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Contents.

(Illustrated articles are marked with an asterisk.)

ELECTRIC EARTH BATTERIES.

In the year 1838, Steinheil made, on the railroad from Nürnberg to Fürther, an experiment in using the rails as conductors for telegraph despatches; but he found that the current passed through the earth from one rail to the other, and then he conceived the idea of using the earth for the return current, thus saving half the wire. He found that it not only worked perfectly, but better than a wire for the return current, as the earth and one wire gave only half the resistance given by two wires, which were used before this great discovery, which was of the utmost practical importance to the progress of the telegraphic art. The manner in which this method of using the earth for the return current is applied is to bury, at each of the two terminal stations of the line, a copperplate in the moist earth, and connect it by means of a wire to the telegraph apparatus or battery. Gauss, in repeating this experiment, conceived the idea of leaving the battery out altogether, and burying at one station a large copper plate and at the other a large zinc plate; and he found that a powerful electric current then passed through the wire. This arrangement is evidently nothing but a single voltaic pair, constructed on a large scale, as the layer of moist earth of a few miles in thickness between the metallic plates replaced the layer of acidulated cloth, paper, or liquid in the cell.

Bain applied this arrangement to his telegraph, so as to obtain a current of long duration and constant quality. He buried a series of zinc and copper plates, opposite to one another in the moist earth, and connected them by insulated wire; and so obtained a current of sufficient strength to work his telegraph. According to the same principle, a variety of voltaic batteries or generators of electricity have been constructed, by means of which Bain, as well as Robert Weare, kept his electric clocks in constant and very regular motion. Such an earth battery remains in similar activity until in the course of time one of the metals has become entirely oxidized, which oxidation, according to experience, takes place only very slowly when large plates are buried deep in the moist ground.

The most extensive application of such batteries was made by Steinheil on the railroad from Munich to Nanhofen; the line was 22 miles long, and the earth battery was completely successful in performing not only the service required on the road itself, but also in serving for the sending of despatches for the public. The metal plate in Munich was of copper, of 120 square feet, while in Nanhofen a zinc plate of the same size was buried; both plates were sunk so deep as to reach the level of the subterranean well water of the locality, and connected with isolated wires to the air line. The current thus established was used to effect the deviation of a magnetized needle in a galvanometer, which Steinheil used as the basis of his system of signals, a system requiring only a very feeble electromotive force, a force entirely insufficient to move the electromagnets of the Morse system, or the hand of a dial telegraph.

The construction of such earth batteries, easy and simple as it appears to be, has never become a settled practice, for reason of the laborious digging required, it being much easier to plunge plates in cups and renew them after a while than to dig up the oxidized zinc plates in order to replace them by new ones. However, when a river or brook is at hand, the practice can be recommended; as in that case a zinc plate has only to be sunk at a convenient and safe spot. Then at any time, if the current becomes weak, the plate may be easily replaced by a fresh one; while in place of the copper, a quantity of coke may be buried in the moist earth. The great objection to this form of battery is, however, the unavoidable total lack of intensity: as the latter quality depends on the number of cups, and the earth or water acts as but one single cup, and thus the burial of several plates is equivalent only to the immersion of them in a single cup. If the plates are connected for quantity, that is, all the zincs together and all the coppers or cokes together, the series will act like a single pair of which the surface is equal to the sum of the individual plates, and thus as one pair of large surface: if, however, the plates are connected for intensity, that is, every alternate zinc to the next copper, only the two plates at the extremes of the series will be of use, because the several intermediate pairs discharge mutually all the electricity generated into the moist earth, through their metallic connections: which shows the fallacy of the advantage claimed for some earth batteries lately constructed and even patented.

Of all the batteries thus far constructed, the most constant appears to be that of Leclanché; it is to a certain extent an imitation of an earth battery. It consists of a large piece of coke surrounded by coarsely pulverized manganese and coke, all contained in a porous cell and surrounded by amalgamated zinc plunged in a solution of sal ammoniac. This battery has, during the last ten years, been more and more used in France; and according to the testimonies of the telegraph operators there, it far surpasses all others, for reliability and constancy.

TORPEDOES FOR HARBOR DEFENSE.

Approaching New York from the sea or the Sound, one can scarcely fail to observe, printed in very large letters on the faces of the forts which command the passage, the warning words: "TORPEDOES: DON'T ANCHOR."

We have heard the significance of the warning, frequently discussed by fellow passengers this summer, with a growing conviction that few implements of modern warfare are so little understood by peaceable people as the torpedo. "There's a lot of them stored in the fort, I suppose" (said one passenger to another the other day, in response to the question, "why not anchor?"), "and of course it wouldn't be safe for a vessel to lie alongside."

That torpedoes are submarine engines, designed to blow up invading vessels, is more commonly understood; but how they are made and placed, how exploded, and why vessels should not anchor in their vicinity, fewer seem to know.

It is natural that this should be the case. As an efficient weapon of defense, the torpedo is comparatively a new affair; indeed, it may almost be said that it is altogether an experimental affair; and though it is confidently predicted that, when the next great struggle between maritime nations comes off, it will be found that a revolution has been wrought by the torpedo in methods of conducting naval warfare, only the few who are actively engaged in developing this future decider of battles know very much about its character or capacity. This, too, is natural. The torpedo, like a mine or a masked battery, is valuable in proportion to the enemy's ignorance; and it would be simply foolishness on the part of any government to develop a torpedo system at great expense, then nullify their work and its advantages by spreading too minute a knowledge of it. Still, a general idea of torpedo operations can be gained from facts which are common property, without reference to any particular system of harbor defense; and a general idea is quite as much as the most of us care for in cases of this sort.

Distributed in a narrow passage, torpedoes are intended to arrest the progress of an enemy's vessels, either by compelling them to pause through fear of unseen danger—thus keeping them longer under fire of powerful land defenses—or by destroying them by direct explosion should they venture within the torpedo-defended area. In construction, the torpedo consists of a strong metallic case filled with gunpowder or other explosive substance, and fitted with an apparatus by which it may be fired, either mechanically by the shock of a colliding vessel or by the action of some one on shore. The first, or automatic exploder, is the simplest in construction and action, but has the great disadvantage that it cannot distinguish friend from foe. A passage defended by self acting mechanical torpedoes is therefore closed to all vessels, and their use must necessarily be confined to special positions and occasions. It is perhaps needless to observe that such a system of defense would not answer in channels thronged with peaceful shipping, like those which lead into our harbor. In cases of this sort, the thing needed is obviously something that will lie safely on the bottom or securely moored below the reach of passing vessels, completely under control by some one on land, and with no risk of untimely explosion.

The earliest torpedoes to be operated from the shore were arranged to be fired by a friction tube attached to a cord communicating with the land: a plan partially successful where the channel was narrow and the period of the firing line's exposure comparatively brief, but quite unsuited for permanent defenses and long ranges. During the Crimean war, the Russians first employed electricity as a means of exploding torpedoes, and the same method was adopted in some instances in the South during our "late unpleasantness." Since then the electrical system, both automatic and volitional, has been developed by numerous experiments in various countries, a very interesting series of them being just now in progress at Portsmouth, England, in connection with an experimental ironclad called the Oberon, the design being not merely to ascertain the destructive effect of torpedo explosions, but various other important questions touching the working of torpedoes arranged on what is known as the network system. By this plan any number of torpedoes may be placed in electrical communication with a firing station on land, so that the condition of each and all can be determined at a glance and any one of them exploded at will, without affecting the others. The connecting cable contains strands of copper wire insulated by gutta percha and covered by a protecting envelope of hemp and coiled iron wire. The copper wires lead from a galvanic battery on shore to the signalling and firing arrangements within the torpedoes, the one indicating to the operator the presence of a vessel within the destructive area of a torpedo, the other enabling him to explode the sunken mine by touching a key. In other cases the firing circuit is so arranged that it can be closed mechanically by the action of the signalling apparatus, thus making the torpedo automatic. The firing is effected by an electric fuse, commonly that known as the platinum wire fuse, in which a strand of platinum wire is made red hot by the electric current on the completion of the circuit. It is evident, as a writer in the London *Times* observes, in justification of the expensive experiments going on at Portsmouth, that a complete system of torpedo defense, embracing more complicated details, cannot be brought to perfection without extensive and exhaustive trials. "There are a multitude of problems connected with the subject which can only be solved by experiment. The action of the circuit closers may or may not be influenced by the rate of the tide in particular positions; the presence of sharp rocks may render electrical torpedoes impossible; the laying and raising of the cables and other parts require constant practice under various conditions to insure efficiency; lastly, it is absolutely necessary to know the range or distance at which a given torpedo ceases to be effective when exploded. This latter question is the more important, because upon its solution may depend, in a great measure, the quantity of the explosive agent to be used, and the relative positions of a group of torpedoes. The disruption of a number of other submarine mines by the explosion of a torpedo in their vicinity would seriously affect the defensive arrangements, and would probably lead to a complete gap in the line. It is therefore advisable that the amount of the explosive agent in a torpedo should be regulated so as to insure the maximum destructive effect upon a hostile vessel with the minimum disruptive effect upon the adjacent torpedoes."

The experiments carried out on the Oberon are said to show that comparatively large charges cannot be exploded without compromising other mines within the effective area. It remains to be decided which is best: to use large torpedoes far apart, and thus diminish the area of danger to hostile ships, or to use a smaller charge and moor the torpedo so that its explosion will occur in contact with or as near as possible to the vessel to be destroyed.

It is scarcely necessary to recur to the warning: "Don't Anchor." What the arrangement of torpedoes may be in the forbidden areas, it is not needful to know; a dragging anchor would be likely to disturb the nice arrangement of electric communication, and might possibly prove disastrous to private as well as government property.

SOMETHING ABOUT BALLOONS.

A reference to our files will show that we have endeavored to keep our readers fully informed in regard to the progress of aerial motors; for although the final success of the problem is far from being assured, the earnest labors of scientists augur well for the future. We have received so many inquiries, of late, in regard to the elementary principles to be observed in designing balloons, that it seems advisable to devote some little space to their consideration. Information of the kind sought for, simple as it may seem, can scarcely be found in any of the published literature of the subject; and the general solution of the question given in this article appears now for the first time in print, so far as our knowledge extends.

The general formula for the proportions of a balloon is somewhat intricate, and we have endeavored to simplify it so that it can be applied by any one who understands arithmetical operations.

The first point to be considered is what makes a balloon rise. We receive numerous questions such as the following: "What is the lifting force of a cubic foot of hydrogen, in pounds?" from which we infer that a few words on this subject may not be out of place. The hydrogen, or any other gas, however light it may be, has no lifting force

On the contrary, if it possesses the least weight, this weight is a force which would cause it to fall, unless it were buoyed up by something else. If it is sufficiently light, however, its tendency to descend is counteracted by the buoyant force of the air, and it ascends. Placed in a vacuum, it would immediately fall. Some illustrations may be introduced. to render this point plain. Suppose that a cubic foot of some substance, weighing in the air 400 pounds, is wholly immersed in water, which weighs 62 pounds per cubic foot. By the immersion, a cubic foot of water is displaced to make way for the substance, and, by its effort to return, presses upward against the substance, with a force of 62 pounds; so that the body, if weighed during immersion, will be found to have its original weight diminished by 62 pounds, and will balance the scale at 338 pounds, instead of the 400 required when weighed in the air. Now if, in place of this heavy body, we immerse a cubic foot of some other substance, which weighs only 40 pounds, the water, as before, will press up with a force of 62 pounds; and as the body only exerts a downward pressure of 40 pounds, it will rise, under the influence of the unbalanced upward pressure of 22 pounds. The action of the air on all bodies immersed in it is precisely similar to that of the water, except that most bodies are so much heavier than equal bulks of air that the effects are not ordinarily noticed. For instance, a cubic foot of air of ordinary pressure and temperature weighs about $\frac{163}{2000}$ of a pound; so that a substance, one cubic foot in capacity, which weighs 400 pounds in the air, will weigh $399\frac{1843}{2000}$, or practically the same, in a vacuum. It is obvious, however, that there is some difference in the weights as estimated in the air and in a vacuum; and since the weight of the air varies somewhat at different times, the absolute weight of a body is its weight in vacuum. Of course, the weight of a body in the air is ordinarily sufficiently accurate, and it is only in delicate scientific researches that the method of weighing in vacuum is employed.

From the foregoing considerations, we are led to conclude:

1st. If a body is wholly immersed in any fluid, it will be pressed upward by a force equal to the weight of a volume of the fluid equal to the volume of the body.

2nd. If the upward pressure is less than the weight of the body, the latter will have a tendency to fall, under the action of a force equal to the difference between the body's weight and the weight of an equal volume of the fluid.

3d. If the upward pressure is equal to the weight of the body, the body will have no tendency either to fall or rise.

4th. If the upward pressure is greater than the body's weight, the body will have a tendency to rise, due to a force equal to the difference between the weight of a volume of fluid, equal to the volume of the body, and the weight of the body. These principles are a concise statement of the theory of a balloon's action. If we have a body whose weight per cubic foot is less than the weight of, a cubic foot of air, the body will rise with a force equal to the difference between the body's weight and the weight of an equal volume of air. For instance, if a balloon is filled with hydrogen, the air will exert a lifting force of about $\frac{7}{100}$ of a pound for each cubic foot in the volume of the balloon, so that, if the weight of the balloon and car is less than this lifting force, the balloon will ascend. If common illuminating gas is used in the balloon, the lifting force will be about $\frac{1}{25}$ of a pound for each cubic foot of the balloon's volume. The weight of the material in a balloon varies greatly, of course, according to the construction, some balloons only weighing, with the net work, about $\frac{1}{16}$ of a pound per square foot of surface, or even less, and others weighing as much as ⅛ of a pound per square foot of surface. The ordinary shape of a balloon approximates closely to that of a sphere, which it is commonly assumed to be in making calculations. An example is appended to illustrate the application of the preceding statements:

A balloon has a diameter of 40 feet, the weight of the material and netting is ⅛ of a pound per square foot of surface, the weight of the car and contents is 600 pounds, and the gas which distends the balloon is subject to an upward pressure of $\frac{1}{25}$ of a pound per cubic foot.

The volume of the balloon is 33,510 cubic feet, so that the upward pressure due to the air is about 1,340 pounds. The surface of the balloon is 5,026·5 pounds, so that the weight of material and netting is about 628 pounds, to which must be added the weight of the car, making a downward pressure of 1,228 pounds; hence the unbalanced upward pressure, which causes the balloon to ascend, is about 112 pounds. It will now be evident, we think, that the lifting force of a balloon is entirely due to the air, and is impeded, instead of being assisted, by the gas; so that it would be better, if it were practicable, to make a balloon with a vacuum in the interior.

It must be remembered that, as a balloon ascends above the earth's surface, the air in which it is immersed grows continually less dense, so that the lifting force becomes less and less, unless the volume of the balloon is increased. Thus at about 18,000 feet elevation, the air is only about half as dense as at the sea level; at 36,000 feet elevation, ¼ as dense, and so on. Hence balloons are rarely filled at the surface, as we have explained in former descriptive articles. We have also detailed the methods of manufacture, varnishes employed, etc., so that it only remains to explain the manner of calculating the size of a balloon required to fulfil given conditions.

In making the estimate for a balloon, one can generally ascertain the weight of the car and contents, the difference of weight of a cubic foot of air and of the gas to be employed (which may be called the buoyant effort), and the weight of the balloon with its ropes and network per square foot of surface. It is then required to find the diameter of a balloon which will have a tendency to rise with a given force. The calculation by which this is determined is somewhat complex, but it will be found explained at length below, an example being added for the purpose of further illustration. The following quantities must first be ascertained:

1. The buoyant effort, or difference between the weight of a cubic foot of air and of gas.

2. The weight, which includes the weight of everything except the material of the balloon and the netting, together with the lifting force.

3. The superficial weight, or weight of the material and netting, per square foot of the balloon's surface.

The operations for finding the required diameter are as follows

(*a*). Divide twice the superficial weight by the buoyant effort.

(*b*). Divide 8 times the cube of the superficial weight by the cube of the buoyant effort.

(*c*). Divide 0·95493 times the weight by the buoyant effort.

(*d*). Multiply 15·27888 times the cube of the superficial weight by the weight, and divide the product by the fourth power of the buoyant effort.

(*e*). Divide 0·91188 times the square of the weight by the buoyant effort.

(*f*). Add together the quantities obtained by rules (*d*) and (*e*), and take the square root of the sum.

(*g*). Add together the quantities obtaiued by rules (*b*), (*c*), and (*f*), and take the cube root of the sum.

(*h*). Add together the quantities obtained by rules (*b*) and (*c*), subtract the quantity obtained by rule (*f*), and take the cube root of the difference.

(*i*). Add together the quantities obtained by rules (*a*), (*g*), and (*h*). The sum will be the diameter required.

Example: It is required to find the necessary diameter of a balloon, the following data being given:

The weight of the car and contents is 475 pounds, of the valve 25 pounds, and the air is to exert a lifting force of 100 pounds. The gas in the balloon is to be such that the difference between its weight and that of a cubic foot of air shall be 0·04 pound. The weight of the material and netting is to be 0·12 pound per square foot of balloon surface.

Pursuing the same steps as indicated in the preceding rules, we find:

1. The buoyant effort $= 0{\cdot}04$ pound.
2. The weight $= 475 + 25 + 100 = 600$ pounds.
3. The superficial weight $= 0{\cdot}12$ pound.

(*a*). $2 \times 0{\cdot}12 \div 0{\cdot}04 = 6$.
(*b*). $8 \times 0{\cdot}001728 \div 0{\cdot}000064 = 216$.
(*c*). $0{\cdot}95493 \times 600 \div 0{\cdot}04 = 14{,}324$.
(*d*). $15{\cdot}27888 \times 0{\cdot}001728 \div 0{\cdot}00000256 = 6{,}187{,}946$
(*e*). $0{\cdot}91188 \times 360{,}000 \div 0{\cdot}0016 = 205{,}173{,}000$.
(*f*). $\sqrt{(205{,}173{,}000 + 6{,}187{,}946)} = 14{,}538$
(*g*). $\sqrt[3]{(216 + 14{,}324 + 14{,}538)} = 30{\cdot}75$.
(*h*). $\sqrt[3]{(216 + 14{,}324 - 14{,}538)} = 1{\cdot}26$.
(*i*). $6 + 30{\cdot}75 + 1{\cdot}26 = 38{\cdot}01$ feet, required diameter.

This explanation will doubtless render the method plain to all who are sufficiently interested to devote a little attention to the matter; and such readers would do well to work out other examples from assumed data.

As there are many who like to know the reasons for a result, we have added the method by which the rules are obtained, which can readily be verified by those who are familiar with algebra. Let

b = buoyant effort, W = weight, and a = superficial weight.

The balloon is to have sufficient volume that the upward pressure of the air, which is the volume of the balloon multiplied by the buoyant effort, shall be equal to the weight, increased by the product of the superficial weight and the surface of the balloon. Assuming that the balloon is in the form of a sphere, this condition is expressed by the following equation, calling x the diameter of the balloon:

$$0{\cdot}5236 \times b \times x^3 = \mathrm{W} + 3{\cdot}1416 \times a \times x^2$$

From which we deduce:

$$x = \frac{2a}{b} + \left[\frac{8a^3}{b^3} + \frac{0{\cdot}95493\,\mathrm{W}}{b} + \left(\frac{15{\cdot}27888a^3\mathrm{W}}{b^4} + \frac{0{\cdot}91188\mathrm{W}^2}{b^2}\right)^{\frac{1}{2}}\right]^{\frac{1}{3}}$$
$$+ \left[\frac{8a^3}{b^3} + \frac{0{\cdot}95493\mathrm{W}}{b} - \left(\frac{15{\cdot}27888a^3\,\mathrm{W}}{b^4} + \frac{0{\cdot}91188\mathrm{W}^2}{b^2}\right)^{\frac{1}{2}}\right]^{\frac{1}{3}}$$

the same value as was given in the foregoing rules.

It will be evident, by inspecting the equation of condition, that the same method can be applied to any form of balloon whose volume and surface can be expressed algebraically.

SENATE CONFIRMATIONS.

We are informed that the nominations of Captain J. M. Thacher as Commissioner of Patents, and General Ellis Spear as Assistant Commissioner, have been confirmed by the Senate, and also that of Major Marcus S. Hopkins as a member of the Appeal Board

It is gratifying to be able to say that they are all gentlemen of the highest personal character, possessed of ability and experience. The duties committed to their charge are of great importance, and will, we trust, be discharged with unswerving fidelity. They have before them a splendid opportunity, by an honest and liberal-minded administration of the Patent Laws, to secure the public confidence, and win for themselves individually, an honorable and widely extended fame.

* * *

WE are requested to state that the case of the rotary blower, illustrated and described in our last issue, is formed of cast iron, bored out true, and bolted firmly to the heads of the machine. The mention of "light boiler iron, formed up very truly and inserted into the heads of the machine," is an error.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW VARNISH FOR METAL WORK.

A late Italian patent contains the following recipe for a varnish for protecting metal work: A paste is made of finely pulverized quartz, carbonate of potash, or oxide of lead and water according to the color required. A thin coat of this is applied with a brush to the object, which is then placed in a muffle, and heated to 1,495° Fah. The articles emerge covered with a sort of polished glass, which resists blows and which does not split nor scale off, while it serves perfectly to protect the metal against oxidation.

RUSSIAN RAILWAYS IN PERSIA.

Since the revoking of the concessions obtained by Baron Reuter from the Shah of Persia, for the construction of the railways in that country, Russia has been negotiating for the privilege, and the success of her diplomacy is now announced.

Russian capitalists will furnish the funds, and the line to be built will connect the Caspian and Black seas through Tiflis and the port of Peti. The Shah guarantees 6 per cent of the cost of such portions of the road as enter his dominions.

ELECTROPLATING ON CHINA.

M. Hansen has recently patented in France the following process for electroplating on a non-conducting material: Sulphur is dissolved in the oil of *Lavendula spica* to a sirupy consistence. Sesquichloride of gold or sesquichloride of platinum is then dissolved in sulphuric ether, and the two solutions are mingled under a gentle heat. The compound is next evaporated until of the thickness of ordinary paint, when it is applied with the brush to such portions of the china, glass, etc., as are desired to be covered with the electrometallic deposit. The objects are baked in the usual way before immersion in the bath.

IMITATION GOLD.

An alloy having a very fine and malleable grain, susceptible to a high polish and impervious to rust (which, while closely resembling gold, may advantageously replace that metal in a variety of cases), is made of 100 parts pure copper, 17 parts tin, 6 parts magnesia, 3·6 parts sal ammoniac, 1·8 parts quick lime, and 9 parts bitratrate of potassa. The copper is melted first, and the magnesia, ammonia, lime, and tartrate are successively added in small quantities. The tin in small pieces is then placed in the crucible, and the whole brought to fusion for 35 minutes, after which the alloy is allowed to cool.

EFFECT OF FLAME ON AN ELECTRIC SPARK.

Mr. S. J. Mixter notices a curious effect of a gas flame on the current of a Holtz machine. The jet consisted of a glass tube drawn out to a point, and the flame bad a length of about an inch and a diameter of only an eighth of an inch. Inserting this between the two terminals of the machine, the length of spark obtainable was at once increased from less than ten inches to over twelve, the full distance to which the balls could be separated. The same increase was not obtained on simply inserting a conductor between the two terminals, a ball an inch in diameter only lengthening the spark about an inch.

A NEW GALVANIC BATTERY.

A new battery is manufactured by Messrs. C. & F. Fein, of Stuttgart, which is said to be remarkably cheap and to have a constant current, with high electromotive power. It consists of a three-necked jar, similar to a Woolff bottle. In one of the side orifices is inserted a charcoal plate, and in the other a strip of amalgamated zinc, the last covered with cotton. By means of the center tube, pieces of coke and preoxide of manganese are inserted until the bottle is about two thirds full. The remaining space receives a concentrated solution of sal ammoniac. The center tube terminates above in an inverted flask, the neck of which is extended down to the level of the liquid. The flask is also filled with the sal ammoniac solution, and, by affording a continual supply, provides against loss by evaporation. The contact between the charcoal and the copper conducting wire is made by platinum plates. The battery remains constant for a year, and is said to be easily cleaned and renewed.

HIPPOPHAGY IN FRANCE.

During the fall of 1874, Paris ate 1,555 horses, asses, and mules. A horse, which, for his skin, hoofs, etc., alone, is worth but about five dollars, brings as food, in the markets of the French capital, five times that sum.

Gas from Crude Petroleum.

In a reply recently given to one of our correspondents in respect to this subject, he was informed that many attempts had been made to employ crude petroleum for the manufacture of illuminating gas, some of which are in progress, and that, as yet, the various inventors have not succeeded in perfectly overcoming the practical difficulties.

The Ashtabula *News*, Ohio, objects to this reply, because, it says, Ashtabula is now and has been for more than a year lighted by gas made from crude petroleum by a process invented by Dr. Wren of Brooklyn; that the process is entirely successful and very economical; and that among other places which are now using this gas we may name Shelbyville, Indiana, and San José, California.

We are glad to record these evidences of successful progress in the use of crude petroleum, and we hope that gas engineers in all parts of the country will send us reports of what they are doing in that line. Crude petroleum is a very cheap, abundant, and valuable natural product. Its successful, economical use for gas illumination will be of great advantage to the country.