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Contents:

(Illustrated articles are marked with an asterisk.)

Special Notice to Advertisers.

The circulation of the SCIENTIFIC AMERICAN has become so large that we are compelled to put it to press one day earlier in the week. Advertisements must be handed in before Friday noon, to insure their publication in the issue of the succeeding week.

SAFETY VS. ECONOMY IN THE CONSTRUCTION OF STEAM BOILERS.

Two kinds of experiment are now and have been for some time in progress, having for their common object the improvement of steam boilers. These experiments are conducted by two sets of inventors, and have each done much to educate the steam consuming public. The first has for its aim the increase of the factor of safety to its highest point; the other aims at the increase of economy in the production of steam.

It is, perhaps, a little singular that those who aim at greatest safety, as well as those who aim at maximum economy, should have for the most part adopted tubular construction, with the distinction that the greater economy party use the tubes as flues through which to transmit the gases of combustion, and thus enlarge the heating surface; while the safety party put water in the tubes, and apply the heat out side, thereby securing great heating surface, while accumulated rupturing power is reduced.

Neither of these systems has proved altogether satisfactory. Unequal contraction and expansion have been a cause of manifold evils in the economy tubular system; and such boilers are confessedly not as safe as desirable. The safety tubular system, though safe, is uneconomical.

Notwithstanding this, the number of boilers constructed so as to make safety the principal point secured, are multiplying in the market, and are finding ready sale in many instances. There is without doubt a mean between these extremes, a mean that gives both maximum economy with maximum safety, so far as these can be simultaneously attained, and we believe we have seen boilers in which this mean is attained; but it is not our purpose to commend any particular boiler, however much it might serve us in illustrating our views upon this subject.

Most of those boilers in which the attainment of maximum safety is made the paramount object, are subject to the great defect of foaming, or priming, as it is called, so that the amount of water passed through them by the action of heat is no index of their true evaporative power. And as the economy of a boiler is entirely dependent upon its evaporative power, or the amount of water it can truly convert into steam per given weight of coal consumed, it may well be doubted whether the factor of safety is not too dearly purchased in this class of boilers.

Some recent experiments, to which we may refer more particularly at a future time, seem to show that in the ordinary mode of estimating the quality of steam by the hand, and its appearance when discharged into the air, very great errors in judgment are committed; and it is probable that many boilers claimed to evaporate from 12 to 13 lbs. of water per lb. of coal consumed, do not really do more than half that. It is further probable, that absolute normal steam from working boilers is much more rarely delivered to steam engines than is at present supposed.

The experiments referred to have also rendered it almost certain that the proportion of priming within certain limits is exactly as the rate at which the steam is delivered—all other things being equal—and that there is a limit to rapid delivery beyond which almost any boiler will prime, more or less, no matter how well it is constructed; and still another limit, below which no boiler will prime, no matter what its form may be. And further, these experiments indicate that boilers deemed safe when delivering wet steam may be unsafe when this delivery is so reduced as to force them to deliver dry steam; although, of course, no boiler composed of small pipes, or their equivalent, can produce such havoc by explosion, as one in which the water and steam are massed, and disruptive pressure accumulated upon an outside shell.

THE STUDY OF IMPRACTICABILITIES.

In this utilitarian age there are to be found many who are impatient of all that seems impracticable. They chafe at all propositions and attempts that do not clearly bear the stamp of practical skill and finished attainments. He who in his quiet workshop is studying for a solution to perhaps some impossible mechanical problem, and the one who timidly suggests some plan having in it elements of failure, plainly discoverable to the experienced and skillful, are as much the subjects of derision to this class of men, as those who dogmatically insist that wrong is right, and persistently parade their ignorance before the world.

The history of all improvement will show that failure has done as much to elevate the world as success. Even in the financial world, men need the instruction drawn from their failures to finally succeed. Few indeed march steadily on to wealth from the beginning of their career.

As in business, so in art and science. The artist perfects himself by the study of his faults. The scientist makes repeated failures ere he succeeds in originating some great and instructive experimental discovery. Scarcely an approach to perfection in mechanical construction exists that has not advanced by the gradual elimination of defects.

What is an improvement but the removal of impracticable elements. Who shall deny then the educating power of impracticabilities?

There is occasionally a correspondent who criticises the course of the SCIENTIFIC AMERICAN, because in its publication and illustration of new inventions, it does not deny its columns to such occasional ones as are faulty. If our views, as above given are correct, we should by making such a denial be narrowing the educational influence of our paper. We wish it distinctly understood that, while in our editorial statements we aim at scientific accuracy, and in our selections from foreign and home sources of miscellaneous contents, choose only such as we deem of general value, we do not wish to adapt our paper to skilled engineers and technical experts alone. We occupy a broader field, and believe we are doing far more good by acting as the general organ for the expression of the inventive talent of our country, learned as well as unlearned.

It is not enough that an invention has in it elements of impracticability to exclude it from our columns. Its publication proclaims a mechanical want, shows how it has been attempted to supply the want, and may suggest even by its impracticabilities how a practicable device may be constructed.

Probably no one of the readers of this journal has been called upon to study more critically and attentively the various devices illustrated and described in it, than the present writer of the descriptions which accompany the engravings. He certainly has not found that study devoid of interest, or of mental profit, albeit he has met with some of little practical merit. Judging from his own experience he now avows his belief that, of all the departments of this widely circulated and popular journal, none is of greater general value than that of the illustrated mechanical descriptions.

NEW MECHANICAL MOVEMENTS.

On page 192, current volume, we published some problems in new mechanical movements, which seem to have attracted considerable attention. We have received many so-called solutions, which, upon examination, have proved incorrect, but the incorrectness of which could scarcely be pointed out without giving a clue to the correct solutions.

We have also received diagrams of supposed new mechanical movements not called for by the problems proposed. Some of these show evidence of having never got further than the paper upon which they are drawn; and we would here remark, that it is well to scrutinize with very great care, any movement not experimentally demonstrated to be correct, before making any statements as to what it will do.

For instance, a gentleman from Massachusetts sends us a diagram of a movement by which it is claimed rotary motion can be converted into reciprocating motion, and *vice versa*. The device is neither new, nor will it do what is claimed for it. It is simply a slotted crosshead with straight slot inclined at an angle of forty-five degrees to the line of direction in which it reciprocates. In the slot slides a block through the center of which plays a crank wrist.

The device will convert a rotary into a reciprocating motion, but will not perform the converse movement. It has only the functions of the slotted crosshead placed at right angles with the line of direction in which the reciprocation takes place.

Problem second, in the article above referred to, has received but two original solutions, which we give below; we think one of these is a very ingenious one. Others have been proffered but they are old. One of these is the method described by Fairbairn. The problem was enunciated as follows: "Required to produce a variable rotary motion in a shaft driven directly by a belt from a pulley having a uniform constant rotary motion, without the use of anything but the one belt and the two pulleys; no cone pulleys or their equivalent to be allowed. All the motions to be continuous and in the same direction."

Fairbairn's method, above alluded to, is to make the driven pulley eccentric to its shaft, and use a belt long enough to accommodate itself to the eccentricity with a friction pulley to take up the slack. This does not conform to the conditions of our problem, which admits nothing but a belt between the two pulleys.

Mr. A. K. Smith, of Nebraska, Ohio, sends a solution new to us, but he says not new to himself, as he saw it many years since. The method described by him is to make the driven pulley eccentric and use an elastic belt. This is a proper solution of the problem.

R. B., a modest young machinist, of Buffalo, N. Y., shows that the elastic belt need not be used. With proper proportions an ordinary leather belt may have slack enough to compensate for the eccentricity of the driven pulley This is also a correct solution.

Mr. L. A., of Brooklyn, N. Y., who does not seek celebrity, and therefore does not wish his name published in full, gives the most ingenious solution of any received. He accomplishes the required result by the use of two ordinary pulleys with shafts in their geometrical centers, but connected by a belt, one half of which is elastic and the other half inelastic. Whenever the elastic half of the belt is put on the stretch, it will yield so that the opposite side of the belt will be slack, the slack increasing as the elastic side receives more and more of the tension. When the inelastic half of the belt transmits the motion there will be no slack on the opposite side. The belt, therefore, alternately shortens and lengthens while transmitting the motion, thus rendering the speed of the driven pulley variable, as required. It is obvious that the greater the resistance which the driven shaft has to overcome, the greater will be the variation in the speed.

The inventor of this movement has employed it to produce some very life-like automatic movements in toy figures.

We hope to receive original solutions to the other problems in due time.

METALLIC HYDROGEN.

At a recent meeting of the Lyceum of Natural History, in New York, a paper was read by Dr. Loew, assistant in the College of New York, on the preparation of hydrogen amalgam, that deserves the attention of scientific men everywhere.

The researches of Graham, which we published at the time, went to show that hydrogen could be alloyed with palladium, and that it was also contained in meteoric iron. He condensed the hydrogen in the palladium, and came nearer proving its metallic character than any other person had done. Schoenbein, in his search for ozone, found a method for making the peroxide of hydrogen, that was simpler than any hitherto known, and which brought him to the very threshold of discovering hydrogenium. Schoenbein's experiment was this: An amalgam of zinc and mercury is violently agitated in water; the water is then filtered, and on being examined with iodide of starch and protosulphate of iron will be found to contain peroxide of hydrogen or oxygenated water. The experiment is a very beautiful one, and is now repeated in the class room. Dr. Loew has carried the investigation further, and has, instead of oxidizing the hydrogen, succeeded in combining it with the mercury. He takes an amalgam composed of not more than three or four per cent of zinc, and shakes it with a solution of the bichloride of platinum; the liquid becomes black, and a dark powder settles to the bottom. The contents of the flask are then thrown into water and hydrochloric acid added to dissolve the excess of zinc. The amalgam of hydrogen and mercury at once forms in a brilliant voluminous mass, resembling in every way the well known ammonium amalgam. It is soft and spongy and rapidly decomposes, but without any smell of ammonia. The hydrogen escapes, and soon nothing but pure mercury is left in the dish. The experiment appears to show conclusively that an amalgam of hydrogen and mercury can be formed, and that hydrogen is really a metal. It would also throw some doubt upon the existence of the amalgam of ammonium and mercury, and offer an explanation of that compound on the basis of its being the same amalgam of hydrogen and mercury that is prepared in the way now pointed out by Dr. Loew. The smell of escaping ammonia must be traced to some other source than the existence of that radical in combination with mercury.

The question may arise, What practical value can be derived from this discovery? We may not be able to appreciate its importance at this early stage, but heretofore it is easy to perceive that the possession of metallic hydrogen will enable us to make a vast number of compounds artificially, and will give us an explanation of many phenomena that are now obscure. If Professor Graham had not published his researches, the experiment exhibited by Dr. Loew would have attracted the attention of the world; as it is, it is likely to excite much interest both in this country and in Europe.

USES OF FLUOR SPAR.

We are sometimes asked to give the applications of Fluor Spar, and as we cannot answer these questions separately, we we propose, for the benefit of all of our readers, to devote some space to an account of the properties and uses of this valuable mineral.

Its name indicates two things—first, that it easily melts or flows; secondly, that as a spar it is frequently found associated with ores in our mines, for the Germans gave the name spar to the minerals which occur with metals, as, for example, calc spar, feldspar, iron spar, manganese spar. When worked up into ornamental objects, it is known as Derbyshire spar, from one of the localities where fancy articles are made. It is sometimes found in beds, but generally in veins, and often occurs as the gangue of metallic ores.

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