Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN. A. E. BEACH.

☞ "The American News Co.," Agents, 121 Nassau street, New York.
☞ "The New York News Co.," 8 Spruce street, New York.
☞ Messrs. Sampson Low, Son & Marston, Crown Building, 185 Fleet

VOL XXIV., NO. 19 . . . [NEW SERIES.] *Twenty-sixth Year*

NEW YORK, SATURDAY, MAY 6, 1871.

Contents:

(Illustrated articles are marked with an asterisk.)

COMPOUND ENGINES.

The idea of exhausting from one cylinder of a steam engine into another, and there utilizing the expansive force remaining in the steam after it has done its work in the first cylinder, is not by any means new. The history of the earlier attempts in this direction is so familiar to engineers that a review of it would be trite. Of late, however, this idea has been revived, and we are now in the midst of a compound engine mania.

A certain class of engineers seem to think that there is some peculiar law which works in a compound engine, by which a large gain in economy can be made. That great gain has been made by the substitution of compound engines for single cylinders, in certain cases, cannot be denied. That this gain is inherent in the compound system *per se* is denied by able engineers. The use of steam expansively, if the expansion be carried to its economical limit, will always show great gain over steam used non-expansively, or imperperfectly expanded. Whether the substitution of compound engines for single cylinder engines has accomplished more than would have been done by single cylinders so constructed as to admit of expansion to the same extent, is a question open to debate. A given volume of steam, at a given temperature and pressure, has in it the capacity for the performance of a given amount of work, which theoretical amount of work can never be exceeded by the use of any appliance whatever.

If compound engines can be proved to work steam nearer up to its theoretical limit than single ones can do, their value will be established. It is not established, however, by the comparison of compound engines with single ones confessedly inferior to other single ones. A gain in economy must be clearly traceable to the system as a system, and not only traceable to it, but capable of being explained on rational principles, before it can be accepted as a scientific fact. If there be any such gain, it neither depends upon any occult cause, nor results from anything other than the operation of well known laws of heat and steam.

With the same initial pressure and the same expansion, waiving the effects of friction, radiation, and clearance, the same results would be obtained by engines of either class; but the disadvantages of clearance, radiation, and friction are increased in compound engines, and hence there must be some good reasons for their use, which compensate for these disadvantages.

These reasons may be briefly stated. Improvements in surface condensers enable marine boilers to carry much purer water than they could do formerly; and hence they can carry higher steam. With higher steam, the principle of expansion has become more economically available. Marine engines are for the most part, direct acting, using slide valves with which steam can not be cut off so as to expand in single cylinders to the extent desired. To effect this expansion without the use of an independent cut-off, the compound engine is employed, and it may therefore be considered as a substitute for independent cut-off single engines, designed to produce the same result.

It is evident that in the compound engine, the expansion might be carried to its extreme economical limit, by the proper proportioning of the size of the large cylinder to that of the small one, were it not that some losses occur, alluded to above; a commonly great source of loss arising from the waste space or clearance between the two cylinders.

It is not, then, because any principle is employed in the compound engine, not involved in the action of other engines, that it is found good practice to use them for propelling ships, but simply because their use renders it possible to accomplish a result not otherwise attainable except by the use of complicated valve gear, and by relinquishing other features desirable to retain in marine engines.

For land engines, there is less to be said in their favor. We doubt that any result, not attainable by a good variable and independent cut-off, has ever been shown by them; while at the same time they are more cumbrous and expensive. There have been, however, some statements made in regard to a 150 horse-power compound engine—running at Yonkers, a short distance from New York on the Hudson river—which, if substantiated, will go far to modify our opinion. We have not seen this engine, but are told that it is compact in the extreme, and that it gives an economical result of less than two pounds of coal per horse power per hour.

There is no mistaking the fact that we have entered upon an era of compound engines. Not only are old vessels being refitted with such engines, but some of the best new steamers are supplied with them. The steamship *Oceanic*, recently described in our columns, has a fine specimen of this class of engine, finished in a style worthy of that magnificent craft. A well-known engineer of this city is superintending the construction of several for the United States Navy, while abroad they seem to meet universal favor.

INSPECTION OF STEAM BOILERS.

We are in receipt of the second annual report of Mr. T. J. Lovegrove, Inspector of Steam Engines and Boilers, Philadelphia, Pa., which states that, during the year 1870, only two persons in the department have been injured by steam; one slightly scratched by the explosion of one of the sections of a Harrison boiler; and another scalded by the explosion of another boiler, but only so as to be confined to his residence for two weeks.

It is claimed that the immunity from disastrous explosions in Philadelphia, when contrasted with the large number that occurred during the same year in various parts of the United States, is evidence of the efficiency and utility of boiler inspection in that city.

If proper systems of inspection can be secured, there can be no doubt that steam boiler explosions would become so rare that the dangers attending the use of steam would be reduced to scarcely more than attend the use of water power. The difficulty lies in the selection of inflexible and thoroughly qualified officers, who know enough to perform their duties, and who will not, for any consideration, neglect them. Laws are easily framed, but it is not always easy to obtain their faithful execution.

The inspector regards as safe the class of boilers known as "sectional," which comprises numerous devices of tubes, globes connected by tubes, etc., in which the water is contained, and heated by the external application of the gases of combustion. He thinks such boilers might be properly exempted from inspection.

The increasing use of steam is shown by the fact that 31 new boilers have been put into use in Philadelphia during the year, while 27 old ones have been repaired and re-created, making a total of 58 more than were inspected the previous year, and which will furnish power to establishments employing in all 3,500 operatives.

During the previous year, so large a number of boilers were condemned that in the present year it has only been necessary to condemn one.

The inspector refers, in his report, to an editorial published in this journal (in our issue of April 23, 1870), upon Steam Boiler Inspection; in which we opposed a proposition said to have been made in Chicago, to vest the power of inspection wholly in a steam boiler insurance company. He thinks the other suggestions made in the article referred to would, if adopted in Philadelphia, prove advantageous to its interests. We felt certain, when writing the article in question, that we were reflecting the views of intelligent steam engineers and steam users throughout the country; and we trust that the remarks made on that occasion, in connection with others made before and since, will continue to aid in the efforts now making in different parts of the country to establish thorough systems of boiler inspection.

We also gather from this report, that the system of inspecting and licencing such men as are to have the charge and care of boilers, is working well, although we are surprised that there are so many reported as examined and licenced, considering the fact that there is no penalty attached to the employment, for this purpose, of men who have not passed such an examination, and who possess no licence. To be efficient, such examination should be made compulsory, under penalty for neglect. Without this, it will be little more than a farce.

The average qualifications of men who claim to be able to perform the duties of engine and boiler tenders, is shown by the fact that, out of 56 examined, only 4 were first class: 26 were second class, 22, third class, and 4, fourth class. Out of 39 renewals, only 9 were first class.

We are convinced that the inspection of boilers needs to be supplemented by the thorough examination of boiler tenders, before we can expect the full value of any system of inspection to be fully demonstrated. With good sound boilers, and men thoroughly qualified in all respects to use them, we should rarely hear of disastrous boiler explosions.

ONE HUNDRED THOUSAND DOLLARS REWARD FOR A NEW INVENTION FOR PROPELLING CANAL BOATS.

The Legislature of the State of New York, at its recent session, passed a bill offering a reward of one hundred thousand dollars for the best improvements for the propulsion of canal boats. This bill had not, at the time of our going to press, been signed by the Governor, but his prompt signature is expected, and thereupon it becomes a law. In another column, we publish the full text of the bill.

The reward offered is a handsome one, is not hampered by any obnoxious or narrow conditions, the terms of competition are broad and liberal, and the whole matter is highly creditable to the authorities. In nearly all other examples of public rewards for improvements, it has been made an imperative condition that the inventor should surrender his rights to the patent. In the present case, nothing of this kind is required, but the inventor will be entitled to the offered reward, and to all additional benefits that he may be able to derive from his patents.

These liberal and judicious terms will have a tendency to stimulate the inventive geniuses of our country; and, that some of them will succeed in studying out good and practicable plans, meeting every requirement of the case, we cannot for a moment doubt.

The Commissioners, who are to decide upon the merits of the various plans, embrace some of our most honored and able citizens. Gen. George B. McClellan, of New York city Chief Engineer of the Department of Docks, 348 Broadway is to be chairman of the commission. Rules and regulations for the filing and examination of plans will doubtless be issued by the Commission, which we shall duly place before our readers.

The Commissioners, after examining the plans, will decide as to the best, and may issue in the aggregate three certificates. Should they issue but one certificate, the holder will receive fifty thousand dollars. If two certificates are issued, the holder of number one draws thirty-five thousand dollars, and number two, fifteen thousand. If three certificates are issued, number one draws thirty thousand dollars, number two, fifteen thousand, and number three, five thousand.

After this selection from the plans and payment of rewards, practical trials thereof upon the Erie Canal are to take place, and upon such trials, the Commissioners are to award the further sum of fifty thousand dollars, issuing three additional certificates, as before described, making the total sum of one hundred thousand dollars.

The improved navigation of the Erie Canal is a matter of momentous importance to the State of New York. Upon the economy and expedition with which produce can be transported through the canal depends the question, whether this State is to maintain its pre-eminence as the main highway for Western export and supply, and this city, its proud position as the emporium of shipping and commerce.

THE REMOVAL OF THE HELL GATE OBSTRUCTIONS.

Few who have not visited the scene of operations now in progress for the removal of the Hell Gate obstructions in the East river, have an adequate idea of the extent and difficulties of the undertaking. We have in progress an engraving illustrating the work, which will shortly be published, and we shall accompany it with more detailed description than we have yet given.

The rock which has to be removed in making the headings is a very hard trap rock, extremely difficult to drill. The drills used are the diamond drills of Severance & Holt, illustrated descriptions of several kinds of which have, at different times, appeared in this journal. The style of drill used in this work may be described as follows:

The boiler, a small upright, used extensively in mining work, is stationed in the shaft, and steam is driven through a two inch rubber pipe to the machine proper. This consists of a simple framework of iron, about seven feet high by three feet square, formed by four upright posts, with cross arms at top and bottom. A small double acting oscillating engine, with cylinder three by six inches, drives the rotary drill, which is a hollow tube, upon the end of which is secured a piece of steel somewhat less than two inches in diameter, called the "head." In the face of this head are set four rows of the carbons or black diamonds, three in each row, with four more in the outer circumference, one between each row, making sixteen diamonds in all. The setting of these stones is similar to the setting of a jewel in a finger ring. Although they are diamonds, the value is but a trifle compared with the more common yet less useful carbon bearing that name. The market price is from three to six dollars each.

A small force pump connected with the machine, and worked by it, forces water through the tube or drill, so that the surface upon which the diamonds act is always wet. This prevents the heating of the drill, and at the same time softens in a measure the surface of the stone. The drill is driven at a speed of about 400 revolutions in a minute, and is capable of drilling a two inch hole about six feet per hour,

or twenty-four feet each four hours. Three experienced miners will drill a hole of same dimensions three feet in the same time, showing that the machine, with its two attendants and one fireman, will do the work of eight men.

These diamond drills are being used very extensively in the marble and slate quarries of Vermont, and Severance & Holt are extensively engaged in making them. In addition to drilling single holes in the rock, they are used for channeling purposes—a number of drills being used intersecting the holes, so that a complete cutting is made.

MORE HUMOROUS THAN SCIENTIFIC.

The Chicago *Post* is to be congratulated upon having attached to its staff a writer of such rare gifts and acquirements as the gentleman who penned the article, "What shall we Eat?" and which we find floating about through our exchanges. Men who can dress up nonsense in so attractive and spicy a manner, are not numerous, and are a boon to the dailies who can secure their services.

First, he tells us that "when we pour milk into a cup of tea or coffee, the albumen of the milk and the tannin of the tea instantly unite and form leather, or minute flakes of the very same compound which is produced in the texture of the tanned hide, and which makes it leather, as distinguished from the original skin. In the course of a year, a tea drinker of average habits will have imbibed leather enough to make a pair of shoes, if it could be put into the proper shape for the purpose."

Now, we beg our readers aud others who have laughed at the fun of this paragraph, and then grown sick at the thought of their stomachs being turned into tanyards, not to give themselves any uneasiness. The humor of this pleasant writer is far greater than his knowledge. It is gelatin, not albumen, that unites with tannin in the manufacture of leather, and gelatin does not exist in milk, unless it is put in by mistake or design.

Again, our funny scientific lecturer says: "A great many things go into the mouth. This is not an original remark. We have seen it somewhere. But it is an alarming fact. We drink, every one of us, a pair of boots a year. We carry iron enough in our blood constantly to make a horseshoe."

Smelting furnaces, as well as tanneries, are we called? Let us see. The average quantity of blood in persons weighing 140 lbs., is one fifth the entire weight—28 lbs., which contains, according to Lecanu, less than 0·002 of its weight of oxide of iron, or less than 0·64 of an ounce, of which less than three fourths, or less than half an ounce, is iron. What sized horses have they in Chicago that wear shoes weighing only half an ounce?

Again, we are told, that "we have clay in our frames enough to make, if properly separated and baked, a dozen of good-sized bricks."

Whereabouts is this clay located in the human system? The statement is, no doubt, based on facts peculiar to Chicago. One brick is about as much as a good-sized New Yorker can carry. Does our friend mean to intimate that people in Chicago can carry a dozen, and good-sized ones at that? Of course, when speaking of frames, he means hat frames, since clay does not enter as an ingredient into the animal economy. "We eat at least a peck of dirt a month—no, that is not too large an estimate." That *may* be true, but we don't think Chicago can beat New York in this particular, no matter how many bricks her citizens can, individually, stagger under. In the matter of dirt eaters, we do believe we have some champions that can beat the world; we will not do violence to their modesty by publicly naming them.

But we are not only charged with being tanneries, iron works, and brickyards, but with being hat factories. Says the scientist of the Chicago *Post*, "The man who carelessly tips a glass of lager into his stomach little reflects that he has begun the manufacture of hats, yet such is the case. The malt of the beer assimilates with the chyle and forms a sort of felt—the very same seen so often in hat factories. But not being instantly utilized, it is lost."

Cannot some inventor make his fortune by inventing a process for saving this felt made, not of lager and chyle, but out of the wool extracted from a Chicago editor's eyes? Certainly his acquaintance with lager is limited, or he does not know chyle.

But we are "marble yards" as well. He goes on to say: "It is estimated that the bones in every adult person require to be fed with lime enough to make a marble mantel every eight months."

This is good, when it is considered in connection with the fact that a dried human body weighs from fourteen to twenty pounds altogether—bones, muscles, and viscera.

Finally, our Chicago physiologist sums up;

"The following astounding aggregate of articles charged to account of physiology, to keep every poor shack on his feet for threescore years and ten:

Men's shoes, 70 years, at 1 pair a year..... 70 pairs.
Horseshoes, 70 years, 1 a month, as our arterial system renews its blood every new moon. 840 shoes.
Bricks, at 12 per 7 years.....120 bricks.
Hats, not less than 14 a year.....980 hats.
Mantels, at 1½ a year.....150 mantels.

Here we are surprised to observe that we eat as many shoes as we wear, and a sufficient number of hats to supply a large family of boys; that we float in our blood vessels horseshoes enough to keep a span of grays shod all the while; that we carry in our animated clay, bricks enough to build a modern fireplace, and in our bones marble enough to supply all our neighbors with mantels. We have not figured on the soil, at the rate of a peck a month; but it is safe to say that the real estate that a hearty eater masticates and swallows in the course of a long and eventful career would amount to something worth having, if sold like the corner lots on State street, at $2,000 a front foot."

In this summary the horseshoes, bricks, hats, and mantels are multiplied in a manner that shows its compiler to be just the right man in the right place. Let him alone for making mountains of molehills. Clearly the Chicago *Post* never need be at a loss for something sensational so long as it keeps to itself this astonishing computer, and sees to it that he keeps an ample supply of bricks in his hat.

ARE NOISOME EFFLUVIA INJURIOUS TO HEALTH?

In the last number ot the New York *Medical Journal* appears an article from the pen of Wm. C. Roberts, M.D., Vice-President of the New York Academy of Medicine, in which he discusses at length the effect of what he styles "non-specific emanations," on the public health.

In this article, Dr. Roberts refers to a paper read by him some years ago before the New York Academy of Medicine, in which he took the ground that "noisome smells, effluvia, or fetid emanations were not necessarily and in all cases injurious to the health of individuals or communities." In that paper, the author maintained that the importance of such emanations as sources of disease had been overrated; that only under certain circumstances were such odors and exhalations pestilential, and that when non-specific, that is, when not proceeding from matters containing the infection or contagion of specific diseases, such as small-pox, etc., they were, for the most part, innocuous.

In the article under consideration, he admits that, in certain idiosyncrasies, such emanations do occasionally cause a train of disorders, acting partly through the brain and nervous system, and partly through the blood. Among these disorders are enumerated diarrhœa, cholera morbus, dysentery, and typhoid fever.

Dr. Roberts, however, after making these admissions, thinks them of little effect as bearing upon the point at issue—the effect of bad odors upon the general health—and goes on to state, that, in the filthiest and most fetid streets of New York, where the air "reeks with tainted odors of slaughter houses, etc.," the inhabitants do not suffer more than those in cleaner localities; that persons engaged in offensive manufactures enjoy good health; that while, not long ago, small pox prevailed extensively in the city, a certain locality, which, according to his statement, was in too disgusting a condition for description, did not show any special susceptibility to the endemic.

In support of this view, he also cites facts stated and assertions made in a discussion of this question before the British Association, at its annual meeting at Bath, England, in 1864. Some of these facts and assertions we will enumerate as briefly as possible.

The large quantity of sulphureted hydrogen emitted by the volcanoes near Naples does not render that city more susceptible to typhoid fever than other cities. The hospitals of that city are dirty and noisome, yet this condition of affairs does not cause fever. The worst fevers prevail endemically where there are no bad smells. Carbureted hydrogen, which has no smell, is as injurious to health as sulphureted hydrogen, which has a most disgusting smell.

The smell of the water of Leith is offensive to such a degree that it is said "it will knock down the de'il," yet its banks are the healthiest part of the city.

Dr. Livingstone, the great African explorer, believes tha foul odors are not the cause of fevers in Africa. "He stopped with his suite all night at a place down the Nyanzi, where the water, as it came out of a marsh, was as black as ink, and had a most abominable smell, turning the paint on the ships white, etc. This phenomenon did not produce illt ness in the crews, nor was it known to do so among the natives. It would, he said, be a great mistake to suppose that fevers came from the presence of bad smells."

Dr. Kirk concurred in Dr. Livingstone's opinion. Dr. William Budd, who is distinguished for his researches into the causes and pathology of epidemics, believes that mere smells are innocuous. In 1858 and 1859, when the river Thames stank so grievously that the committee rooms of Parliament were only habitable through the use of deodorizers, and the law courts were broken up; and when the steamers lost their traffic, passengers going miles around to avoid even crossing the bridges, the health of London remained remarkably good. Fever, diarrhœa, and dysentery were even less than in 1857.

Thus much for Dr. Roberts' opinion, and the facts which support it. Before remarking upon them, we will mention a case in point, which adds to the strength of his argument. Gloversville, in central New York, produces annually a very large quantity of gloves, the leather for which is tanned in and about the village. There is in summer a constant smell pervading the air, resembling that of carrion, extremely offensive to those not accustomed to it. Yet the average health of the community is as good as that of other villages in the same county, exempt from this odor.

It is, in the opinion of Dr. Roberts and of other authorities cited, necessary to remove and disinfect the substances emitting foul smells, not because they are necessarily inimical to health, but because they *may* contain the germs of specific diseases; therefore, for the safety of the public, they should not merely be deodorized, but *disinfected* also.

While, in the main, agreeing with the opinions above set forth, and not disputing the alleged facts brought forward to support them, we still believe that foul odors, emanating from organic substances in a state of decay, even if free from contagion, do, through their debilitating effect, predis pose or fit the human system for certain kinds of disease; so that, while there may be no greater number of cases in which such complaints originate, those who are attacked are less liable to resist the attacks, and recover more slowly.

It is also admitted by many, who do not believe specific diseases can be generated by foul smells *per se* that such smells produce disturbance in the digestive organs; and disturbance in any function of the human economy certainly may lead to positive disease, even if not of the class called specific.

We are greatly averse to any excuse for filth. Dirt is a foe to good morals, and bad morals are a fruitful source of disease, so that indirectly, if not directly, dirt is inimical to good health.

SCIENTIFIC INTELLIGENCE.

TO DISTINGUISH COAL TAR BENZOLE FROM THAT MADE FROM PETROLEUM.

Brandberg recommends a piece of pitch for this purpose. Pour the liquid to be examined on to a small piece of pitch in a test tube. Genuine benzole dissolves pitch in a few moments to a tarry liquid, while that made from petroleum, as well as petroleum ether and ligroin, is scarcely colored by it, even after having been left in contact with it for several hours. The properties and uses of benzole vary considerably, according to its source, and the above test will therefore be found convenient.

A NEW GALVANIC BATTERY.

M. Laschinoft recommends a convenient form of battery for lecture room experiments. It is a modification of Bunsen's, and is so constructed that both caps can be emptied by inverting the battery, or refilled by turning it back to its original position. In this way, the battery can be got ready at a moment's notice, and the tedious operation of filling and emptying is avoided. It would be impossible, without an illustration, to convey an idea of the contrivance; but our readers may be able to invent something of the kind, now that they know the thing has been done.

A NEW CINCHONA ALKALOID.

D. Howard observed that, in analyzing certain quinine salts, a considerable loss was always encountered. This led to a systematic examination of the subject, and he discovered a new alkaloid, differing in its chemical properties from quinine and cinchonine. What peculiar physiological properties the new alkaloid may have has not been determined, nor has the author given a name to his bantling. The probabilities are that it is nearly identical with quinine, and that it is contained in most cinchona bark. It is said that Liebig's extract of meat contains an alkaloid analogous to caffein and theobroma, which may account for the peculiar action of this form of meat.

A CASE OF POISONING WITH NITRO-BENZOLE.

A British medical journal reports a case of poisoning with nitro-benzole; and as this article is extensively employed as a substitute for bitter almonds, in confectionery and cake, it is well to caution the public against its use. A healthy workman, in sucking some of the nitro-benzole, in a syphon, accidentally swallowed a small quantity. He continued for two hours at his work, when he was seized with headache, loss of memory, and difficulty of speech; his countenance was livid; then followed convulsions and unconsciousness. Five hours after the accident, the physician observed cold extremities, enlarged pupils, unconscious urinal and excremental passages, then vomiting. Although every effort was made to save the man's life, all remedies proved in vain, and he died after three days of great suffering, It is thus conclusively shown that nitro benzole, like its derivative aniline, is a poisonous substance, and one that ought to be handled with care.

NEW SOURCE FOR BENZOIC ACID.

The urine of horses and cattle is utilized in Northern Prussia for the manufacture of benzoic acid. One house at Königsberg supplies the market from this source. The establishment makes 7,700 lbs. of benzoic acid annually, for which 3,850,000 lbs. of urine are required, not to speak of ship loads of fuel to evaporate it. Benzoic acid is now chiefly used in the manufacture of a red color for woolen goods, and is also highly prized in making certain kinds of perfumery.

PREMATURE DISCHARGE OF NITRO-GLYCERIN AT HOOSAC TUNNEL.

There appears to be some danger in employing electrical discharges during a thunder storm. At Hoosac, the connecnection was made with a battery ready to explode a large quantity of nitro-glycerin, when the whole series of drill holes was fired by the sudden passage of an electric cloud, before all the workmen could get out of the way. A similar experience in Europe ought to teach greater caution in making connections with the electric wires during thunder storms. Telegraphic operators understand the danger and keep out of the way. Miners ought to be equally cautious.

PREVENTING RUST.—To make an improved anti-rust composition, Mr. E. J. Powell, of Birmingham, takes equal parts of Russian tallow and the greasy matter obtained by the distillation of resin oil, and called anti-friction grease. He fuses the said tallow and grease together, in a vessel heated by steam or hot water, and to each 100 lb. of the mixture he adds two pounds of mercurial ointment, and one pound of lampblack. He first melts and thoroughly incorporates the tallow and grease, before adding the other ingredients, and when the whole has been thoroughly incorporated, the composition is either cast into blocks or masses of a convenient size, or allowed to cool in the vessel in which it is made, and afterwards removed.