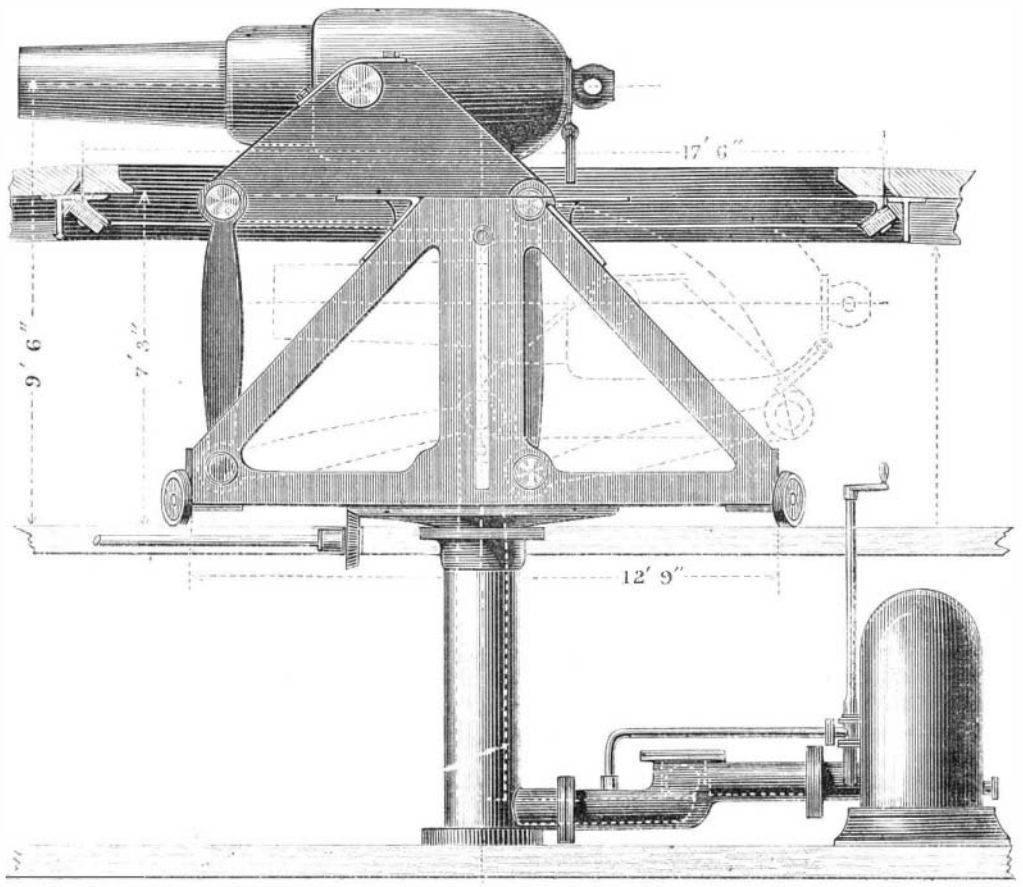
HYDRO-PNEUMATIC GUN CARRIAGE.

We illustrate herewith, from *Engineering*, the revolving hydro-pneumatic gun carriage, especially designed for naval purposes. The engraving we now publish shows the perfected system in all its details, and indicates both the loading and firing position of the gun, which is mounted upon a revolving carriage. The circular travel described by the wheels upon the lower deck is 12 feet 9 inches, and at the upper deck the framework is free to turn round an inclined path 17 feet 6 inches diameter, upon which rollers set at an angle take their bearing, the revolving motion being effected by bevel gearing, as shown. Under the carriage is placed an hydraulic cylinder, the ram of which has a T-shaped head, and is provided with small rollers which bear upon the under side of the moving part of the carriage. In the lower part of the carriage, that which has no movement except a circular one, a vertical opening is left on each side, as shown, and these serve as guides for the ascending or descending ram, the end of the T-head, projecting through the openings on either side. Parallel links, the position of which, when the gun is in firing position, is vertical, are secured at the lower end to the bottom of the fixed part of the carriage, and at the upper end to the movable part, their motion being the same as the links in a parallel ruler, as the gun rises or falls. Connected with the hydraulic cylinder is a pipe leading to an air vessel, and having a valve chamber containing a spherical valve. A bye-pass pipe, which can be opened or closed by a lever from the gun platform, establishes an independent communication between the air chamber and that portion of the main pipe between the valve chamber and the hydraulic cylinder. In the rear of the air chamber is a small pipe for supplying water-deficiencies by leakage. The action of the mechanism is as follows: Water is pumped into the apparatus until the air in the air chamber is placed under a considerable pressure. When the gun is loaded, and it is desired to raise it, the opening of the bye-pass establishes a communication with the hydraulic cylinder, the ram of which rises carrying with it the gun. The valve is then closed, and when the piece is fired the recoil throws it back with a constantly decreasing velocity, due partly to the increasing resistance of the coupling links, and partly to the increasing pressure within the air chamber.



MONCRIEFF'S HYDRO-PNEUMATIC GUN CARRIAGE.

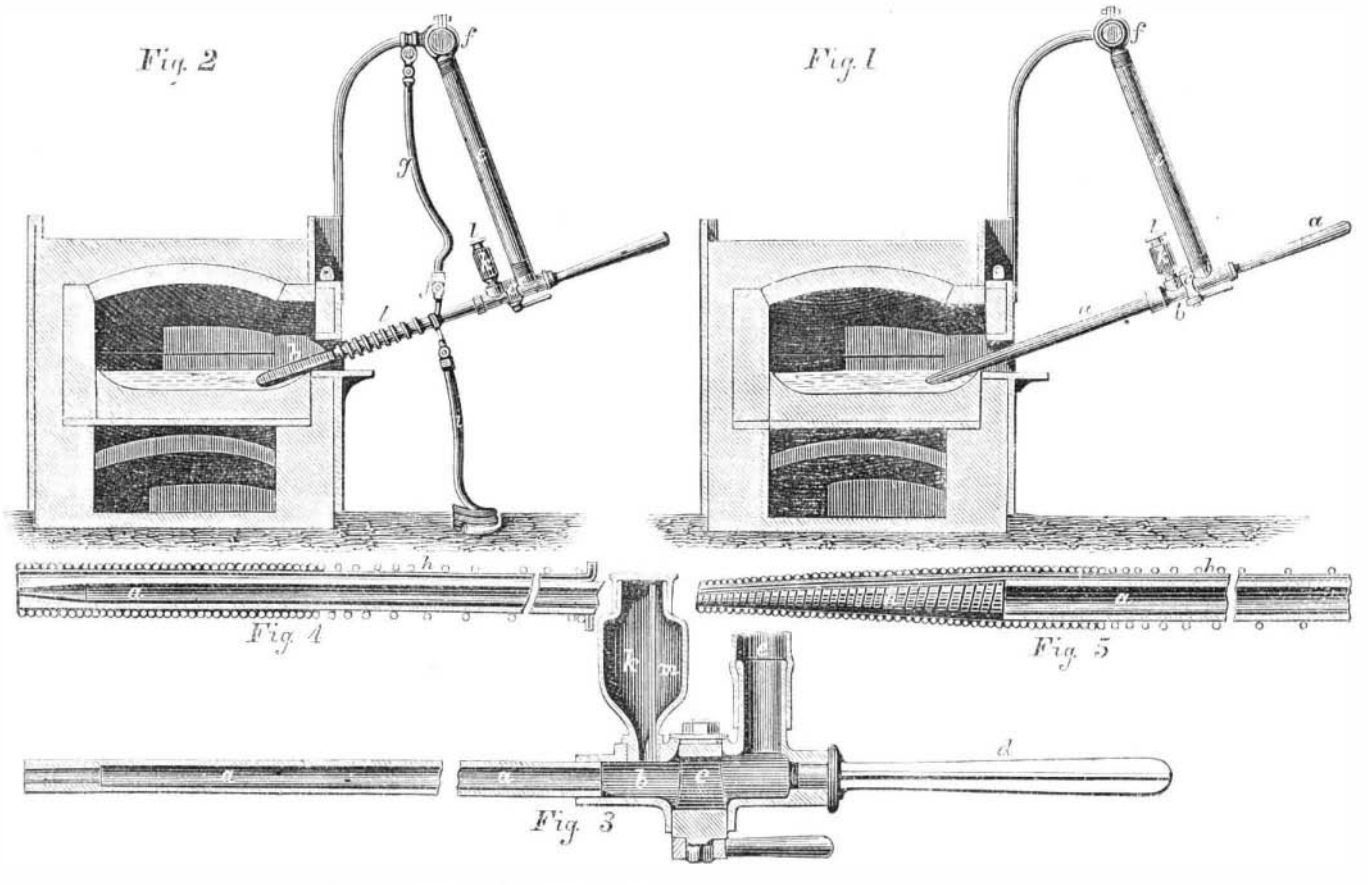
PONSARD'S IMPROVEMENTS IN APPARATUS FOR PUDDLING IRON, ETC.

[From Mechanics' Magazine].

According to this invention, just patented by Mr. A. Ponsard, of Paris, it is proposed to combine with a tubular stirrer which is suspended at or near its center of gravity so as to be easily manuvered a coil of pipe, which is made to closely surround the fore part of the stirrer, through which coil cold water is caused to circulate for the purpose of preventing the burning of the end of the stirrer. The stirrer itself is suspended by a flexible pipe or by a properly-jointed metallic pipe from an overhead fixed main pipe extending along any number of furnaces, and supplied with compressed air from a blower or other source, such air passing down the interior of the stirrer into the liquid metal in the furnace. A handle is fitted on to the rear end of the stirrer for facilitating the working of the same, and a stopcock is provided on the stirrer for regulating the passage of the blast therethrough. A second stopcock is also fitted on to the cold-water pipe in a position convenient to the hand of the puddler. The cold water is also supplied through a flexible pipe from a fixed main overhead, and is carried direct to the point of the stirrer, either by quick coils or by a straight length of pipe parallel to the stirrer itself, and then returns by a series of close coils back to the rear part of the stirrer, where it communicates with a flexible pipe for carrying off the water which has been heated by the metal in the furnace. The stirrer may either consist of a tube extending the full length required, or this tube may stop some distance short of the end of the stirrer, the remaining length being composed solely of the cold water coils, before referred to, closely brazed together.

In order to facilitate the admixture of any of the well-known chemical reagents employed in the manufacture of iron and steel in a dried and pulverized state with the metal, a closed box or receptacle is fitted on to the stirrer, and communicates therewith, an air pipe being caused to enter the said box from the interior of the stirrer, so as to maintain an equal pressure therein and facilitate thereby the descent of the ordinary or any other suitable dried and pulverized chemical reagents into the tubular stirrer, whence they are forcibly expelled by the blast into the molten metal. The same apparatus may be used with a reverberatory furnace for making steel, and, so far as regards the arrangement of the coiled pipe, is applicable as an adjustable pipe blast or tweer in substitution for the ordinary water tweer. Figs. 1 and 2 of the engravings show in section the application of the improved rabble to a puddling furnace; Fig. 3 is a longitudinal section drawn to an enlarged scale of the rabble detached, and Figs. 4 and 5 show in longitudinal section on an enlarged scale two different arrangements for applying cold water circulation to the rabble. This rabble is composed, as shown in Fig. 1, of an iron tube, *a*, attached to a tube, *b*, which carries a cock, *c*, and a handle, *d*, for the purpose of manipulation. The tube, *b*, is by means of a flexible tube, E, placed in communication with a conduit, *f*, fed by a blast engine, which may serve to supply one or more puddling furnaces. The flexible tube, *e*, may be composed of metal and jointed, or of caoutchouc, leather, or strong cloth coated with caoutchouc, and provided with an external strengthening covering. It is arranged so as to form also a support to the rabble, and thus relieve the workman, who has simply to conduct it into the molten cast iron, the agitation of which is effected by the outlet of the air which escapes from the end of the rabble. In order to prevent the tube, *a*, from being injuriously affected by the high temperature to which it is subjected there is suspended at the side of the air inlet tube another flexible tube, *g*, Fig. 2, maintained constantly supplied with cold water from a reservoir, where it is compressed under considerable pressure. This tube is connected to the iron tube, *h*, which is laid along the rabble to its extremity, and then wound around it spirally and brought back to its starting point, where it is attached to another flexible tube, *i*, which serves to carry away the water which has become heated. A cock, *j*, is provided within reach of the workman for the purpose of regulating at will the rate of flow of the water in order to prevent its vaporizing in the tube, *h*. In the arrangement shown in Fig. 4 the inlet water pipe, *h*, is laid in a straight line along the rabble to its extremity, whence it returns in the form of spirals or coils towards the handle.

Fig. 5 shows a modification of the preceding arrangements. In this the iron tube which forms the hollow rabble is dispensed with at the end which enters the furnace, and the spirals of the water tube, *h*, are brazed and welded together, thus forming a rigid durable tube of themselves. Whichever arrangement may be adopted the rabble as it is constantly cooled by the current of water traversing over or around it cannot be deteriorated or burned by contact with the incandescent matters in fusion, or if so, only very slightly. The operation of puddling takes place in the following manner: After having melted the cast iron on the hearth of the furnace the workman lays hold of the hollow rabble by the handle, *d*, and after having opened the cocks, *c* and *j*, plunges it into the molten cast iron so as to submit every portion of the material to the action of the air in order to refine it. This operation may be arrested at any stage; thus it may be suspended at the desired point in order to obtain puddled steel, or prolonged to produce wrought iron. By the simple forms and arrangements adopted for this tool these various operations are facilitated and rendered more convenient; the rabble may be readily withdrawn in order to test the degree of refining of the cast iron. This method of puddling at a high temperature admits of the steel being run into ingots in lieu of withdrawing it from the furnace in blooms as in ordinary puddling. With this new mechanical puddler it will be advantageous to operate upon a hearth of silica for pure cast irons, and



PONSARD'S APPARATUS FOR PUDDLING IRON, Etc.

for cast irons containing phosphorus to a marked extent it is desirable to operate upon a hearth of magnesia or of carbon agglomerated with lime, it order that it may be less liable to be effected by the basic matters which the puddling of these cast irons necessitates.

For pure cast iron it is evident that this system of puddling may be carried out with facility, and will give good results, but the greatest advantage that it presents is its application to the puddling of the common cast irons containing phosphorus, which it has been attempted to purify by the use of raw tartar and alkaline carbonates, nitrate of soda, chloride of sodium, hyperchlorites, and such-like reagents. But it is difficult to use these reagents in reverberatory furnaces, their relative volatility rendering the reactions very imperfect. The contact between these matters and the cast iron is purely superficial, and the stirring of the workmen cannot sufficiently remedy it.

The improved puddling apparatus or rabble admits of the whole of these reagents being used in a more efficient manner by driving them with the air in fine jets through the cast iron, thus multiplying with the orifice the points of contact. For the puddling of impure cast irons this puddling apparatus is provided with a distributing receptacle, *k*, fixed on the tube, *b*, as shown in the drawing. This receptacle may be composed of thin sheet metal or malleable cast iron, the upper part being by preference contracted, and the neck closed by means of a capsule, *l*, secured by a bayonet screw or other joint. The lower part terminates in a small opening of about 1-8in. diameter, through which the salts or reagents employed (which are contained in the receptacle, *k*,) fall into the tube, *a*. They are carried along the tube, *a*, by the current of air under pressure and driven into the molten metal. In order that the pressure of the air may not prevent the salts or reagents from falling freely a small tube, *m*, is provided and fixed in the receptacle, *k*, so as to admit of the entrance of compressed air into its upper portion. The salts employed should be thoroughly dried and pulverized. The method of operating with the distributor is exceedingly simple. The rabble being out of the furnace and the cocks, *c* and *j*, closed the workman raises the capsule, *l*, and inserts in the receptacle, *k*, the reactive or purifying agents (such as salts or oxides) to be blown into the furnace; he then closes the capsule, opens quickly the cocks, *c* and *j*, and introduces the rabble into the molten cast iron, into which the salts or reagents, which are carried along by the current of air, are forced in fine jets. When the whole charge has been forced in, the rabble is withdrawn from the furnace, the cocks, *c* and *j*, closed, and the receptacle refitted; after which the refining of the cast iron may be resumed. This operation may be renewed several times during the working of one charge, but this is left to the judgment of the workman.

In the puddling of cast irons containing sulphur or phosphorus it is desirable to remove the slag or scoriæ containing the sulphur and phosphorus, and to replace it by scoriæ free from such impurities, which may be effected either by introducing into the molten mass oxides of manganese or titaniferous iron ore forced in through the improved rabble. By operating in this manner the whole of the phosphorus in the cast iron may be removed and pure wrought iron produced from the most impure cast iron.

It will be readily perceived that this mechanical puddler facilitates the refining of the cast iron, since it relieves the workman of the more laborious part of the operation, and since the stirring or agitation is much more energetic by the injection of air than by the ordinary method; a saving of time is therefore effected; it admits of compressed air being applied in a practical manner to the puddling of cast iron and to the manufacture of steel in a reverberatory furnace; and of the employment of reagents, either as oxidants or as fluxes, by being forced into the furnace. By its adoption the quality of the wrought iron produced from phosphoric pig is greatly improved, and also a considerable saving, both in fuel and time, is effected, together with an increase in the daily yield of the puddling furnaces.

Either of the above arrangements, as applied to the rabble, is applicable to tweers for metallurgical furnaces, whereby their durability is increased to an almost unlimited extent, while the use of the ordinary water tweers is dispensed with. This arrangement of tweer with an internal current of water admits of its being plunged more or less into the furnace, and in general of its position and direction being varied without any deterioration resulting from their contact with the fuel or the molten materials in which they are immersed.

Oiling Farm Implements.

The Boston *Cultivator* gives the following sensible and practical advice to its readers:

"Every farmer should have a can of linseed oil and a brush on hand, and whenever he buys a new tool, he should soak it well with the oil and dry it by the fire or in the sun, before using. The wood by this treatment is toughened and strengthened, and rendered impervious to water. Wet a new hay rake and when it dries it will begin to be loose in the joints; but if well oiled, the wet will have but slight effect. Shovels and forks are preserved from checking and cracking in the top of the handle by oiling; the wood becomes smooth as glass by use, and is far less liable to blister the hand when long used. Ax and hammer handles often break where the wood enters the iron; this part particularly should be toughened with oil to secure durability. Oiling the wood in the eye of the axe will prevent its swelling and shrinking, and sometimes getting loose. The tools on a large farm cost a heavy sum of money; they should be of the most approved kinds. It is a poor economy, at the present extravagant prices of labor, to set men at work with ordinary old-fashioned implements. Laborers should be required to return the tools to the places provided for them; after using, they should be put away clean, bright, and oiled. The mold-boards of plows are apt to get rusty from one season to another, even if sheltered; they should be brushed over with a few drops of oil when put away, and they will then remain in good order until wanted."

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Boiler Explosions.

Messrs. Editors:—Ignorance and stupidity still hang upon the minds of ordinary men respecting those perennial inflictions, known as "fatal boiler explosions." Unfortunately, much difference of opinion exists in the minds of the engineering community, regarding the cause of these disasters. The distinction between the bursting and the exploding of a boiler has not been defined with any degree of accuracy.

Some engineers are very fond of airing their ignorance, by asserting that when boilers burst nothing serious can result therefrom, save extinguishing the fires, and causing slight local damages to the boiler. To this too prevalent opinion there are strong reasons for not subscribing. Suffice it to say, that it is difficult to escape the conviction that much loss of life and property results from its general acceptance. Huge boilers of several hundred-horse power are often allowed to burn and corrode, for several years, without any examination whatever as to their condition. If the plates be so rust-eaten and corroded that a pocket-knife could be thrust through them without difficulty, the owner and those in charge of the engine and furnace, take the matter very quietly, comforting themselves with the assurance that the only danger connected with the management of a boiler is an explosion, and that due attention to the pump and indicator will always prevent that contingency. On the other hand, the act of bursting is a mere local affair, conveniently limited to the forcing of a rivet, or the rending of a tube, by which the elements of destruction are released in the most harmless and accommodating manner.

Some of these danger-scorning people will go so far as to affirm that there is no absolute necessity to overhaul a boiler, as it will always give timely warning of its rickety and dangerous condition, by bursting in that particular and commodious spot where it is weakest.

Has any one who has inquired into this subject, with any degree of thoroughness, a right to be surprised that boiler disasters are on the increase, when those directly concerned appear so devoted to the crab-like direction of progress in the matter? The most provoking peculiarities connected with the inquiries into these casualties are, that no one is to blame, and that the killing and maiming of a score or two of human beings are considered as circumstances belonging to the natural order of things.

There are, doubtless, many boiler casualties which are caused by ignorance and carelessness on the part of operatives; but it is scarcely going too far to say that most of the phenomena called explosions are simply the bursting or rending of boilers corroded and worn out by excessive wear. In this case the whole of the rickety fabric suddenly gives way under an increase of pressure, which a sounder structure could bear with perfect safety.

The system at present in use of embedding the large class of boilers in masses of solid masonry, should be unreservedly condemned, as it is the indirect cause of more than half the disasters that occur with such frequency. When a boiler cannot be thoroughly repaired without the necessity of disintegrating and pulling down walls of brick and mortar several feet in thickness, it requires no very blamable degree of suspicion that in nine cases out of ten no repairs will be made. A very dim idea, in fact, can be formed of the condition of a boiler under such circumstances, seeing that it is completely buried out of sight. "Out of sight, out of mind" is an ancient adage, not inapplicable to the present case. There are many boilers now in operation in this city which have not been overhauled or examined for many years, because much expense and delay would be incurred in "getting at them." The presiding functionary treats the matter in question with an indifference that makes a prudent observer tremble for the future. The opinion that is generally expressed on the subject is, that it will be quite time enough for a thorough overhauling when a flue, tube, or something else gives way and puts out the fires. Surely such an order of things imperiously demands legislative correction.

Some effective measures should be taken for the thorough inspection of boilers at stated periods, quite irrespective of the delay and cost which may be incurred by disemboweling them from massive layers of brick and mortar. It is said, with some truth, that wise men often quail at the very things which fill the thoughtless with a sense of security. The mode of managing boilers at the present day would doubtless afford the former a boundless source of uneasiness, were the subject looked into as searchingly as it ought to be.

Boilers which are "bricked up" present a neat and compact appearance, and it is too often taken for granted it is all right within, when the demon of devastation may break loose at any moment.

Boilers should be thoroughly covered to prevent the escape of heat by radiation and convection, but the covering should be such that it can not only be easily removed when required, but the material should be such that steam can readily penetrate so as to expose leakages. There is evidently an opening here for improvement, and any one who can successfully fill it will be entitled to rank among the benefactors of mankind.

C. M. O. Hara, C. E.

Gas and Air Carbureters.

Messrs. Editors:—The want of a safe, reliable, cheap, convenient, and stationary method for domestic illumination, where heat is not a means of production, and the great number of, and increasing patented contrivances therefor, prompt me to respectfully submit the following remarks upon this highly important subject:

A consecutive history of the progress in carbureting illuminating gas and air would be most interesting, but would require more space than is designed for this paper.

More than forty years ago the late and world renowned Mr. William Clegg, of London, who first practically introduced commercial gas, tried several plans to increase its illuminating power by combining it with the vapors of some light hydrocarbon, and for some years after those trials other persons atempted it. Yet, while several were, like Mr. Clegg, temporarily successful, all of them finally abandoned it.

About the year 1848 the late eminent and widely known Mr. Charles B. Mansfield, also of London, succeeded in carbureting atmospheric air, but he was compelled to manufacture his naphtha "benzole," a distillate from coal tar, by a new process. His invention was made public at the time, but was found too expensive for general introduction. Other inventions were patented subsequently for the same use, but practical objections, more or less serious, were found to all of them.

Up to the year 1858, the hydrocarbons to be obtained were either charged with some non-volatilizable property, or, if pure, were made in limited quantities, and they were expensive and difficult to obtain. But after the improved method for distilling petreleum, coal tar, etc., by gradual heat and distinct vaporization, then those naphthaline products were first obtained in a condition of purity, quantity, and cost, to warrant the popular introduction of carbureters, which had increased in variety, in this country and Europe, since the year 1865 for treating either common gas or air. Embarrassments are, however, still encountered in the attempt to treat either gas or air in this way.

The carbureting features of the various systems employed consist of four classes, each being enveloped in a close vessel.

First. Where the medium to be carbureted passes directly into the fluid by a series of small openings from the conducting pipe, and thence to the service pipe.

Second. Where it passes into and through some absorbing porous medium, as sponge, cotton, wool, shavings, pumice stone, etc., which is saturated by the fluid, in some cases by capillary attraction from a shallow reservoir below in which it rests, and in others where the fluid is allowed to fall or trickle upon the mass from above.

Third. Where it passes over a series of shallow trays or channels lined with a warm fabric that is kept saturated automatically with the fluid.

Fourth. Where a woven or a spun fabric or a fibrous woody material is arranged in a regular fixed position, and either stands in or upon or is rotated in the fluid below it.

In all of which systems the result is that the vapors of the fluid are mixed, with more or less facility or uniformity, with the gas or the air which passes through the instrument.

The difficulties have chiefly arisen from the following causes:

First—Quality of the fluid. The hydrocarbons obtainable were charged with oily or resinous matters, which, collecting in the apparatus, rendered it inoperative until cleared of its contents.

Second—Uniformity of pressure and size of flame. This difficulty particularly pertains to carbureters for commercial gas, the pressure of which is only equal to a column of water about three inches high: hence its passage through the instrument should be quite unobstructed, the size of the burner should be enlarged, or the gas prsssure increased, which latter will tend to induce leakage at the joints of gas pipes and fixtures.

This difficulty is, however, modified by the fact that if the gas be well and uniformly carbureted, the light thus being intensified does not require a size of flame to produce a light due to the standard size of the burner.

It is found this trouble of pressure applies often, also, to air carbureters, owing to their construction, which impedes the flow and varies the size of the flame, as more or less burners are worked.

Third—Tendency to surcharge the gas or the air with the vapor, and its condensation in the pipes. As the volume or density of the vapors taken into the pipes is always due to the temperature of the medium passing into the carbureter—the mixture being mechanical, only—and while the higher the temperature the greater is the load this medium will take up, it follows that if after leaving the instrument the temperature be lowered, as is often the fact, a due proportion of those vapors must separate there and accumulate.

They finally trickle down and along to the burners, so that on turning the cock and applying the match, you will have, instead of an upward flame of gas, a downward stream of liquid fire, igniting all combustible matter within its reach.

Fourth—Refrigeration. A result of all evaporation is refrigeration, and this causes, with most carbureters, a diminution of temperature upon their exteriors, so that when in a cellar or other place holding moist atmosphere, water becomes condensed upon the apparatus and frozen there as solid ice, to the detriment, and often involving the safety, of the instrument.

Fifth—Safety. In addition to the insecurity, as represented in the two last mentioned difficulties, are others attending the charging of fluid to the apparatus, and the necessity of skilled attendants, which embarrassments or hazards from the use of this class of inventions have induced combined opposition to them from our most respected and powerful underwriters.