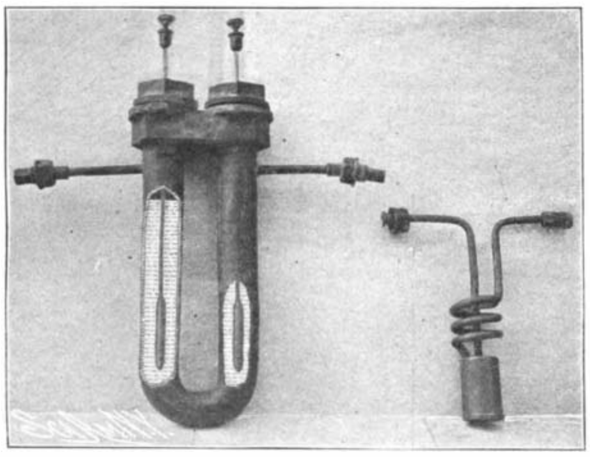
HOW LARGE STEAMERS ARE DIVIDED AND TAKEN THROUGH THE CANADIAN CANAL.

The construction of steamships and barges in yards on the Great Lakes, as is well known, has included a fleet built for the ocean as well as lake service. Some of these vessels are of very large dimensions, having a carrying capacity ranging between 4,000 and 5,000



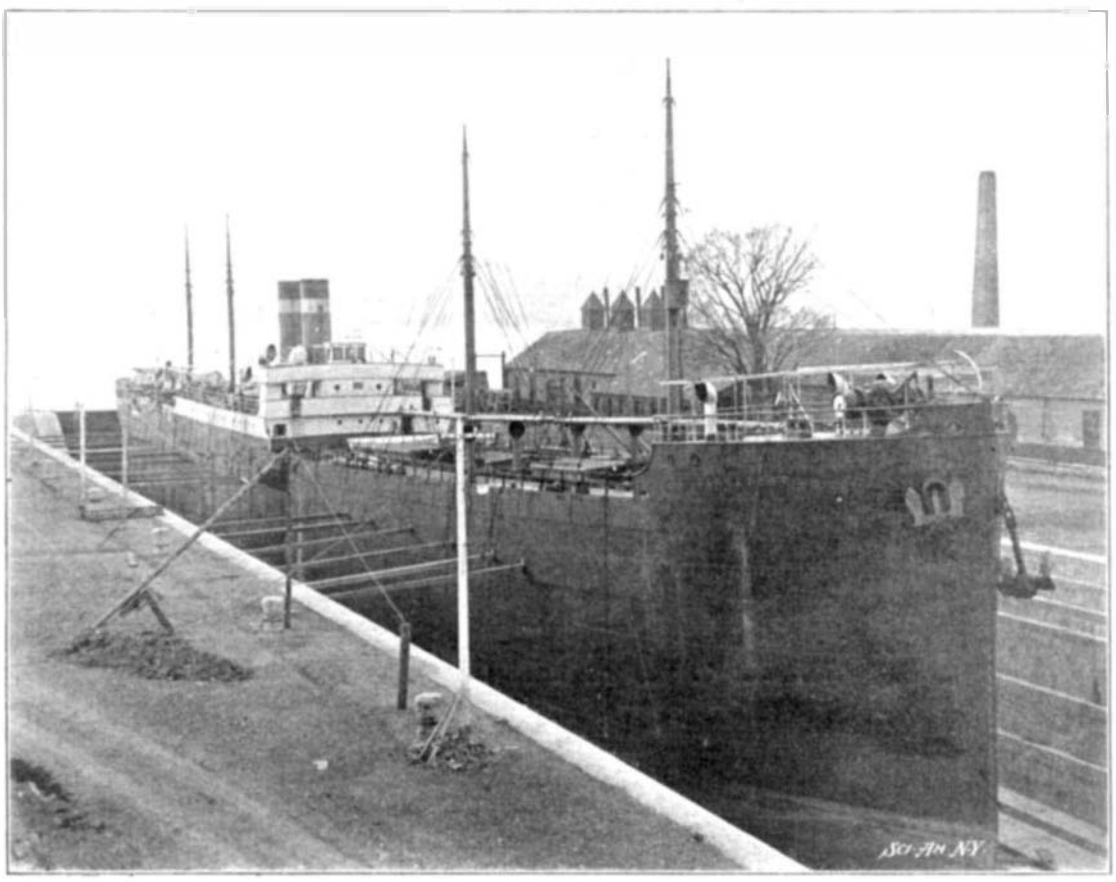
U-Tube with Electrode and Stopper. Worm Condenser.

MOISSAN'S APPARATUS FOR THE ELECTROLYTIC PRODUCTION OF FLUORINE.

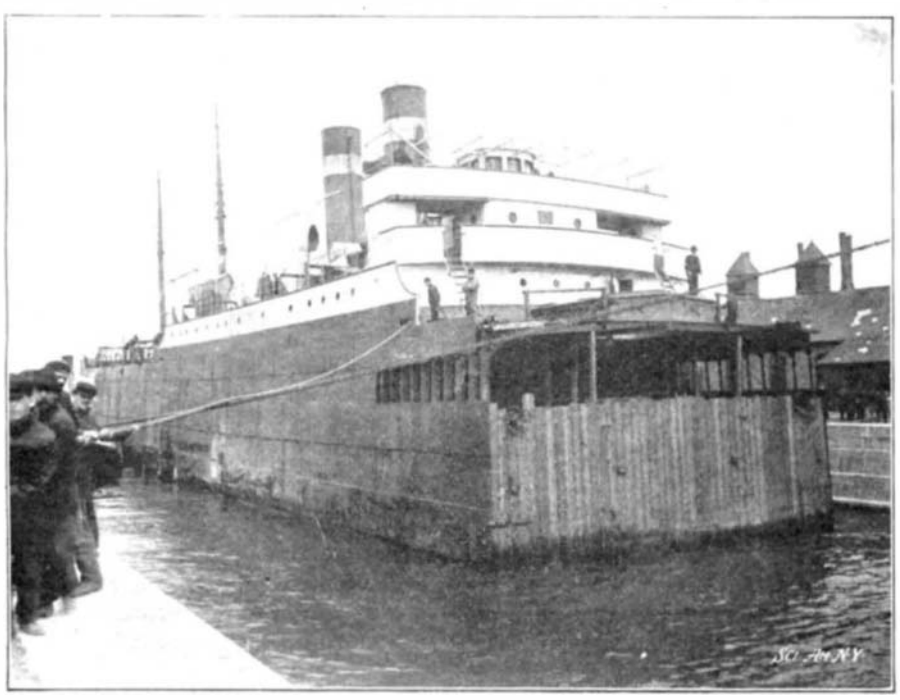
tons, and equal in size to many "tramp" ships of the small class which are engaged in the Transatlantic trade. To bring these ships to the seaboard and through the Canadian canal system has required some interesting engineering feats; in fact, some ships are of such length that it has been found necessary to cut them into two pieces to allow them to pass through the locks of some of the small canals.

The American Shipbuilding Company at its Cleveland yard has recently completed several vessels intended for the American seacoast trade. As it was impossible to reach tide-water except by way of the Welland Canal and the St. Lawrence system they were planned with the view of being divided as stated. One of these ships, the "Minnetonka," recently made the voyage from Cleveland to the head of the St. Lawrence system. Here she was placed in a drydock and divided just forward of her engine room. The openings were filled with a bulwark composed of a framework of timber supporting heavy planks, the spaces between the edges of the plank being made water-tight by caulking. The two sections were then taken through canals without difficulty, the rear portion being moved by its own engine and guided by the tugboat, the forward section of course being towed. In this manner the steamship was taken to Levis, Quebec, where the sections were placed in the drydock of Davie & Son and joined together.

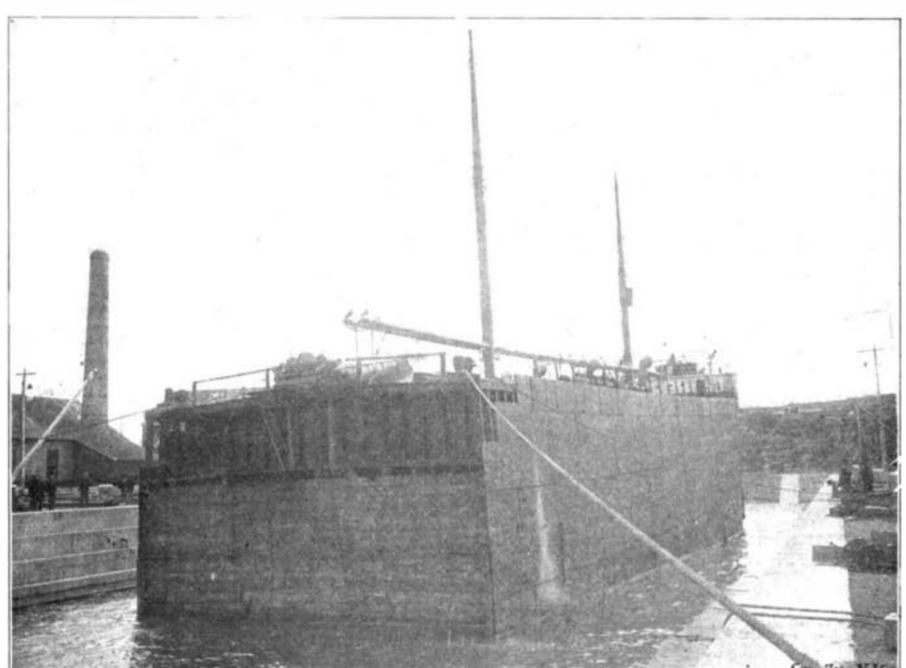
In constructing the "Minnetonka," the hull plates as well as ribs were planned so that the division could be made with comparatively little expense, and but a few days were required to join the parts of the vessel. Owing to the method of construction the re-united hull is as stiff as if it had never been cut in two. The accompanying photographs show the vessel in sections passing through the canals, and just after the shell was joined together in the Levis dock.



The "Minnetonka," Docked, With Her Sections Rejoined After Passing Through the Canal.



The After Section of the "Minnetonka" Passing Through the Canal.



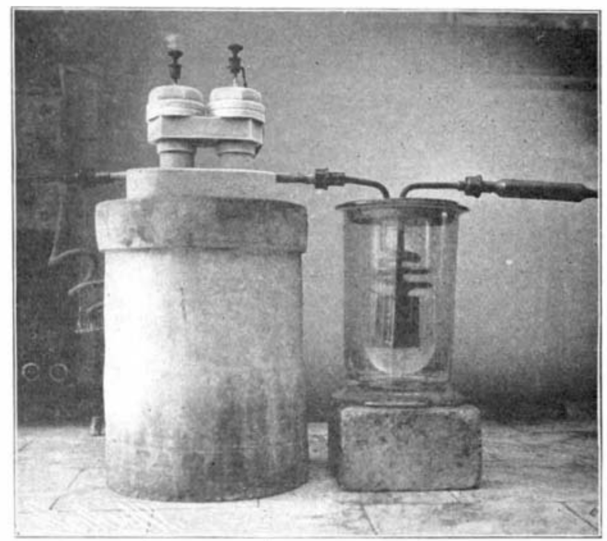
The Bow Section of the "Minnetonka."

HOW LARGE STEAMERS ARE DIVIDED AND TAKEN THROUGH THE CANADIAN CANAL.

PRODUCTION OF FLUORINE IN MOISSAN'S ELECTROLYTIC APPARATUS.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Although the existence of fluorine has been long established, it is but recently that this element was set free by Prof. Henri Moissan in the gaseous state. It has been since liquefied by using liquid oxygen, and solidified by liquid hydrogen. M. Moissan produces fluorine gas by the electrolysis of pure hydrofluoric acid, to which a small amount of fluorhydrate of fluorine is added to make it conducting. The electrolytic apparatus is illustrated in the engravings. The electrolysis takes place in a large copper U-tube. Each of the branches is closed by a screw stopper formed of a copper screw which is bored out and has fitted into it a cylinder of fluor spar. Through the latter pass the long platinum rods which serve as the electrodes. Fluor spar is used to insulate the electrodes from the tube, as most other bodies are attacked by the fluorine. The stopper closes the top hermetically by means of a lead washer placed between the head and the top of the tube. The electrodes are enlarged at the lower part so as to resist the action of the electrolyte for a longer time. At each side of the U-tube is a small platinum tube for taking off the gases which are produced at each pole. In the first experiments, M. Moissan used a platinum U-tube, but as this is quite costly he looked for another metal and found that a copper tube would answer very well, as it is but little attacked. In fact



MOISSAN'S FLUORINE LIQUEFYING APPARATUS SHOWING U-TUBE COVERED WITH FROST.

the fluorine which enters into solution produces a thin layer of an insulating fluoride of copper which thus protects the metal; but for this same reason copper electrodes could not be used, as the insulating layer stopped the passage of the current. The apparatus is placed in a vessel filled with chloride of methyl, which keeps it at a temperature of —23 deg. C. This is placed in an outer vessel containing fragments of chloride of calcium so as to surround the inner vessel with a layer of dry air, which is a bad conductor of heat. It was indispensable that the fluorine should be quite pure and free from vapors of hydrofluoric acid which might be drawn along at the time of its formation. To collect the vapors he uses a small worm-tube and condenser of platinum which is placed in a second vessel filled with chloride of methyl. Nearly all the hydrofluoric acid vapors are condensed here and remain in the lower part of the condenser, while any that might remain are absorbed by a series of platinum tubes placed at the end of the apparatus, containing pieces of melted fluoride of sodium which absorb them very energetically, and thus the fluorine gas comes out of the apparatus in a pure state. With a current of 50 volts and 15 amperes the fluorine is produced at the rate of 5 liters per hour, but the experiment cannot be made

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longer than 15 minutes at a time, as the apparatus heats up rapidly. He was, however, able to collect several liters of the gas at a time, which enabled him to make different experiments to show its physical and chemical properties.

When the current is passed, hydrogen is given off at the negative pole. At the positive pole the fluorine comes off as a seemingly colorless gas with a penetrating odor resembling that of chlorine and attacking the mucous membranes. The gas is very energetic and its chemical activity is superior to that of all other simple bodies. On account of its powerful affinity it gives rise to many interesting combinations with other bodies which often take place with flame or brilliant incandescence.

Fluorine is such an energetic body that its chemical affinity still holds good when in the liquid state, even at such a low temperature as —187 degrees. When a piece of sulphur is let fall in liquid fluorine it burns with an intense flame of a livid blue which fills the whole apparatus. The heat is so great that the vessel is broken. When the excess of fluorine has become volatilized, the glass is seen to be covered with crystals of hexafluoride of sulphur. The effect is still more violent in the case of selenium. When it is let fall in the liquid it produces a brilliant flame and explodes, shattering the tube containing the fluorine, and the vessel of liquid oxygen which surrounds it. The fragments of the tube are found to be coated with red selenium. Phosphorus burns in the liquid with a bright flame. With crystallized anthracene the action is very violent, with an explosion and a deposit of carbon. Arsenic also gives a bright flame. Carbon in the form of lampblack will combine with fluorine in the cold and is raised to incandescence, while wood charcoal takes fire spontaneously in the gas. Charcoal seems at first to condense the fluorine within its mass, then all at once it burns at a white heat and throws off brilliant sparks.

Gaseous fluorine was also studied as to its physical properties. Its density is found to be 1.26. The gas appears at first sight to be colorless, but when viewed in a tube 2 or 3 feet long it is found to have a marked greenish-yellow color, which is lighter than that of chlorine. Its spectrum was examined and found to have at least 13 rays in the red, from $\lambda = 744$ to $= \lambda$ 623.

AUTOMATIC MACHINERY FOR HANDLING COAL.

BY DAY ALLEN WILLEY.

The recent controversy in the Pennsylvania coal-mining region has probably aroused more interest in labor-saving machinery, not only for mining the coal, but for transferring it to the breaker and the railroad car, than ever before in the history of the country. Apparently it would seem as if the anthracite districts have not progressed as rapidly as the bituminous districts in the application of such apparatus, for a large amount of work is performed by hand which apparently could be more rapidly and economically accomplished by the use of machinery. The application of electrical drills and chain cutters has revolutionized the mining industry in some portions of West Virginia and in the bituminous collieries of western Pennsylvania, not only greatly reducing the expenditure for excavating the chambers, but allowing a much larger tonnage to be secured than where the ordinary hand tools are utilized. Tests with some of the electrical mining machines have already been made in veins of hard coal with, as stated, very satisfactory results, but in some cases their use has aroused such opposition from the unions that the mine owners desisted from installing them from fear of a strike. The principal forms of chain cutters and drills were fully described in these columns some time ago.

The improvements made in various forms of conveying machinery have reached such a point that this apparatus seems almost indispensable in the operation of modern anthracite as well as bituminous workings, although here the soft coal companies apparently have displayed more enterprise. A variety of forms of both elevating and conveying apparatus are now manufactured especially suitable for handling coal of all kinds. Several of what are known as the Jeffrey designs are herewith illustrated. One is known as the pivoted bucket conveyor, which consists of two long-pitch steel chains of the thimble type carrying a series of pivoted buckets arranged continuously. They are fed by means of a steel apron or belt actuated by the conveyor, so that the buckets can be automatically loaded uniformly without spilling. They are also discharged automatically by means of pairs of shoes operated eccentrically in the path of the buckets. The rollers at the end of each receptacle engage the shoe, thus tilting the former and allowing the material to pour into the receptacle.

Another system of conveyor is known as the endless trough. This conveyor is arranged with two strands of long-pitch steel thimble chain with self-oiling flange-rollers, the chain having attachments on one side, to which double-beaded or corrugated plates are belted; overlapping sides or ends are also provided, thus forming an endless open trough. The corrugations overlap one another, thus forming a perfectly tight apron in any position of the conveyor, whether traveling on a straight line, curve, or around the sprocket wheels at the end. These corrugations furthermore stiffen the plates, thus making it possible to use a much lighter steel than would otherwise be the case. The load, as well as the weight of the conveyor itself, is carried entirely by the flange rollers, which travel on a track, preferably light T-track. This type is especially suitable for transferring large quantities of material, and as the engraving indicates, can be installed for transferring coal from the mouth of the mine to the railroad tracks, while it could also be substituted for the car elevator in handling material from the mine to the top of the breaker by means of a special installation, as the receptacles are made as large as 5 feet in width and 12 inches in depth. By means of this system a continual service could be maintained from the mine opening to the top of the breaker if desired.

A method especially suitable for long distances, and which is now extensively used in handling coal, is known as the roller scraper conveyor. It is composed of a single-strand steel chain roller, the special feature of which is the rollers attached to the scrapers; the rollers traveling on an angle iron track placed beside the trough, also overhead. With this construction the friction, noise, and wear are reduced to a small per cent; permitting the use of a much lighter chain and other parts, besides requiring a comparatively small amount of power. The conveyor also travels upon shoes or wearing blocks in place of rollers where the installation of the latter may be inconvenient. The capacity of this form is the same as that where rollers are used.

A form of conveyor adapted for coal picking and sorting is known as the Century belt conveyor, which has been installed in a number of large plants for storing iron and other ores in the West. It consists of a continuous belt manufactured of very strong fabric and lined with rubber to resist abrasive action. The belt is supported on carriers of iron so arranged as to hold it in the form of a trough. It is provided with what is known as a traveling tripper, which by the pull of a lever will discharge the contents of the belt at any point and on either side as desired. As the speed can be graduated, broken stone and other impurities can be separated from the coal as it passes along the belt as readily as with the ordinary coal picker, while the arrangement of the belt renders the apparatus much more convenient as well as economical. It can be constructed in nearly any width, some of the larger ones at present in use extending four feet from side to side.

An improved form of screen which has already been introduced in some of the Pennsylvania mines is of the double revolving type, and is made with both an inner and outer jacket of cloth; it is constructed with a shaft running through the center, by means of which it is operated, the shaft being attached to cast-iron hubs connected in turn to wrought-iron arms and bands. A substitute for the cloth is perforated metal where the service required is unusually wearing. Another form of screen is of the shaking or vibrating pattern, and has been employed to advantage for separating the various sizes of coal. These screens are actuated by eccentrics provided with spring cushions, thus largely counteracting the jar. The eccentrics are set on thirds, so as to counteract the thrust on the building. The screens are usually constructed of a metal frame and either wire cloth or perforated metal of any length and width to suit the requirements. They are suspended from timbers or steel girders overhead by means of hanger rods. The latter are made adjustable at one end, so that the angle of the screens can be varied. Cars can also be loaded directly from the screens by means of an interesting labor-saving appliance which has been perfected. This is known as an automatic basket. As indicated by the engraving, it consists of two parts separating in the center, so that its contents can be released automatically into the railroad car or bin. It is suspended from overhead chains, which are attached to drums provided with a counterbalance. The basket is held in such a position that the coal from the screens is received by gravity. When filled, the basket is lowered automatically and discharged as indicated. In some forms they are emptied by opening an end and tilting the basket to the required angle.

Prof. W. J. Hussey, of Lick Observatory, who has been experimenting to determine the suitability of several high altitudes in Southern California for a permanent astronomical station, is said to have decided in favor of Mount Wilson, just east of Mount Lowe. Prof. Hussey will mount a 9-inch telescope on Mount Wilson at once for further experiments. An astronomical station was maintained on Mount Wilson several years ago by Harvard University. The atmospheric conditions there are said to be almost perfect for observations.

Correspondence.

A New Word—Phonologue.

To the Editor of the Scientific American:

I beg to propose through the Scientific American the word *phonologue*, meaning a message transmitted by telephone. The word will be analogous with telegram. *Telephone*, the word proposed by the telephone men, is too ambiguous. J. O. Thompson.

Secretary West Virginia Board of Agriculture.
Charleston, W. Va., June 15, 1903.

An Interesting Problem.

To the Editor of the Scientific American:

I would like you to explain the following phenomenon through your valuable paper, if you deem it of enough general interest to take the space. We have near here a telephone line across the Arkansas River, where ground is used for return. During the recent high water, this line was down in water for more than a hundred yards of its length, yet worked all right between the two stations, situated on opposite sides of this water-ground. The wire was new and galvanized, and could not have been insulated from water by rust. I do not understand why the current should pass this water-ground of practically no resistance to seek one that must have been of higher resistance.

Altus, Ark., June 10, 1903. D. A. Allen.

[The phenomenon described certainly appears to be remarkable, and is somewhat in line with others called to our attention at different times. A few weeks ago one of our correspondents stated that he found that a fence wire, to which a transmitter, a receiver, and battery were connected, worked very well for purposes of communication, although the wire was broken by a gate and roadway at a point located between the transmitter and receiver. Another correspondent wrote that in experimenting with a carbon transmitter and a receiver connected with a fence wire, he discovered that no battery was necessary, there being apparently a difference of potential between different portions of the wire sufficient to operate the receiver. While several theories might be advanced in explanation of these phenomena, none of them is altogether free from objection. The Editor would like to consider short communications from persons who may have explanations to offer or who know of facts analogous to those stated.]

The Chicago Drainage Canal and St. Louis Water Supply.

To the Editor of the Scientific American:

After reading the editorial in your issue of the 20th instant, in reference to the "Chicago Drainage Canal and the City of St. Louis," it occurs to me that your conclusions are not only well founded, but that other facts, with which you may not be familiar, still further justify the views enunciated by you.

In addition to your statement of the opinions given by various scientific men appointed to test the waters of the Illinois and Mississippi rivers (and on which investigating board, or commission, St. Louis was offered representation, but declined to avail herself of the opportunity) and the commissioners' idea that the bacteria and bacilli do not survive in running water more than about half the distance from Chicago to St. Louis, I would suggest that there are other reasons why St. Louis need have no fear of deleterious results from Chicago drainage; and one is that when the waters from the Illinois River reach the Mississippi, the latter stream. being much larger, confines the waters from the Illinois River to the eastern or Illinois side, and when the Missouri River is reached, the force of that stream, meeting the Mississippi about eighteen miles above St. Louis, and nearly at a right angle, the stream is again thrown to the Illinois side, and with such force that within the past thirty-five years the waters have washed away the bank until the river is now located about one and one-half miles farther east than at the date named, and it is continuing to encroach on the Illinois bank at the same rate.

That the waters of the Missouri River will be confined to the western line, in the short distance to the St. Louis waterworks—about ten miles below the mouth of the Missouri—hardly requires proof, but can be easily demonstrated when dry weather prevails and the Mississippi is clear, as the division-line between the waters of the two rivers (the Missouri being always yellowish or muddy, while the Mississippi is darker) can be distinctly noticed from the Eads bridge at St. Louis, demonstrating conclusively that the water obtained for St. Louis is from the Missouri River, as the current, or pressure, from that stream forces the Mississippi so far to the east that its waters cannot be reached from the St. Louis waterworks unless they locate their supply pipes more than half-way across the stream. C. E. Gillespie.

Edwardsville, Ill., June 22, 1903.

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