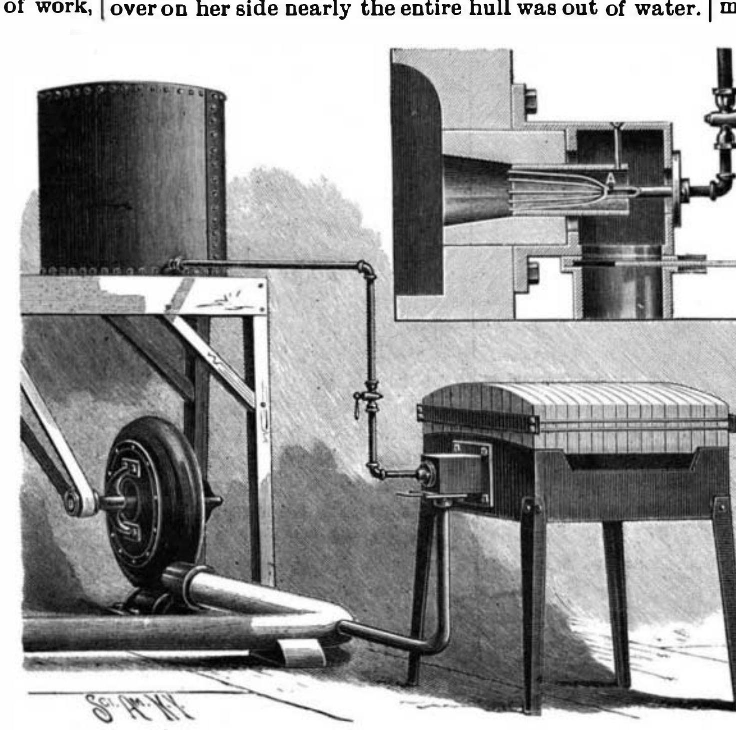
AN IMPROVED HYDROCARBON BURNER.

The illustration herewith represents a simple and very efficient form of burner, with which a most perfect combustion can be obtained, and the heat held uniform for an unlimited period. It has been patented by Mr. Frank B. Meyers, of Fort Plain, N. Y. The burner is provided with a casing to the front end of which is secured a tube with bell-shaped mouth, as shown in the sectional view, this tube usually passing through the mouth of the furnace in such manner that the wide end of the bell-shaped mouth is flush with the inside of the furnace wall. On the casing is a bushing through which passes the oil supply pipe, from any suitable reservoir, which may be a barrel or tank, this pipe having a valve to regulate the flow of oil. On the inner end of the pipe are rods extending to the front end of the tube, these rods extending radially around the pipe, and in the inner end of the pipe is an opening, A, through which the oil is discharged, the oil falling by its gravity around the inner ends of the rods. Into the side of the casing also opens a pipe, connected with a blower, there being in the casing an air supply regulator, by which the supply of air may be increased or diminished, the air passing over the ends of the rods and carrying the oil along them, so that the oil is completely atomized and the air charged with oil vapor, which burns in the bell-shaped mouth. The heat from the furnace also heats the bell-shaped mouth, the tube, and the rods, so that the atomizing of the oil proceeds very rapidly and the gas is highly heated before it is burned. These burners are made for all classes of work, from 6 × 8 inch fires for wire work and brazing to 5 × 24 foot furnaces for heating blooms. For further particulars with reference to this burner address Messrs. Meyers & Tanner, manufacturers, Fort Plain, N. Y.



MEYERS' HYDROCARBON BURNER.

The Samoan Hurricane.

One of the most violent and destructive hurricanes ever known in the South Pacific ocean passed over the Samoan Islands on the 15th, 16th, and 17th of March. As a result four war ships of the American and German navies were totally wrecked and two others badly damaged, while 142 officers and men lost their lives.

This little group of islands has attracted the attention of the world for some months past, and their political status is to be the subject of an international conference shortly to be held in Berlin, but the complications had become such that there were present in the harbor of Apia* at the time of the hurricane three American, three German, and one English men-of-war.

The harbor is a little semicircular bay on the northern side of the island of Upolu, the distance across the entrance to the bay being about three miles, mostly closed by a coral reef, but leaving a gateway of about three-fourths of a mile in which ships can enter. There is but a small space of deep water within which vessels can anchor, as there is a large shoal in the eastern part of the bay, and a coral reef in its western part, from 200 to 400 yards off shore, on which most of the vessels were wrecked, as the wind blew into the harbor from the open sea and forced them back against it.

The storm began on Friday afternoon, March 15, and by 11 o'clock at night the wind had increased to a gale, all the war ships keeping their engines working to relieve the strain upon their anchors. Rain began to fall at midnight, when, with the great waves rolling in from the ocean, the German ship Eber, and shortly afterward the American ship Vandalia, began to drag their anchors. By using full steam power they both managed for awhile to keep off the reef, but by 3 o'clock the situation had become alarming, the wind blowing stronger and stronger, and the rain falling in torrents. Nearly every vessel in the harbor was by this time dragging its anchors, and there was imminent danger of collisions. On the shore the howling of the wind among the trees and houses and the crash of falling roofs aroused every one, and the storm was so violent that it was difficult to stand against it without some protection. Through the blackness of the night could be seen the lights of the men-of-war, moving slowly in different directions, indicating the manner in which they were dragging their anchors in the fierce currents of the little harbor.

A little after 5 o'clock day began to dawn, and revealed the full danger of the situation, the northeast wind working nearly all the vessels from their moorings in the direction of the reef, notwithstanding that the black smoke pouring from their funnels showed that desperate efforts were being made to keep them up against the wind. The decks were swarming with men clinging to masts and other objects and the hulls of the ships were tossing about like corks, one moment the vessels seeming almost to stand upon their beam ends, while the next instant the sterns would rise out of the water and expose to view the rudders and rapidly revolving propellers.

Several small sailing vessels had already gone ashore, and the Eber, Adler, and Nipsic were close together and only a few yards from the reef, the Trenton and Vandalia being farther from shore and almost obscured by the blinding spray. The gunboat Eber, as if making a last struggle to escape destruction, suddenly moved forward, but the current carried her prow against the port quarter of the Nipsic, after which she fouled with the Olga, though not seriously damaging either of these vessels. The Eber now seemed unable to make any further effort to save herself, and swung around broadside to the wind, drifting slowly toward the reef. A great wave, rolling in toward the shore, suddenly lifted the vessel high on its crest and carried her broadside upon the reef. She struck fairly upon her bottom, rolled over toward the open sea, and disappeared from view, apparently not a vestige of her being left. The breakers, however, hid a few struggling men, one officer and five men being rescued out of a total of 76 who were on board.

It was about 6 o'clock in the morning when the Eber was dashed upon the fatal reef, which the Adler was now fast approaching, about 200 yards west of the point where the Eber struck. She was approaching broadside on, and half an hour later was lifted on top of the reef and turned completely over on her side. The Adler did not, however, go to pieces, but was thrown so far up on the reef that when she turned over on her side nearly the entire hull was out of water. Of the 130 officers and men aboard, twenty were drowned or killed, but the rest were rescued, after exertions lasting throughout the day.

It was next the turn of the Nipsic. She was standing off the reef, but her three anchors were not holding, with all the steam it was possible to carry, and her men were preparing to hoist a heavy 8 inch rifled gun overboard to assist her anchors. At this moment the Olga, being unmanageable, bore down upon the Nipsic, knocking down her smokestack, and doing much other damage. After this the Nipsic was unable to keep up her steam power, and her captain seeing that further efforts were useless gave orders to beach the ship. This was done only with great difficulty, but the vessel, although badly damaged, has been hauled off since the storm, having lost but seven men.

At about 10 o'clock in the morning it was seen that a collision was inevitable between the Vandalia and the English steamer Calliope, both of which had been further out from the shore. Great waves were tossing the two vessels about, and they were coming closer together every minute, when suddenly the great iron prow of the British steamer, rising on the crest of an enormous wave, came down on the port quarter of the Vandalia, damaging the latter very much. The English vessel now, by getting up all possible steam, was able to work its way slowly out of the harbor to the open sea. She had powerful engines, and was capable of steaming sixteen knots an hour, but worked her way out against the wind at a rate of only about half a knot an hour.

It now became evident that the Vandalia could not be kept off the shore, her engines not being powerful enough to steam out to sea, and her anchors dragging so that she was fast approaching the reef upon which the Eber had first foundered. It was, therefore, determined to beach the vessel, her bow striking in the soft sand about a hundred yards off the shore and forty yards from the stern of the Nipsic, the vessel swinging around broadside to the beach. It was nearly eleven o'clock when the ship struck, and it was then thought the 230 men on board would be rescued without great difficulty. It was soon seen, however, that the vessel was filling with water, and settling down, while the seas continued to break over her furiously and the water to pour down her hatches. By noon the whole of the gun deck was under water, and the men were continually being knocked from their feet and thrown about so that many were badly injured. Most of them sought refuge in the rigging, but the wind seemed to increase in fury, and nearly every one had cast away most of his clothing. No boat could live for a moment in the surf, and it was impossible to get a line from the shore to the steamer, as there was no firing apparatus on the island. Officers and men were continually being wounded by being knocked about the deck, in many cases being washed overboard while senseless from such injuries. The entire afternoon afforded a continuous succession of such scenes of suffering and death, while the survivors were having their strength tested to the uttermost to sustain themselves in the precarious situations to which they still clung as hope seemed to be fast dying out.

In the meantime the Trenton, the American flagship, and the largest of the ships in the harbor, had succeeded in holding out against the storm, although at ten o'clock in the morning her rudder and propeller had been carried away by fouling with a piece of wreck, while water poured through the great hawse pipes on the berth deck until the firemen were up to their waists in water, and all the fires were extinguished. Such sail was set as could be carried, and reports affirm the most skillful seamanship in the management of the vessel. At one time, it is reported, her sailing master ordered every available man of the 450 constituting her crew into the rigging, that such a mass of men might partly act as a sail and also contribute, by their weight, to keep the vessel down on the side next the storm, and this novel experiment is said to have, for the time, saved the vessel from destruction. Soon, however, the vessel began to drift toward the Olga, and all expected that both vessels would at once go to the bottom. At this time the stars and stripes were seen flying from the gaff of the Trenton, the first time since the commencement of the storm that any flag had been raised. It seemed as if, certain of going down, her officers meant the Trenton to do so with colors flying. The captain of the Olga, however, slipped his anchors, and attempted to steam away, in doing which only a slight collision took place, when the Olga steamed to the mud flats in the eastern part of the harbor, where she was beached with but little damage to the vessel and no loss of life.

The Trenton was now fast approaching the shoal on which the Vandalia lay, and it seemed that the huge hull of the flagship would crush the Vandalia to pieces, and throw the one hundred men still clinging to the rigging into the water. It was after five o'clock, and the light was beginning to fade away, as the Trenton drifted slowly up to the Vandalia, the storm still raging with as much fury as at any time in the day. The men who had continued to cling to the rigging of the Vandalia were bruised and bleeding, and so near complete exhaustion that it was evident they could not hold out much longer. Suddenly those on shore heard the sound of cheering borne across the waters, the 450 voices of the crew of the flagship were cheering the luckless survivors on the Vandalia as the Trenton was closing up to her. But a faint reply was heard from the feeble and exhausted men, and immediately afterward the sound of music was heard. The band of the Trenton was playing the Star Spangled Banner. All who, on sea or shore, heard at this fateful time the strains of the American national anthem as they rose above the howling of the storm and the wild scene of death and destruction around, felt the inspiration of men capable of looking death bravely in the face, with the courage to battle determinedly to the end, whatever that end might be.

The collision of the two vessels, however, was so slight, as the Trenton gradually swung around broadside to the sunken ship, that it proved to be the salvation of the men in the rigging of the Vandalia, who could then jump readily to the deck of the Trenton, the latter now lying filled with water, and a total wreck, within a stone's throw of the American consulate, but holding together sufficiently during the remainder of the storm to afford a refuge for all who could reach her until they could be taken ashore.

All during the storm every effort was made by those on shore, at the little village of Apia, to render such assistance as was possible, and to care for the rescued. But the storm was so violent that, with the total absence of appliances for rescue, such assistance fell far below what all eagerly desired. The natives showed great bravery in dashing into the surf and imperiling their lives wherever a rescue seemed feasible; and all the recent differences caused by local wars and foreign diplomacy, which had originally brought the vessels

* For a review of the topography of the islands and some account of the natives, with illustrations, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 688.

to the harbor, were lost sight of in the sympathy extended to all in the face of this terrible storm visitation.

IMPROVEMENT OF THE RIVER FRONT OF NEW YORK CITY.

The Department of Docks of the City of New York has, for a number of years, been engaged in improving the river front of this city. The work was begun under the administration of General George B. McClellan as Chief Engineer, in 1871. In July, 1875, it passed into the charge of Mr. G. S. Greene, Jr., Chief Engineer of the New York Department of Docks. The work has been principally done on the Hudson River front, where granite bulkheads have been built. Different constructions have been used for different localities. This article is specially devoted to the subject of the new bulkheads that are now being constructed. Two typical forms are illustrated. The wall will be seen to consist of a foundation of concrete or piling or both sustaining a granite wall backed up by concrete. The concrete blocks, which act as a foundation for the granite wall, are backed up by cobble stone and riprap, braced by straight and sloping piling where the nature of the ground requires it. The general method of constructing a wall supported on piling where rock bottom cannot be reached is as follows:

The vertical piling is first driven. It is usually white, yellow, or Norway pine, cypress, or spruce, varying in diameter from 16 to 28 inches, and of a maximum length of about 90 feet. In many instances short piles, however, only can be used, on account of the presence of rock. Where loose stone is to be penetrated, an iron shoe is placed over the foot of the pile. The vertical piles are first driven and the three front rows are cut off 15·3 feet below low water. They are cut by a circular saw worked from a floating pile driver. The saw is journaled to a large timber which is lowered to the proper distance, and the feed is accomplished by moving the pile driver up to its work. The six rear rows of piles terminate 2 inches above mean low water, and are notched at the top to receive transverse caps.

After the vertical piles are driven, cobble stones, gravel, and riprap are put in place around them. As these are put in in layers, the riprap on the outside and cobble stone filling on the inside, each tends to take its own slope, so that a sort of interlacing of the two classes of stone filling occurs. Before the entire cobble stone and riprap filling is in place, binding frames are put in to hold the piles in place. These consist of two pieces of 5 inch by 10 inch spruce placed one above the other. Through the ends 8 inch by 8 inch oak beams pass, and are wedged back against the piling. On the three front rows of piles which were cut off by the circular saw, concrete blocks are placed. Each of these blocks is 7 feet wide on the bottom, 5 feet on the top, and 6 feet in length; their vertical height in front is 13 feet, in the rear 14 feet, affording a step for the granite wall. Each block weighs about 70 tons. Before they are lowered, a mattress, composed of burlaps filled with about two inches of mortar, is placed on top of the piling, which mattress is carried on a network of marlin attached to a wooden frame. When it has sunk to its place divers descend and cut the marlin so that the frame floats upward, leaving the mattress and marlin netting lying on top of the piles. This mortar is made with slow-setting cement, and as quickly as possible the 70 ton concrete base block is lowered on top of it, thus obtaining a firm bedding on the piling, members of which may vary one or two inches in height. More cobble stones are added, and the inclined bracing piles are driven, an inclined pile driver being used for the purpose. These go down between the vertical ones, and are placed at a distance of three feet from center to center; their slope is represented by an inclination of two vertical upon one horizontal. All the piles are adjusted and stay-lathed as soon as they are driven. The bracing piles are now cut off at the top and capped with 12 inch by 12 inch timbers lying horizontally, and more cobble stones and riprap are filled in. The granite wall is completed and backed by concrete, and a general light filling is placed above the riprap. All of these features can be clearly understood by inspection of the drawing. The concrete backing is further protected by a four-inch oak planking. Oak treenails are used for all fastenings, so that the whole represents a structure built without metal, which is, from an engineering point of view, quite a curiosity in the present age of steel. From this peculiarity it has excited much comment abroad.

The moulding and moving of the concrete blocks, which is illustrated in some detail, is a matter of special interest, as they are, probably, the largest moulded blocks ever handled in this manner. They are made in moulding boxes, and consist of two volumes of sand and one volume of Portland cement, mixed dry and moistened down with a sufficiency of water. To this mortar small sized stone, broken so as to pass through a 3 inch ring, is added in such proportions that there will be enough mortar to fill all interstices when rammed. This proportion is determined by hydraulic or water test, as well as by the practical mixing of samples. The concrete will average in its proportions 1 cement, 2 sand, and 5 broken stone; but is found to vary with the stone used. The same is to be said with regard to the water used for mixing the mortar. This is added to the mixture in such quantity as may be required by the particular sand and cement used.

The concrete blocks as moulded have vertical grooves passing down each side, and a groove across the bottom or a hole through their mass near the bottom. This groove, and hole, if present, are for receiving the hoisting chain by which they are lifted, as shown in the large illustration. The floating derrick which raises them has a capacity of 100 tons, and as each block weighs 70 tons, there is quite a surplus of power for handling them. When lowered into position the clevis of the chain is detached and a rope is fastened to the loose end. The derrick then draws the chain out and clears it from the block. By means of the rope the end is allowed to descend just as fast as the other end is hoisted, in order to prevent the chain from being caught in the aperture or on the corners. The hole passing through the block at a distance from the base is found to be objectionable, as tending to cause a fracture of the base, and the method shown in the cut is usually employed.

All this work applies to the formation of a bulkhead or river wall. It is done in sections, much delay being experienced from the opposition made by private owners. By means of this bulkhead a depth of 12 feet at mean low water against the face of the wall is secured, which is considered a sufficient depth for any vessel 200 feet long, that being the maximum length between piers. Where rock bottom exists the piling is dispensed with and concrete in bags is used for the base blocks to rest upon. An example of this construction is shown in one of the cuts. Different shaped concrete blocks are employed for different situations also. The general type is given here.

Through the concrete blocks weep holes are carried from rear to front, which are left open in order that water accumulating in the filling may have a chance to escape. When the blocks are put in place, it will be seen that the vertical grooves must come together. They are filled with concrete in bags rammed down, so that a species of tongue is formed, anchoring the blocks together and preventing transverse displacement. The granite headers of the wall are dovetailed at their rear end, so as to be anchored back into the concrete, while a firm longitudinal bond is given by the breaking of joints in the stretcher courses. One feature of the work is the thorough ramming to which the concrete is subjected, the object being to have stone touch stone in the mixture, to have no space between them, and to have sufficient water to insure setting. The quality of the cement is of the best, and it is subjected to elaborate tests for strength, time of setting, color, etc. In one section, where the piling failed to reach hard bottom, the whole structure is practically floating on a soft mud. Yet this section appears to be as secure as any.

The Outer Ring of Saturn.

BY JAMES E. KEELER, ASTRONOMER OF THE LICK OBSERVATORY.

In the *Sidereal Messenger* for February, 1888, and more recently in *Ciel et Terre*, I described the appearance of a very fine division on the outer ring of Saturn, which was seen on several occasions with the 36 inch equatorial immediately after its erection at the observatory, and particularly well on the night of January 7, 1888. In the year which has elapsed since the time of its discovery, the division has been repeatedly looked for by different members of the observatory staff, but without success; and I had come to the conclusion that it was either invisible by reason of the greater obliquity of the ring, or that it was of temporary character, and no longer existed. More recent observations show that our failure was due simply to the lack of sufficiently good definition.

On the night of March 2, which was one of the finest that we have had at the observatory, the division was seen by Professor Holden, Mr. Schaeberle, Mr. Barnard, and myself, and was independently estimated by all four observers to be situated at one-sixth of the width of the outer ring from its outer edge.

Mr. Barnard and I continued to observe the planet, with different magnifying powers, until after it had passed the meridian. The brilliancy of the whole system, particularly of the gauze ring, was remarkable, and the outlines appeared with a sharpness more characteristic of the lines of a steel engraving than of the usual telescopic image. With a power of 400, a faint shading could be seen on the outer ring, A, at about one-third of its width from the outer edge. If no higher power had been available, we should have said that we had had an excellent view of the Encke division (or shading).

With a power of 1,500 the appearance was different. The division near the outer edge of the ring then became visible, not as a shade, but as a distinct black line of exceeding fineness, and from this a dark shading extended inward nearly to the inner edge of the ring. Mr. Barnard placed the maximum depth of shade at one-third the distance from the outer edge, or where the Encke shading appeared with the lower power. To me it seemed farther out, nearly at the division which separated the shading from the brighter margin of the ring. The narrow strip lying between the division and the outermost edge of the system appeared to both of us to be the brightest part of ring A.

The outline of the planet's shadow on the ring was seen with the greatest distinctness, and was a perfectly smooth curve, agreeing, as nearly as we could judge, with that required by geometrical principles. A very minute irregularity could easily have been detected.

In my opinion, the division described above is a permanent feature of the outer ring, but it is so minute that it may fairly be classed among the most difficult and delicate of planetary details, requiring the most powerful instruments and exceptional atmospheric conditions for its observation.—*The Astronomical Journal.*

A Suggestion for Fuel at Apia, Samoa.

The question of cheap fuel is important to us all, and none the less so in the oil regions, where to burn up our surplus stocks means better prices for our commodity.

To obtain perfect combustion in burning crude oil as a fuel under boilers, stoves, etc., is and has been a desideratum.

The best device brought to my notice is a cast iron burner, which is placed in the fire box of a boiler and connected to an oil retort by pipes having the necessary shut-off cocks, with a slight fall toward the burner.

This burner is also connected by pipes, etc., to the boiler itself for steam.

In order to start the fire, you have only to turn on a small amount of oil and ignite it. Then open the steam connections to burner, and as the oil passes through the burner it becomes superheated into gas, and as the gas and steam blend and rush into the firebox, you have a gas fire at once of most intense heat, and as effective as natural gas, and when the steam and oil supply are adjusted, nearly perfect combustion is obtained.

In case you do not have steam up when the burner is started, and have water pressure at hand, the burner is adjusted to make its own steam.

What suggested this letter were the numerous articles in the papers of late indicative of anxiety at our naval headquarters as to our fuel supply for war ships centered at Samoa; also the need of a fuel for the navy that would steam quickly.

For the war ships plying the Pacific Ocean at Samoa, I would suggest the government erect, at Pago-Pago, several iron tanks of two thousand barrels capacity each, near the coaling docks; to connect these tanks with the docks, by pipe lines and proper shut-off cocks; to buy crude oil from the California or Ohio oil fields and have it delivered at the nearest seaport harbor, and thence transported in bulk in ships to Pago-Pago and stored in these iron tanks to be used when wanted.

About 3 to 3½ barrels of oil (weight about 350 pounds to 42 gallons) equals in heating units a ton of coal.

Crude oil can be purchased at Hueneme, California, on the coast, for about two dollars per barrel, or in Ohio on cars for 35 cents per barrel.

Have made for each ship a certain number of iron air-tight storage cylinders, the number to be regulated by the rules that govern the coal supply.

Put an oil burner in each boiler, to be connected with and supplied by these storage cylinders, which in turn are fed from the tanks on shore before the ship leaves the harbor.

Keep steam in one boiler continually, and this will call for very little oil if the steam supply is not drawn upon, and the amount of oil can be regulated so as to keep a certain amount of steam with no waste of fuel.

Now, then, an order is given to steam ready for action.

The boats using oil fuel will be ready and off long before the coal burners will have steam up.

Steam can be raised this way as quick as if generated by natural gas. This system of burning oil can be used to steam up with only, and then use coal, or if desired, coal and oil can be burned simultaneously.

The greatest danger to be overcome would be to store these oil cylinders where they could not be reached by the enemy's shot.

The cost of firing with oil wholly would reduce the firemen's pay roll three quarters. C. L. GIBBS.

Titusville, Pa.

A Valve for Electricity.

A device which may be of considerable value is described by M. Neyreneuf in the *Journal de Physique* as an electric valve, by means of which the current can be sent in one direction, but not in the other. With a voltameter constructed of two aluminum electrodes, dilute acid as electrolyte, and an alternating current, he found that pure hydrogen was evolved at both electrodes, but on making up an arrangement with one electrode of aluminum and one of mercury, using distilled water as electrolyte, the current was found to pass in one direction only.