament. By far the handsomest of the cannon is a large one weighing about four tons. Just what part of Cuba it came from the present owners do not know, but it has been tested and found to be of pure bronze. From muzzle to breech it is covered with raised decorations, principally flowers and leaves. In the center is the royal crown and arms of Philip V, the fleur-de-lis in the shields raised some distance above the rest. Below is the inscription in raised letters:

PHILIP V. HISPANIAR. REX.

Running around the breech is the following:

VOIE (partly illegible) ABET FECIT,
Sevilla, AANNO D. 1735.

There are two inscriptions near the muzzle running across raised ribbons traced in a sort of lovers' knot. One is (first word uncertain) "FVLMINA REGIS," the other "ELISABE. FARNE. HISP. REGINA," which refers to Elizabeth Farnese, queen of Spain and second wife of Philip V, first of the bourbon kings of Spain. This gun, like all the others, is named, "El Dedalo" is the name in raised letters near the breech.

FIGURES ON HAY.

Value and Volume of the Crop and Increased Demand.

The introduction of electric motor power does not seem to affect either the volume or value of the hay crop, reports the Chicago Record. In 1897 it was worth $401,390,728. In 1898 the acreage was larger and the yield was better, although prices were not so high, and the total value was $398,660,647. The people realize that the hay field, with one exception, is the richest source of our national wealth, richer than the coal or iron mines or the lumber forests or any other product of the soil or the factory with the exception of corn. The value of the wheat crop in 1898 was $802,770,270 and the value of the corn crop was $952,022,428. Last year's hay crop of the United States was worth one-third more than all the gold the world produced and twice as much as the silver.

During the last fiscal year we imported about $20,000 worth of hay from Canada. There would have been more but for the high tariff imposed by the Dingley law. We exported more than $1,000,000 worth, chiefly to Mexico, South America and the West Indies. The exports will be much larger next year because we are sending a quantity to Cuba and Porto Rico to feed the horses of the army, which have not yet become accustomed to the fodder of the tropics. No hay is grown in the hot countries; grass will not stand the hot rays of the sun. The chief food for animals is alfalfa, a kind of clover which is juicy and nutritious and grows the whole year around. It is never cured, but is cut fresh every morning and peddled through the streets on the backs of donkeys to those who are fortunate enough to have cattle or horses.

New York is the best hay market in the United States. The average consumption of that city is 3,200 tons a day, or nearly 450,000 tons a year. The consumption of hay has not fallen off with the abandonment of horse cars. On the contrary it has increased, which is said to be due to improved trade conditions, the increase of trucking and larger shipments of live stock.

New York state used to produce the finest hay known, but the best quality now comes from Michigan and Indiana.

The total product of all the mines in the United States last year reached $810,650,928, which is only double the value of the product of the hay fields. This was an increase of $59,787,768 over 1897. The value of the coal mined within the limits of this country was $230,268,959; iron, $111,858,294; gold, $64,500,000; copper, $64,144,328; petroleum, $40,277,000; silver, $37,021,326; coke, $31,920,000; lead, $16,410,260; zinc, $10,267,397. The remainder of the total is made up of 126 different minerals known to the useful arts. Nearly every mineral of value is produced in the United States.

CANADIAN HIGH ROLLER

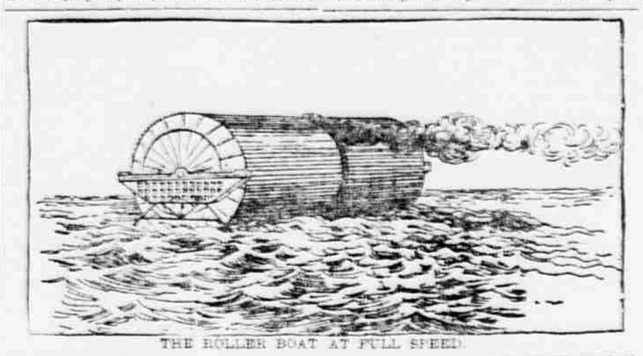
Fred Knapp's Freak Boat for Tumbling Over the Deep.

DETAILS OF THE NEW BARREL-SHIP

A Novelty that First Amused, Then Perplexed and Now Astonishes the World of Navigation.

Last year the world was amused, then perplexed, then astonished at the effort of Frederick A. Knapp, a daring Canadian inventor, to navigate a huge boat which rolled on the sea like a barrel. The initial trip of the experimental boat convinced a number of capitalists that Mr. Knapp's invention would revolutionize the science of navigation, and now with thousands of dollars at his command the inventor is letting contracts for the construction of the first Knapp roller boat. It will enter into active competition with steam and sail vessels of the present type for the world's water traffic. The big cylinder will be finished and launched at the beginning of next summer.

The success of the first full-sized roller boat, the initial steps in the building of which are now occupying the attention of Mr. Knapp and his associates in Chicago, will mean a complete and sweeping revolution of all deep water transportation. If this pioneer roller achieves no greater speed than that made by the crude model which has been operated in Toronto bay the craft now plowing the inland seas may read their orders to tie up in permanent quarters, for the carrying capacity of the roller boat is immensely greater on the same draught than that of the prevailing type of vessel, while the power required to propel it is far less.



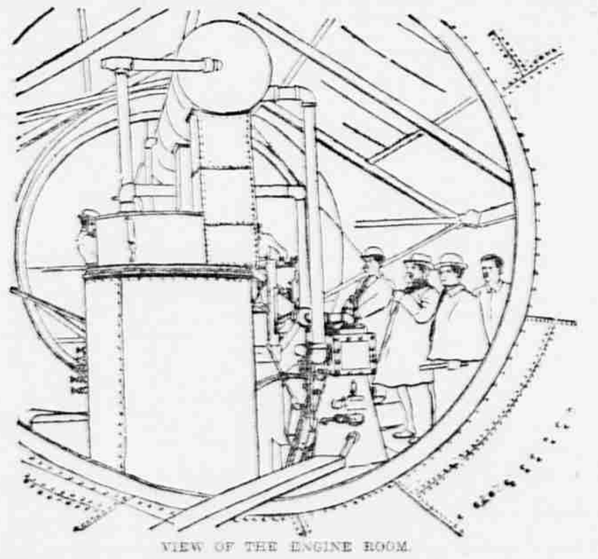
THE ROLLER BOAT AT FULL SPEED.

Odd Appearance of the Boat.

To form a correct mental image of the roller boat, picture a huge barrel or cylinder 500 feet long, 96 feet in diameter and 24 feet from the hollow core to the outer surface. This is constructed of boiler plate so riveted as to be airtight. It has an inner, an outer and a middle skin, these tubes being held at proper distances from one another by circular partitions forming airtight compartments which make the boat unsinkable.

Not only is this great barrel the shell of the boat, but it is also its propeller—the wheel which gives the craft its actual traveling capacity. Think of a boat with a paddle wheel 500 feet broad and 96 feet in diameter! But the term "paddle wheel" is not strictly applicable in this case, for the roller boat has neither screw nor paddles. The 4-inch T-rails running from end to end of the outside of the cylinder are better described as cogs which set into the water and enable the roller to roll forward over the sea instead of merely revolving without progress. The progressive action of the cylinder is similar to that of the broad-tired wheels of a country traction engine pulling its way up a hill, the cogs with which the tires are crossed biting into the roadway and giving foot hold and pulling power.

Within the tunnel or core of this hollow cylinder is suspended the boat proper, or the portion carrying the passengers, crew, cargo and engines. The cylinder revolves around this inner cradle, the latter always remaining level. Only at the points where the "spider work" of the cylinder projects down to the "journals" or huge hollow steel axles by which the central section of the boat is suspended does the frame work of the roller come in contact with the hanging or nonrotating part of the craft. The suspended interior is divided into three lengths, two long sections separated by a short one. The short central section of the inner cradle contains the engines, one end section the first-class and the other the second-class passengers. The passage from one to another of these sections is through the hollow "journal" which is a part of the non-revolving life center of the boat. As these steel axles in a roller boat for ocean service are bored by tunnels ten feet in diameter, it will be seen that they are ample for carrying all the electric lighting cables, telegraph and telephone wires, etc., and for affording a passageway. The steering is done by rudder "drags" at each end, operated from a bridge suspended outside the boat.



VIEW OF THE ENGINE ROOM.

How the Power is Applied.

A knotty problem in the construction of this boat was the application of the power by which the outside cylinder is revolved. This is accomplished by a battery of three engines having a long, upward stroke, the pistons being attached to "cranks" of the big driving shaft. The points on the circle of the shaft at which the pistons apply the power are equi-distant from each other or 120 degrees apart. At each end of the driving shaft is a powerful cogwheel fitting into the cogs of the cylinder's bearings, or more properly into an internal "spur gear" rigidly connected with the solid bulkhead of the cylinder.

Above the suspended cradle of the boat is an arched ceiling hiding from view the interior of the revolving cylinder overhead. Light and air are freely admitted at the open ends. Only the ends of the cradle are, of course, in the least exposed to sun and weather and the fact that the bottom of the suspended section of the boat is high above the reach of the fiercest storm waves is calculated to inspire in the future passengers of this craft a feeling of complete security. As there will be no swaying or pitching motion the inventor promises entire exemption from sea sickness. Rocking or swaying is prevented by the perfect equilibrium of the suspended body and the great length of the craft, together with the fact that it rolls over the water "broadside on," allowing little opportunity for end-to-end pitching.

Speed Possibilities.

The problem of the speed which the roller boat will be able to show is an interesting one, certain to provoke a wide range of comment from nautical men and engineers. Regarding this point the inventor says:

"If the freight boat which we shall put into commission next summer for the ore and grain traffic of the great lakes makes no better speed than did my first crude working model it will outclass all competition on the part of the swiftest freighters now on the inland seas. That model was 120 feet long and twenty-two feet in diameter. Loaded to 100 tons displacement she revolved ten and one-half times a minute on the application of less than twenty-horse power of steam. This gave her a steady speed of six miles an hour. The roller boat for ocean traffic will be 800 feet long and 200 feet in diameter. On the basis of what has already been done with the model in Toronto bay, operating under an insignificant expenditure of power, I think it may be reasonably granted that adequate engines will be able to turn the ocean boat thirteen times a minute. That means a speed of 100 miles an hour!

"I have constantly to meet the objection that the roller boat cannot make progress against a gale. This point is raised by engineers who are willing to grant that the boat will be able easily to attain a speed of 200 miles an hour in still water. In answer to this I have only to say that if the boat can go a mile a minute it can keep out of the face of any gale, for storms travel in the form of a progressive circle. With such speed as that under discussion the boat can so quickly shift her course as to put the wind at its back and get where the opposing current of the gale cannot overtake it. However, I take the position that no wind can ever stop the roller boat, because the greatest wind resistance the big ocean roller can possibly encounter is 500 to 600 tons, and this cannot have any appreciable effect in overcoming the momentum of a rolling cylinder weighing 25,000 tons. The lesser power must give way to the greater.

"And right here some engineers will exclaim that this conclusion is contrary to 'well established scientific principles,' that momentum is not a force, but an energy, that the engines of the boat must exert sufficient steam power to overcome the resistance of the wind independent of momentum. This is answered by a simple illustration, the basic facts of which no well-informed engineer will dispute. An ordinary

locomotive developing a speed of a mile a minute is mounted on Holman trucks and thereby increases its speed to two miles a minute, meeting a wind resistance of more than 2,000-horse power while actually exerting only 1,500-horse power of steam force.

"In this operation the engine does not increase its piston speed. While its drivers are working at the rate of a mile a minute the geared trucks increase its actual speed on the track to two miles a minute. This means a tremendous increase of wind resistance without any increase of steam power. Now what force is it that enables 1,500-horse power of steam to overcome 3,000-horse power of wind resistance? There is but one answer: Momentum!—the inertia of motion maintained by the continuity of the initial steam power.

Advantages of the Craft.

"The broad and really scientific engineer invariably accepts this illustration at its full face value. It is only the theoretical rule-of-thumb man who fails to recognize its force. And this observation applies to every principle involved in the construction and operation of the roller boat. There are two or three simple and fundamental principles which help to make clear the points of difference between the present type of ship and the roller boat so far as the problem of speed is concerned. The present ship is a huge plow, the largest portion of which must be submerged in order to prevent it from being overturned. Its progress is made by forcing its way through an incompressible fluid, the resistance of which increases as the cube of the velocity up to a speed of twenty knots an hour and beyond that the ratio of the increase is unknown. It is a question of 'brute force,' of engine power, working against the force of nature.

"On the other hand, the roller boat reverses the operation and works with nature's forces. Direct water resistance and 'skin friction' are its friends which help instead of hinder its progress, furnishing the leverage necessary to produce the forward movement. Without the water resistance which the T-rails on the exterior of the roller meet the cylinder would simply roll over and over without any forward movement. The stronger the resistance the more easy and rapid its progress. Then, the greater the speed of the roller the less will be its draught. At very high speed it will be practically in the position of a broad wheel rolling on a level surface.

Weight and Cargo Capacity.

"The weight of the big steam vessel will be 16,000 tons and it will require 4,000 tons of cargo to put it down twelve feet into the water. Its displacement as a freighter will be so great that when it is drawing thirty feet of water it will be carrying 60,000 tons of cargo. On the same draught as the lake vessels passing through the 'Soo' the roller boat will carry a cargo three times greater. It should be remembered that the interior circle of the airtight compartments in the cylinder may be used for carrying many kinds of freight, like coal, grain and ore. So long as the cargo of the diameter is equally distributed it will not interfere with the proper action of the cylinder, which will remain at all times as exactly balanced by wheel. The freight boats will be so constructed that trains may run into the boat at the open end, unload and back out upon the dock again. The loading and unloading of the compartments in the cylinder will be accomplished with great facility, the roller being so turned that the compartments from which grain or ore are to be unloaded will be elevated above the level of the cars, on the dock into which the cargo is to be transferred. Unloading from the cars will be done on the same principle, the compartments for the reception of the cargo being brought lower than the cars, thus making it possible for gravity to do the main part of the work."

The absolute safety and indestructibility of the roller boat is a feature of intense personal interest to all who travel by water. The cylinder is a mammoth life preserver and the perforation of any considerable number of the air chambers would not affect its buoyancy. The steel construction of the interior portion renders it indestructible by fire. If the machinery of the roller boat were disabled and the winds were to dash it on the rocks of a lee coast it would remain unshakable and the accident would not result in loss of life or cargo. Such a catastrophe as that which befell the Bourgogne will be impossible with the roller boat.

Frederick A. Knapp, the inventor, is a successful Canadian barrister, living at Fresson, Ontario. He has been at work on his invention since 1895.

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