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Contents:

(Illustrated articles are marked with an asterisk.)

GAS STOVES FOR ORDINARY DOMESTIC USE.

In a recent article we took occasion to show that, for steady use, either for domestic purposes or for the generation of steam for motive power, gas could not compete with coal in economy, but that, in summer, when fire is only needed, while temporary culinary or other domestic work is in progress, the fact that gas can be instantaneously kindled or extinguished, enables it to compete with coal on the score of economy, while, on the score of cleanliness, comfort, and convenience, it is vastly superior.

We are greatly surprised to see the loosest statements upon this subject in journals that ought to know their assertions are not based upon fact.

Thus, we find in an English engineering paper, the statement that gas may be economically used for the production of steam. Another scientific English journal broadly asserts, that "the economy of a coal fire is *far outbalanced* by the economy which results from the use of coal gas,*both for warming and cooking*." Has the author of this absurd statement ever heard of the axiom that "a part cannot equal the whole?" It would seem not.

Nothing is more certain than that the perfect combustion of a given weight of an element produces a constant amount of heat. Gas consists of only a portion of the combustible elements of the coal from which it is distilled, and this portion costs more than the total weight of the coal from which it is obtained. If, then, it be more economical in constant use, than coal, it must be because a much greater proportion of heat generated from the combustion of gas is utilized than is the case with coal. There may be some difference in favor of the gas in this particular, but we unhesitatingly assert, that nothing like such a difference as will make good the difference in cost per heat unit, in these materials, exists.

The assertion above quoted, in regard to the superior economy of gas, occurs in an introduction to a description of a gas stove, which will do cooking for one thousand persons, recently made by a London firm for a charitable institution. This stove is "sixteen feet in length, six feet six inches in hight, and two feet six inches in depth, and weighs about three tuns. It is divided into twelve compartments, in two tiers of six each, being only half the width of the four central compartments, although of the same hight. The top range consists of a roasting or baking compartment at each end, the four central compartments—which, however, only appear to be four from the outside, having four sets of doors—form one spacious hot closet. The lower range consists of six roasting compartments around the bottom of which the gas burners are placed; they are simply gas tubes with perforations, from which the jets of gas issue. At the top of each compartment is a sliding frame, from the bars of which the joints are suspended. The dripping falls into a pan below, which slopes from all sides toward the center, where there is an outlet, through which the dripping runs into a trough beneath, which is withdrawn and emptied as required, without lowering the heat of the oven. The doors are fitted with sight glasses, through which the progress of the cooking and the state of the burners can be observed without opening the doors and thus letting down the heat."

No provision is made for boiling or steaming, as there is already an apparatus for that purpose at the institution for which the stove was built.

The gas is used admixed with atmospheric air, the arrangement for that purpose being placed beneath the apparatus. It is calculated to consume 150 feet of gas per hour, which is very small considering the size of the apparatus and the work done. The hot chambers, forming the upper row, are heated by the waste heat from the ovens beneath, and have no direct supply of gas. The products of combustion and the fumes of the cooking are conveyed away by flues at the back of the stove to a common flue, and thence to the outer air.

The journal referred to asserts, that "from a variety of experiments, made from time to time, it has been definitely settled that—apart from the advantages of superior cleanliness, economy, and convenience—gas stoves effect a saving in weight of eighteen lbs. against thirty-four lbs. on 184 lbs. of meat, as against cooking by coal fires."

We do not consider this as definitely settled. On the contrary, we believe it a crude statement, without a shadow of of basis in fact. If such a saving has been effected, it depends upon the construction of the apparatus, and not upon the nature of the fuel, although we grant that the use of gas *may* render possible a form of oven whereby meats may be cooked with less waste than can be the case when coal is used. We do not, however, regard this as by any means demonstrated.

The fact is, that a large majority of gas stoves sold and used in this country do not bake meats at all, or, at least, very imperfectly. At least, we are so informed by those who sell these stoves, and to whom we have recently applied to obtain one for this purpose.

The reason is quite evident. The greater number of such stoves are made of thin sheet iron, and have not the power to distribute the heat with sufficient equality throughout the oven space, to do such work, or to bake properly, even a loaf of bread, although some of them will bake pastry or biscuits quite well.

It is obvious that if the plates be made of sufficient thickness, then a loss of heat must take place whenever the gas is extinguished by the radiation from the plates of the heat accumulated in them, so that a gain in efficiency, obtained in this way, would be attended by a lessened economy.

The problem then is this: to devise some way of equally distributing and confining heat in the ovens of gas stoves without the use of thick plates of iron, soapstone, or other material. The inventor who solves this problem, in a cheap and effective manner, will stand as good a chance to make money from his invention as by the production of any other improvement in present demand.

STATICS AND DYNAMICS OF FRICTION.

That mere pressure is not power seems a truth hard to be generally understood. Of course a general assent to the proposition will be given by nine out of every ten mechanics; the tenth—being at heart a perpetual-motion man on principle, or on what he considers principle—will perhaps deny that there is any distinction between the terms. But while most will admit the fact that mere pressure cannot perform work, and is therefore not mechanical power in the sense in which the latter term is generally used, it is obvious to the careful observer that, in their reasoning, the majority of men fail to keep the distinction in view, and thus arise a great number of popular errors.

Among these errors stands most conspicuous that in the belief in the possibility of the so-called perpetual motion, in the pursuit of which many minds and fortunes have been wrecked.

When one body rests upon another body, a certain force or weight is required to move it or to overcome the friction. This weight or force is found to be independent of the extent of surface, or the rate of motion, and is called the co-efficient of friction. This would seem a plain law and easily understood, yet few men, comparatively, are clear upon the subject. They say "the greater the velocity the greater is the expense of power in overcoming friction," forgetting entirely the relation which the meaning of the word "power" has to space and time, and that the word "power" as well as "velocity," involves the ideas of space and time. Velocity is motion through a definite space in a definite time. Mechanical power is the overcoming of a definite resistance through a definite space in a definite time, when it is considered as a mathematical quantity expressed in units of work.

A body moving at inconceivable velocity through space, and meeting no resistance, exerts no power, but the power it is capable of exerting should it meet a resistance may be computed from its velocity and its mass or weight. A body of sufficient weight moving at a velocity inconceivably small, may exert an enormous power, but one thing is certain, it must move. Power is inseparable from the idea of mass motion. No matter what may be the weight of a body or what may be the static pressure it exerts, it will develop no mechanical power till it moves as a mass.

Now let us apply these conceptions of power and velocity to the consideration of friction. The co-efficient of friction is a constant, for a given pressure, and is independent of extent of the surface of the bearing, or its velocity, but this does not imply that the expenditure of power to overcome friction does not increase with the velocity where the latter *is maintained through a given time*, as many seem to think. On the contrary the expenditure of power will increase directly as the velocity increases, and this not in spite of, but *in consequence* of the fact that the co-efficient of friction is a constant.

Suppose the weight of a body to be one thousand pounds, and that its co-efficient of friction is five per cent of its weight when resting upon a surface of given material. Five per cent of one thousand pounds is fifty pounds. The friction is therefore a constant resistance of fifty pounds to motion at any velocity, but as velocity implies space traversed, and as every foot of motion, through which the fifty pounds of frictional resistance are overcome, requires an expenditure of fifty foot pounds, for two feet accomplished there would be one hundred foot-pounds expended, and so on. But velocity implies more than mere space traversed; it implies definite space traversed in definite time. If, then, the velocity be doubled the space traversed in the same time will be doubled, and the expenditure of power to overcome frictional resistance through this increased space will also be doubled.

The frictional resistance expressed by the co-efficient of friction is static, but when it is overcome through space the power required to perform the work must be estimated according to the laws of dynamics.

The principle of all dynamometers is, that they measure the static pressure of a resistance, which is considered in connection with the distance through which that resistance is overcome in a definite time. Hence friction of machinery may be—and is best—measured by one of these instruments and when thus determined the co-efficient of friction for a particular combination of mechanism may be found by describing the power expended per minute by the number of foot-pounds of work expended in overcoming it.

The friction of any machinery, however, is increased while performing work, and will be a varying quantity so long as the work is not constantly uniform in its resistance; so that while the friction due to machines when running idly may be accurately measured, their friction when performing work can be only determined as an average of the varying friction during a given time.

THE DARIEN CANAL SURVEY.

The U. S. Government expedition sent to survey the Darien Isthmus has returned. Owing to unavoidable causes the expedition did not reach the Isthmus till about April 1st. They immediately landed at Caledonia Bay and made a careful exploration of the route proposed by Dr. Cullen. They found the lowest mountain pass to be over 600 feet about the sea level. About the 1st of May the party proceeded to explore the San Blas route from Mandinga Bay, on the Atlantic, to Chepo, at the southern end of Panama Bay on the Pacific. This route, Com. Selfridge thinks, is available. The rainy season commenced before he landed at San Blas, and all the country was flooded with water, yet from his reconnoissance he thinks that a careful survey will develop a route whereby a canal can be made with only twenty seven miles of cutting. We are pleased to see that he is already ordered to re-organize his expedition for a renewal of the survey next winter. The route favored by Com. Selfridge is the narrowest point of the whole Isthmus. It is said that the tidal waters of the two oceans there come regularly within seven miles of each other, and it is there that the tradition exists that the Indians and buccaneers drew their canoes across. It was there, too, that Vasco Nuñez di Balboa landed, and journeying toward the Pacific first saw the waters of that ocean from the hights south-east of Panama. The harbors on both sides are good. This route was brought before the public by Mr. Oliphant in a lecture before the British Geographical Society. It was reconnoitered for F. M. Kelly, Esq., of New York, in 1864, and, while having many favorable points, was reported against on account of a proposed tunnel. The engineers at the same time stating that they believed a better route could be found.

One of the great objections urged to this part of the Isthmus has been supposed unhealthiness. Com. Selfridge reports his men had good health, and only one died. This from a crew numbering fully 600 men does not indicate a very unhealthy climate.

As Com. Selfridge is to proceed again to the Isthmus next winter, and we suppose not only make a thorough survey of the San Blas, but also of the Panama route, some definite information may at last be expected as to an American inter-oceanic canal. Then, too, we notice that Congress is about to appropriate $35,000 for the survey of the Tehuantepec line. Let the work be placed in hands of such a man as Selfridge, and it will be executed without fear or favor, and a result reached of which Americans may be proud.

A DENUNCIATION OF WATER METERS.

We were about to entitle this, "Arguments Against the Use of Water Meters," but the article, the fallacy of which we propose to show up, and which we find in the *Baltimore Underwriter*, has so much more the character of denunciation than of argument, that we changed our minds and chose the above heading as more appropriate.

The article in question commences with the following bit of rhetoric: "The latest iniquity of the political economists who manage our system of tax gathering is the determination manifested in some of our large cities to impose unwarrantable charges upon the use of water by the introduction of meters into private households as well as into hotels and manufacturing establishments."

Then follows an enumeration of the great benefits of water in general and particular, a subject so trite that we will not weary our readers by a review of this part of the article—the burden of which is to show, what needed no showing, that health and good morals greatly depend upon an ample supply of water, but we cull a couple more specimens of rhetoric, which will serve us as texts for what we have to say upon this subject.

"Next to air and light, no element of primal necessity is so indispensable to the sanitary condition and comfort of society as water, and any restriction upon its use is an injury