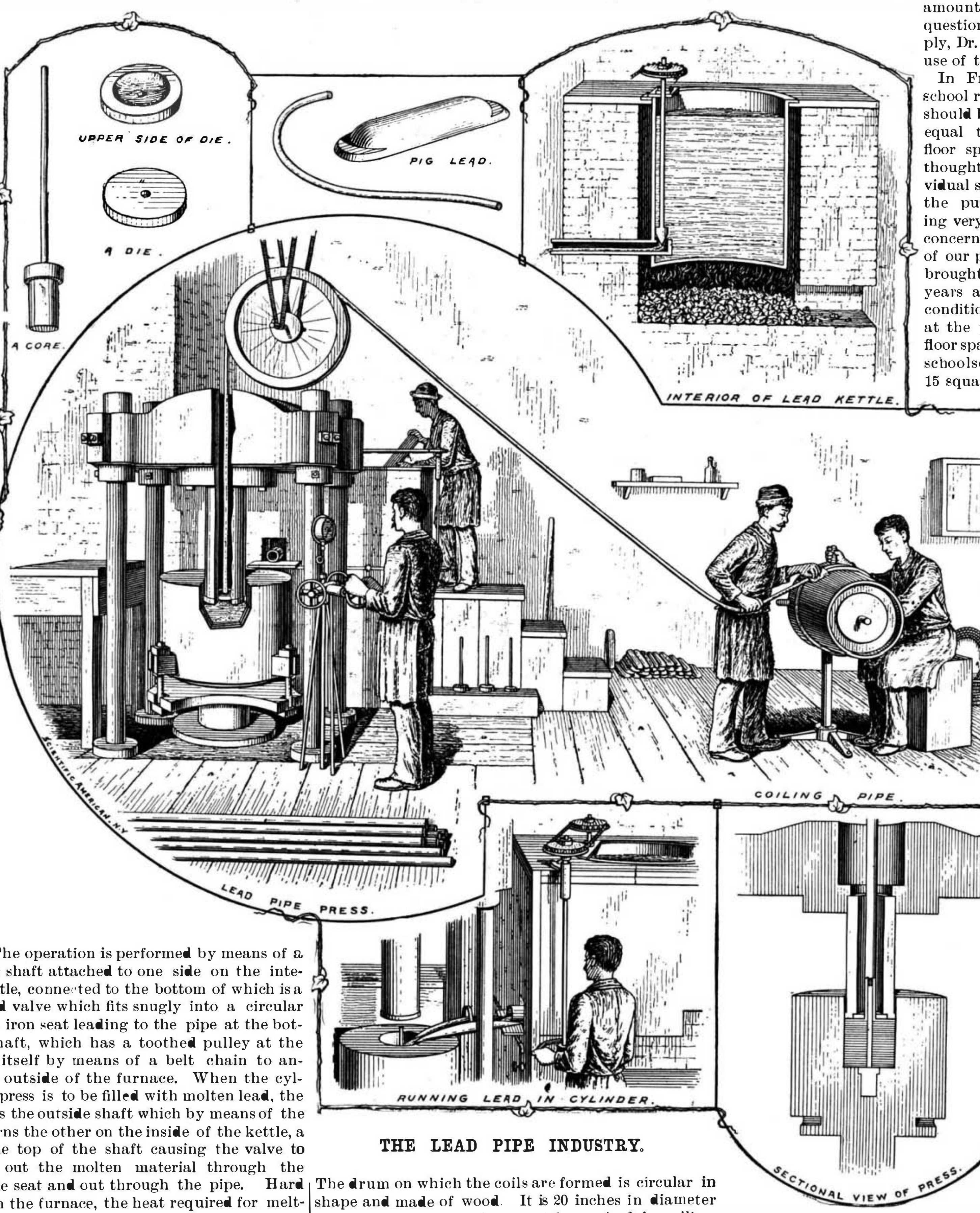
MANUFACTURE OF LEAD PIPE.

The ore from which great quantities of lead pipe is made comes from Colorado and Missouri. The material is first smelted and refined and cast or moulded into pigs weighing from 50 to 100 pounds each. These pigs average about 3 inches in thickness and range in length from 1½ feet to 3 feet. The first operation is the melting of about 40 of these pigs of lead in a kettle incased in a fire brick furnace about 4 feet square. The kettle is made of cast iron about 2 feet 3 inches in diameter, 2 feet 3 inches in depth and about ¾ of an inch in thickness. It is flanged at the top and rests on an iron frame

Connected to the outside near the bottom of the kettle is a 4 inch iron pipe or spout through which the molten lead is passed into the cylinder of hydraulic lead press. The operation is performed by means of a perpendicular shaft attached to one side on the interior of the kettle, connected to the bottom of which is a conical shaped valve which fits snugly into a circular opening in an iron seat leading to the pipe at the bottom. The shaft, which has a toothed pulley at the top, connects itself by means of a belt chain to another on the outside of the furnace. When the cylinder of the press is to be filled with molten lead, the operator turns the outside shaft which by means of the belt chain turns the other on the inside of the kettle, a thread at the top of the shaft causing the valve to rise, letting out the molten material through the opening in the seat and out through the pipe. Hard coal is used in the furnace, the heat required for melting the lead being about 450°.

To keep up the supply of molten material the kettle is charged about every ten minutes with 5 pigs of lead. The cylinder of the hydraulic press is about 2 feet in diameter on the outside, and about 2 feet in height. The diameter of the inside in which the molten lead is run is 8½ inches, and in depth about 17 inches. In the center of the bottom of the cylinder is a socket in which a circular iron core is placed. The cores are about 24 inches in length, and run in diameter from ⅛ inch upward. They are keyed fast in the socket at the bottom and project up above the top of the cylinder about 2 inches. Keyed to the press above is a hollow circular steel ram, in the bottom of which is a circular steel die about 1½ inches in thickness. These dies range from 4½ to 6 inches in diameter. The dies are keyed fast in the ram, each having a circular hole a little larger than the cores passing through the center. The cylinder is first heated by steam and about 350 pounds of molten lead is run into it from the kettle, the operation taking about one-half minute. The cylinder is then started in motion, rising upward with a hydraulic pressure of 5,000 pounds. As the cylinder moves upward, the core and the molten lead which surrounds it is pressed up through the hole in the die. As soon as the lead reaches the upper side of the die, it instantly thickens or chills around the core by means of the air in the hollow ram, which is about 4½ inches in diameter.

From the ram the pipe is forced upward from the core, passing through an opening at the top of the press, where an attendant passes it over a 4 foot wheel above, and down to a drum below, where it is formed into coils. The cylinder is emptied of its contents in about 3 minutes, making about 50 feet of lead pipe. The drum on which the coils are formed is circular in shape and made of wood. It is 20 inches in diameter and 2 feet in length. An expert is required in coiling the pipes, it being necessary to know how many rounds of lead are required for each size pipe. The operator presses the lead pipe against his hip with one hand, while with the other, he forms the coil, his attendant at the same time turning the drum, which revolves loosely on a horizontal shaft running through the center. Two 150 pound coils are formed at once, the operation taking about two minutes. The pipe as it leaves the press is also cut up into straight lengths of 10 feet each, the cutting being done by a hand saw. The molten lead enters the cylinder from the kettle at a temperature of about 450°, the pipe when reaching the coiling apparatus still retaining a temperature of about 200°. The lead runs from $\frac{1}{64}$ to ½ inch in thickness, according to the size of the pipe. Six hands on two presses turn out about 25,000 pounds of pipe per day. About 18,000,000 pounds of lead pipe is manufactured in New York City yearly. The sketches were taken from the plant of the New York Smelting and Refining Company, New York City.



THE LEAD PIPE INDUSTRY.

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Ventilating the School Room.

Dr. Shaw, a prominent pedagogist, in an address delivered recently before the Association for Improving Public Schools, has made some very interesting suggestions concerning the proper arrangement and equipment of school rooms. In the matter of ventilating and lighting, Dr. Shaw believes that an ideal school room should provide fifteen square feet of floor space for each pupil, and a supply of 200 cubic feet per minute for every person in the room. A supply of less than twenty cubic feet he considers very bad ventilation. Such provisions would insure the free movement of every child and a wholesome amount of air. As to the question of the light supply, Dr. Shaw suggests the use of the French system.

In France the perfect school room, it is thought, should have a glass surface equal to one-fourth the floor space. It is also thought best to have individual seats and desks for the pupils. The following very significant figures concerning the conditions of our public schools were brought together some few years ago, and the same condition, it is said, exists at the present day. The floor space per pupil in the schools of Boston averaged 15 square feet, in Chicago 14 square feet, in Washington from 10 to 15 square feet, and in New York from 5 to 9 square feet. In the matter of ventilation the average in the Boston schools was found to be about 185 cubic feet, in Chicago 225 cubic feet, in Washington from 115 to 250 cubic feet, and in New York from 70 to 100 cubic feet. The average school room, especially of New York, it would seem, is insufficiently ventilated and very much overcrowded. There is besides very often a lack of a wholesome quantity of sunlight and an inadequate supply of desks. The fault is a very serious one. It is to be hoped that some trustworthy scientific standards relating to these matters may be adopted and rigidly enforced.

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THE postmen of London together walk something like 48,350 miles per day, a distance nearly equal to twice the circumference of the globe.

Indigo Blue Surface Colored Paper.

The indigo carmine used for the production of indigo blue surfaced colored papers is best obtained from a solution of indigo by precipitation with common salt. The vessel in which the precipitation takes place does not require to be large, there being no effervescence produced by this method of precipitation, as in the older method of precipitating the carmine with soda. The precipitate subsides, moreover, in an hour or so, while a day at least is required when soda is used. The character of the two precipitates is also different; that obtained by common salt having greater covering power than the other. The carmine obtained by precipitation with soda is always pasty, and is apt to produce dark streaks on the surface of the paper.

Indigo carmine is prepared as follows: 2½ parts of indigo are first ground to a fine powder by passing it several times through a grinding mill, and then spread upon a thick sheet of unsized paper in a layer about ⅜ of an inch deep and placed in a warm dry room for three or four days. A strong earthenware jar is then tared on a balance, and if indigo of medium quality is taken, 11¼ parts of fuming sulphuric acid accurately weighed off. It is usually reckoned that 1 part of good Bengal or Java indigo requires 5 parts of fuming acid, but for other kinds from 4 to 4½ parts. The mixing must take place in an open space, so that the vapor evolved can escape. The dry pulverized indigo is added to the acid in small quantities at a time while continually stirring with a glass rod to prevent overheating. When all the dry powder has been added, the vessel is set aside and stirred from time to time. After three or four days the indigo will be dissolved, which can be ascertained by withdrawing the glass rod and examining it for any particles of indigo powder. If small particles are noticed adhering to it, too little sulphuric acid has been originally used, and it is necessary to add a further quantity of ¼ or ½ part, stirring well after the addition and allowing to stand two or three days longer. The dissolved indigo is then slowly poured into 20 parts of cold soft water contained in a wooden cask, stirred gently, and allowed to stand 24 hours. The fluid is then filtered through a linen cloth filter into a second wooden vat provided with a running off tap filled in the bottom. The greenish black residue remaining upon the filter is preserved, and sold for use in the manufacture of felt hats.

The filtered indigo solution is now precipitated. The vat in which this takes place is made of wood and should be of large capacity (40 gallons capacity for 5½ lb. indigo), and is provided with taps in the side for running off the clear liquor, etc. It is placed two feet from the ground upon a wooden frame. The filtered indigo solution is poured into this vessel, and there is then gradually added a solution of common salt, containing 23 parts NaCl dissolved in 40 parts water. The indigo carmine separates out as a very fine precipitate, which remains suspended in the fluid. The whole must therefore be filtered and the precipitate washed. The apparatus for this purpose consists of two boxes resting upon one another, the bottom one being about 4 feet 6 inches long by 2 feet 6 inches wide and 1 foot deep; the upper one is a little smaller, and is placed on cross spars directly over the large one. Small holes are drilled in the bottom of the upper box to allow the liquid to escape. It is then lined with the filtering medium, which consists of a double layer of good unbleached linen, previously steeped in a solution of crystal soda. The filter bag itself, consisting also of linen, is placed in this. It is steeped in soda solution before being used.

A small quantity of the fluid containing the precipitated carmine is first poured upon the filter to fill the pores of the linen filter cloth. The fluid containing a little of the precipitate which first passes through is returned to the bulk of the liquor in the large vessel. After a short time, however, a clear dirty yellowish green liquid passes through alone, which is thrown away, the indigo carmine remaining behind upon the filter. After the whole of the liquor has passed through, the precipitate is washed twice with cold soft water, the first wash water being allowed to pass through before the second is added. The first washings are usually dirty, and are thrown away; but the second are strongly colored, and may be used for a variety of purposes. After the second washing, the indigo carmine is ready. It forms a thick, brown-looking mass, and is removed with a wooden spatula and preserved in boxes for further use. Two and a half parts of indigo yield from 30 to 35 parts of paste.

In this state it is too concentrated for direct use in the manufacture of surface colored papers, and therefore it is dissolved in 80 parts of warm water (60° C.) in a wooden vat by continual stirring for two hours. The carmine should dissolve completely. The deep blue fluid is now tested to ascertain whether it is free from acid, the presence of which causes the color to pass through the paper, coloring it an intensive yellowish green. In all surface colored papers the color should not penetrate the texture of the sheet. Two beaker glasses are half filled with the indigo carmine solution and a glass rod placed in each. Four or five drops of a strong aqueous solution of crystal soda (50 per cent) is then added to one of the glasses and the mixture stirred. If only a trace of acid is present, the fluid becomes much thicker than that in the other glass. When such is the case, 1 part of crystal soda dissolved in 5 parts of hot water is slowly added to the indigo carmine fluid in the large vessel.

Indigo carmine prepared in the above way is excellently adapted for producing blue surface colored papers, either by machine or by hand. Usually the paper receives only one coat on each side; the finest kinds are, however, coated twice, well sized papers free from wood being used. Weight, about 25 lb., d. crown. Six and a half reams of 480 sheets each, 13½ inches by 17 inches, can be covered with 5½ lb. of commercial indigo.—Chem. Tr. Jour.

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A MAGNESIUM TORCH.

Amateur photographers, and some professionals, find in the flash light a great accession to their photographic properties, inasmuch as it enables them to produce really creditable work at times and in places which would prove disadvantageous if daylight had to be depended upon.

For such subjects as require instantaneous work, the explosive powders are useful, and perhaps in the majority of cases necessary, but for nine-tenths of the work flash lights of the torch type, using pure magnesium powder, without any explosive, answers perfectly, while it has the advantage of producing a less offensive smoke.

The annexed engraving shows an exceedingly simple and very effective torch for burning pure magnesium powder. It is similar to some found at the stores; it differs mainly in the matter of construction and materials. A vial three inches high, and one inch in diameter, forms the receptacle for the powder. The neck of the vial is large enough to receive a small rubber or cork stopper (rubber preferred) having two perforations. In one is inserted a tube having its lower end projecting a quarter of an inch below the stopper, this end being contracted so that its aperture is about one thirty-second inch in diameter, or about as large as a good sized pin. This tube is curved over to receive the rubber pipe by which the blast is furnished to the apparatus.

A MAGNESIUM TORCH.

In the other aperture of the stopper is inserted a piece of tubing of about three sixteenths inch internal diameter and a length of three and three-quarters inches. The tubes may be of glass or brass.

A wire spiral bent into a circle and connected at the ends receives a roll of woolen cloth, or better a filling of asbestos fiber, and the end of the wire forming the spiral is bent at right angles, and wrapped around the tube. A quarter inch space is left all around the tube, betweeen the tube and the inner portion of the spiral. The vial is one-quarter or one-half filled with fine, pure magnesium powder, and the fibrous material in the wire spiral is saturated with alcohol. When all the preparations for the exposure have been made, including lighting the alcohol, the operator blows strongly through the rubber tube; the concentrated jet stirs up the powder in the vial thoroughly, and the air escaping through the longer tube carries the powder through the flame, thus producing a spire of flame about two feet high. Several puffs may be made if the subject is one requiring strong illumination.

The principal point to look out for is to make the contracted blowpipe of such capacity relative to the discharge tube as will insure the comparatively slow passage of the powder through the flame. If the blowpipe is too large, the powder will pass through the flame so rapidly as to fail of igniting. In this way a large proportion of the powder may be lost; but with correctly proportioned tubes the combustion is very perfect.

The writer has taken a number of fair sized interiors with this torch. Pure magnesium powder can be used in this apparatus with perfect safety, but explosive powders used in a confined space (such as the vial in this torch) are dangerous. G. M. H.

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The Nature of Electricity.

At the last meeting of the Boston Scientific Society, Prof. A. E. Dolbear presented a paper entitled the Nature of Electricity, which the Boston Commonwealth says was a clear and comprehensive statement of the condition of our present knowledge. The subject has interest aside from its great relations practically to our daily lives and convenience, from the fact that, while there have been many theories proposed to account for electrical phenomena, yet to-day there is no one that is generally held, even as a provisional one, among physicists, while some have even abandoned the hope of ever reaching a consistent explanation of the phenomena.

Prof. Dolbear first gave consideration to fundamental notions in physics, speaking of the phenomena and factors thereof, these being matter, ether energy and motion; the properties of ether being that it is continuous, non-molecular, frictionless, elastic and energized. The origin of electricity was next discussed, this being either from friction, chemism or heat for its direct production or induction for its indirect production.

Consideration was next given the ether, which with its properties becomes the medium in which exist gravity, light, magnetism and electricity. The definitions which have been given for electricity were then reviewed, it having been considered a form of energy, a form of motion, energy itself, a form of motion of matter, a form of motion of ether, etc. Edlund defined it as ether itself; Lodge thinks it to be a wave motion in ether; Roland considers it a property of matter; while Trowbridge assigns it place among the great unknowables.

As to its origin, electricity must have some antecedent motion. When the face of the thermopile is heated, we know that vibratory motion is the condition for its appearance; while in the battery, chemical action is the source, and the heat equivalent of this is a measure of the electricity produced. In glass, wax, etc., mechanical friction produces it, and when a conductor is moved in a magnetic field and electricity results, this will stop on the cessation of the motion. In every case the mechanical motion turned into it is the antecedent, and the energy of the engine is represented by the electricity developed.

From motion, then, results energy; and, if it be molecular motion, we call it heat; if ether waves, we call it light; if molecular exchange, we call it chemism. And all electrical action is motion between matter and ether.

As a summary of his arguments, Prof. Dolbear brought forward the following propositions: Energy is an embodiment of motion in some medium and does not exist independently, while the so-called forms of energy are due to the different kinds of motion a body may have. Transformation of energy is a change from one kind of motion to some other kind. Electricity never appears except when some known form of motion of matter is antecedent, and continuity of motion is a logical and experimental necessity; hence electricity must be a condition of things in matter or else a condition of things in ether.

In support of his position, the speaker mentioned quite a number of experiments which illustrate the rotary, spiral character of the motion of the molecules for example, by transmitting a beam of polarized light through an electric field, while the transmission of currents in opposite directions may be shown by means of a ring of rope which, on being twisted while held in both hands, exhibits a twist in both directions, both twists being traceable completely around the ring.

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Vesuvius Destroys Derelicts.

The dynamite pneumatic gunboat Vesuvius, of which there is a full page illustration in the SCIENTIFIC AMERICAN of November 3, 1888, returned to the navy yard in March from a cruise in search of dangerous floating wrecks. The Vesuvius succeeded in finding the wreck of the schooner Josie Reeves floating about six miles off shore, between Shinnecock and Fire Island, and it was destroyed with gun cotton, which was lowered into her and exploded by electricity.

The Vesuvius then went to a point off Barnegat and began the destruction of a submerged three-masted schooner, which is lying in fifteen fathoms of water. Her rigging was broken up and her mainmast was shattered but the weather was so rough that the completion of the work was postponed until more favorable weather sets in. It is customary to leave at least ten fathoms of water above each wreck that is destroyed. At this season of the year, Lieutenant Commander Knox says, there are not more than four days out of every ten that are favorable outside for the work of destroying wrecks, as it is so rough that the little boat cannot work alongside without danger.