Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN. S. H. WALES. A. E. BEACH.

☞ "The American News Company," Agents, 121 Nassau street, New York
☞ "The New York News Company," 8 Spruce street.
☞ Messrs. Sampson Low, Son & Co., Booksellers, 47 Ludgate Hill, London, England, are the Agents to receive European subscriptions or advertisements for the SCIENTIFIC AMERICAN. Orders sent to them will be promptly attended to.
☞ Messrs. Trubner & Co., 60 Paternoster Row London, are also Agents for the SCIENTIFIC AMERICAN.

VOL. XVII., No. 21....[NEW SERIES.]....*Twenty-first Year*

NEW YORK, SATURDAY, NOVEMBER 23, 1867.

Contents:

(Illustrated articles are marked with an asterisk.)

PECULIARITIES OF MACHINES---THEIR INDIVIDUALITY.

An article cut from an exchange has revived in our mind some recollections which may have a practical bearing. Years ago we had some personal experience as a builder and manager of steam engines, both stationary and locomotive, and we had noticed the peculiarities of machines, which, according to the rules of mechanical skill and the exactness of human endeavor, should be alike, yet which presented such marked points of difference, if not of divergence, that mechanical talent was entirely at fault to account for the variation.

Every experienced engineer—to take steam engines as a sample—has noticed frequently, or repeatedly, that while one engine developed its full amount of power, or that quota which was expected of it, another, built after the same patterns, with the same tools, and by the same workmen, failed to fulfill the design of the constructor.

Sometimes it is difficult, if not impossible, to account for these differences, but it is noticeable that they are the more marked as the machinery is the more complex, so that it is natural to suppose that there is, somewhere in the details, a difference of construction, otherwise we must impute the variation to some mysterious agency whose operations are irremediable by mechanical skill. But even when the machine or implement is simple in its parts and built after unvarying gages, the differences may occasionally be detected. The little pocket pistol which may be one of thousands built by the same machinery and workmen will, in some cases, differ widely in its execution from others of the same lot, when a careful comparsion fails to detect the reason. That there must be some variation either in quality of material or construction the mechanic is assured, but he may not be able to ascertain what it is. Sometimes, however, the cause of difference may be detected. A case in point, which we remember, was that of two locomotives running on the same road, the machines being so nearly alike that their parts were interchangeable, yet which differed widely in their respective performances. Repeated examinations of the working parts failed to reveal the cause. The engineer of the inferior machine spent many hours in "tinkering" and "coaxing" his engine, yet still it refused to perform the work of its mate. As a last resort he measured the apertures of the exhaust pipes on both engines, and found that while those of the rival machine measured one-and-a-quarter inches, his measured one-and-three-eights inches. The pipes being of copper, he "drew in" those of his engine one-eighth of an inch, when it performed even better than the other, owing, undoubtedly, to the better care which had been taken of it and its more perfect condition. The difference in the diameter of these pipes was but a trifle, yet no doubt it was the reason of the variation in the work of the two locomotives.

So it may be often that a slight change in the proportions or the actual dimensions of parts may insure evenness and accuracy where the divergence and uncertainty may have been remarkable and mysterious. To ascertain and remedy these points of difference is the province of the intelligent, practical, and educated mechanic. Exactness and accuracy in tools—of which we spoke in a recent number—and educated skill are the true remedies for these difficulties. There is nothing about these differences which need be mysterious or undiscoverable.

But there are some curiosities about machines which seem to be unaccountable. Every user of a sewing machine knows that from some unknown reason the machine which yesterday performed its work so well, so almost enthusiastically, to-day refuses to do more than half its task, and does that half in a surly, indifferent manner. So with many other machines. Even the steam engine is subject to these fits. Is there some occult bond of sympathy between the operator and his machine, by which the latter is influenced by the mental condition of the former; for it is certain that these differences cannot always be attributed to atmospheric or other external influences? This matter is quite humorously and truthfully treated in the subjoined extract, to which we referred in the beginning of this article:—

"It is perfectly well known to experienced, practical engineers, that if a dozen different locomotive engines were made at the same time, of the same power, for the same purpose, of like materials, in the same factory, each of those locomotive engines would come out with its own peculiar whims and ways, only ascertainable by experience. One engine will take a great meal of coal and water at once; another will not hear to such a thing, but will insist on being coaxed by spadesfull and bucketsfull. One is disposed to start off, when required, at the top of his speed; another must have a little time to warm at his work and to get well into it. These peculiarities are so accurately mastered by skillful drivers, that only particular men can persuade particular engines to do their best. It would seem as if some of these 'excellent monsters' declared on being brought out of the stable, 'If it's Smith who is to drive me, I won't go. If it's my friend Stokes, I am agreeable to anything!'

"All locomotive engines are low spirited in damp and foggy weather. They have a great satisfaction in their work when the air is crisp and frosty. At such a time they are very cheerful and brisk, but they strongly object to haze and mists. These are points of character on which they are all united. It is in their peculiarities and varieties of character that they are most remarkable.

"The railway company who should consign all their locomotives to one uniform standard of treatment without any allowance for varying shades of character and opinion, would soon fall as much behindhand in the world as those greater governments are, and ever will be, who pursue the same course with the finer piece of work called Man."

BOILER FURNACE GRATES---THEY SHOULD BE SUITED TO THE COAL.

It has been found by long experience with coal-burning locomotives that furnace grates that will give very satisfactory results with one kind of coal, will give results with another kind (which although it may not show on analysis any material difference in the quantity of its combustible elements or indeed in the quantity of the ash) not at all satisfactory. This is due, for the most part, to the different nature of the substances which constitute the ash left from the combustion of the two species of coal.

If there is a great deal of silicious matter in the ash, which the high temperature in the locomotive furnace can partially fuse, it will run together and a hard vitreous clinker will be the result; and as in a locomotive furnace, owing to the power of the artificial draft produced by the rapid puffs of the exhaust steam, an immense quantity of coal is burned on a very small grate, it will not require a very rapid formation of vitreous clinker to cover the grate (if no means are provided to clean it) to impede the draft and reduce the steam so that the engine can no longer "make time." If, on the other hand, the ash is of a lighter nature, instead of fusing on the grate bars and making clinker, it will be carried through the tubes of the boiler, by the fierce draft, and peppered over the train and the passengers. It is obvious, therefore, that a grate which in the one case will burn the coal perfectly well, will in the other, cause the engineer to be disgusted at the inadequate supply of steam and complain loudly to his superiors of the inferior quality of the coals. With the coal which forms the sort of ash which the draft does not haul through the tubes and scatter over the train, a grate will be required sufficiently coarse for all the clinker to fall through it, and also provided with a suitable "rocking" arrangement to shake the ashes out. If by thus making the grate coarse enough to allow the ashes to pass through, the air spaces through it are too large for the proper and economical supply of air which is necessary to burn that portion of the coal which is consumed on the grate bars themselves—viz., the carbonaceous portion—the supply can be readily governed to the proper amount by simply partially closing the ash box doors.

For freight trains it may not be important which sort of coal is used—that is, the kind which keeps its ashes in the fire box, or the kind which sends them through the tubes and out of the pipe. But the case is quite different with passenger trains, for in one case only one or two brakemen are incommoded by flying soot and cinders; in the other, however, the passengers are peppered and begrimed by black dirt rendered sticky by contact with the exhaust steam mixed with the grease from the cylinders.

It will, we think, be admitted that by a proper construction of the grates, a railroad which has at command two species of coal possessing the characteristics alluded to, can add greatly to the comfort of the passengers by using the sort which keeps the greatest portion of its dirt within the firebox and at the same time maintain an evaporative power in the boilers equal to that produced by the other. When we come to coals which have different proportions of combustible elements, still greater attention must be given to the distribution of the air required for combination in order to insure the perfectness of the combustion.

Thus the greater the proportion of volatile combustible matter, the less must be the quantity of air admitted through the grate bars and the greater the quantity which must be admitted, distributed, and mixed with the combustible gases above the fire. This is clear, for the reason that the hydrogeneous portions of a coal must be burned above the fire, or else not be burned at all and pass unconsumed into the atmosphere and this, as is now well understood, can only be accomplished by introducing a sufficient quantity of air, which, when mixed with the combustible gases, will combine with them to the point of saturation and thus attain the highest temperature possible under the conditions; the carbon, on the other hand, is burned on the grate bars themselves and consequently the air for its combustion must pass through the spaces between them, and the supply of air should be governed to the proper amount by the dampers before alluded to.

From our own observations we are pretty well convinced that if the master mechanics on our railroads understood a little more about the principles of combustion and the chemical characteristics of the coals they are called upon to burn that not only would there be less complaint from passengers on account of the smut from the locomotives, but that there would be considerably less growling from the engineers about bad coal and "could'nt make steam."

IMPROVED CONDITION OF THE PATENT OFFICE.

We observe a marked improvement in the condition of the Patent Office. The Commissioner has increased the examining force very materially, both by new appointments and by promoting Assistants to be primal Examiners. Many of the classes most in arrears have been divided, additional space has been attained, and every department of the Office indicates progress and improvement. The machinery is not yet so perfect in its running as we expect to see it, but the motive power and room are supplied, and when the men occupying their new positions get better accustomed to their duties we bespeak for the Office an administration of its details worthy its patronage.

The Commissioner has latterly exhibited a commendable degree of enterprise in reorganizing the Office, obtaining additional room and appointing new Examiners, and we are assured that it will not be long before the back work of the Office will be brought up. As an evidence of the activity of the examining force of the Office, we would refer to the long list of patents reported weekly in these columns.

Mechanical Music.

A musician of this city has contrived an apparatus which he calls a "Pianautomaton," and which is designed, as its name implies, for automatically playing upon a pianoforte any piece of music desired. The instrument is described, externally, as a box of the width and length of the keyboard to which it is clamped. Through a slot runs the piece of music which is to be played, and which has this peculiarity, that all the notes are perforated through the sheet. The box has a crank which sets in motion a magneto-electric apparatus, and by its means a series of axial bars protuding below the box, strike the pianoforte keys and correctly perform the musical composition indicated by the holes in the paper. This contrivance rather belies its name in that music is ground out, as in the better known street instrument of humbler pretensions; but in another form, the apparatus is entirely self-acting. the insertion of the perforated paper causa small lever to come in metallic contact, thus completing an electric current, the instrument then continuing to play until all the music paper has passed through the aperture, when the lever being no longer held up, the circuit is broken and the performance terminated.

The axial bars strike the key notes with four different degrees of strength, either with a *legato* or *staccato* touch, and with a suitable connection with the pedals, all degrees of musical expression are attainable. It is apparent that this instrument can be made to produce effects of execution which no living artists could think of attempting. For example, a chromatic scale in octaves, thirds, or tenths; or produce the effect as if four, six, eight, or more hands were performing. There is no hesitancy in "reading at sight," and the variety of pieces need not be a limited *repertoire*, like a hand organ.

An Absolutely True Water Wheel Thirty-one Feet in Diameter.

Mr. S. F. Gold, of Cornwall, Conn., an amateur millwright, has built and put in operation a water wheel thirty-one feet in diameter, which he claims runs absolutely true, and can be kept in motion by the water through a two inch pipe.

If the wheel is of wood, and when dry runs true, and also runs true when wet and soaked, the wheel must be pretty nearly perfect. The head of the water delivered through a two-inch pipe is an element to be considered. However, the wheel is an achievement to be proud of, when it is considered that the maker is not a practical millwright.

AMERICAN MADE TOYS.—A correspondent, alluding to an article on the above subject, in a recent number of the SCIENTIFIC AMERICAN, says that "at Cromwell, Conn., is a large factory where all kinds of cast iron toys are made. At Bristol, same state, doll heads are made of untanned leather, which cannot be easily broken or injured. Large mechanical toys, as velocipedes, imitation steam engines, steamboats, fire-engines, etc., are made in Forestville, Conn., the only place in the United States where such toys are manufactured." Toys are also largely manufactured in Hartford, Conn.

WE have received from Messrs. Babbit Brothers some samples of their patent penholders which we find to be excellent The pen is held between springs so as to give elasticity. The holder is marked with the French and English measures of length