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Contents:

(Illustrated articles are marked with an asterisk.)

WHAT WE HAVE DONE IN 1869, AND WHAT WE INTEND TO DO IN 1870.

We promised at the commencement of the present year to give increased value to the SCIENTIFIC AMERICAN, both in quantity and quality of the illustrations and general reading, and added the hope that with the hearty co-operation of our many friends we should greatly increase our circulation.

We have fulfilled our promise, and are happy to say that our hopes have not been disappointed. Numerous correspondents have expressed their satisfaction with our paper in such hearty terms as show our efforts in their behalf are thoroughly appreciated.

During the coming year we shall take still another step forward, and shall devote increased attention to the illustrations of foreign inventions, machines, designs for machinists' tools, and all matters of general industrial interest, at home and abroad. In doing this we shall incur a large additional expense, but we are resolved to spare neither pains nor expenditure to make our paper the most splendidly illustrated industrial journal of the age.

To reimburse us for this prospective expenditure, we must either increase our subscription list, or raise our subscription price. Our paper is now unparalleled in cheapness. Nothing approaching it in value is published anywhere in the world at our subscription price. Still we are resolved not to advance the rates. We rely upon the efforts of our friends to increase its circulation. Remember that for every subscriber you send us you will be remunerated in the increased value of the paper itself. Besides this remuneration we offer extra inducements in the cash prizes and splendid steel engraving, advertised in another column. The picture of some of the greatest geniuses of our age, is one which will adorn any gentleman's library, and nothing could be a more fitting ornament for an inventor's laboratory.

Those who intend to compete for the premiums offered in another column should be wide awake. We have already received encouraging letters from subscribers who propose to get up clubs, and the prospect is good that the work will go bravely on.

We are moving onward, Friends, and we mean to keep moving, and we here pledge ourselves that the SCIENTIFIC AMERICAN for 1870 shall keep march with the age in all that can adorn or improve it.

BRAIN AND MUSCLE.

It is an old proverb that what "one has not in his head he must have in his heels." This proverb is applicable to those whose memories are so treacherous that they find it necessary to go many times to perform what might have been done in once going. This old saw might have been made more comprehensive, at the expense of alliterative force, by changing it to "what one does not possess in inventive forethought he must make up for by muscular strength."

The intelligent, contriving workman, though his physical frame may be slight, is more than a match for the stupid, unthinking one, in any kind of work depending upon aught except blind strength. The former rises and the latter sinks in the scale of value, just as naturally as oil rises to the surface of water.

A man may expend a vast amount of muscular energy and do little work, and *vice versa*.

On one occasion we had a novel piece of work to get done, and took it to several shops, where its accomplishment was unsuccessfully essayed. After much trouble and expense we met a German friend, who being informed of our predicament, recommended us to a shop where he assured us we could get our work performed satisfactorily.

Being rendered somewhat skeptical by our previous experiences, we made some inquiries about the facilities of the shop recommended, and were told by our Teutonic adviser, that it possessed a tool not to be found in any of the shops previously tried, by which all sorts of difficult work impossible to the others could be quickly and excellently executed. We were curious to see this remarkable machinists' tool, which our imagination pictured as quite out of the usual run of lathes, planers, and common paraphernalia of the machine shop, but were at once informed that it would not be shown.

We sent our order to this shop by the hands of our adviser, and duly received it, just the thing we wanted. It was so satisfactory, that seeing the same gentleman a few days after, we pressed him for some description of the machine by which such a marvel of delicate and accurate work could be performed. He avowed that he could not describe it but he could give us its name. "Well what *is* the name?" cried, we.—"Brains" was the laconic reply.

Ah! what, not essentially impossible, can not be done with this great tool which the Almighty has bestowed upon man. But to use it skillfully requires practice. The commonest cause of failure is not want of natural mental ability but want of training; training that might have been attained through personal effort had its value been known. In fact all training, whether of brain or muscle, must be attained by personal exertion. The most that teachers can do is to direct, and give the best methods in which the process may proceed.

We are of those who believe the kind of training should be adapted to the intended life-occupation of the student. To the mechanic, or to any man whose occupation is connected more or less with constructive mechanics, inventive ability is of the first consequence. Not that by its exercise all will be enabled to make great improvements upon existing methods, or to strike out entirely new and original devices; but that all will, by its aid, be rendered more efficient mechanics, farmers, manufacturers, or chemists, as the case may be.

The farmer grubbing up the big stump in yonder field, is engineering on a small scale. The next stump he essays can not be got out in precisely the same way. He must modify his plan somewhat. He must *invent* a way to do it. Whether it will be the best way or the worst way, will depend upon the degree to which his inventive talent has been trained or neglected. He may break his chains and kill his team, or by skillful management uproot the unsightly stub which cumbers the ground.

This training may be constantly going on during the ordinary avocations of life. Every mechanic should feel that it is not enough to simply do a thing; it should be done in the best way possible. Studying how to do things is the best and surest way to get proper mental training. Where living teachers can not be obtained books may be. The nineteenth century in free America offers no excuse for ignorance.

THE SPIRIT OF THE AGE.

Certainly those papers which have assumed to condemn the establishment of a chair of positive philosophy at Harvard, and the publication of lectures of Professor John Fiske, the able expounder of "positivism" in that institution, by the New York *World*, have greatly mistaken the spirit of the age.

The thinkers of the period are struggling by every possible means to arrive at truth. They have disembarrassed themselves of all superstitious reverence for old doctrines and old beliefs, and have entered into their work with the determination to recognize nothing as true merely because it has long been accepted as such. They are obeying the injunction of St. Paul: "Prove all things."

The clamor of bigots against free thought and free discussion avails no more to stem the current of thought, than the howling of the wind below Niagara to stay the mighty cataract. If some—if all the men who are molding the thought of the age, are wrong in their conclusions, the prohibition of discussion in our public institutions is the very best way to perpetuate their errors. It has been in all ages by prohibiting discussion that falsehood and quackery have flourished. And no essentially false theory can ultimately outlast the scrutiny which is brought to bear upon it by free discussion.

Therefore, if positivism is a false philosophy, it has been brought to execution in its introduction to the thought which pervades our universities, and its enemies should ask no greater advantage than is given through its public exposition by one of its acknowledged champions, in the columns of a widely circulated journal. It thus offers itself to general attack, and its defeat is morally certain if it has not truth for its basis. Those who refuse to confront it are moral cowards, who do so only in the fear that their favorite creeds will suffer in the conflict.

PROGRESS OF LABOR.

In the reign of Henry VIII., artificers and laborers were compelled to eat horse-corn, beans, peas, oats, tares, and lentils. They slept on coarse straw covered with canvas, and lived in straw-thatched hovels of mud and wood, with the bare earth for a floor. They ate their food from wooden trenchers, and their clothing was of the coarsest possible materials. The laborer of to-day lives in what would have been considered a palace at the time of which we speak. He eats food which would have been deemed fit for a lord of Henry VIII.'s court, and commands furniture, clothing, books, and other mental and physical wealth which that monarch's kingdom could not have purchased.

In the three centuries which have since elapsed, labor has been constantly progressing more rapidly than capital, until at the present time the supremacy of the latter has become extremely doubtful, and many of the most careful thinkers of the age prophesy the speedy arrival of the day, when the present wages system must be abandoned for a co-operative system, in which labor shall enter into partnership with capital, and share profits according to its productive value.

THE STEAM ENGINE INDICATOR.

We are in receipt from the publisher, D. Van Nostrand, Nos. 23 Murray street and 27 Warren street, New York city, of a copy of a work on the steam engine indicator; being the treatise of Charles T. Porter, revised and adapted to American practice, by F. W. Bacon, M. E., Member of the American Society of Civil Engineers, with an appendix containing useful formulas and rules for engineers.

Were we called upon to prescribe the best method whereby a student could gain, not only the most easy but the most thorough theoretical knowledge of the laws which govern the formation and expansion of steam and the application of steam to the performance of work in engines, we should unhesitatingly recommend a course of study with the indicator. The indications of this beautiful instrument not only tell what is going on in the cylinder of an engine, but in doing this they lead the mind to the consideration of the fundamental principles of steam generation, as well as the doctrines of expansive force, latent heat, temperature, laws of condensation and radiation, and the subtile relations which all the phenomena of steam bear to each other.

Mr. Bacon has, in his revision of Mr. Porter's work, done the American engineering public a great service, and has supplied a valuable hand-book of reference and instruction. Mr. Porter's treatise has been for some time out of print, and the present revision has offered a good opportunity for the addition of much valuable matter, and the adaptation of the work to American practice.

The work commences with a full description of the indicator and the mode of applying it, and we are glad to see that Mr. Bacon has in this department been profuse in practical details which are apt to embarrass a novice. Next follows a discussion of the interpretation of indications, given in a plain and concise style, and perfectly comprehensible to men of ordinary intelligence. This part of the work contains a number of tables, by the use of which much of the labor in reducing indicator cards is avoided.

Mr. Bacon's method of determining where the true theoretic curve on a card intersects the ordinates is very clear, and will greatly assist beginners; the numerators of the fractions being constantly the number of the ordinate where the steam is cut off, and the denominator the number of the ordinate, the length of which is sought. This is well illustrated by a special diagram.

A great variety of diagrams is given. A careful study of these diagrams cannot fail to interest all who desire to understand the working of the indicator.

We herewith produce two of them, one of which was taken from an English locomotive engine, and the other from an American locomotive.

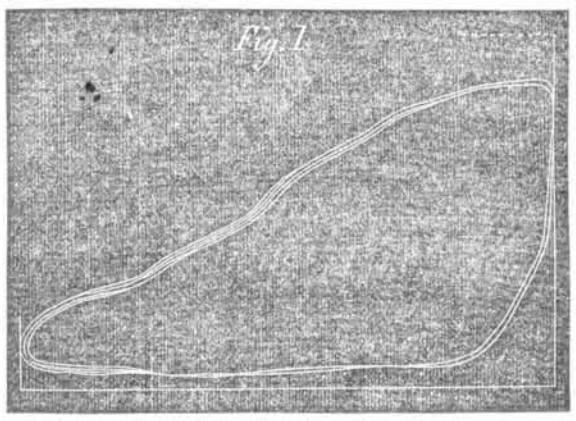

Fig. 1 is the English card, taken from the locomotive "Eagle," on the London and Southwestern Railway, in April, 1863. This diagram, with three others given by the author, are fair samples of a large number taken from the same locomotive.

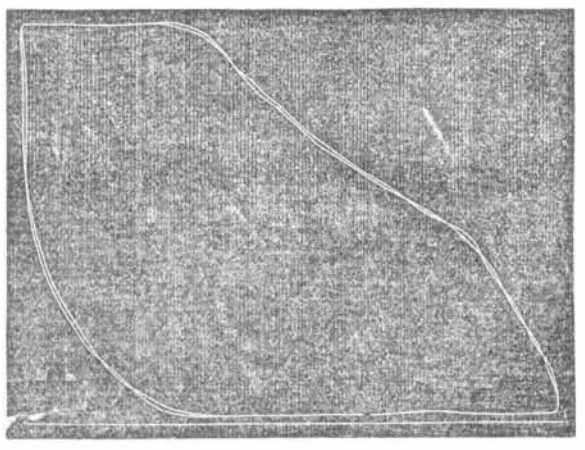

Fig. 2 is a diagram of a card taken from locomotive No. 50 on the Philadelphia, Wilmington, and Baltimore Railroad, in 1867. It was taken at sixty miles per hour, the piston making 1,222 feet per minute, with 305·46 revolutions.