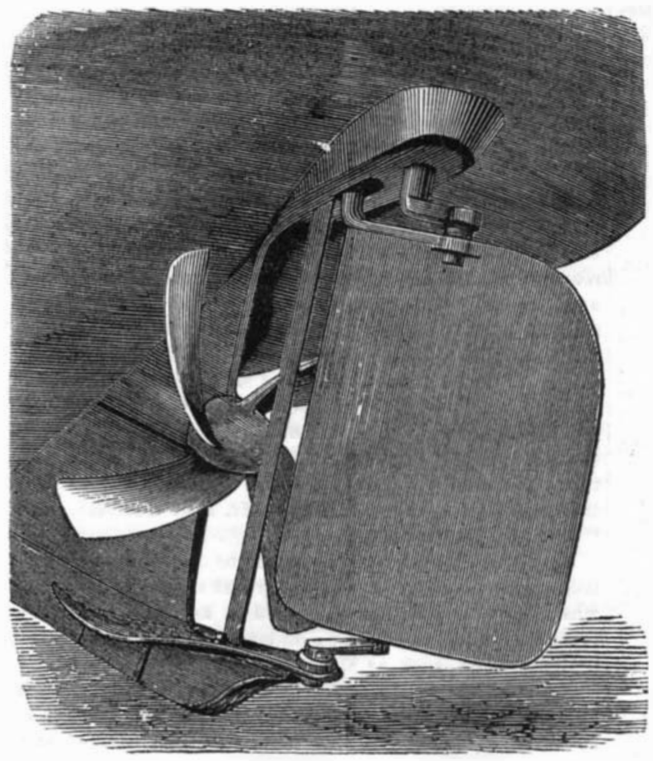
IMPROVED RUDDER.

The ordinary balance rudder, as is well known, is pivoted near its middle, and can, with a large rudder area, be easily put over to large angles. But it has certain disadvantages which have prevented its being adopted in any except a few very large steam vessels in the Royal Navy. It stops the way of the ship at slow speeds, and is uncertain in its action when the vessel is under sail. This is supposed by many to be due to the fact that the fore part of the rudder is on one side of the ship while the after part is on the other side; and the idea of Mr. Gumpel's rudder is to retain the advantage of the ordinary balance rudder as to ease of turning with a large rudder area, and to obviate its drawbacks by keeping the whole of the rudder on the same side of the vessel for any degree of inclination.

The means by which Mr. Gumpel accomplishes this can best be described by reference to the engraving, which is taken from a photograph. The fore part of the rudder is kept in the middle line of the vessel by the guide rod at its upper fore corner, which is capable of sliding forward and aft in a groove or slot under the vessel's counter. The inclination of the rudder is obtained by making its axis, which is near its center, move round on a crank on what usually forms the rudder head. A spindle goes down through the rudder center, round which the rudder is capable of revolving, and this spindle, with the arms at the top and bottom, form the crank, which carries the rudder center out of the middle line; and the direction of the plane of the rudder is regulated by the guide rod at the fore end being compelled to slide along the middle line. It will easily be seen that the advantage which this rudder has over the common rudder in point of power is mainly at large angles.

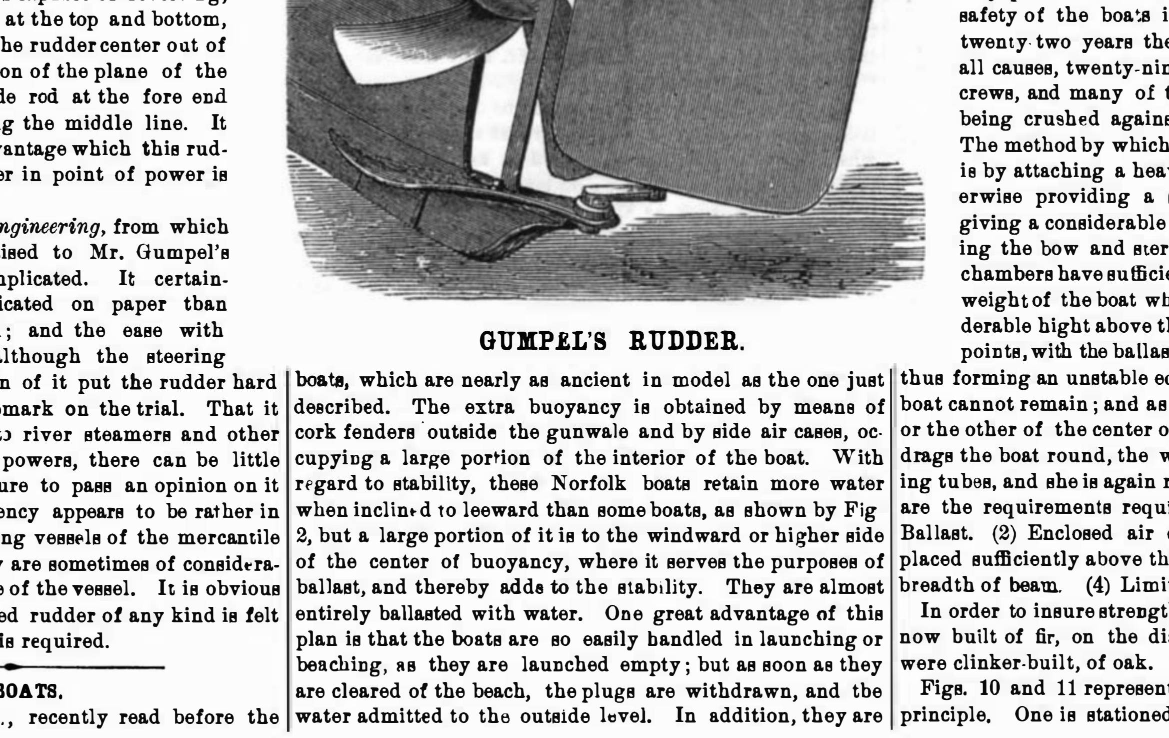
The chief objection, says *Engineering*, from which we extract the engraving, raised to Mr. Gumpel's rudder is that it seems complicated. It certainly does appear more complicated on paper than when seen fitted to the vessel; and the ease with which it could be worked, although the steering wheel was small, and a half turn of it put the rudder hard over, was a subject of much remark on the trial. That it would be of great advantage to river steamers and other craft requiring good steering powers, there can be little doubt; but it would be premature to pass an opinion on it for sailing vessels. The tendency appears to be rather in favor of small rudders for sailing vessels of the mercantile marine, although in yachts they are sometimes of considerable area in proportion to the size of the vessel. It is obvious that the advantage of a balanced rudder of any kind is felt chiefly where large rudder area is required.



GUMPEL'S RUDDER.

ON LIFEBOATS.

Mr. Charles H. Beloe, C. E., recently read before the Liverpool Polytechnic Society an exhaustive and able paper on the above important topic. Excluding such appliances as rafts, buoys, belts, and similar apparatus, he confines himself solely to the single subject in question; and dividing the boats into two classes, namely, those used off shore and those kept aboard ship, he proceeds to discuss the peculiarities and valuable improvements existing in the many types now in use. In general, the qualities which should be present in every vessel of this description are summed up by the Royal National Life Boat Institution as: (1) Great lateral stability or resistance to upsetting. (2) Speed against a heavy sea. (3) Facility of launching or taking the shore. (4) Immediate self discharge of any water breaking into her. (5) Self-righting if upset. (6) Strength. (7) Stowage room for a large number of passengers. From the descriptions which follow, taken from Mr. Beloe's paper, and by the aid of the annexed diagrams, for which we are indebted to the *Engineer*, the reader will be able to examine comparatively the principal varieties of life boats now in use in England:



LIFEBOATS.

Fig. 1 represents the north country or improved Greathead plan, and is now nearly obsolete. These are the widest rowing life boats in existence, some of them having as much as 10½ feet to 11 feet beam, with a length of 30 feet. These wide boats require long oars, with two men to each, to propel them, thereby risking a large number of lives in every boat. They do not possess the property of self-righting, and it was in one of them that twenty lives were lost in 1849. The airtight compartments are marked A. These side air cases contribute vastly to the stability of the boat, by leaving a very small space for the water to occupy, when one gunwale is thrown level with the sea, and that space but slightly on one side of the center of gravity, consequently the water shipped would have but little tendency to weigh the boat down. The continuation of the air cases to the gunwale is objectionable, as they occupy space which is valuable for the stowage of shipwrecked persons. A water tight deck, marked B, extends across the boat, a little above the level of the sea outside; and any water that may be shipped is discharged through tubes into the sea below. Fig. 2 represents one of the Norfolk and Suffolk sailing life boats, which are nearly as ancient in model as the one just described. The extra buoyancy is obtained by means of cork fenders outside the gunwale and by side air cases, occupying a large portion of the interior of the boat. With regard to stability, these Norfolk boats retain more water when inclined to leeward than some boats, as shown by Fig 2, but a large portion of it is to the windward or higher side of the center of buoyancy, where it serves the purposes of ballast, and thereby adds to the stability. They are almost entirely ballasted with water. One great advantage of this plan is that the boats are so easily handled in launching or beaching, as they are launched empty; but as soon as they are cleared of the beach, the plugs are withdrawn, and the water admitted to the outside level. In addition, they are furnished with iron keels. They are exclusively sailing boats, being nearly unmanageable under oars. They measure from 39 feet to 46 feet in length, and from 10½ feet to 12 feet in breadth. A plan and sections of the self-righting life boat of the Royal National Lifeboat Institution are shown by Figs. 3, 7, and 8. This is the result of all the experience gained by the institution in the management of its large fleet, now consisting of 235 lifeboats.

On the plan, Fig 8, A represents the watertight deck, B the relieving tubes, C the side air cases, D the end air chambers, E the ballast, F scuttles to admit of a free current of air under the watertight decks when the boat is ashore, G another scuttle for air, and to receive a pump. In the cross section, Fig. 3, A represents the sections of the sideair cases; B the relieving tubes, of the same depth as the space between the decks and the boat's floor; C C C C are spaces beneath the deck, placed longitudinally at the midship part of the boat, and filled with cases packed with cork, forming a portion of the ballast; D, scuttle for ventilation, having a pump fixed in it, by which any leakage beneath the deck can be pumped out when afloat. The extra buoyancy is obtained entirely by means of air cases. When the lee gunwale is level with the sea, there is more space inside to leeward of the center of gravity than in Figs. 1 and 2, the air cases having the corners taken off to afford room for the stowage of passengers, and to prevent the side buoyancy being placed too high for the purposes of self-righting. The self-discharge of water is provided for by the relieving tubes, B, for, as the watertight deck is always slightly above the level of the water outside, any sea that is shipped must flow out through these tubes, which are furnished with very simple self acting balanced valves, that afford no obstruction to the free egress of water, but, closing by the pressure of the sea outside, effectually prevent the admission of any. The actual time occupied by one of these boats in freeing itself from water is about 30 seconds. A large portion of the ballast is composed of cork or wood, as shown at C C C C. The really distinguishing feature of these boats is the property which they possess of self-righting. The best proof of the safety of the boats is the fact that during the last twenty-two years the Institution has only lost from all causes, twenty-nine persons from its own lifeboat crews, and many of these lives were lost by the men being crushed against wrecks, falling overboard, etc. The method by which this peculiar property is obtained is by attaching a heavy iron keel to the boat, and otherwise providing a sufficient weight of ballast, by giving a considerable amount of sheer, and by enclosing the bow and stern by airtight chambers. These chambers have sufficient buoyancy to support the whole weight of the boat when upset, with the keel at a considerable hight above the water; it is then floating on two points, with the ballast far above the center of buoyancy, thus forming an unstable equilibrium. In this position the boat cannot remain; and as soon as the keel falls to one side or the other of the center of gravity, the weight of ballast drags the boat round, the water escapes through the relieving tubes, and she is again ready for service. The following are the requirements requisite to insure self righting: (1) Ballast. (2) Enclosed air chambers at the bow and stern, placed sufficiently above the center of gravity. (3) Limited breadth of beam. (4) Limited side buoyancy.

In order to insure strength and elasticity, these boats are now built of fir, on the diagonal principle; formerly they were clinker-built, of oak.

Figs. 10 and 11 represent two boats built on the tubular principle. One is stationed at Rhyl, and the other at New Brighton, both being under the control of the Lifeboat Institution. The latter boat tows and sails admirably, though a trifle heavy under oars. A sectional elevation of her is shown in Fig. 10. Her dimensions are as follows: Length over all, 40 feet; diameter of tubes, 3 feet; distance apart, 3 feet 6 inches. The Mersey Docks and Harbor Board has a boat built on this principle, but with a difference in the mode of construction. The tubes, instead of being circular, are flat on the inner sides, see Fig. 11; the ends of the tubes are not brought together, but the inner sides remain parallel throughout, and have a sort of bow or cutwater at one end. One object of this plan is to prevent the water thrown off by the bows of the tubes being thrown in between them, where the space is confined, and where it undoubtedly retards the boat. By the altered plan, it is contended that all the water thrown off by the bows shall pass away freely outside the tubes. This boat is undoubtedly faster under oars than the New Brighton one, but not equal to her in buoyancy and strength. Her dimensions are as follows: Length, 36 feet; breadth, 10 feet 2 inches outside tubes; breadth, 9 feet 8 inches outside gunwales; diameter of tubes, 3 feet. The objections to this class of boat are: The prejudices of the fishermen and boatmen respecting a boat so unlike anything to which they have been accustomed; their great weight, the clumsy carriage which they require, their unsuitability for launching off a lee shore, and their great cost.

SHIPS' LIFEBOATS.

In order to improve this most important description of boat, in February, 1870, the Society of Arts offered its gold medal for a ship's lifeboat, suitable for the mercantile marine, under the following conditions, mentioned in the second division of the discourse. Mr. Beloe said that all ships' lifeboats should have these requirements: (1) Buoyancy sufficient to insure that the boat be manageable, when, in addition to the number of persons and additional dead weight (if any) she is intended to carry, she is filled by a sea. (2) The fittings or appliances by which such buoyancy is obtained to remain efficient under all circumstances of climate and temperature, as well as under exposure to sun, weather, and salt water. (3) Fitness for use as an ordinary ship's boat. (4) Strength. (5) Durability. (6) Lateral stability, or resistance to upsetting on the broadside. (7) Relief of water to the outside level. (8) Cheapness. (9) Simplicity of structure. (10) Lightness. It will be seen at once how different are the conditions from those of a shore life boat, and how the ordinary boats of the Institution would fail to comply with them, especially with requirements Nos. 3, 8, 9, and 10. Self-righting is not considered as essential; in fact, boats in an open sea are far less likely to be upset than in the heavy breakers near the shore. The council of the Society of Arts has awarded two gold medals, one to Messrs. Woolfe & Son, for their wooden boats, and one to Messrs. Hamilton & Co., for their iron boats.

Messrs. Woolfe & Son's lifeboat was 25 feet long by 7 feet beam, was built of wood, and had end and side compartments of the proportions recommended by the committee. There is no special peculiarity in the shape of the boat, except that she is very flat-floored; the top of the air cases being flat and level with the thwarts, they afford additional accommodation for passengers. With the crew on board and the water admitted to the outside level, this boat has a freeboard of 20½ inches, and with fifteen additional passengers the freeboard is reduced to 12 inches. It takes eight men to stand on the gunwale to bring it awash. The air cases are easily removed, thus rendering the boat available for service as a cargo boat. The seas breaking into her are ejected to the outside level by means of two plug holes in the bottom, the remainder being baled out after the plugs are again inserted.

Messrs. Hamilton & Co.'s metallic lifeboat is a counterpart of Messrs. Woolfe's boat, having the same length and breadth; and the proportions of the air cases are identical. The two points of difference between Hamilton's and Woolfe's are in the material (one being built of galvanized corrugated iron, and the other of wood) and the means of ejecting the water. The two plug holes, 3 inches in diameter, are placed in the center of the boat, and a watertight bulkhead is fixed on each thwart, on opposite sides of the plug hole, see Fig. 12. Each of these bulkheads is furnished with a simple flap valve, opening inwards. In the event of the boat shipping a sea, she is turned head to wind; and as the bow rises to the waves, all the water contained in the forepart of the boat passes through the valve in the foremost bulkhead, but cannot pass the second one, consequently the water is heaped up in the space between the two bulkheads. As the bow falls again the valve closes, and the water in the center would be higher than the outside level if the plugs have been left in; on withdrawing them it would fall to the level of the sea. The same process is repeated as the stern rises, and a few movements of the boat are sufficient to free her from water, with the exception of about one inch in the bottom. The larger the central space, the more rapid will be the discharge of water; but on the other hand, the greater will be the residuum left in the boat.

Messrs. Lamb & White's lifeboat was the first real ship's lifeboat that was ever adopted, and has undoubtedly done a great deal of good service. A cross section of it is shown by Fig. 5. It is built of two thicknesses of plank, with prepared waterproof material of an adhesive nature interposed. The whole of the internal work, comprising the watertight compartments, bulkheads, and decks, is of the same construction.

Combe's cork and cane lifeboat, Fig. 13, is composed of two baskets, placed one inside the other, and secured to a deep wooden keel, the space between the baskets being filled with cork. No provision is required for the ejection of water, which passes freely through the basket work and between the cork, the bottom of the inner basket or floor of the boat being above the outside sea level. One of the best features of this most ingenious invention is the mode in which the stability of the boat is increased by the water being retained on the windward or elevated side, and discharged on the leeward or lower side. This is effected by leaving a central space in the bottom, extending fore and aft, which is not filled with cork, and by lining a portion of the bottom of the boat and the sides of this central water space with a waterproof material, by which means the water is retained on the side which is lifted up, and its weight acts as ballast on the side where it is wanted, and tends to right the boat. One great advantage of this form of construction is its lightness, a boat, 25 feet long, 8 feet beam, and 3 feet 4 inches deep, only weighing one tun.

THE ST. GOTHARD TUNNEL.—It appears, from a recent report made to the Swiss Federal Council, that at the close of June the contractors had completed nearly one seventh of the whole distance of nine miles, 2213 feet. The progress made during July was about evenly balanced, but the advance on the Goeschenen side was rather more rapid than that effected on the Airolo side.

SMOKING BY CLOCKWORK.—A new toy, lately patented, consists of a figure of a dandy with a cigar holder in his mouth. In the pedestal there is a small bellows, operated by clockwork and spring. A small cigar is lighted and placed in the holder; and when the spring is set in motion, the dandy puffs away, as natural as life, until the cigar is consumed.

Correspondence.

Practical Mechanism.

To the Editor of the Scientific American:

I have carefully read Mr. Joshua Rose's essays on practical mechanics, and also the controversy upon hardening and tempering tools. Mr. Rose is elucidating a perfection of workmanship not attained by one experienced mechanic in a hundred. It is an easy matter to run a lathe; but to get the utmost attainable duty out of it is quite another thing, and this Mr. Rose shows exactly how to do. I have worked in shops where the work was let out by the piece, and have found innumerable cases where one man in a particular branch, with the same tools, did much more work than others. How is this? It is done by little, fine points in the manipulation of the work and the tools, which only a few succeed in perceiving. For instance, in one essay Mr. Rose says: "So much side rake may be given a tool that it will feed itself without the aid of any feed motion: for the force required to bend the shaving (in heavy cuts only) will react upon the tool, forcing it up and into the cut; while the amount of bottom rake, or clearance, as it is sometimes called, may be made justsufficientto permit the tool to enter the cut to the required thickness of shaving or tool feed, and no more; and it will, after the cut is once begun, feed itself, and stop itself when the cut is over." Such a tool as is here described is the very perfection of a tool for heavy cuts; there is absolutely nothing beyond it, that is, provided always that it is forged and hardened as Mr. Rose directs. Not a "wrinkle" has he omitted.

Mr. Hawkins says that "if a tool be dipped at the lowest temperature at which it will be hard at all, it will be harder when ready for use than if dipped at any higher temperature, if required to be drawn in temper at all." A tool for ordinary work, such as shown by Mr. Rose in his Fig. 6, treated by either of these methods would be utterly worth less for the work assigned to it by Mr. Rose, that is, running 36 or 27 feet a minute with a feed of 20 or 25. Nine out of ten expert workmen discard the feed motions of small lathes and feed the tool by hand, when doing short work, because the feeds are so fine as to prevent getting out a satisfactory amount of work. The employer of a fine feed is incapable of judging of the merits of a tool, since his practice never puts a tool to a full test. "The temper of a tool, made just hot enough to harden at all," is altogether indefinite, and practically useless. Mr. Rose gives special instructions for taps, etc., and he gives the colors in combination (as patent lawyers say) with the conditions; so that, both being observed, the result is uniform and correct. What result may be obtained by other conditions is another thing. I know of no better plan than Mr. Rose's, and I do not believe there is one in use. Mr. Hawkins appears to have varied his conditions, and his results have therefore become varied and indefinite in consequence. The latter says in one place that a workman may dip a chisel too little, and the chisel will be soft; in another place he may bungle and make it too hard, and that this is an everyday shop practice: "an unprofitable shop experience," he calls it. He afterwards says that the chemical action which produces the colors in tempering is a subject not, in his opinion, beyond the American mechanic's capability to comprehend. The capability to comprehend is as undisputed as the fact that it is foreign to the whole question. No mechanical motive, no fair motive called forth, such a remark. I do not believe that it is American shop practice to make the blunders Mr. Hawkins charges, but I do believe that, were such a deplorable state of things true, the first duty of American mechanics would be to learn to heat and dip a tool properly, so that the chemical action of tempering, whether it be oxidation or carbonization, may be put into proper operation, without which considerations of time, color, etc., are all valueless.

Greenpoint, N. Y. W. H.

The Plague of Locusts.

To the Editor of the Scientific American:

The grasshopper or locust plague of the Western States is an evil which threatens the entire country, and steps should be taken to stop it. In order to do that, we must get at the cause of it. Every acre of land producing wild or cultivated vegetation supports its equivalent of animal life; and when the balance of power is violently disturbed, it will revenge itself. When a man steps on the teeth of a rake, the handle will rise up and strike him. If we destroy on the plains one kind of animal life, another kind will spring up which we cannot destroy. Millions of buffalo have been killed for sport, and millions for their hides or tongues. Every one who sees a buffalo shoots at it. If it does not fall then, it lingers with the wounds till death relieves it. Every one who has crossed the plains knows that few are the spots which are not dotted over with decaying and decayed carcases. But the greatest slaughter of animals is done by poisoning the wolves and coyotes. Each hunter spreads poisoned bait over a large track of country, and every morning rides round to take the skins; and each dead animal left to rot is in turn a bait to slay thousands of vultures, crows, ravens, hawks, and birds of all kinds, forming a carpet of their feathers for yards round each carcass. It is no wonder, then, that the hoof of the buffalo and the sharp bill of the feathered tribe disturb not the egg of the locust, as it lies near the surface of the ground, waiting for the warm, dry days to come, that it may be hatched out and fly.

The vast plains, while waiting to be used as the abode of man and his dependents, should not be deprived of their beasts and birds. Every prairie chicken and bird consumes an enormous quantity of insect eggs. The wolf and the bear feed on the locusts before they can fly. By these agents, clouds of these plagues would be prevented from rising to strike the Western farmer with want and famine. The locust must now be consumed or abolished in some way, or he will possess the land. We must improve the means of gathering them and using them for fuel or fertilizers, and laws must be enforced which will protect the beasts and birds of the wilds. If large brilliant fires were kept burning at night in the line of their flight, they would come to the light, and, getting their wings burnt, would remain.

Chicago, Ill. JOHN WHITEFORD.

Passage of Gas through Heated Cast Iron.

To the Editor of the Scientific American:

It is generally supposed that the products of combustion will, under some circumstances, pass through heated cast iron. My impression is that experiments, made in Paris several years ago, lead to this conclusion. I remember reading something of the kind at the time, but I have never been able to find an authorized statement of the investigations which lead to this conclusion. Can you put me in the way of finding an account of these experiments? In case you are unable to do this, will you kindly inform me what you think the facts in the case are? J. W. PINKHAM.

Montclair, N. J.

[ANSWER.—We have heretofore published the reports of experiments to which our correspondent refers, wherein it was claimed that carbonic acid gas, resulting from the combustion of the fuel in cast iron furnaces, will pass directly through the iron plates; and the recommendation was therefore made that wrought iron should be substituted for cast iron in the manufacture of hot air furnaces, stoves, and other domestic heaters. But this conclusion we regard as erroneous, for we think that the quantity of gas that thus passes through the cast iron plates is too small to be ordinarily appreciable. In fact, Dr. Hayes, of Massachusetts, in a note published in the SCIENTIFIC AMERICAN last year, stated that that he had conducted a series of special experiments which fully confirm the above view.

We are aware that the escape of gas from our stoves and furnaces is a subject of serious and common complaint. But the trouble is principally due to the badly fitted joints of the cast iron plates, to the improper closing of dampers (thus forcing the gas out at the joints), and also to defective draft in the chimney. It would be difficult to find any cast iron stove or heater in use that is not more or less visibly open at some of its plate or pipe joints, through which gas may, of course, freely flow out. Until some method is invented to seal these openings, the subject of the issue of gas through the pores of the plates, as a sanitary question, will be likely to remain in abeyance.—EDS.]

The Small Engine Question.

To the Editor of the Scientific American:

Some years ago I built a small engine, with a cylinder 2x5 inches, and a balance wheel of 3 feet diameter and 100 lbs. weight. The boiler is 15x36 inches and has fifty ¾ inch flues. It is set horizontally, with the fire box at one end. The fire returns through the upper flues, superheating the steam. The cylinder is on top of the boiler. Fifteen gallons of water are required to charge the boiler; and when the engine is running at 50 lbs. pressure and 300 revolutions per minute, it evaporates about 2 gallons per hour. The amount of fuel is about the same as required by a good sized cook stove. It runs 12 feet of 2 inch shafting, a 6 inch circular saw and cuts 2 inch lumber well; or it runs a wood lathe to turn stuff 6 to 8 inches in diameter. The engine has been run, more or less, for ten years without repairs of any importance, and is in good order now.

Brunswick, N. J. N. T. W.

To the Editor of the Scientific American.

I have a vertical engine, 2½ inches stroke x 2½ inches bore. The feed pump plunger is ⅜ inch x 2½ inches stroke. The boiler is horizontal, 24 inches x 12 diameter, with 12 flues, each 1¼ inches in diameter. Boiler is set in a heavy sheet iron case, with fire box 12x14 inches; the fire passes under the boiler, back through the flues, and over the top of the boiler, and out of smoke stack. No part of the boiler is exposed to the air. The feed pipe passes into the boiler front through the fire, and delivers the water in the back end of the boiler at nearly the boiling point. I have the engine in a boat 16 feet long x 4 foot beam, turning a 14 inch wheel. It makes steam very freely; in fact I run with the door open two thirds of the time. I have run 60 miles in 9 hours with 4 men, burning 48 lbs. of coal. It is the most perfectly working engine I ever saw, large or small.

Manistee, Mich. N. G. NEER.

The Speed of the Mary Powell.

To the Editor of the Scientific American:

In your issue of September 5, I see you mention that the Mary Powell ran to Piermont, a distance of 28 miles, in one hour. On investigation, I fail to find your statement of the distance to Piermont confirmed. I make it about 22 miles

New York city. L. H. ROSSIRE.

J. FRAUENBERGER, of New York city, has recently patented a composition for producing artificial corals, ivory, and similar articles, made of caseine, mixed in the proportions described, and boiled under suitable heat, with a varnish-like solution of copal in concentrated liquid ammonia and alcohol, to be colored and prepared for the various applications in the arts.