Correspondence.

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

Street Cars.---Atmospheric Engines.---Economy in their Use.

To the Editor of the Scientific American:

Your article last week in regard to the propulsion of street cars by steam, and your expressions contained therein, in regard to the want of street car companies of a reliable and cheap means to take the place of animal power, have brought to my mind some reflections which, I think, may be of service and interest to your readers. It is a fact, long since patent to every thinker, that the humane spirit of the age is much averse to the killing of horses by their use in street car propulsion, and loudly calls for some radical improvement in that direction. It is further true that street car companies are ready, willing, and waiting to "look at" something that will meet the want, if it will diminish the cost of running cars.

For two years past I have given much thought upon this matter, have visited numerous street car companies' offices and stables, and have learned the want; and I will, if agreeable to you, give some facts, as I have gleaned them, as I often see that you urge upon your readers that "one fact is worth a thousand theories."

I find that there is a prejudice against any vehicles, in a street, not drawn by a horse. This, however, is only a matter of education, and will vanish as soon as the coming man will bring forward a machine which will move street cars back and fro, with the conditions substantially as set forth below. These are things which must be attained, and which education cannot overcome.

One important feature is simplicity. It must be of such ease of manipulation that any common laborer of ordinary sense can be "picked up" and in a few hours made master of the situation, in starting, running, and stopping a car. This makes it practicable for companies to run their cars without hindrance and with economy.

It is necessary that the machinery to run each car should be under it, or in such manner concealed as to hide such deformities as are repulsive to the presence of human beings and the eye of brutes.

The absence of fire, smell, smoke, and the accompanying sense of danger, and the use of all the space above the wheels for carrying capacity, are required.

It imperatively demands that no extra car or dummy should be used. It is a very great matter to get rid of the extra weight and wear and tear of machinery incident to carrying the motive power on extra wheels. The percentage of repair and necessary help to run the same operates fatally. In other words, when the coming man shall discover the means of running street cars without carrying the motive generator or power with the car in such weight and bulk as is required in the use of steam, hot air, furnace, etc., there will be a revolution in running street cars. If the coming man can place, say a 100 horse power engine in some by-alley or to one side, and with one engineer and fireman propel successfully thirty to fifty cars, then it will begin to look as if things were assuming shape.

Great exertions have been made to accomplish this desired end in the transmission of air. To this end I have made various experiments, and for the benefit of those whose minds are running in this direction, I will give some of the results. I find it expensive to condense air at high pressure. It must be worked, say at forty pounds to the inch, and better at thirty. It is so very subtle that, in order to condense it without too great a loss from leakage, it is necessary to have machinery in the very finest condition, and it must be kept so. It requires a large tank to draw from. It is only successful to use a large reservoir, with which the engine can be in constant connection. This gives regularity in the motion of the engine.

The engine for using compressed air is substantially the same as for steam, with the exception that it should be somewhat freer in the exhaust. It is impracticable to carry a tank or tanks on the cars filled with air. It is nicer and cheaper to place springs on the axles, and wind them up by steam or horse power. But this plan is not practicable. Such power is not reliable, and cannot be depended on under the various circumstances in which a street car is found. For instance, the wheels slip, as in sleet and wet; the power calculated to take the car to the next railway station is not enough; it is wasted in the slipping. Besides, it becomes clumsy, and lacks the essential simplicity spoken of above.

The cost of compressed air, forced into a large tank by engines and windmills, is trifling compared with horse power. For instance: It costs, say, in Chicago on the south side, at least fifty cents per day for feed and grooming a horse. They run eighty cars and use 500 horses. This foots up to the snug little sum of $250 per day for motive power alone. Two men can run a 125 horse power engine with three tuns of coal, at a cost of $20 to $25 per day for motive power. Now you have the wear of horses, harness, and shoeing, with the interest on capital in stable and fixtures to offset the repair of engine in compressing air.

You see the snug little difference that will appear to the capitalist's eye of at least $225 per day, or $82,125 per year, counting Sundays, one of the best days for street car travel. This is no idle chimera; it only wants the coming man to apply this force in the manner above mentioned. By the use of air from large reservoirs, much longer street cars can be used for early and late travel in large cities, to take operatives to their work and home at night. This is a want in cities. In fact, some strong, reliable power must be devised to bring the suburbs of cities into close proximity, as it were, to the center. It will greatly enhance the value of suburban property, as well as property down town.

Inventors will bear in mind that the first cost of putting down apparatus, pipes, machinery, etc., to run street cars, does not cut such a figure as might first appear. The only questions are its permanence and cheapness of operation after it is finished.

Hurry up, the coming man, and solve the great problem of threading cities with neat, quick, and comfortable street cars, passing and repassing with undeviating regularity. They will be a boon. A. R. C.

Lincoln, Ill.

Curious Freak of Twin Steam Boilers.

To the Editor of the Scientific American:

Will you allow a constant reader of your paper to lay before your readers the mysterious working of two flue boilers in the packing house of Messrs. Nossingers, Tobey & Co., Kansas City, Mo.?

The boilers are set in brick work, having a partition wall between them, the gases passing off through a sheet iron stack. Each boiler is sixteen feet long and forty inches diameter, with two twelve inch flues. They are connected below by a mud drum, ten feet long and fourteen inches diameter; the stand pipes, connecting mud drum to boilers, are each two feet in length and two inches diameter. Feed water is fed through the check valve at one end of the mud drum communicating to each boiler.

Steam connections between boilers are made of two inch pipe, tapped in, on top of each boiler, three feet from front end, and rise vertically twelve inches to where elbows direct the pipe across and connect the two boilers; from a tee, midway between the boilers, in this pipe, rises another pipe, nine inches in length, and to this the safety valve is attached; the steam pipe then takes its course over the partition wall, leading to engine tanks and elsewhere in the house.

The mysterious working of these boilers is that the same water level cannot be maintained in both boilers. Two, and sometimes three gages of water would fall from one boiler and fill in the other, changing at regular intervals from one boiler to the other.

To bring the return of water in the empty boiler, the furnace and sometimes even the connection doors had to be opened on the empty boiler. Even firing was maintained at all times. The boilers were clean, and driven wells supplied the feed water. Cold feed water was used at times, and even warm and quite hot water at other times, but all to the same effect.

My experience of handling steam boilers of all kinds extends over a period of over ten years, and the working of the boilers in question is a new case with me; and I would wish to have the decision, of older engineers than myself, as to the cause and the remedy for the same, given in your paper.

Two other large packing houses at this place have boilers set in the same manner as above, and at both places a water level in both boilers cannot be maintained.

H. P. S.

Wanted, a Substitute for Whalebone.

To the Editor of the Scientific American:

Allow me to call the attention, of the numerous inventors who read the SCIENTIFIC AMERICAN, to a new article on which to experiment. It is an established fact that whalebone is growing scarcer and higher in price every year, and disasters, like the recent one to the whaling fleet in the Arctic sea, send it up to an enormous price. Whoever will discover a satisfactory substitute for this article has the prospect of large reward. Steel has been used to some extent as a substitute, but it is not satisfactory. Some experiments have been made with rawhide, but the results attained, so far as I know, have not been very successful. The important point to aim at, is to get a substance that has the required degree of elasticity, without liability to break.

New Haven, Conn. J. H. FOY.

[The above statement is very *apropos* to our recent editorial on the "Dependence of further Mechanical Progress upon the Discovery of New Materials." We hope our correspondents will make public all such requirements.—EDS.

Artificial Stone.

To the Editor of the Scientific American:

Feeling, as I do, a vital interest in all improvements, and seeing, in the last number of the SCIENTIFIC AMERICAN, an article on artificial stone which pleased me much, and being qualified to confirm, by experimental and practical experience, its durability, I submit the following:

In the year 1855, I made a piece of flagging, 16 inches by 24, 2 inches thick, in the following way: I made a mold of the above size and filled it with granite stone chips, then with mortar, of Portland cement and coarse sand, equal parts. I floated it off and when set, brushed it over with clear cement and then left it to harden. It is in the street, and subject to the action of frost and carriages, and is as perfect as when first laid. ELIJAH MYRICK.

Ayer, Mass.

WATERPROOF STARCH is the subject of a French patent, and consists in passing the goods, after being properly starched, through a bath of chloride of zinc at a temperature of about 60° Fahr. The starch will then remain in the clothes after several successive washings.

HE who can suppress a moment's anger may prevent days of sorrow.

[For the Scientific American.]

UNITS OF HEAT AND OF FORCE.

As the word unit is so much used at the present day in relation to heat and power, it may be well, for the benefit of some readers not clear on this subject, to give a few words of explanation.

It is evident that the mere mentioning of the temperature of a certain amount of hot water can by no means be considered a measure of the amount of heat consumed to heat the same. Let, for instance, the water in the boiler of the steamer *Westfield*, which recently exploded, and which contained nearly 600 cubic feet or 36,000 pounds of water, be heated to 274° Fahr., so that, to water of 54°, some 220° had been added in order to raise it to the temperature corresponding with a pressure of twenty-seven pounds, by which it is said that it exploded. Then it is evident that these 220° are by no means a measure of the amount of heat given by the furnaces to that boiler, as a single pound may be heated to the same degree, with evidently one 36,000th part of the amount of heat required for the 36,000 pounds; it is therefore, in order to give a correct measure of the amount of heat, necessary to take in account the amount of material which was heated, and it has been agreed to take one pound of water in connection with one degree of Fahrenheit's scale as a unit, and to call a unit of heat that amount of heat required to heat one pound of water one degree. Therefore heating one pound 220° or 220 pounds one degree indicates, in either case, 220 units of heat; but heating 220 pounds 220° indicates $220 \times 220 = 48{,}400$ units of heat. And the *Westfield* boiler, if it contained 36,000 pounds of water, diffused by its explosion $220 \times 36{,}000 = 7{,}920{,}000$ units of heat, in case the pressure was only twenty-seven pounds, and consequently the corresponding heat 274°. The number of pounds of water multiplied with the number of degrees it was heated, gives us a product expressing what is called the number of units of heat.

It is the same with force. A number of pounds alone expresses no force, and it is totally erroneous to speak of a force of say 100 pounds, because when they stand on the floor and are not moving, they are a mere dead weight; but lift them against gravitation, and then you have to exert a force to do this; or let them descend, and they will exert a force themselves, proportional to their amount. But even then the mere mentioning of the number of pounds gives no measure of the force expended or obtained, because it is evident that it takes twice the amount of labor to lift them two feet that it does to lift them one foot; and inversely, it is clear that in descending they will produce an effect proportional to the space they descend. For this reason also here a second element is introduced, the foot, and it has been agreed to accept as a unit the force required to lift one pound of matter one foot high, so lifting 100 pounds one foot or one pound 100 feet is 100 units, and lifting 100 pounds 100 feet high is 10,000 units of force.

To use this as a correct measure, the weight must be lifted so many feet perpendicularly against gravitation, and not be hauled up against an incline of say 100 feet long; one pound moved in this way would not indicate 100 foot pounds, but, in case the raise of the incline was one in ten, only ten foot pounds. Much less must the space of the weight, moved over a horizontal plane, be taken as the measure of distance, as I have once seen done by a school teacher, who, to find the number of foot pounds of the power of a locomotive, multiplied the number of feet the train advanced in a minute by the whole weight of the train, and obtained several billions for the number of foot pounds. This would suggest a few millions of horse power for a single locomotive, and be only correct if the locomotive lifted the whole train perpendicularly upward in the air with the ordinary velocity at which it moves forward. In this forward motion, the force expended is, if there are no inclines, solely expended in overcoming friction and the resistance of the air; and, of course, this may be estimated in foot pounds, but does not compare with the weight and velocity of the train, any more than the velocity of a steamer has anything to do with its weight; its engine only overcomes the resistance the water offers to its progress.

The unit of force has therefore been called the foot pound, and in order to find it, we have only to multiply the number of pounds lifted with the number of feet they are raised. So in regard to the Brooklyn water works, which raise the water 170 feet high, every pound of water has to be multiplied with this number; and every pound of water used by the citizens represents a force of 170 foot pounds spent in the labor to bring it to his dwelling. The engines there throw, every hour, 2,000,000,000 pounds water into the reservoirs, representing a force of $170 \times 2{,}000{,}000{,}000$ or 340,000,000,000 foot pounds per hour.

It is evident that these standards, of units of heat and force, are arbitrary, and only conventional like other standards of measurement; but they have been of the most eminent service in making researches and experiments positive, and I conclude in stating that the French have adopted similar standards, founded on the decimal and metric system, but which are easily reduced to the American standards. The French unit of heat is one kilogramme water heated one degree of the centigrade scale, and of force, one kilogramme lifted one meter high; and they use in place of our "foot pound" the expression "kilogram-meter." As a kilogramme is nearly 2·205 pounds, and the centigrade degree equal to nine fifths of the Fahrenheit, the French unit of heat is $2{\cdot}205 \times \frac{9}{5}$ or nearly four times larger than ours; while the French unit of force is 7¼ times ours; the meter being 3·3 feet, this, multiplied with the value of the kilogramme in our pounds, 2·205, gives 7·2766 or about 7 28, when more accuracy is required than is obtained by the round number 7¼.

New York city. P. H. VANDER WEYDE.