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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 466,

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The annual election of periodicals may be said to be going on now. This is the time when people make choice of the papers and magazines they are to enjoy during the next twelve months. New volumes begin with the coming year, and subscriptions are soon to be entered up. All readers of the SCIENTIFIC AMERICAN will, as a matter of course, renew. The cost—$3.20 a year—is less than a penny a day. We should be glad if each of our friends would send in one additional penny per diem, and thus add the SUPPLEMENT to their regular subscriptions. For $7 a year—less than two cents a day—both papers are supplied. These are the cheapest as well as the best scientific publications in the world. We issue a double number this week to present the catalogue of valuable papers published in the SUPPLEMENT. The reader will therein find the key to vast wealth of information, and will conclude, we trust, that duty to himself, to the needs of his calling, to the wants of his mind, requires him to give the additional penny and enroll his name as a subscriber.

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THE EFFICIENCY OF FLUID IN VAPOR ENGINES.

Last year, when the so-called thermic motor, or bisulphide carbon engine, was on exhibition here, an effort was made by several engineers to subject the motor to critical tests, to determine how nearly correct were the pretended claims of great economy set up by the motor people. But no disinterested tests were allowed, and purchasers of stock are said to have been badly stuck. Among those who desired to test the "thermic" were the mechanical engineers, Messrs. H. L. Gantt and D. H. Maury. Failing to obtain permission to test the engine in question, they were compelled to confine themselves to a purely theoretical discussion of the subject, and the results they have now given in a very able paper, under the above title, published in *Van Nostrand's Magazine.*

The authors say: "Rankine, Clausius, and others have proved that the amount of heat transformed into work does not depend upon the fluid which is the conveyer of that heat, but simply upon the limits of temperature between which the fluid is worked. It follows that, theoretically, all fluids are equally efficient in transforming heat into work; it does not follow, however, that all fluids are equally valuable as the working fluid of an engine, for there are other considerations besides efficiency to be taken into account in making choice of a working fluid. We have set ourselves the task of choosing the best working fluid from the following liquids: water, alcohol, ether, bisulphide of carbon, and chloroform."

The final conclusions reached are substantially as follows: "*If we limit maximum pressure to that employed in the steam engine, steam is the most efficient fluid we can use.* The relative size of cylinder necessary to produce the same power is smaller for steam than it is for the non-aqueous vapors when all have the same initial pressures.

The higher initial pressure, involving higher initial temperature, and consequently greater range of temperature, causes such an increase of efficiency of the non-aqueous vapors as to put them all above that of water, and to cause some doubt as to which would be the best working fluid, judged thermodynamically only.

As the most convenient method of deciding the question just raised, we may compare each of the vapors with that of water, showing their advantages and disadvantages.

The vapor of alcohol gives us 1·4 per cent more efficiency than steam, and requires a cylinder whose volume is only 0·853 of that of the steam cylinder to produce the same power. The disadvantages of alcohol are the high tension of the vapor, the great danger which arises from the ready inflammability of the hot liquid, and its cost.

The use of ether would give us a greater gain in efficiency (2·11 per cent), and would require a still smaller cylinder (0·535 of that of steam), but it is open to the same objections as alcohol, and in a more marked degree.

The vapor of bisulphide of carbon gives a gain in efficiency of 3·71 per cent, and demands a cylinder 0·550 of that of steam. It, however, is not only open to all the objections that have been stated against alcohol and ether, but it has two which are peculiar to itself, viz., its intensely disagreeable odor and its power of rapidly corroding iron which comes alternately into contact with it and with the air.

The vapor of chloroform, which gives a gain of 3 per cent efficiency, and requires a cylinder 0·761, the volume of that of steam, is not open to the objection of inflammability, but it has so high a cost that it is probably impossible that it can ever be used economically in competition with steam.

All the apparent advantages of the non-aqueous vapors may be gained in the steam engine by an increase of initial pressure; and, as the tendency of modern practice is in that direction, it seems certain that *none of the non-aqueous vapors will ever successfully compete with steam.*"

STEEL UNIFORMITY.

The users of steel for manufacturing purposes, and probably the producers of steel, would welcome any information that would insure uniformity in the product. It appears to be almost a waste of investigating endeavor to argue on the relative merits of steel produced from the iron and that cemented from the bar. The true test of their relative merits is that of use in practice. Yet there seems to be an almost insane desire to turn all our iron into steel, and to produce steel as directly from the ore as pig iron is produced. An enthusiast recently called attention to some lathe and planing tools, cast from iron melted in the cupola in the regular way, and then submitted to a cementing process of brief duration, claiming them to be true cast steel, or its equivalent. And there are others who assume that all the work of cementation and the after processes may be dispensed with, and good tool steel result.

This nonsense will be taken up and repeated by mechanics who may be like the Athenians described in Acts xvii., 21; but there are workers who know steel from carbonized cast iron, and who require for their work all the proper qualities of cast steel.

What is needed in regard to steel information is how to make cast steel to-day, to-morrow, and so on indefinitely, the same. We know that iron can be refined, and that its components can be changed, so as to improve its quality, and so that it can assume some of the qualities of cast steel, and be called steel commercially. But what is required is an equable quality of the steel used for tools.

This equable quality does not exist among the steels made by the best known manufacturers; they may claim it, but the facts of practice do not sustain the claim. All the differences in working different lots from the same makers, in working different bars from the same lot, in working from the same bar, do not come from the difference in treatment and manipulation. A chart of tests comprehending the steels of five of the best known manufacturers of steels show not only a difference between the products of the different establishments, but a great lack of uniformity in the specimens tested from the same maker. An establishment that makes the production of small steel tools a specialty, and is probably as successful as any other in this country, or other countries, has its tools returned for failure in exactly opposite directions—too soft, too brittle. What is to be done? There is the same treatment of, commercially, the same material. The fact is that uniformity in the character of crucible steel is an attainment yet to be reached and it is time that scientific and practical men devoted their attention to this attainment, instead of arguing on the identity of purified iron, called "Bessemer steel," and cast steel *per se.*

St. Petersburg Canal.

This canal, which has just been completed, is intended to enable ships of large tonnage coming from abroad to reach the port of St. Petersburg direct, and to take in cargoes there, without having recourse to the hitherto inevitable transshipment at Cronstadt. The canal extends from Goutouiew on the Neva as far as the small roadstead of Cronstadt. A branch has been excavated along the Pontilow Railway in the direction of the Catherinhof, an arm of the Neva. The Neva has also been dredged to meet the requirements of the Russian navy, between the canal and the source of the Catherinhof. The length of the canal is 17¾ miles, and the length of its branches is 2½ miles.

The bed of the Neva has been dredged for a distance of 5,333⅓ feet. The canal and the dredged portion of the Neva have a depth of 24¼ feet. The depth of the branch varies between 17½ feet and 23½ feet. On the portion of the canal which is protected by embankments, the width of the base is 213 feet for the first four versts from the Neva. This width is carried to 275½ feet for the next 3¼ miles, and to 355½ feet for the remainder of the canal, which is the portion of it which is not protected by embankments. The work of excavating the canal was almost entirely carried on by means of nine dredgers. The imperial order prescribing the construction of the canal was signed June 1, 1874, but the works were not actually commenced until September, 1878. Water was admitted into the canal in the presence of the Emperor Alexander III., November 12, 1883; but it is only recently that the canal has been finally made available for the passage of vessels. The works of the canal cost altogether 1,642,464*l.*