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(Illustrated articles are marked with an asterisk.)

END OF VOL. XVIII.---BEGINNING OF A NEW VOLUME

The present issue of the SCIENTIFIC AMERICAN completes Volume XVIII., new series. Probably there never was a time when greater activity was displayed in the sciences and arts than the present. And this activity is not confined to this country, but our foreign exchanges afford us, weekly, many items of interest to the scientist, mechanic, and farmer. From these sources we glean everything which can interest our readers, in whatever walk of life, and every important improvement in mechanics or discovery in science, which is made in this country, receives an early and prominent recognition. Thus the SCIENTIFIC AMERICAN is literally a compendium of all that is new and valuable in the arts and sciences.

In other departments we believe it to be equally valuable. Its pages contain correspondence from all parts of the country and the world, on subjects which cannot fail to interest all classes. They are frequently the productions of our most eminent scholars and engineers, while the hints, suggestions, and directions of our working mechanics find place in our columns. These are always interesting, and not seldom exceedingly valuable.

The answers to correspondents are always instructive. We endeavor in framing them not only to convey the information sought by the individual inquirer, but to instruct others. In fact, this department is intended to give such items of information succinctly as do not require a column of editorial. The contributors to this department are men who are practically conversant with the subjects upon which they profess to treat.

Our descriptions, accompanied with illustrations, give our readers accurate information of the latest and most important inventions. The engravings are not equaled by those published in any other country, and the descriptions, for terseness, clearness, and conciseness, are certainly not surpassed.

Our weekly list of patent claims are received direct from the Patent Office in Washington. They are full, accurate, and alphabetically arranged for convenience of reference. They are invaluable to the mechanic, inventor, and capitalist.

Editorially, we believe the SCIENTIFIC AMERICAN will compare favorably with any journal devoted to similar objects. The writers are gentlemen of long experience and undoubted ability, and they aim rather at presenting facts and practical suggestions than mere conjectures and speculative theories.

That we have succeeded in making a popular scientific and mechanical journal, our constantly increasing list of subscribers fully demonstrates. What the paper has been in the past it will be in the future; encouraging the struggling inventor, instructing the unlearned mechanic, informing the scientific student, interesting the young and the old. It will fearlessly expose unwarranted pretension, and rebuke charlatanism, while it faithfully records the improvements made by inventors and mechanics.

THE INDICATOR AS A FIXTURE TO THE STEAM ENGINE.

The steam engine indicator has received occasional notices in our columns, in which its construction and operation have been described and its uses partially enumerated. We have shown that it gives exact information of the working of the valves, the admission, expansion, and pressure of the steam, its action at all parts of the stroke, transferring these points to paper and forming a diagram which is a basis of the calculations to ascertain the force expended and the power exerted.

But there are other offices and uses of the indicator. By it the relative value of the lubricants used can be ascertained and the best mode of applying them; the amount of steam required to work the attached machinery as compared with the work done, consequently the saving that can be made in changing machinery to do the same work. Another important office of the indicator is to compare the power developed with the amount of fuel used. This is a check upon the carelessness of the fireman or of the engineer; for if it is known that an engine can be run with an expenditure of two and a half or three pounds of coal per hour for each horse power on one day, there can exist no reason, except carelessness or heedlessness, why, other things being equal, it should not do the same on another day. It also determines the quality of the fuel. Suppose the last invoice of coal gave one horse power for every two and a half pounds consumed per hour. On one day four thousand pounds are used, but on another day, four thousand five hundred pounds. The indicator shows on both days the same amount of power exerted and that the engine is in the same condition. Then the question is narrowed down to the neglect or carelessness of engineer or fireman, or to a difference in the quality of the coal. If, on weighing the ashes and clinkers it be seen that on one day they exceeded in amount those made on the other day, it would be plain that the difference in results arose from difference in the quality of the fuel. The incombustible portion of anthracite coal varies from six per cent to thirty per cent. The proof of its quality can be determined in no way so well as by the indicator combined with the scales.

Every engine—all large engines—should have a pair of indicators permanently attached, and an engineer should be employed who can intelligently use them. A pair of diagrams should be taken twice a day, say at 9 P. M. and 3 P. M. Let every pound of coal be weighed and also the ashes and clinkers, and a tabular statement of these facts and the results of the indicator diagrams be made out daily on blanks furnished for the purpose, and a balance struck each week. Thus the proprietor will know at a glance the condition of his engine, the efficiency of his machinery, and the value of his fuel—in fact the cost of all his expenditure of power as compared with the work done.

This may be objected to on the ground that few engineers can be found who can use the indicator, and that some firemen cannot read the scale of the weighing machine. The objection refutes itself; if men are not competent to perform these duties they are not competent engineers or firemen. The use of the indicator can be acquired by the study of such elementary books as "Porter on the Indicator," "Paul Stillman's Treatise," "King's Notes on Engineering," "Bourne's Handbook," etc. By the aid of these and practice with the implement any intelligent engineer can readily become an adept in the use of the indicator.

Such education will tend to raise the status of mechanical engineers, reduce the cost of power, insure better work, and induce superior mechanics to adopt practical engineering as a vocation.

CAPITAL AND LABOR AS AFFECTED BY LABOR-SAVING MACHINERY.

It was thought in former times that the introduction of labor-saving machinery into any department of manufacture, would be the means of throwing large numbers of operatives out of employment, yet the result has shown those fears to be unfounded. The introduction of any improvement that enables individual productions to be made with less manual labor, and at a consequently reduced cost, has always made an increased demand for labor in that department. *Labor creating machines* would be a more significant term, so far as the effect of such inventions upon the amount of production is involved.

To illustrate this idea, let us suppose a machine to be invented that would enable an operative to make two hats while he now can make one. Let us further suppose the cost of producing hats by manual labor only, to be $3 00 apiece, one half the cost being for labor and the other being for the materials of which each is made. Allow a profit of one dollar, which will make the price of the hat to the purchaser $4 00, so long as manual labor alone is used. Upon the introduction of the machinery, which doubles the amount of production, the cost for labor would be reduced one half. The profit for a single hat, estimated at the same rate of percentage, would be less than a hat costing $3 00, so that the price of hats would thus be reduced, say one third. Further, suppose the reduction in price to increase the demand for hats, so that three hats would be wanted where one was desired previous to the improvement in their manufacture. It will now be apparent that the introduction of machinery, while it has reduced the manual labor connected with the production of a single hat one half, has increased by one half the amount of labor needed for the entire production of hats.

How has the relation which capital bears to labor been affected by the constantly increasing use of machinery in all branches of manufacture? Manifestly they have been brought nearer together, until now it is somewhat difficult to determine which has the balance of power. Operatives complain of insufficient remuneration, and are continually embarrassing large manufacturing interests by combinations and strikes. On the other hand, capitalists complain that, in view of all the risks and complications attendant upon fluctuations of trade and unreasonable demands of employés, that capital cannot be embarked in any manufacturing enterprise with a certainty that it will return the legal interest upon the amount invested.

These complaints, though in some measure sustained by facts upon both sides, are essentially without a solid foundation. Capital and labor are interdependent, and are only rendered antagonistic when either disregards the just claims of the other. Both suffer from the withdrawal of either; but when they mutually and harmoniously coöperate, all classes prosper.

We cannot admit, however, that of late capital has obtained any undue advantage over labor. That money has been made in certain branches of manufacture cannot be denied; but if we deny the right of capital to accumulate by legitimate use, we strike a blow at the very root of sound social organization. But where any remarkable instance of profit by manufacture, within the last ten years, can be pointed out, it will doubtless be found that the question of capital is involved with other elements, which should not be allowed to escape observation. If, for instance, an individual with limited means is enabled to commence the manufacture of a patented article, and, by virtue of the intrinsic value of the invention, can obtain a very large advance on cost of production, sufficient to allow him to realize a fortune in a short time, it is not the capital involved, nor the labor, considered singly or together, that are the cause of profit; it is the brain which devised, and the skill which developed the means for the acquisition of wealth. For employés to demand, in such a case, an increase of wages, on the ground that the employer is making money so fast, is equivalent to demanding of him a share of the privileges which are granted to him by letters patent, in addition to the market value of labor, at the time the demand is made. Notwithstanding the evident truth of this proposition, such demands are often made. In fact, the sole cause of discontent among operatives at the present time, is the desire to enjoy the luxuries and privileges, which in former years were only the accessories of wealth. It is not the gratification which such things are capable of imparting of themselves alone, which is sought, but the avoidance of the unhappiness generated by the lack of them.

We intend in a future number to show that the effect of the introduction of labor-saving machinery has been to constantly increase wages, and to prevent any permanent reduction, and that, from the nature of the case, such must be its effect in the future. If we establish this proposition, it will follow that the whole machinery of "Trades Unions," and combinations of a similar character, are only attempting to secure that which is inevitable, and to prevent that which can never come to pass.

THE LATEST NOVELTY IN PHOTOGRAPHY.

Perhaps the most curious invention of the present day is the new kind of photographs, made on a so-called phosphorescent surface, of which absolutely nothing can be seen in the daylight, but which is distinctly visible in the dark. Many years ago, compounds were invented which had the property of shining in the dark many hours, and even days or weeks, after an exposure to sunlight for only a few seconds. These phosphoric compounds, called after their inventors Canton's, Baldwin's, Bolognian phosphorus, etc., were formerly of no use whatever, but it was hoped that they might eventually reveal something concerning the nature of light; and such has indeed been the case, as the phenomena connected with these experiments are a strong argument in favor of the undulatory theory, and the correlation of forces.

An English photographer lately conceived the idea of covering a sheet of paper or glass with a layer of such a phosphorescent substance, and then treating it in a similar manner to paper or glass sensitized in the ordinary way for taking a photograph. Pictures taken in this way seem, by daylight, to have no existence, but the places where the light has acted upon, become phosphorescent or luminous in the dark, the shadows remaining invisible, the semi-tints slightly luminous, and the result is such a change in the surface that the picture is only perceptible in a dark room, by an unearthly glow of a greenish, blue, red, or purplish tint, according to the preparation used.

We notice this invention only by reason of its oddity, and not for its utility. The only practical use we see for it, would be to terrify the uninitiated by the exhibition of luminous images of skulls, skeletons, demons, and similarly cheerful subjects suddenly appearing on the walls, window panes, curtains, or other unexpected localities at the moment the lights are extinguished. It is very easy to make such pictures. A sheet of albumen paper is moistened to make it sticky, and then equally covered with a thin layer of the finely powdered phosphorescent substance, or a pane of glass is covered with a thin coating of paraffine, to which also, when warmed, the powder will stick; then the prepared surface is treated as in taking an ordinary photograph, either by placing it in the camera, or exposing it for a few seconds under a positive to the rays of the sun, or the magnesium or electric light.

The only thing remaining to state is the preparation of these phosphorescent substances. One of the cheapest is Canton's phosphorus, and it is made by burning oyster shells for half an hour, powdering and mixing with an equal weight of sulphur, and heating again for one hour in a covered crucible. The produced substance must of course be preserved in the dark, and protected from moisture in a well closed bottle. Wach found that the luminosity is much increased by moistening the mixture of shells and sulphur before the second heating, with a solution of sulphide of arsenic in liquid ammonia. The powder thus obtained emits so strong a light of blue color that it does not require perfect darkness to perceive its glow.

Baldwin's phosphorus, mentioned above, is prepared by dissolving chalk in nitric acid, then heating and grinding it to powder. The Bolognian phosphorus is made by simply heating a mixture of powdered heavy spar with the white of eggs, gum water, or a solution of tragacanth. Fluor spar is naturally such a phosphorescent substance, some specimens however more than others, and diamond appears to be the best; but the expense of the powder would hardly admit of its employment for the above mentioned purpose. Experiments have proved this property, in some degree, to exist in a great number of substances not suspected to possess such a singular quality; for instance, many natural compounds of lime, baryta, strontia, and magnesia; besides corals, fossil bones, and teeth; the shells of eggs, oriental