Correspondence.

Combined Steam and Bisulphide Engines.

To the Editor of the Scientific American:

Your correspondent Mr. C. H. Aaron suggests that it would be better to apply heat directly to bisulphide of carbon, by putting it in the boiler instead of water, and dispensing with the steam engine altogether. Many men have made the same suggestion since I began to experiment in utilizing the latent heat in exhaust steam, and have fallen into the error of supposing that power could be produced with much less heat when it is applied to the bisulphide of carbon than when applied to water.

The difference in the amount of fuel that would be required to produce a horse power an hour with the two fluids is by no means as great as most persons imagine. To illustrate: 4 lbs. of coal will run an engine of 1 horse power an hour, if the boiler and engine are well constructed. If the boiler is filled with the bisulphide of carbon instead of water, 4 lbs. of coal will run an engine of 1½ horse power an hour. If a combined steam and bisulphide engine is used, the 4 lbs. of coal will work the steam cylinder 1 horse power an hour, and the exhaust steam from this cylinder will work the vapor cylinder nearly 1½ horse power during the same time; and we get about 2½ horse power from the same fuel that would be required to produce 1 horse power with steam alone or 1½ horse power with bisulphide of carbon alone. This I have proved by trial many times.

In other words, with the combined engines, the same heat is used twice and produces two results; and I know by actual tests that the latent heat in the exhaust steam from an engine will do nearly as much work when used to heat a bisulphide boiler as the coal, burned to make that steam, originally would have done had it been burned under the bisulphide boiler in the outset. The loss of heat by using the steam in an engine does not exceed 95 per cent; and the exhaust will heat, to 200°, 95 per cent of the water that the coal used to make that steam would have done. The loss of heat is entirely due to the radiation from the pipes and cylinder; it does not make the slightest difference in the amount of heat it contains, whether the high pressure steam is used to produce a large amount of power in an economical engine or whether it escapes direct from the boiler. The theory that the heat extracted is in exact proportion to the power produced is theory only, and cannot be sustained by any practical tests; but on the contrary, heat is no more destroyed or used up in producing power than water is by flowing through one wheel to another at a fall below.

Another popular error is that a large amount of the heat produced by combustion goes up the chimney flue, in a well set boiler. I have put a bisulphide boiler into the smoke stack of a steam boiler and found that more work could be done with the exhaust steam from one engine, when applied to a bisulphide boiler, than with the heat escaping from the smoke stacks of twenty-five engines of the same size.

I hope that these facts will convince your correspondent and others that more work can be done with a combined engine where the heat is used twice than with a single engine where it is used but once.

Springfield, Vt. JOEL A. H. ELLIS.

To the Editor of the Scientific American:

I have read C. H. Aaron's remarks on the steam engine; and I wish to say that a pound of steam at any temperature contains about 1,150 units of heat; of these not more than 250 go to working the engines, even when the feed water is heated to 180°; the rest is blown off through the exhaust pipe or enters the water of condensation. Fifty years ago, the Cornish steam engine made one horse power per hour out of 2½ lbs. of coal; to-day the average of all engines running will not be less than 4 lbs. of coal per horse power per hour, the very best compound condensing marine engines requiring 2 pounds of coal per horse power per hour.

The units of heat in a pound of coal, when tried with the mechanical equivalent (772), ought to produce 2 horse power for 1 hour.

We have been exercising our ingenuity in making every imaginable style and shape of engine, cut, off, catching the gases going up the chimney, etc. So far as they go, these are good; but they do not go to the root of the evil, which is, preeminently, the 966·6 units of latent heat which pass out with the exhaust steam. The half of this may perhaps be utilized by making it heat a second boiler containing a substance with a low boiling point, which substances render latent a small quantity of heat. Such are ether, gasoline, bisulphide of carbon, etc.; all these boil at about 100°. Ether in passing into steam renders latent only 163° of heat.

With regard to putting the fire directly to the boiler containing these substances, it would be very dangerous; and I doubt not, if Mr. C. H. Aaron were to try it, the chances are that he would not long be able to eat apple pie even though it be seasoned with quince. And it would be of little practical utility; because, when the specific heat of a substance is low, the steam is proportionally weak, that is, although 1 unit of heat will raise 1 pound of water 1° and 1 pound of ether 2°, but the steam of the ether will only have half the power of the steam of the water.

Wilmington, Del. J. W. H.

The Patent Right Question.

To the Editor of the Scientific American:

Several of your correspondents have given opinions on this question, arguing in favor of certain general principles which seem to me to be essentially wrong. Permit me to say a few words on the other side, though we all come to the same conclusion, but for different reasons. Mr. H. A. Walker says: "A citizen has a right to claim from the State only such protection in the use and ownership of property as shall redound to the general good." J. E. E. says: "I cannot see that an inventor has any inherent right in his own discovery." Both of these propositions, I call fundamentally wrong. The citizen claims protection from the State for his property because it is his, independently of the State, and the State itself exists, simply by the universal consent of the individual members, because it is only by union that each can be protected; and without that union there would be and could be no such thing as public good. If this principle be correct, all Mr. Walker's reasoning fails.

As to the other *dicta* of J. E. E., I must say that, in my opinion, the inventor has as much inherent right to his own discovery (exclusive right, I mean) as he has to the use of his hands or his teeth. But he is powerless to enforce that right; to do so, he becomes a member of a community or State, each member of which, by mutual agreement, binds himself to all others; so that, if any one will invent a new thing that is useful, they will all protect him in the exclusive use and profit of that thing. But only for a limited time, for the cost of a perpetual monopoly would be too much. Under this condition, the inventor has an inducement to invent, and the State the benefit of the free use of the invention finally. CHARLES STODDER.

Boston, Mass.

To the Editor of the Scientific American:

On reading H. A. Walker's letter on page 132 of your current volume, I can see very plainly that a citizen has the exclusive right to whatever he produces with his head or hand, and none but a thief or robber can take it from him without obtaining his consent, and remunerating him for it. The best protection to the individual is for the best interest of the State. The State has no right to my service, in any capacity, only as I sell it, and the idea that it has is only one of those barbarisms which advancing civilization has failed to eradicate. The above will do also for J. E. E., and I will add that the idea of reward for doing good and punishment for doing the opposite is as old as man; and if the inventor benefits the public, he is entitled to a reward, simply because he does so. J. E. S.

Portland, Me.

Water as Fuel.

To the Editor of the Scientific American:

I observe in your issues of April 5 and July 19, under the head of "Water as Fuel," some observations on the newly invented Stevens steam furnace exhibited in San Francisco. Will you allow one who has seen its workings, and had its objects stated to him by the inventor, to correct a few errors in those communications?

First, I will mention to the *Alta* reporter that the "tremendous roaring" is caused simply by the escape of steam from the pipe, as would be the case if there were no combustion at all, and not, as he seems to think, by the chemical action. Next, the inventor is not so unscientific as to think that steam can be decomposed simply by striking disks of iron, or by any other mechanical means. It is true that it is practicable to decompose water by contact with red hot iron, but only at the expense of the metal, which is oxidized, hydrogen being set free; but this is far from being the design of the inventor, he using the disks of iron only to deflect the current of steam on to the jet of oil. As stated by him to me, the objects of the inventor are: To decompose superheated vapor of water in presence of red hot carbon, thereby getting abundant oxygen in a very small space, and then to burn the carbonaceous matter to carbonic oxide. The merit of the invention consisting in having at command a limited space where the temperature is very high. This would make the furnace specially valuable for reducing very valuable ores, and for other metallurgical operations. He did not pretend to economy of fuel, and such a device could not possibly be economical when no arrangements are made to introduce air to consume the hydrogen set free from both oil and water. Oil is used, being the only fuel that could be fed constantly into the right spot.

The inventor knows that as much heat is necessary to decompose water as will be produced by combining the oxygen set free with the carbon of the oil. But if his ideas are correct, he gets, as I said, an abundant source of oxygen. I make these corrections for the benefit of those of your readers who might be misled. H. O. L.

Stockton, Cal.

The Thermal Expansion of Mercury.

To the Editor of the Scientific American:

In your clear and useful article on the "Properties of Saturated Steam," in your issue of August 9, current volume, there is an error, derived probably from a similar error on page 61, of Charles T. Porter's useful "Manual on the Steam Engine Indicator," to which work you refer in terms of just commendation

The coefficient for the expansion of mercury for each degree of Fahrenheit's scale, as there given, is 0·0010085, and you reproduce it exactly. As given by Rankine ("Steam Engine," art. 107, I, p. 111), it is 0·00010085, and it is so given in Rankine's "Civil Engineering" and Young's "Physics." Your coefficient is therefore ten times too large, and may mislead the inexperienced. I have called Mr. Porter's attention to the error. J. C. HOADLEY.

Lawrence, Mass.

REMARKS BY THE EDITOR:—We are much obliged to our correspondent for calling attention to this error, which was reproduced, as he supposes, from Mr. Porter's valuable and, in general, very accurate work. Applying the correction to the problem given in our article on the properties of steam (page 81, current volume of the SCIENTIFIC AMERICAN), we find that the expansion of mercury is $61{\cdot}11 \times 0{\cdot}00010085 \times (80-32) = 0{\cdot}3$ inches, and the corrected hight of the column $= 61{\cdot}11 + 0{\cdot}3 = 61{\cdot}41$ inches. We advise our readers to make a note of this correction, and affix it to the article.

A Toad in the Solid Rock.

To the Editor of the Scientific American:

The other day Mr. Moses Gains of this place, while digging into a bank, found a toad embedded in the hard pan. He came to a stone some 2 feet square; and after digging this out, a man who was with him observed something black: taking his pickaxe, he carefully dug it out, and it proved to be a toad. It was some six inches below the surface of the stone, and its place of concealment was as smooth as if it had been made of putty. The toad was about 3 inches long and very plump and fat. Its eyes were about the size of a 3 cent silver piece, being much larger than those of toads of the same size such as we see every day. They tried to make him hop or jump by touching with a stick, but he paid no attention to them.

How came this toad embedded, 5 feet below the surface under a stone, in that hard pan? What did he subsist on? Will such toads live on being brought to the light? Is there any air in the ground, on which a toad could live, and how long must we suppose that he had been there?

New Hartford, Conn. A. W. ARNOLD.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the month of July, 1873:

The number of visits made during the month were 1,108; boilers examined, 2,300; internal examination, 1,112—these were very thoroughly done, including examination of bottoms and all fire sheets, as well as flues and tubes and boiler attachments; external examinations, 2,029. The hydraulic pressure was applied in 180 cases. These were, in most instances, boilers so small, or of such construction, that an inspector could not get into them; but, in addition, the hammer test was applied externally while the boilers were under cold water pressure. Number of defects in all discovered, 1,123; dangerous defects, 275. The dangerous defects were in most cases such as were liable to result in accident at any moment, and they were in many instances caused by bad management. The defects in detail were as follows:

Furnaces out of shape, 49—9 dangerous; fractures of plates, 56—20 dangerous; burned plates, 53—34 dangerous. These defects were from various causes. In some cases, the fires were too fiercely urged from insufficient boiler capacity. In other cases, the boilers were not properly constructed. The builder, anxious to provide the greatest area possible of fire surface (very likely to outbid his rival), had placed his tubes so near together that, when the fires were driven, the heat was so great that the water was nearly or quite all forced away from the iron, and, having no protection, it could not be otherwise than burned. Another difficulty; tubes and flues are often placed too near the shell of the boiler. The space is sometimes not more than one inch, when it should be not less than three inches. Even four inches would be better. There should be abundance of room for good circulation of water. We have found fire sheets, tubes, and flues badly burned from want of sufficient water space between them. Another difficulty, and one which causes many boilers to be burned, is that they are not opened frequently enough. Cleaning is neglected. Potatoes, or some solvents of scale are used in the boiler, the scales are thrown off and down into the bottom of the boiler, and, instead of having it removed through the hand-holes or man-hole, it is allowed to remain, and, becoming conglomerated, prevents the water from protecting the fire sheets, and they become burned and contorted, or, as it is generally called, "bagged" and buckled. Hundreds of boilers are injured or ruined in this way every year. Have your boilers constructed so that no tube or flue shall be nearer than three inches to the shell. If tubular, have the tubes placed in vertical rows, and not staggered—the water will circulate much more freely and the tubes can be much more easily cleaned, and scales will not be as likely to fill up the space between them. We have had some bad cases of late, where the spaces around staggered tubes were filled with scale. Cases of blistered plates, 182—31 dangerous; deposit of sediment, 261—36 dangerous; incrustation and scales, 223—15 dangerous. The danger of these defects is sufficiently explained above. External corrosion, 88—18 dangerous; internal corrosion, 52—12 dangerous; internal grooving, 28—3 dangerous; water gages defective, 72—5 dangerous; blow-out defective, 23—10 dangerous; safety valves overloaded, 29—7 dangerous; steam gages defective, 149—16 dangerous—dangerous varying from —17 to + 50. Where there space, we should say something on this defect. We have often enlarged upon it, but will leave it for a future report. Boilers without gages, 83; cases of broken and dangerously loose braces and stays, 50—21 dangerous; boilers condemned as unsafe and unfit for future use, 18.

THE railway link, of about eighty-five miles, between Cairo, Ill., and Jackson, Tenn., is progressing rapidly, and is expected to be finished about next October. On the completion of this road, Chicago will have an uninterrupted railway line to Mobile and New Orleans by the Illinois Central Railroad, over which passenger trains will run the entire distance without change of cars.