SCIENTIFIC AMERICAN

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WROUGHT IRON TUBULAR SAFETY BOILER.

The inventors of the improved steam generator herewith illustrated hold that the principle of having a boiler directly over the fire is wrong, inasmuch as the heated gases, ranging from 1,700° to 2,000° Fah. in temperature, when striking the cooler surfaces so near them, which are heated only to about 300°, become condensed, and, as a result, there is imperfect combustion, smoke, and a large expenditure of fuel. To obviate this difficulty the present boiler was constructed, so that a flame from 12 to 18 feet in length is obtained, wherein, it is claimed, almost all gases, etc., are consumed. Actual tests made upon a boiler in use at the Centennial Exhibition demonstrate the temperature of the escaping gases to be very nearly of the same degree as the steam, in lieu of from 600° to 1,200°, as is commonly the case. It thus appears that the heat of said gases is almost fully utilized for steam production, and that the steam was 40° to 50° hotter than that obtained from other generators tested. The log of the tests referred to exhibits in some instances a difference between the steam temperature and that noted by the pyrometer in the uptake, of less than 40°, and an inspection of its figures also indicates a high evaporative efficiency. The calculation, made by Professor Thurston of the Stevens Institute, from the log of the tests furnished him and made by the experts appointed by the Centennial judges, shows that, for each lb. of combustible consumed, 11·737 lbs. of water were evaporated at 212°.

The engravings given herewith represent a sectional view, Fig. 1, and a perspective view, Fig. 2, of the boiler. In the latter illustration, portions are broken away so as to exhibit the interior. At A are the two horizontal mud drums; at B two drums, each half filled with water and steam, the water line being in the center; and at C is a steam drum. The mud drums and the steam and water compartments are connected by a number of heating tubes, D, arranged obliquely. The grate is located between the two mud drums. The fire bridge wall, E, divides the interior of the brickwork into two compartments, while the inclined walls, F, Fig. 1, placed at a suitable distance from the heating tubes in the rear compartment, divide this into two side passages with an interior air chamber. Thus the gases of combustion are compelled to take a course from the fire box upwards over the bridge wall and downward in the two rear channels, whence they escape to the chimney by the duct, G. The mud drums vary from 12 to 28 inches, and the upper drums from 20 to 40 inches, in diameter, and in length from 4 to 18 feet, according to the capacity of the boiler. The heating tubes are from 2 to 5 inches in diameter, and from 3 to 16 feet long. They are arranged in two or three rows and are expanded in the mud and upper drums. The masonry consists of plain brick walls lined in the inner side with fire brick. All the drums are provided with large manholes, which admit of ready examination of the whole interior of the boiler and easy cleaning and the removal of sediment. By holding a light in each heating tube from the inside of the mud drums, and examining them from the upper drums, their condition can be at once ascertained; and by striking them lightly upon the outside, the deposits, if any, we are informed, may be quickly removed. There are no heating tubes placed horizontally or nearly so in the boiler, so that no resting place is afforded for soot and ashes, nor for sediments, to accumulate to cause the burning of tubes or destructive explosions.

To the rear and entirely outside of the boiler are two 4-inch circulating pipes, through which the water is constantly passing, causing a continuous circulation of water in the generator.

The water is forced into the mud drums, and the inventors claim that, as it is heated, the impurities fall to the bottom of the drums, whence they can be easily removed. It is further claimed that nearly every particle of carbon in the fuel is consumed, and that the flame is actually brighter at the top of the furnace than at the bottom. This is partly due to the introduction of heated air from the rear or air chamber into the fire box, through the downwardly inclined passages shown in the fire bridge wall, which furnishes a proper supply of oxygen of a temperature of about 800° or more. The ignition of all the unburnt carbon contained in the gases of combustion is thus produced. The supply of this heated air is regulated by a damper in the rear wall, controlling the ingress of cold air to the said rear chamber. Any description of fuel can be burned, including tan bark, sawdust, slack, etc. For the heating of dwellings and public houses, for power purposes on small vessels and in oil regions, the boilers are made portable, from 2 horse power upward. The general advantages claimed may be summed up as follows: Safety from destructive explosions, durability, no cleaning of flues, no deposit of soot or ashes, easy access to all parts, no leakage from unequal expansion, saving in first cost, entirely dry steam, and every facility for removing injured parts for repairs, etc. One of these boilers supplied steam for driving part of the machinery at the Centennial Exposition, and received a medal of award and a log by experts as already stated, showing it to be more economical and productive of dryer and hotter steam by 40° than other boilers tested. A generator of this type, rated at 160 horse power, has been in use, we are informed, for over three years night and day, under a pressure of from 90 to 100 lbs. of steam, without any external cleaning or repairs. The manufacturers have complete tables and calculations prepared by Professor Thurston from the log above alluded to, copies of which they will furnish upon application.

Patented July 5, 1875, November 16, 1875, and January 6, 1876. For further particulars or regarding agencies throughout the United States, address the manufacturers and patentees, Messrs. Joseph & George Firmenich, 13 to 23 Mortimer street, Buffalo, N. Y.

Blue Lamp Chimneys.

Noted oculists, for instance Gräft, Arlt, and Stellwag-Carion, recommend either blue, bluish gray, or smoke-colored glasses as a protection for weak eyes against the unpleasant effect of red, orange, and yellow light. On the same principle, the trying reddish yellow light of candles, lamps, and gas, on normal eyes as well as weak ones, can be pleasantly modified by the use of blue chimneys or globes (or at least of shades for the reflection of the light) colored a light ultramarine blue. A remarkably near approach to a light as agreeable as daylight is said to be produced by a petroleum lamp with a round wick and a light blue chimney of twice the usual length, the latter causing so great a draught that the petroleum burns with a nearly pure white flame.

THE distance apart of the rivets used to connect two pieces of metal plate together is regulated by the rule that the joint sectional area of the rivets shall be equal to the sectional area of plate left after punching the rivet holes.—*Rankine.*

Fig 1

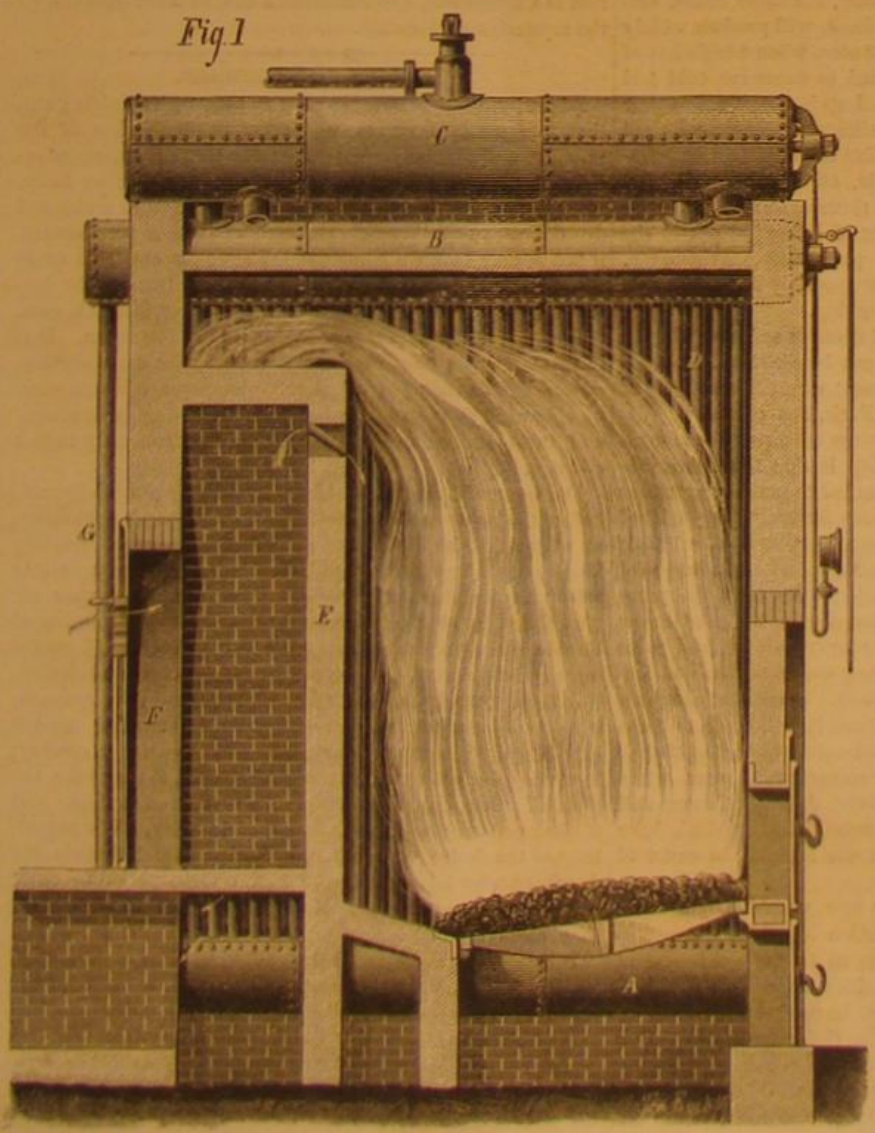
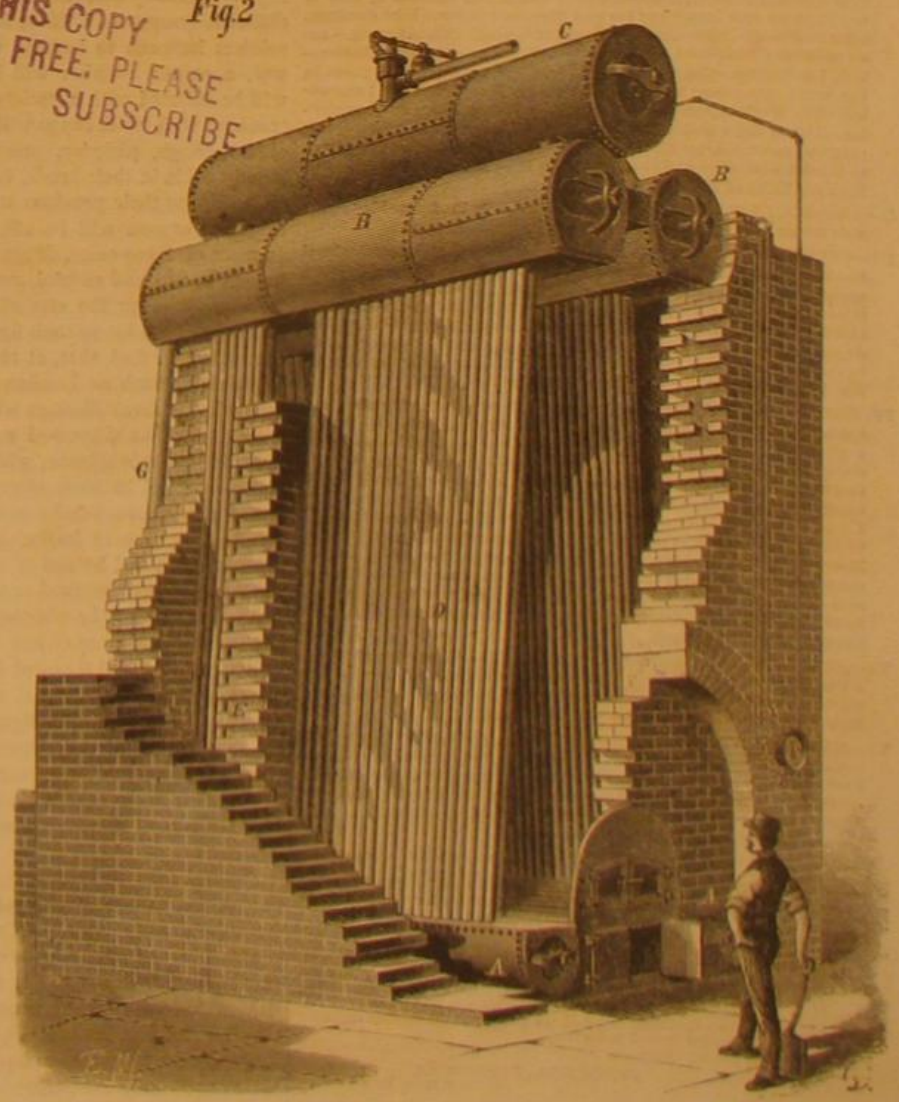


Fig 2



FIRMENICH'S WROUGHT IRON TUBULAR SAFETY BOILER

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT,
No. 56.
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THE MODERN TENDENCY OF THE MEDICAL ART.

In regard to the manner of conducting a thorough diagnosis of an impaired human constitution, Dr. Willard Parker, of this city used, in his lectures to the students of the College of Physicians and Surgeons, to make an appropriate comparison, likening the process to hunting up a thief known to be hidden somewhere in a large house. In place of running about, without system or plan, and looking carelessly about, the proper course is to submit each apartment of the house to a thorough and exhausting search, looking in all closets and recesses; and when sure that the thief is not in any particular room, the apartment should be closed, and the search commenced in another. So, in making a medical diagnosis, the first thing would be, for instance, to inquire into and examine the circulation of the blood, count the pulse, listen to the beating of the heart; then the respirations may be counted, the lungs sounded by percussion and auscultation, etc. All these may be normal, and then the digestion may be investigated; then the various organs of secretion, especially the liver; and if these are all found to be in working order, they may be considered as disposed of, and another section taken up, say, for instance, the nervous system: beginning with the brain, then the spine, the sympathetic nerves, etc. In proceeding in this or a similarly systematic manner, the skillful and acute physician is sure to find the disease, if it is not an imaginary one; even if the latter be the case, it is a disease of the mind, and has to be treated accordingly, sometimes merely with advice for the mind, sometimes with medicine for the body, each being adapted to the character of the patient.

This way of searching for a disease is eminently practical; but it must not be considered to be based on the old idea that a disease is like a thief or an enemy, trying to take possession of certain organs, and who must be driven out by drugs. In ancient times, many human ailments were actually attributed to personified evil beings, who could be driven out by incantations or ceremonies, and we find this belief still prevailing among certain races of savages; and we regret to say, even among certain classes of our civilized and enlightened peoples, there are some who believe in charms, and in magnetic and mesmeric manipulations. But, thanks to the light shed by recent thorough investigations in two important branches of biology, namely, physiology and pathology, more correct views now prevail among all educated physicians; and they now know that diseases are mere phenomena, proceeding from the constant and intimate relations of man with surrounding Nature; and in place of attempting to suppress such symptoms by the use of dangerous prescriptions, the properly qualified physician, knowing that every disease and symptom has a certain cause and must run a certain course, watches carefully, and, recognizing the all-powerful *vis medicatrix naturæ*, in place of interfering with Nature, he assists her efforts to save the sufferer. This is the true basis of modern enlightened medical treatment.

This rational way of considering a case shows also how absurd are the claims put forth on behalf of so-called specific remedies and the danger of treating with such nostrums the mere exterior symptoms, which may proceed from one of many different causes; and conversely, the same cause, acting on variously constituted individuals, will produce widely different symptoms. Thus, for instance, when a regiment of soldiers happens to become exposed to excessive cold and wet, a certain number will be laid up in hospital, but they will be afflicted with a variety of ailments. Those who are troubled with weak lungs will exhibit such diseases as bronchitis, cough, pleurisy, pneumonia, etc.; others will have merely colds in their heads, others rheumatism or even gout, according to their previous manner of living; in others the digestive organs will be affected, producing diarrhœa, etc. In most of these cases, drugs cannot possibly be of as much benefit as rest and careful, good nursing.

In considering the statistics of diseases and mortality in olden times, so far as such figures can be obtained, it is encouraging to find that, at the present day, the mortality of large cities, such as London and Paris, has enormously decreased, and many diseases which were once very fatal are no longer so. The decreased mortality is due to modern progress in hygienic science, which has led to sanitary measures being adopted in such cities, where formerly people lived under the constant influence of an atmosphere full of effete exhalations, due to imperfect drainage and the absence of cleanliness, a real hotbed of contagion. These sanitary improvements have resulted in the total disappearance of many diseases, such as the plague and scurvy, which used to be always present, more or less, in many communities, and frequently spread and traveled to others. Small pox, of which the ravages were such that at present it is difficult to form any idea of its former malignity and universality, has, thanks to Jenner's discovery, become comparatively rare; while other diseases, such as spotted fever, dysentery, fever and ague, etc., from which many persons formerly died, have lost their fatal virulence, and now are seldom the cause of death.

Medical science is now upon a new, unselfish, and noble career, and is aiding the introduction of sanitary measures by enlightening public authorities as to the best means of preserving the health of communities by anticipating and preventing disease; and it cannot be denied that society in general has been largely benefited by the progress of medical research, and by the labors of investigators in pathology and its kindred sciences, who have given the world the benefit of their continually increasing knowledge and insight into the nature of the ailments to which human nature is subject.

IDEATION IN UTERO.

It is admitted by all physiologists that the mother exerts a general formative control over the fœtus *in utero*. Hitherto the belief has been that this influence is altogether structural, even where it is manifested, not merely in physical resemblance, but also in active tendencies, disposition, and modes of thought and action. But there are manifestations of maternal influence which this hypothesis does not easily cover: for example, those strange, yet well authenticated, cases in which children have described or recognized places which they have never seen before, but with which the mother is familiar. Still more unaccountable has been the common and perplexing feeling which poets and speculative thinkers have held to constitute subjective evidence of previous existence—the feeling that a particular occurrence or locality witnessed or visited for the first time has been seen before—or the sensation that some particular act in the drama of life is but the repetition of something witnessed or performed in some unremembered state or period in the past. In many cases these sensations are, no doubt, vague reminiscences of dreams or equally unreal creations of the waking imagination: still, after this allowance is made, there remain instances which cannot be so accounted for. For these the most satisfactory explanation yet offered is furnished by a suggestion made in the *Lancet*, the other day, by Dr. Mortimer Granville.

It is well known that, for several weeks before birth, the vital organs are all in more or less full operation; also that portions of the brain are so active as to produce concerted muscular contractions and automatic movements; and there is no reason to suppose that the intimately related cerebrum is not likewise, to some extent, capable of action previous to birth. At any rate Dr. Granville contends, and with a good show of evidence, that, during at least six weeks or two months of the ordinary period of human life *in utero*, the brain is susceptible of passive ideation, or the reception of impressed ideas derived from the mother's mind.

There is abundant evidence that a lively though fleeting impression made on the mind of the pregnant mother, or a prolonged dominant thought or emotion, can so modify the nutrition of the child's brain as to fix on it a permanent shadow, so to speak, of that impression or mental state. Thus a child will in after years exhibit tokens of special dislike or dread of a particular animal by which the mother has been frightened during the later months of pregnancy, or will have an otherwise unaccountable antipathy to a particular person or article of food, or will unconsciously mimic through life the mother's moods or prevailing states of mind or temper during that critical period. In like manner, it is suggested that scenes or occurrences, deeply engraved or repeatedly forced upon the mind of the mother, may become fixed as images in the fœtal brain, while it is yet incapable of thinking; and in later years, when they are vaguely recalled by something similar, an undefinable sense of repetition is felt. Memory, like education, thus has its beginning back of birth; and as the mother's structural and emotional characteristics are echoed in the child, so sometimes her special thoughts and ideas may be. The suggestion is a fertile one, and furnishes a clue to more than one of the mysteries of heredity.

INEBRIETY AS A DISEASE.

Ethically, there is but one view to take of inebriety; and that necessarily involves unsparing condemnation of the practice, and earnest endeavors on the part of society to reclaim those addicted to it. But Science, on the other hand, draws a broad distinction between drunkenness as a vice and drunkenness as a disease. The man who drinks for pleasure, it holds, may look for benefit in the counsels of others or in his own strength of will; but he who drinks because he cannot help it, being led by an irresistible impulse, is a sick man, and needs not a temperance pledge but a physician. It is in this last aspect that we propose to consider the assertion, quoted from a daily journal, that "intemperance is a growing vice, bearing constantly heavier upon the rising generation," and incidentally the subject of inebriety generally in this country.

Dr. George M. Beard, of this city, not long since delivered, before the American Association for the Cure of Inebriates, an address on the "causes of the recent increase of inebriety in America," in which he embodies many of the conclusions which medical men have reached relative to the disease superinduced by alcohol. Inebriety he holds to be a functional disease of the nervous system, and should be treated on the same principle as other nervous diseases. It becomes classed, therefore, with dyspepsia and neuralgia; and like neurosis, it possesses periodicity, and—the fact is a startling one—is hereditary. When hereditary, it is all the harder to combat; in conformity with the laws of inheritance, it may take the place of other disorders, or may, in turn, lead to them; and it often conduces to various forms of insanity. The periodicity of the desire for liquor, the feeling which impels the drunkard who has abstained for a certain period to enter upon a "prolonged spree," is too well known to need more than mere reference.

It is a curious and somewhat paradoxical circumstance that, while drunkenness as a vice—public opinion to the contrary notwithstanding—is actually decreasing, the disease of inebriety is on the increase. "There never was a time," says Dr. Beard, "in the history of our race, when in proportion to the population there was so little intemperance and so little drinking among the higher classes as to-day." The nervous systems of Americans are now such that we cannot bear alcohol

as our fathers could; and there is no doubt but that the efforts of reformers and the general progress of culture has exercised a potent effect toward temperance. Cases of drunkenness were rare among the thousands who visited the Centennial. But on the other hand that very heightened nervous sensitiveness, which prevents our indulging in alcohol for pleasure, equally heightens the susceptibility to nervous diseases; and of these, inebriety not being considered, it is well known the increase of late years has been marked.

It is not necessary here to repeat the facts, which every observer of American habits has noted over and over again, in order to prove that we live too rapidly. For the pursuit of wealth, we concentrate an enormous quantity and intense quality of work; we carry the seriousness of labor into our amusements; we crave the sensational and the fever of constant excitement; and under the terrible tax put upon it, the nervous force necessarily weakens. Thus, in accordance with all analogies, nervous diseases increase with the progress of modern civilization; and hence the greater prevalence of the nervous disease known as inebriety during the present time.

Dr. Beard further supports his views by inductive reason based upon extended examination. By comparing the higher and lower classes, he shows that, among the latter, such functional nervous diseases as sick headache, neuralgia, and nay fever are wanting: while the vice of drunkenness abounds in its most revolting aspects. Comparing the prevalence of functional nervous maladies now with the same half a century ago, he points out various diseases, such as hay fever, now common but then unknown. He also suggests various refinements in nervous troubles, which are peculiar to the present, but not to an earlier, period. Going back still further for purposes of comparison, he shows that "not only were many of the nervous maladies, so prevalent now quite unknown three centuries ago, but those which are common to those eras and ours are far less abundant than now." Lastly he points to the multiform nervous disorders now found among women.

There is no specific for inebriety. It is a constitutional ailment, to be treated constitutionally. It is not necessarily due to alcoholism. Chloral and opium inebriety are already becoming dangerously common; and there are hundreds of other stimulants and narcotics to which resort may be had. The only remedial course is to place the inebriate where alcohol or the provoking cause of his ailment cannot be had; for the sight of it, or the smell of it, will excite all the desire for it. To this treatment, sedatives, tonics, and nutritious food to build up the system may be added. To persons having any tendency to inebriety, the only safe course is absolute abstinence during early life. As regards the human race, the disease finds its remedy in itself; for degeneracy in any direction cannot go on indefinitely; and after any qualities, good or bad, attain a certain stage of growth, they cease to reproduce themselves. The excessively feeble and nervous stocks must perish, and the fight for existence be maintained between the less feeble and less nervous and the well balanced and strong; and thus, by a process of successive eliminations, a race may be developed that shall be every way adapted to the complex conditions of a high civilization.

A NEW HUNTING GROUND.

With the rapid extinction of the large game of our Great West, and the scarcely less rapid disappearance of the once numerous herds of South Africa, there remains but one country with virgin attractions for the modern Nimrod. That is also the highest, and in many respects the least known, region on the globe—the lofty plains of Thibet.

The first scientific traveler to penetrate that country, so zealously guarded from European invasion by both man and Nature, is the Russian officer, Colonel Prejevalsky, who, in the triple capacity of explorer, zoologist, and sportsman, spent three years in the hitherto unexplored wastes of Mongolia and Northern Thibet, crossing the desert of Gobi twice and traveling in all upward of 7,000 miles. Of the additions thus made to our knowledge of the geography of those strange regions, it is not our purpose here to speak, nor especially of the rich collections of plants and animals which he brought home—a large portion of them new to Science—though 5,000 specimens of plants, including a hundred new species, 37 large and 90 small mammals, 1,000 birds, embracing 300 species, 80 specimens of fish and reptiles, and 3,500 insects furnish a record of scientific work well worthy of minute description. Our present purpose is rather to notice the claims of this new land to the attention of the adventurous huntsman in search of large game.

Chief among the wild beasts of Northern Thibet is the wild yak, which Colonel Prejevalsky describes as an animal of extraordinary beauty. When full grown, the male yak measures eleven feet in length, exclusive of his bushy tail, which is three feet long. He stands six feet high at the shoulder hump, and weighs from ten to sixteen hundred weight. His head is adorned with ponderous horns, from two to three feet long, and sixteen inches in circumference at the root. The body is covered with thick black hair, a deep black fringe hanging from the flanks almost to the ground. The females are smaller and less hairy, with shorter and lighter horns. The yak is enormously strong, but has a small brain and comparatively little intelligence. His sense of smell is very keen, but his sight and hearing are defective. The females, young bulls, and calves assemble in vast herds, like our American bison, to protect the young from wolves. The herds make long journeys for pasturage; and when in danger they form a phalanx with the calves in the center, some of the full grown males advancing to reconnoitre. The old bulls do not journey with the herds, but have their fixed abiding places, always selecting the coldest spots they can find for resting, and preferring to sleep on snow in the shadow of some cliff. At breeding time they fight savagely with each other, all the old bulls killed by Colonel Prejevalsky bearing numerous wounds received in these fierce combats.

Wild yak shooting is exciting and dangerous sport, as the bulls charge when wounded, and are very hard to kill. Fortunately for the hunter, their courage exceeds their decision in attack, giving the marksman ample opportunity to aim. On one occasion Colonel Prejevalsky, supported by a Russian companion and a Cossack servant, fired volley after volley at an old bull, who stood his ground until it was too dark for the hunters to continue the fight. The next morning he was found dead with thirteen balls in his body and three in his head. The flesh of the cows and young bulls is excellent eating; but that of the old bulls is "indescribably tough." The wild yak is peculiarly characteristic of the highlands of Thibet, where he must be seen to be appreciated. There, on the vast plains, 1,500 feet above the sea, swept by violent storms and seamed with rocky ridges, as wild and barren as the surrounding desert, these animals swarm in such numbers that it is a marvel how or where they find subsistence. They also wander to the confines of Siberia, and are said to haunt the mountain ranges of Kan-su.

Another characteristic animal of the highlands of Asia is the argali, or mountain sheep. Colonel Prejevalsky often asked himself which was the finer beast, this or the yak; and the best answer he could give was that each was perfect in its way. The mighty size of the yak, his ponderous horns, long fringe, bushy tail, and jet black color, make him a magnificent specimen of the brute creation. On the other hand, the gracefulness of the argali, his great curving horns, snowy breast, and proud bearing, entitle him to rank among the noblest creatures of the desert.

The white-breasted argali (*ovis Poli*) is found only in Northern Thibet. It frequents the more elevated plateaus, avoiding steep and rugged mountains, and may often be seen feeding with the wild asses and antelopes in the ravines. It is an exceedingly wary animal, though scarcely ever hunted, the matchlocks of the natives being altogether useless for this purpose. The more common mountain sheep of the highlands of Central Asia (*ovis argali*), ordinarily prefer the most rocky places, only descending to the valleys in early spring to graze on the young grass. Their senses are keen, but they lack the wariness of their Thibetan rival. The poorly armed Mongols and Chinese are unable to kill them from sheer lack of skill, so let them alone. They are easily stalked; and when one is killed the rest remain with it, regardless of the approach of the hunter. They will jump from considerable heights, always alighting on their feet. The stories about their throwing themselves down steep precipices, and alighting on their massive horns, Colonel Prejevalsky pronounces pure fiction.

A far more attractive game for the sport-loving naturalist is the wild camel which abounds in Northwestern Tsaidam, where the country is so barren and so destitute of water that the camels have to go seventy miles to drink. Reports of these rare creatures have reached the outer world time and again, but European naturalists have always doubted their truth; and though Colonel Prejevalsky was unable to penetrate their country, owing to want of money, the accounts he received of them were so direct and convincing that there remains little, if any, doubt that they are a distinct variety which has never been brought under the subjection of man. They are hunted in the desert of Tsaidam for their delicate flesh and fine wool, and are described as smaller and more slender than the domestic camel, with smaller humps and more pointed noses. They are long-sighted and keen scented, but are unable to see well at short range. That they are not the descendants of camels escaped from domestication seems altogether probable from the circumstance that the latter are unable to procreate without assistance; besides, the new-born domestic camel is the most helpless creature imaginable, and has to be lifted by hand and placed under the mother's teats.

In the same region (Western Tsaidam) troops of wild horses are occasionally seen, but are more numerous in the vicinity of Lob-nor. They generally go in large herds, are very shy, and when frightened continue their flight for days, and do not return to the same place for a year or two. They are never hunted by the Mongols and Chinese, owing to the difficulties of the chase. Their color is uniformly bay, with black tails and long manes hanging down to the ground.

Another interesting animal of this quarter is the kulan, or wild ass, which ranges over Northern Thibet and Tsaidam, but is most abundant on the steppes of Koko-nor. In size and external appearance, the kulan resembles the mule. They keep mostly in troops of ten to fifty, though larger herds, sometimes several hundred in number, are occasionally seen about Koko-nor. Each lot of mares is led by a stallion, whose following depends on his age, strength, and courage. Their sight and hearing are excellent, and they are very hard to kill on level ground. The best time to stalk them is while they are drinking. They are hunted for their flesh, which is considered a great delicacy.

The antelopes of Mongolia and Thibet are small, but numerous and attractive. Specially characteristic of the eastern part of the desert of Gobi is the swift-footed dzeren (*a. gutturosa*), which was seen also in Western Mongolia and around Lake Koko-nor. The dzeren are most frequently seen in small herds; but where the pasturage is good, they collect in droves of a thousand or more. Like the Mongols, they migrate in search of food, traveling great distances, especially in summer, when the drought drives them to the rich pasture lands of Northern Mongolia. They belong exclusively to the plains, avoid hilly country, and shun thickets and high grass, except in May, when the does seek the covert to conceal their young They are about the size of goats; they have great intelligence and keen senses, and are marvellously swift. They are hard to hunt, being wary, and extremely tenacious of life. Even with a broken leg, they can run faster than a horse can gallop.

Another species (*a. subgutturosa*), called by the Mongols the kara-sulta or black tailed, inhabits Ordos and the desert of Gobi as far north as the 45th parallel of latitude, and as far south as Kan-su and the saline marshy plains of Tsaidam. Unlike the dzeren, it avoids rich pasturage, and selects for its habitation the wildest and most barren parts of the desert, or small oases in the midst of sand drifts. The explorer often marvelled to find them in places where no water could be found for sixty or seventy miles. They generally go in couples or in small detachments: in winter sometimes fifteen or twenty may be seen together. Their color is so like that of the sand and yellow clay that they can scarcely be distinguished, except when in motion or when standing on the summit of a hill. They are more shy than the dzeren, and harder to kill.

In the Thibetan highlands, two remarkably beautiful antelopes were found; one, called the orongo (*a. Hodgsoni*), being about as large as the dzeren; the other (*a. picticanda*) one of the smallest antelopes known, standing only 2 feet 4 inches high and weighing no more than 36 lbs. The orongo has a beautiful body, set on long slender legs, and elegant black horns standing vertically above the head. It loves the valleys and rolling plains, where water abounds; and where pasturage is abundant, they were seen in troops of several hundred. When trotting, the legs of these swift and graceful animals move so quickly that at a little distance they are invisible. In their flight, the males follow the herd, while with the dzeren and kara-sultas the males take the lead. They are quite fearless, and are easily approached, though, like all antelopes, they are hard to kill, and will run a long way after receiving a wound. The orongo is held sacred by the Mongols and Tanjutans, and the horns are much prized by pilgrims and conjurors. Colonel Prejevalsky mentions as a prevalent superstition the belief that sometimes the orongo is a veritable unicorn, with a single horn growing vertically from the center of the head. It is quite possible, however, that single horned orongos may not be infrequent, as these pretty creatures are very pugnacious, and may occasionally lose a horn in their fierce battles.

The smaller antelope is the swiftest and most graceful of the antelopes of High Asia. It frequents the elevated plains, but prefers mountain valleys where water is plentiful. It goes in small herds and is exceedingly wary. Its swiftness is amazing; it bounds along like a rubber ball, and when startled seems absolutely to fly. Both this and the orongo are swift runners over smooth ice.

Among the mountains of In-shan, Colonel Prejevalsky had some fine sport hunting a little mountain antelope which inhabits the wildest and most inaccessible crags of the alpine zones. Its favorite and almost exclusive grazing places are the alpine meadows and small grassy spots between the rocks. It is extremely timid and wary, and, when startled, seeks safety in rapid flight, scaling the crags with chamois-like skill and speed. Colonel Prejevalsky declares that one, which he had startled, suddenly sprang from a rock a hundred feet high and got away apparently unharmed. The thick fine coats of their winter skins are much prized for clothing.

Second Bridge Between New York and Brooklyn.

The projectors of this proposed bridge over the East River, between New York and Brooklyn at 77th street, by way of Blackwell's Island, have, in response to the invitation sent out, received ten separate designs and estimates from as many engineers. Ground will be broken as soon as a plan shall be decided upon. The preliminary specifications call for an approach on the New York side of 4,580 feet, 1,000 feet of which is to be in form of a tunnel extending from Fourth to Lexington avenues. From the end of the tunnel, an iron superstructure, curving to the center of the blocks between 76th and 77th streets, and thence direct, leads to the river. From the pier on the brink of the river, Blackwell's Island will be reached by a single span of 734 feet. An iron structure 700 feet long will then lead over Blackwell's Island, and the channe. between the island and the Long Island shore will be spanned by a single arch of 618 feet. The shore approach on the Long Island side will be 3,900 feet in length. This will give in all a total length of 10,532 feet, or nearly two miles. A single track tramway will run across the bridge. There will be, in addition to the main approaches, two auxiliary ones, one from Avenue A on the New York side and the other from Vernon avenue, Long Island city. The spans are to be 135 feet above mean tide water. Double passenger elevators are to be placed at the piers on each side.

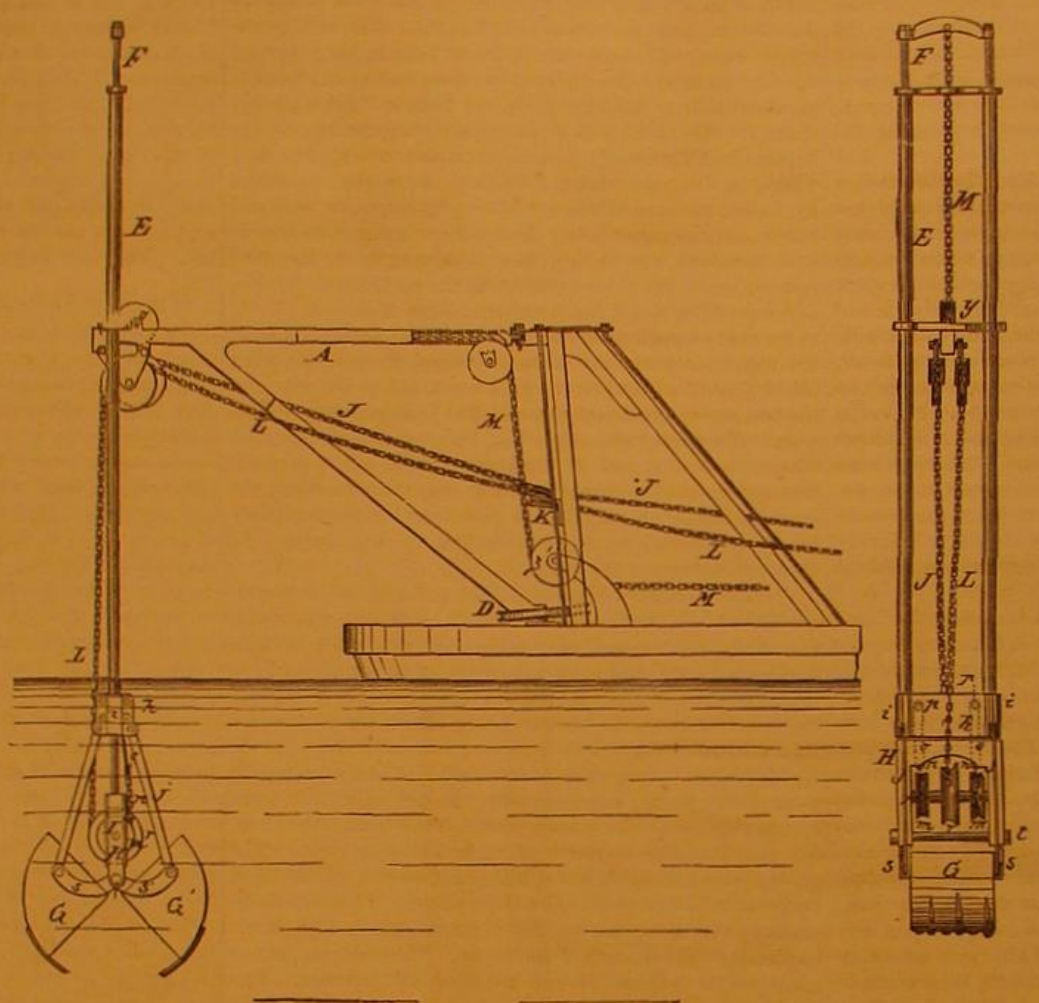
In order that a wedge key or collar may be safe against slipping out of its seat, its angle of obliquity ought not to exceed the angle of repose of metal, upon metal which, to provide for the contingency of the surfaces being greasy, may be taken at about 4°.—*Rankine.*

A NEW DREDGING MACHINE.

The object of the invention herewith illustrated is to obviate the difficulties experienced in operating dredges of ordinary construction, and provide a dredge whose buckets can be held down to their work with more or less force.

A is a crane rigidly made and swinging on an inclined axis. D is a friction wheel having a strap brake and lever. At E are tubular shafts held in suitable guides. These carry the dredge buckets. The operation of the apparatus is as follows: The chains J L H being connected with suitable drums driven in the ordinary manner, the crane is moved into the required position by pulling more upon one of the chains J L than upon the other. The strap is tightened on the wheel D by the lever. The buckets G G' are now opened by sustaining the weight mainly by the chain J, which permits them to hang by the bars *j*, while the weight of the bars F and frame H, resting on the pivot, throws the buckets open. The buckets are lowered by slackening the chains J and L, and when in contact with the surface to be excavated, if the weight of the buckets and superimposed parts is not sufficient to hold the buckets down to the work, an additional downward pressure is created by drawing the chain M. The chain L is now drawn, and, in unwinding from the sheave *r*, it winds the chain *n* upon the sheaves *m*, thus drawing up the frame H until the buckets are closed, when the chain M is slackened, and the load is raised by drawing equally on the chains J L. When the load is sufficiently high to dump, the strap on the drum D is loosened, and the crane moved in the required direction by pulling more upon one of the chains J L than upon the other. The chain L is slackened, while the chain J is held taut, which permits the frame H to drop and throw the buckets open.

The advantages claimed for the invention are, that by using a crane which is not capable of vertical motion, an amount of force may be put upon the buckets which is limited only by the strength of the parts and weight of the dredge. The crane can be effectively and quickly stopped and held in any desired position, and may as easily be released. It is peculiarly adapted to work in sand, and in other places where the earth offers resistance to the excavating buckets. Patented through the Scientific American Patent Agency, October 24, 1876, by Mr. C. O. Davis of Portland, Me.



DAVIS' DREDGING MACHINE

IMPROVED CARPET STRETCHER.

We illustrate herewith a new and ingenious device of especial utility to housekeepers, as it is calculated to save much of the tedious and arduous work of putting down carpets. It is light, simple in construction, durable, and inexpensive. It is easily operated, and is warranted by the patentee not to injure the finest carpet. It consists of a simple arrangement of a lever, by a gentle motion of which a broad spur seizes the carpet and draws it forward to its place, while a smaller spur at the rear sets through the carpet to the floor, holding the carpet fast, and thus giving the operator the free use of both hands to handle hammer and tacks. The lever, E, is then folded back and down upon the push bar, A, so that it will be entirely out of the way while the carpet is being fastened down. The device is manufactured of steel and malleable iron, thus assuring its durability.

Patented June 13, 1876. For further information relative to sale of the patent address to E. W. Bullard, P. O. box 16, Worcester, Mass.

BULLARD'S CARPET STRETCHER.

Suspended Animation in Vegetables.

Captain Nares, of the late English Polar Expedition, reports the curious fact that wheat left in the arctic regions by Captain Hall in 1871 was planted in 1876, and it germinated and produced healthy plants under glass. Captain Young, of the Pandora, has also a rose tree, which has completely survived the intense polar cold. The plant to all appearances died on being subjected to the low temperature, and showed no sign of life until warm latitudes were regained, when it put forth leaves again, and became as flourishing as ever. It would seem as if, in both the above cases, the cold acted as a means of suspending animation in the vegetable, and that the latter resumed its functions at the point where they were arrested, on the cause of its insensibility being removed, without regard to its habits peculiar to the period of the year when the revival was effected. "American research has proved that the seeds of certain plants, if gathered in one climate and sown in another, will germinate earlier or later, and with more or less vigor, according as the new climate is warmer or colder than the old. And even a perceptible change of climate is not required to show these results; a difference of a few degrees only in latitude is sufficient to do so. For example, wheat from Scotland, sown in the south of England, will germinate and ripen much more quickly than wheat of exactly similar quality gathered in the south and planted in the same latitude in which it was grown.

"This fact is of the utmost importance to agriculturists. To secure early growing wheat, it is only necessary to take care that the seed is gathered in a colder climate than that in which it was sown. The process is perfectly practicable, as it might be so arranged that the wheat sown in the north should not be consumed, but preserved for seed for the next season in the south. The same thing is noticeable among other plants, and florists and horticulturists might take advantage of this circumstance to produce both earlier and stronger plants than they do now, without the appliances for forcing."

Test of Fire Hose and Couplings.

We learn that an exhaustive test has been completed at the navy yard, Washington, D. C., by a board appointed by the Secretary of the Navy, of which Captain O. C. Badger was president, to establish a standard for hose and couplings. A great variety of hose was submitted, and subjected to one of the most elaborate tests that has ever been made, and the result was the approval and acceptance of hose, for ship use, made by the Eureka Fire Hose Company, of New York, and the "Work" patent coupling, made by the Allen Fire Department Supply Company, of Providence, R. I., as standards in the future, for naval purposes.

The Human Hair.

Hall's Journal of Health has an excellent article on this generally interesting subject, in the course of which it condemns in its usual unequivocal way the numberless hair restoratives; and as a simple remedy for baldness it proposes the following wash: Pour three pints of hot water on four handfuls of the stems and leaves of the garden "box," boil it for fifteen minutes in a closed vessel, then pour it in an earthen jar, and let it stand ten hours; next strain the liquid and add three tablespoons of cologne water; wash the head with this every morning: it is cleansing and tonic, and if the root bulbs of the hair are not destroyed (which is the case where the scalp looks smooth and shiny, and then there is no remedy), the hair will begin to grow with vigor. If this wash fails after a few weeks' perseverance, the baldness may be considered incurable, because the structure of hair growth is destroyed.

But a more certain and more easily understood method of restoring the hair, when such a thing is possible, is to strive to secure a larger share of general health: keeping the scalp clean in the meanwhile, by the judicious application of a moderately stiff brush and a basin of plain old fashioned soapsuds: for, as a general rule, baldness arises from one of three things: inattention, which brought on a decline of health, dirt, or stupidity.

The girls of Brittany and the lower Pyrenees, says the *Journal*, repair to the annual hair fairs in droves, where each one waits her turn for shearing, with her rich long hair combed out and hanging down to the waist. The most valued head of hair brings five dollars and down to twenty cents, according to quantity and quality. The weight of a marketable head of hair when first taken from the head is from twelve to sixteen ounces, or from three-quarters of a pound to a pound, under twelve not being accepted, and over a pound, or sixteen ounces, especially if silken and long, bringing fabulous prices. Rare qualities have been sold at double the price of silver, weight for weight. Two hundred thousand pounds of hair are shorn from the heads of young girls every year, to supply the demands of the Paris and London markets, and from these we derive our supplies.

The hair growers seem to be rather a degraded set of people, living in mud huts, in filthy community, with garments so patched and worn as to scarcely hold together by their own weight. For once at least, fashion bows to profit, and the richest and most luxuriant head of black hair is accounted an incumbrance. Caps are worn by these people, so as to conceal the hair almost entirely; hence there is no need for combs and pins and plaits and ties, and as a consequence no hair is strained at its root, nor is it distorted by being pulled against the grain—against its natural direction.

The Manillans have the longest, blackest and most glossy hair in the world. They do not wear caps at all, but allow the hair to fall back behind in its own natural looseness. Taking these two facts together, it would seem that one condition for having a fine head of hair is that it should never be on a strain, and should hang pretty much in the direction of its growth, or if diverted at all, as from over the face, it should be in a gentle curve over and behind the ears, with a loose ribbon to keep it from spreading too much at the back of the neck, the hair hanging its length down the back.

The lessons learned from the study of fine natural growths of hair is that the hair of children should never be plaited, or braided, or twisted, or knotted. Nothing should ever be put on it except simple pure water, and even this not until the scalp is cleaned. The hair should be kept short, and should be always combed leisurely and for some considerable time, at least every morning, and neither brush or comb ought to be allowed to pass against the direction of the hair growth.

And if at times any falling off is observed, and it is desirable to arrest it sooner than mere cleanliness and improved health would do it, one of the most accessible washes is boiling water poured on tea leaves, which have already been used and allowed to stand twelve hours, then put in a bottle. It should be of moderate strength.

A WINE glass of spruce beer and three quarters of a wine glass of rum or whiskey, with brown sugar to taste, taken in a tumbler of hot water every alternate night, is said to be an excellent cure for lumbago.

PROFESSOR MAREY'S INVESTIGATIONS ON THE ACTION OF THE HEART.

It is well known that the heart of an animal, after removal from the body, continues its pulsations for a time, longer or shorter in accordance as the animal was cold or warm blooded. In this manner, its muscular action, free from all mechanical effect, may be studied; and thus the cardiac muscle may be compared with others in the human economy. A simple way of experimenting is to place the heart of a frog or turtle in a small wax cup which contains it exactly, and to rest it on a tablet of metal. Above the heart, place a thin, light, wooden lever, articulated so as to have a free vertical motion, and terminating in a fine stylus which traces a line on a rotating cylinder. This apparatus is represented in Fig. 1, and is called the heart myograph.

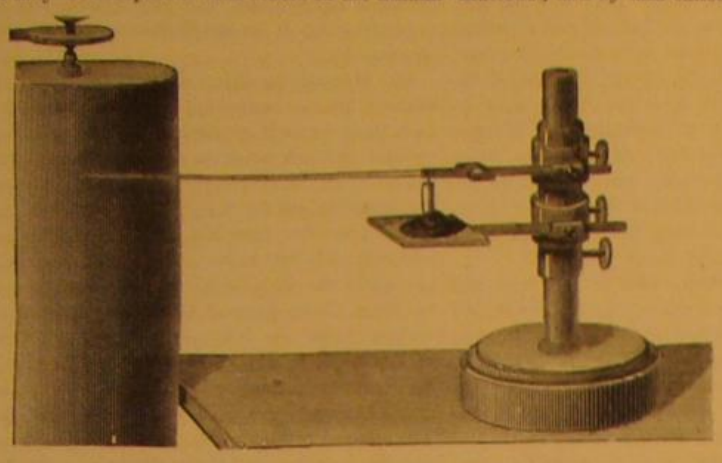


Fig. 1.—The Heart Myograph.

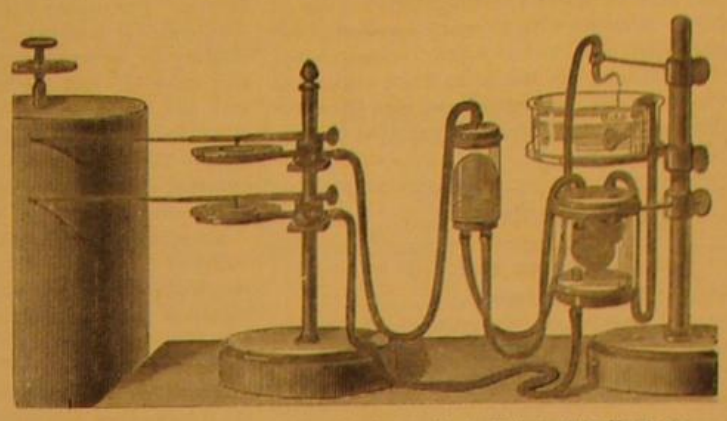


Fig. 2.—Apparatus for Studying the Changes in the Volume of the Heart, etc.

The lever, which is suitably connected with the ventricular portion, rises whenever the latter, contracting, swells as do the muscles of the arm when the forearm is vigorously bent. The point of the lever then describes an ascending line, more or less vertical according as the swelling of the muscle—that is, the systole of the ventricle—is more or less rapid. Then the lever descends as the systole ceases, when the cardiac muscle passes from the period of activity to that of repose. In this way, a curve is obtained whereby the movement of the heart muscle may be compared with that of any other muscle placed in identical or analogous conditions for exploration.

This comparison, when made, soon shows that each systole of the heart constitutes a simple act, which Professor Marey designates under the name of "shock" (*sécousse*).

The muscular shock is produced by the heart under the influence of a kind of simple discharge of the nervous apparatus which the heart contains in its sides, just as it is caused in any other muscle under the influence of excitation, similar in effect to the rupture of an electric current or the discharge of a Leyden jar. This simple action, which occurs at each beat of the heart, represents but one element of the more complex phenomenon observed in other muscles when they contract under, for example, the influence of the will. In this voluntary contraction, a series of shocks is produced which succeed each other so rapidly that practically a continuous action results. The same is observed when the nerve of a muscle is excited by rapidly interrupted currents; and it is evidently the more perfect as the interruptions of the exciting current are more frequent, or inversely. In the latter case dissociation takes place more easily, as the electric intermittences are the more separated. Now, by removing these excitations far enough apart, and conforming them, for example, to the rhythm of the heart: when a muscle is excited by electric currents, traces of independent shocks are obtained which are absolutely comparable, as Professor Marey has observed in the heart under the myograph. Consequently the systole of the heart is nothing more than a shock, an isolated element of the contraction, and not a true contraction. The complementary proofs of this theory are numerous. We cite one which is decisive: When the foot of a frog is removed and the nerve excited, the muscles contract. They furnish a simple shock when the excitation is single, and a series of shocks, more or less mingled (such as is termed tetanus) when the excitations are multiple. Now if, to the muscles in action, the nerve of a second foot, prepared in the same way, be applied, the remarkable phenomenon discovered by Matteuci, and by him called induced contraction, is observable. At each shock of the muscle excited, another shock is caused in the muscles of the other foot; at each tetanus of the first another is produced in the second; so that shock induces shock, and tetanus tetanus, and these truths may be considered to be laws.

It is now clear that, by substituting for the first foot a heart in action, the second foot will present either a shock or a tetanic contraction, according as the inducing heart gives either a shock or a tetanus.

Experiment shows that the induced foot gives a shock at each systole; and by virtue of the preceding law, it must follow that each systole is none other than a shock, and not a contraction. If we examine the effect produced by these systoles or shocks, we shall find that each of them drives from the heart and into the arteries the blood brought by the veins in the preceding diastole. It is important to discover whether work of the heart, that is to say, the quantity of blood thrown into the arterial system, increases proportionately to the number of systoles. For this investigation Professor Marey uses the heart of a turtle. He adapts one tube to the commencement of the arterial trunk, another to the opening of a vein, and shuts up all the other orifices, so that the organ is supplied with tubes leading to and away from it. Then he suspends the heart in a corked jar. The vein tube serves as a siphon to lead defibrinated beef blood into the heart, which thus maintains its motion, while the artery tube carries away the blood driven out. The arrangement of the apparatus is shown in Fig. 2. By dividing the volume of liquid carried through by the number of systoles which register themselves while the test tube is being filled, the average volume of each wave generated is obtained; and thus it is found that the quantity of blood pumped does not augment when the systoles increase in number. The same apparatus answers for determining the amount of mechanical work performed by the heart under various conditions. By connecting the interior of the jar in which the heart is placed with a suitable inscribing lever, Professor Marey is also enabled to take account of the changes in volume of the organ, which, as it swells or contracts, produces a compression or expansion of the air in its receptacle. By other apparatus, which need not here be described, the author obtains the curves of changes of arterial pressure with relation to the changes of the state of the heart. These changes of pressure constitute the pulse.

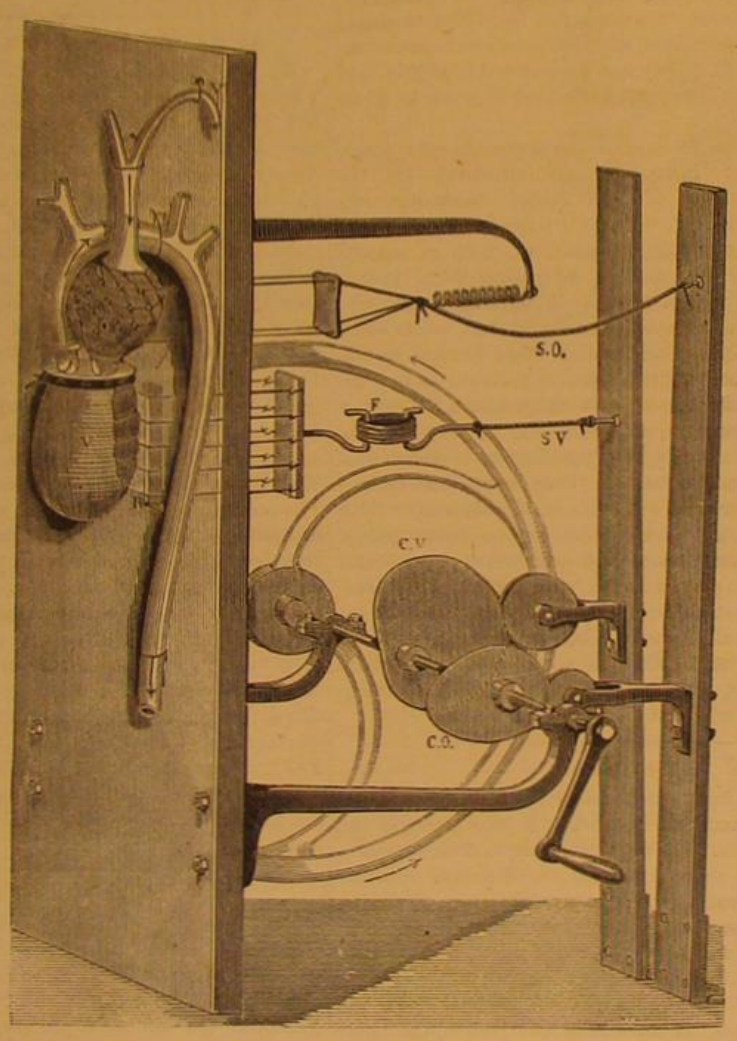


Fig. 3.—Schematic Apparatus for Demonstrating the Circulation of the Blood.

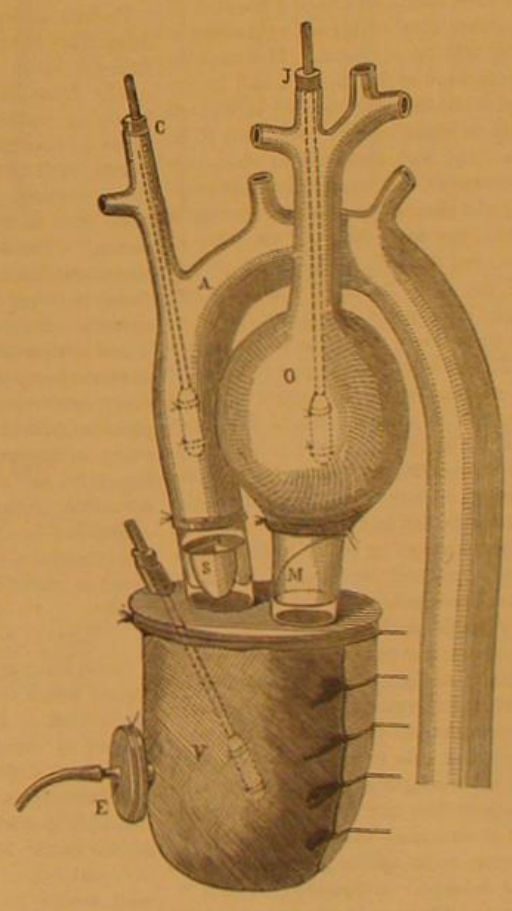


Fig. 5.—Arrangement of the Schematic Apparatus for obtaining Cardiographic Tracings.

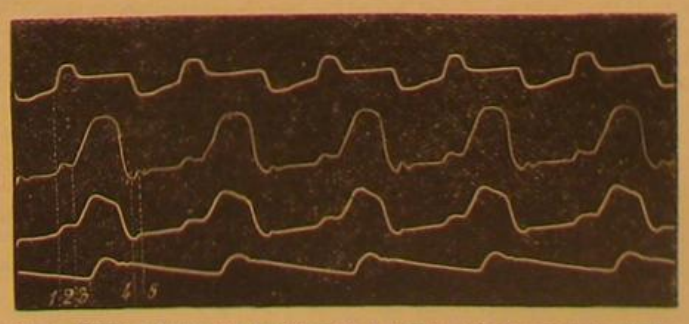


Fig. 4.—Tracings obtained by the Schematic Apparatus. O, pressure in the auricle; V, pressure in the ventricle; A, pressure in the aorta; P, beating of the heart.

Having determined a comparison of the heart with other muscles, and examined its mechanical effects, Professor Marey next investigates how the phenomena noted manifest themselves by the cardiac pulsation. To this end he constructs what he calls the schematic apparatus of the circulation; it is represented in Fig. 3. The heart and artificial vessels are disposed on an upright plate as shown. O is the auricle receiving the liquid from the tube above, and V the ventricle, separated from the auricle by a valve, the latter opening when the ventricle dilates, and shutting when the same contracts, to prevent reflux. The ventricle opens into a large tube which represents the aorta. A number of small sigmoid valves are located at the junction, and prevent reflux from the aorta. To the elastic bag which represents the ventricle are attached a number of cords; these connect with a small plate. To the latter is secured a hook which, in turn, is connected to another hook, S V, by a number of rubber bands. The force of traction of the cords augments with the number of bands, and the elasticity of the latter imitate the elasticity of the muscular tissue.

The auricle, O, is surrounded by a silk net, to which four cords are attached, communicating with a small rectangular piece of wood, and then unite in one, being kept taut by a horizontal spiral spring. The vertical levers on the right connect with the cords, S V and S O. Now, these levers are oscillated by the cam mechanism shown, and they therefore produce movements of the auricle and ventricle similar to those of the natural heart. This is done by proportioning the cams according to the data previously obtained regarding

the muscular action of the heart from the myograph. By applying, to the apparatus just described, proper indicating devices, it was found that it produced a tracing identical with that of the human heart.

In Fig. 4, we give the tracings obtained by the pressure of the ventricle, V, the auricle, O, the aorta, A, and the pulsation, P, of the artificial heart.

In Fig. 5, we represent the arrangement of the schematic apparatus used for obtaining the tracings.

The results of Professor Marey's investigations are that we are now enabled to interpret with accuracy a host of details presented by the tracings of the human heart. He has imitated, on the artificial circulation, the lesions to which organic affections of the heart are due, and reproduced both the abnormal sounds of the heart beat and the principal types of traces furnished by actual patients.

Communications.

Extinguishing Fire.

To the Editor of the Scientific American:

In your issue of December 30, you recommend discharging water through perforated pipes in the form of spray for extinguishing fire. If water in the form of spray be a good extinguisher, as it undoubtedly is, as numbers of proofs exist in our factories and picker rooms, why do not our fire departments use it in that form in all cases where they can? Leaving the firemen to answer that question, I will proceed to adduce a few facts in support of the theory that a spray is the true method of applying water wherever the burning object can be reached by it.

Water operates, in extinguishing fire, by absorbing the heat and reducing the temperature of the burning substance so low that fire cannot exist; and as the amount of heat that water will absorb depends on the amount of surface of water in contact with the fire, the more surface we can cover with a given amount of water, the better. As flame is the principal propagator of fire, to arrest it is the first thing to do; and as it is more than three thousand times lighter than water, and in most cases a mere shell or curtain, a fraction of an inch thick, the extreme absurdity of trying to subdue it with solid streams of water will be apparent. If a man in the character of a sportsman were to fire an inch ball into a flock of humming birds, with the intention of killing as many as possible, he would be regarded as a fool; but if he were to melt the inch ball up, and cast it into shot one-thirtieth of an inch in diameter, he would have twenty-seven thousand such shot, and their aggregate surface would be thirty times greater than the inch ball. If he were to load his gun with this shot, and fire into the flock, at proper distance, the slaughter of the little beauties would be terrible; and if a fireman would divide up his stream into spray, so that he could cover thirty times more flame, he might expect a corresponding result. The globules of water would be so small that a large portion of them would be heated through and converted into steam; and as steam contains five times more heat (latent) than boiling water, we gain a great advantage in this. Steam is also an excellent extinguisher, and this is an additional advantage. As a large portion of the water is converted into steam when applied in the form of spray, a small amount serves, and the damage by water is very small.

If the two first engines that reached the burning Brooklyn theater could throw five hundred gallons of water each per minute, and divide every cubic inch of water into sixty thousand drops, in two minutes the smoke and heat would have been sufficiently subdued to have enabled outsiders to enter and rescue the unfortunate inmates. I am well aware that this statement may seem extremely absurd to firemen, who have never experimented in this line; but before they condemn it, let them take out a couple of engines and try the experiment. The barbarous system now in use, that so frequently desolates portions of our cities, fills our houses with mourning and our cemeteries with new-made graves, must give way to the dictates of Science. Humanity demands it, and I call on the scientists and chemists throughout the land to aid in introducing this needed reform.

Little Falls, N. Y. CHARLES OYSTON.

Sir Titus Salt and Saltaire.

The example of one such man as Sir Titus Salt, the great manufacturer and inventor who recently died in England, is worth more, as a means of pointing out wherein a just and equitable solution of the labor problem lies, than all the results of the strikes and lockouts that ever agitated the industrial world. He has shown us how the inexorable laws of demand and supply may be covered with a broad mantle of charity and philanthropy; how a great and complex business may be conducted to the mutual benefit of employer and employed without involving other than those simple relations, free from entangling co-operative or profit-sharing alliances; and above all, he has unmistakably proved that the employer in no wise serves his own interests better than in promoting the welfare of those dependent upon him. Many men have died and left monuments of liberality wherein their wealth has nobly been devoted to the public good; but as a rule, such dispositions have been the means chosen of investing riches already acquired in pursuits not necessarily connected with the object of the outlay. Few men have, like Sir Titus Salt, combined their business with their philanthropic enterprises, and thus while benefiting themselves have doubly benefited society by their wise munificence.

Titus Salt was the son of a Yorkshire wool stapler. In early life he became a farmer, but subsequently entered into partnership with his father, and as the business extended started alone as a wool spinner. At this time immense quantities of alpaca wool were stored in Liverpool, finding no purchasers because no one knew how to utilize it. It occurred to Salt that it would spin out good yarn. He privately tested it, produced an excellent fabric and at once bought up all of the material that he could find. This was the first manufacture of alpaca, and likewise the basis of Salt's colossal fortune. For twenty years he labored on as a wool spinner, always thrifty and industrious, until, having completed his fiftieth year, he concluded to retire upon the competency he had amassed. But the necessity of providing for his five sons and the desire to carry out the philanthropic plans which he had long meditated induced him to change his mind. The locality where he was located was already overcrowded, and hence he determined upon the gigantic scheme of founding a new town—a working man's Arcadia.

Accordingly he purchased a large plot in the beautiful valley of the Aire, contiguous to a railway and a canal, and thus well provided with shipment facilities. Here he erected buildings covering six and a half acres, including roomy factories and abundant dwellings for the work people. On the opening day of the village of Saltaire, says Smiles, three thousand five hundred people dined in the combing shed; and the founder then said "that nothing is to be spared to render the dwellings of the operatives a pattern to the country: and if my life is spared by Divine Providence, I hope to see satisfaction, contentment, and happiness around me."

This was no empty wish, as circumstances soon proved. A church was added, then a literary and philosophical institution. Large schools for children of all ages were erected; cricket grounds, croquet lawns, and abundant pleasure grounds were provided; and a large dining hall, baths and wash houses, a dispensary, and almshouses for pensioners were built. For the accommodation of the three thousand workmen, seven hundred and fifty-six houses were constructed of stone and brick. Each has gas and water supply and separate enclosures. The rents vary from 58 cents to $1.80 per week.

Besides taking part in musical performances—for which even the necessary instructors are provided by the firm—a large number of the skilled workmen (we quote from Mr. Smiles' "Thrift") "devote their leisure hours to various scientific amusements, such as natural history, taxidermy, the making of philosophical instruments, such as air pumps, models of working machinery, steam engines, and articles of domestic comfort, while some have even manufactured organs and other musical instruments." There is no drinking house in Saltaire; so that the vices and diseases associated with drunkenness, as well as those peculiar to poverty, are unknown. Every sanitary measure—drainage, cleansing, and ventilation—is attended to. The work people are also thrifty. They invest their savings in banks provided for them and in lucrative ventures. "With every convenience and necessity as well as every proper pleasure provided for them; with comfortable homes and every inducement to stay at home; with fishing clubs, boating clubs, and cricket clubs; with school rooms, literary institutions, lecture hall, museum, class rooms, and churches established in their midst, there is no wonder that Saltaire has obtained a name, and that Sir Titus Salt will be remembered as one of the wisest of popular benefactors."

Color Ghosts.

Some years ago a book was published in this country—we cannot recall its exact title—the purpose of which was the production of ghosts. On its pages were various representations of spectral shapes, printed in extremely brilliant colors on a white ground. Directions were given to fix the eyes intently on these for some moments, and then turn them suddenly to a white wall or screen, when the "ghost" would appear in the form depicted in the book, but of an entirely different color. If the picture was red, the specter on the wall would be green; if the former was yellow, the latter would be blue; and so on.

A similar illusion may be produced by any of our readers in a much simpler way. Cut a small disk out of white paper and lay it on a black surface. Look at it steadily for a quarter of a minute or so, and then direct the eye to a white, or, better, to a gray surface, as a sheet of gray paper; and you will see a dark image of the shape and size of the white disk. If a colored disk is used, the after-image, as it is called, will be colored, but of the hue complementary to that of the disk; that is, if the one is green the other will be purple, if the one is yellow or orange the other will be of a darker or lighter blue, etc. Complementary colors, as most of our readers probably know, are those which, if mixed, will produce white.

If the surface is of the same color as the disk, the after-image will be faint and whitish; if it is of the color complementary to that of the disk, the image will appear of the same color intensified. Thus, if the disk is bluish green, and the gaze is turned from it to a red ground, we shall see a "ghost" of a deeper and more brilliant red. If we look upon a colored surface of any other than the complementary hue, the color of the after-image will blend with that of the surface. For instance, if the object is green and the surface blue, the image will be violet.

These phenomena admit of a very simple explanation. When the retina of the eye has been exposed to a continued impression of one color, it is wearied and becomes less sensitive to that color. If now it is exposed to the impression of white light, it will respond more readily to the other colors that make up white, that is, to those which produce the complementary hue. Quite likely some of our readers who have occasion to use red ink have observed that if, after writing with it for some minutes, they change directly to black ink, the latter will at first appear of a distinct green color. Some eyes are more sensitive than others to these delusive impressions, but any person can see the complementary color if he has looked at the other long enough to tire the eye.

Dr. Bezold, in his "Theory of Colors," among many curious things connected with this subject, illustrates the fact that, while if a black object be seen against a colored ground (as black print on red paper), the black, when viewed intently, will show a slight tinge of the complementary color, the effect is greatly heightened by laying thin white tissue paper over the surface; showing that "an admixture of white light is favorable to the production of contrast." He also notes the singular fact that the various colors which may be given to the ground differ greatly in their capability of calling forth the contrasting colors. "Green, blue, and violet—in fact, all the so-called cold colors—will originate very vivid contrasting colors, while this is the case to a much lower degree with red, yellow, and yellowish green." The colored plates in Dr. Bezold's book illustrate this very vividly, but the reader can produce a similar effect by putting a disk or figure cut out of black paper or cloth on a bright colored surface—red, yellow, green, blue, or purple—and spreading the white tissue paper over the whole. The variety of hues which the black assumes is very striking, and tends decidedly to shake one's faith in the popular proverb that "seeing is believing." We know that the black is black, but we cannot see it as black, however earnestly we may endeavor to reason ourselves out of the illusion.—*Boston Journal of Chemistry.*

An English Editor on American Railways.

Mr. Walter, of the London *Times*, has been interviewed by a New York paper. The report says: "Mr. Walter did not feel himself competent to judge of the comfort of ordinary American railway travelling. He had ridden so luxuriously in the special Pullman car which had been placed at his disposal that he was unable to form an idea of the way in which other people travelled. 'The palace car,' he exclaimed enthusiastically, 'is fit for the Queen to ride in! In fact, it is much handsomer than the one she uses.' The liberality with which railroad directors carried him to and fro over the land was a cause of great astonishment to Mr. Walter. It was a courtesy entirely unknown in England. The Queen herself was obliged to pay immense sums every year for railway conveyance, and no railroad company in all England would think of offering a coach for the free use of any gentleman, public or private. The American car, in Mr. Walter's estimation, was far superior to the English carriage. The possibility of being shut in with thieves or madmen (it had fallen to his own lot to be shut in with a madman); the close, cramped quarters which, in their very nature, stifled all the comfort out of the unhappy traveller; the partitioning a man from the sight and society of his fellow-creatures; and, above all, the shortness of the carriages, which caused them to sway and jerk about so violently that conversation became a torture and reading an impossibility—all these things combine to render a journey in an English railway carriage a matter of something worse than unpleasantness. The 'permanent way,' or road bed, of the English railroad was much more substantial than that of the American; but the English carriages could not be compared with the American cars."

Gold Mining in China.

Mr. Adkins, the British Consul at Newchwang, gives an account of the valley of Chia T'i Kou, some 30 miles long, in which there are rich diggings about five or six days' journey east by south from Kirin and Newchwang. The veins of quartz in the hill sides are very numerous. The quartz, when dug, is roasted, then crushed, and then washed on a cradle or "slip;" and so rude and imperfect is the operation that it usually pays to wash the quartz two or three times. The quantity of gold found in a ton of quartz varies; but a Chinese miner, who showed the Consul a slab of quartz brought from these diggings, assured him that less than $230 worth of gold per ton is considered a poor yield. The miners in this locality are said to be a lawless set, and to have a very peculiar social organization. A man named Han pays an annual tribute of 20,000 thaels to the Chinese Government and governs absolutely within the limits of his concession, and no official writ runs there without his permission. He has an armed following, and a number of miners and workmen in his pay. Those who are not in his employ pay a royalty for permission to mine. The community under his rule is said to number about a thousand, and is principally Chinese, but a number of Coreans have recently found their way into the territory and are working with considerable success.

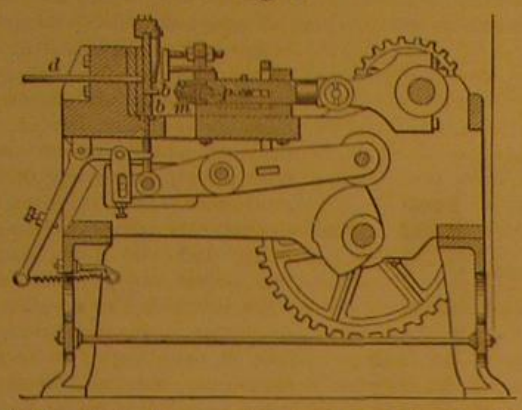
A Magazine Gun Invented in 1775.

A writer in *La Nature* states that in 1775, one Charrière, a gunmaker of Paris, devised a musket capable of being discharged "ten times in a minute." The description is preserved in the archives of the French Navy, whence it appears that after trials the gun was rejected as dangerous. The cartridges were all placed in the single bore and separated by movable partitions so that but one could explode at a time.

RIVETS AND RIVETING.

Rivets are made, usually, by special machinery, such as we shall describe further on, from the most tough and ductile iron, having an ultimate tenacity of at least 60,000 lbs. per square inch. In practice, their ordinary dimensions are estimated by the following rules: Diameter of a rivet for plates less than half an inch thick, about double the thickness of the plate; for plates of half an inch thick and upwards, about once and a half the thickness of the plate. The length of a rivet before clinching, measuring from the head, should equal the sum of the thicknesses of the plates to be connected added to 2½ times the diameter of the rivet.

Fig. 1.

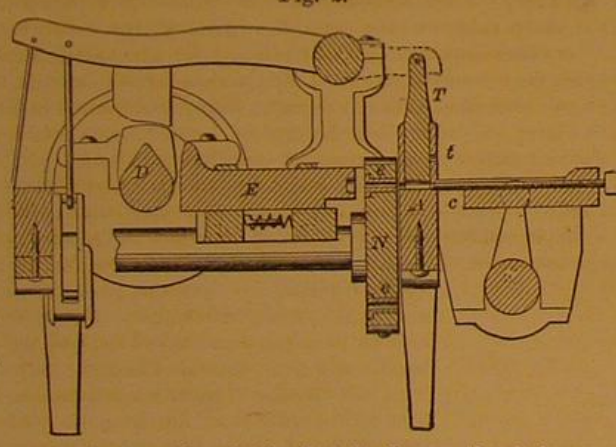


The longitudinal compression to which a rivet is subjected during the operation of clinching, whether by hand or machinery, tends to make it fit the hole tightly, and thus to produce uniform distribution of the stress; but as such uniformity cannot be expected always to be realized, it is usual to assume, in practice, that there is a deviation from uniformity of shearing stress sufficient to neutralize the difference of the toughness of the metal in the rivets and that in the plates which they connect; and therefore, the distance apart of the rivets used to connect two pieces of metal plate together is regulated by the rule that the joint sectional area of the rivets shall be equal to the sectional area of plate left after punching the rivet holes.

STRENGTH OF RIVETED JOINTS.

The tenacity of good wrought iron boiler plates is about 50,000 lbs. per square inch. Professor Rankine states that that of a double riveted joint per square inch of the iron left between the rivet holes (if drilled, and not punched) is the same; that of a single riveted joint somewhat less, as the

Fig. 2.



tension is not uniformly distributed. In practice, it is convenient to state the tenacity of riveted joints in lbs. per square inch of the entire plate, and it is so stated in the following formula: The joints of plate iron boilers are single riveted; but from the manner in which the plates break joint, the ultimate tenacity of such boilers is considered to approach more nearly to that of a double riveted joint than to that of a single riveted joint.

The forces required to burst asunder iron plates, riveted and other, are as follows:

Wrought iron plate joints, double riveted, the diameter of each hole being $\frac{6}{10}$ of the pitch or distance from center to

Fig. 4.

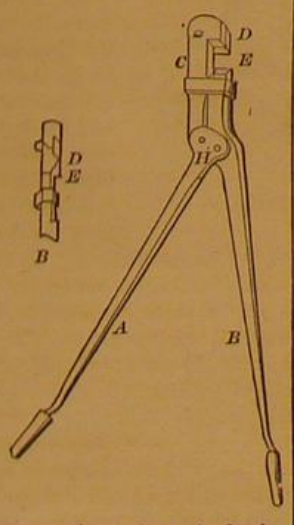
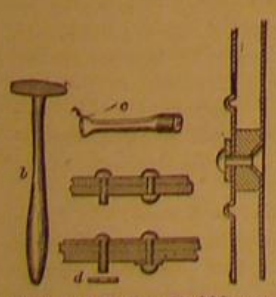


Fig. 3.



center of holes, 35,000; wrought iron plate joints, single riveted, 28,000; wrought iron boiler shells, with single riveted joints properly crossed, 34,000; wrought iron retort, with welded joint, 30,750; cast iron boilers, cylinders, and pipes (average), 16,500; malleable cast iron cylinders, 48,000: all in lbs. per square inch.

THE MANUFACTURE OF RIVETS

is accomplished by special machines, such as are exhibited in Figs. 1 and 2 (which, with the other engravings here given, we select from Knight's *Mechanical Dictionary*).* In the apparatus shown in Fig. 1, the rod, *d*, is fed through a guide plate into movable dies, *b b*, the length of the blank being regulated by a stop. The movable dies have reciprocating motion, and they cut off the rod fed into the machine, carry the blank in front of the heading die, and finally serve as the die in which the head of the bolt is formed. As they descend, they cut off the length of rod against the face of the guide plate, and carry it in front of a hollow die, *m*, that has a horizontal motion, the interior of the die corresponding to the intended form of the shank of the rivet. The stub end of the rivet is formed against the plunger, B, which also serves to eject it when finished.

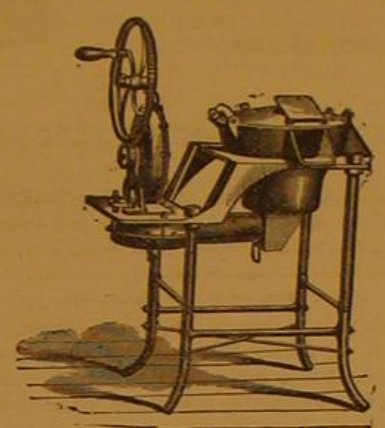
In Fig. 2, the rod is fed into the feed plate, A, through an aperture, *t*. A blank is cut off by the downward motion of the plunger, T, which holds and guides it while being forced into one of the openings, *e*, in the die wheel, N, by the reciprocating rod, *c*, where it is subjected to the action of the header, E, operated by the same compound cam, D, that actuates the lever carrying the plunger, T.

RIVETING TOOLS.

Riveted joints are shown in Fig. 3.

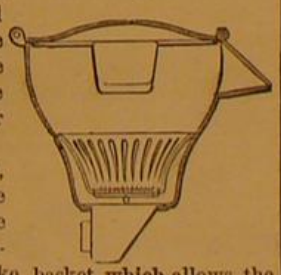
In riveting the plates composing the skin of iron ships, it is necessary that the outer end of the rivet should be flush with the plate. A countersink is, accordingly, formed in this side. The operation of riveting is performed by three

Fig. 5.



men and a boy. The latter brings it from the furnace with a pair of tongs and passes it to the holder up, who receives it in a short pair of tongs and inserts it into the rivet hole from the inside. He then presses against it with a hammer or with a tool called a dolly, *c*, Fig. 3, having its end indented to receive the head of the rivet, while the two men, on the outside, hammer the other end down so as to fill the countersink

Fig. 6.



For cutting off flush the stub ends of rivets or bolts, the tool shown in Fig. 4 is used. The handle, A H, is pivoted to the handle, B, and piece, C, so that the jaws, D E, are brought together as the handles are compressed.

The portable riveting forge, Fig. 5, has a pot, Fig. 6, rotatable by gearing and having three doors, so as to employ three operatives. It contains a grate-like basket, which allows the blast from the tuyere to pass through. At the bottom of the basket is a grate and a comb raker, operated from the outside. Beneath the grate is the tuyere box. A fan is provided for creating a blast.

The first application of steam to

RIVETING MACHINERY

is due to Sir Willam Fairbairn. He states that it was contrived when he had a large number of orders on hand for his double flued boilers, and the men struck. "In this dilemma I was driven to the necessity of supplying the place of the riveters by a passive and unerring workman, which, from that day to this, has never complained, and did as much work in one day as was formerly accomplished by twelve of our best riveters and assistants in the same time. I desired the foreman to reverse the action of the punching machine, and with proper dies to rivet the plates instead of punching them. In six weeks from that date we had the riveting machines at work, making tighter joints and executing the work with greater perfection than could possibly be done by the hammer."

The machine, illustrated in Fig. 6, is set in motion by a band on the pulley, *a*; on the axis of the latter is a pinion gearing into a large spur wheel, *b*, on whose axis is a cam, *c* operating the riveting lever, *d*, the face of the cam being steeled, and the end of the lever having a roller to diminish the friction. The riveting lever has a fulcrum in the frame, and acts by its face upon the riveting rod, *e*, when punching, and by a link connection with the tool when retracting, the tool sliding in a socket fixed in the side frames.

The anvil post, *f*, rises from the foundation, and has a riveting block of the shape of a frustum of a cone. The sections of boiler are lowered from above, by means of tackle, *g*, the point at which the rivet is to be placed being adjusted between the punch and the anvil block. The rivet is placed in the punched holes, the band slipped on to the fast pulley, and the upward motion of the cam raises the lever and swages the rivet.

Fig. 7.

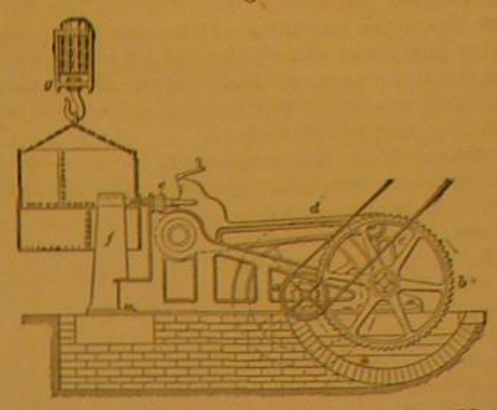
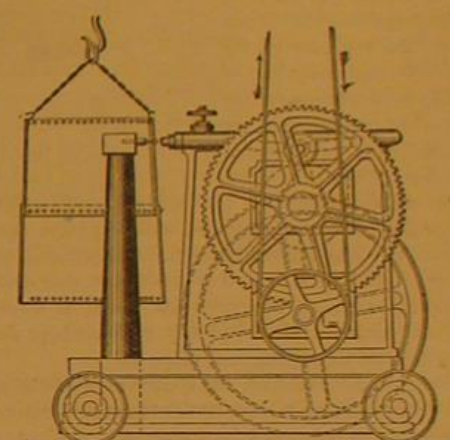


Fig. 8 is a portable machine on the same plan. Not being intended for such heavy work, its frame is less massive than that of the foregoing, and the construction and arrangement of its details are slightly different.

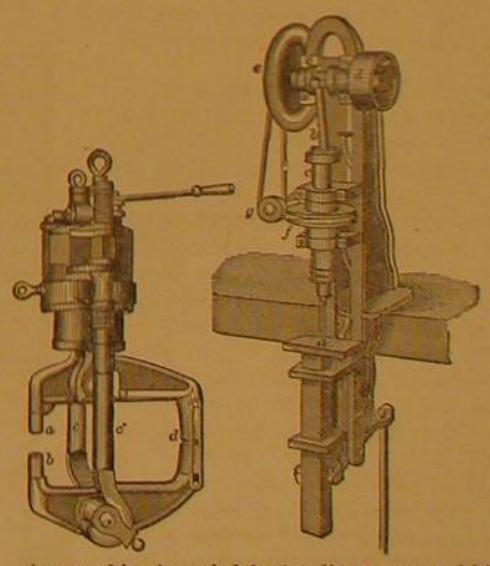
In Tweddel's machine (Fig. 9), the distance between the punch, *a*, and the anvil, *b*, is regulated, according to the thickness of the plate, etc., by screws, *c c'*, and links, *d*. The whole apparatus is mounted on a truck, and the pressure applied by a hydraulic accumulator operated by a portable engine.

Fig. 8.



In Adt's machine (Fig. 10), the work is supported on the table, *a*; the punch is reciprocated by a pitman, *b*, having a universal joint connection with the spindle, *c*, and actuated by an eccentric on the pulley shaft, *d*; the punch spindle is at the same time revolved by a belt on the shaft of the fly wheel, *e*, imparting motion to the pulley, *f*, through two small change pulleys, one of which is seen at *g*.

Fig. 9. Fig. 10.



In another machine intended for heading caster and hinge pintles, etc., the spring hammers strike the opposite ends of the pintles at once. The working parts are adjustable.

Fig. 11.

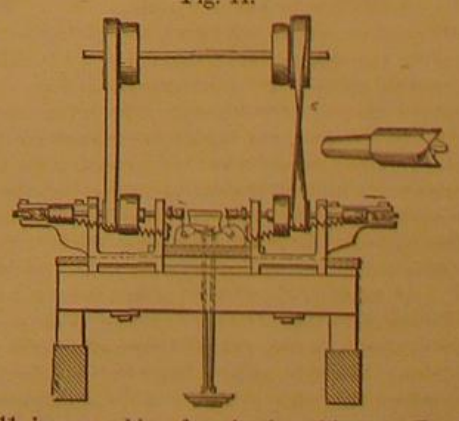


Fig. 11 is a machine for riveting hinges. Peculiarly shaped revolving milling tools spread the pintle when forced against it, and form the head.

*Published by Hurd & Houghton, New York city.

IMPROVED SELF-OILING AXLE BOX.

We illustrate herewith a new self-oiling axle box for railroad cars, which is claimed to prevent overflow of the oil, to exclude all dust and dirt, to insure thorough lubrication, and to necessitate the use of a remarkably small amount of lubricant in proportion to the distance run. The inventor submits a report of a competitive trial of the device on the Bombay, Baroda, and Central India Railway, from which it appears that a box was filled with 3 pints of oil and not opened or in any way disturbed for a period of four months. During this time, the car ran 35,498 miles. On opening the box, about 2½ pints of oil were found to still remain and to be quite free from grit of any kind.

The construction of the invention will be understood from the two sectional views given herewith. The new features consist, first, in the improved iron keep, A, which is fitted to the axle box so as to secure the brass bearing, B, in its proper place, and at the same time to admit of the easy removal of the latter when desired. It will be observed from Fig. 2 that the brass bearing forms a kind of dovetail joint with the keep. This arrangement is calculated to save much of the superfluous metal now used only for holding the brasses, and which cannot in any way be brought into contact as surface bearing.

Another improvement lies in the stuffing boxes. These are found at C, Fig. 2, one on each side of the brass bearing. They are cast in the top part of the axle box. No cushion plate or other appliance is necessary for the purpose of supporting or keeping the pads in position. Each receives a pad of felt extending the whole length of the journal, and which, by capillary action, becomes supplied with oil from the surface of the axle. The lubricating box, D, is situated in the oil reservoir of the axle box, and is partitioned therefrom by plates of metal, in which apertures are made, as shown in Fig. 1. This box is also filled with felt, which is kept pressed against the axle by the spring and plate, E.

In order to prevent overflow, the contrivance of the wooden washer, in connection with a center tongue of iron cast in the groove in which it is fitted, as shown at F, Fig. 1, is used. This center tongue projects higher than the outer flanges, so that it, on one hand, prevents rain drift from entering the boxes, and the consequent overflow of oil; and on the other, it prevents escape of oil from within. It also serves to exclude dust and grit. The two parts of the wooden washer are caused to fit closely on the axle by means of a small steel camber spring (not shown), fixed to the outer edge of each half of the washer, which forces the parts together. There is a slight clearance at the lap joint for wear of the washer; as the latter becomes gradually worn by the axle, this clearance is closed up by the springs.

For further particulars, address Mr. J. B. Tomlinson, care of G. L. Kelty, 80 and 82 White street, New York city, or Wm. Knifton, Black Hawk, Gilpin county, Col.

Fig. 1

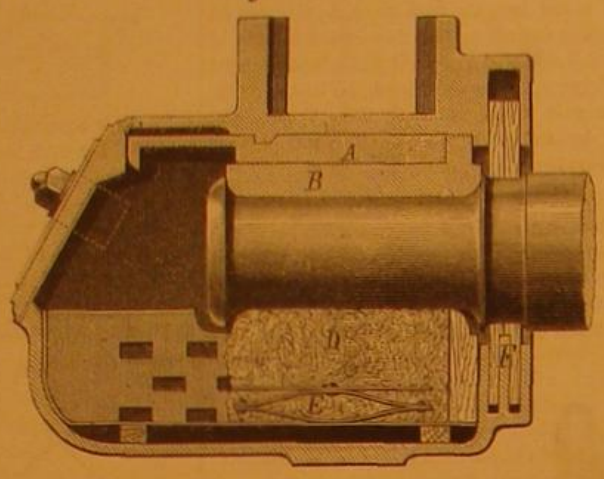
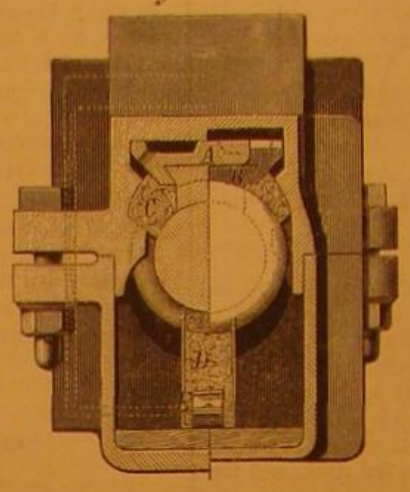


Fig. 2



TOMLINSON'S SELF-OILING AXLE BOX.

USEFUL KIT OF SCREW-CUTTING TOOLS.

We illustrate herewith a set of screw-cutting implements, neatly encased, which is designed more particularly for carriage makers or other mechanics who frequently have crooked work to cut. There are five taps, a similar number of dies and wrenches, a die plate, and also a holder whereby the dies may be held in a bit stock.

The dies and taps, we have illustrated some time ago under the name of the "Lightning Screw Plate;" but latterly the construction of the dies has been materially improved by the addition of a guide to each, which insures the straight presentation to the teeth of the object to be threaded. Any mechanic who has attempted to fit together untrue screws and nuts is conversant with the difficulties encountered, and hence will appreciate the advantages of the above simple improvement. The guide serves also another useful purpose, as a holder for the two parts of the die, which formerly were inclosed in a collet. The latter is now done away with, and the die is fastened to the guide by a square-headed screw (which serves as a hinge) and a wedge-headed screw, by moving the latter of which, the parts may be adjusted so as to compensate for wear. In this way, the dies keep the exact size of the tap, and the nuts and bolts always correspond without trying or fitting. The threads are perfectly finished at a single cut. A worn-out die is readily removed from the guide, and the latter lasts indefinitely.

In the side of the guide, as shown in the illustration, there are a couple of notches. These receive lugs made on the inside of the screw plate, and are thereby prevented from turning. The dies are firmly held in the plate by the clamp screw shown.

In a suitable receptacle on the right of the tool case will be seen a device for holding the die, which may be inserted in the ordinary bit stock. The die is *simply* dropped into the open end and clamped by a single screw, as in the plate already described. The wrenches, which are shown in the front part of the box, are disks of metal having recesses to fit nuts of different sizes, either square or hexagonal. Being in shape similar to the dies, they are readily inserted and secured in the holder above noted, so that the power can be applied by the brace. The tap is of course secured in a vise.

The whole kit is one which will meet with favor from workmen generally. The tools, thus neatly put up, are manufactured by the Wiley & Russell Manufacturing Company, Greenfield, Mass., and may be obtained from Messrs. Frasse & Co., 62 Chatham street, New York city.

THE WILEY & RUSSELL COMPANY'S SCREW-CUTTING TOOLS.

Corrosion of Sheet Zinc, etc.

Herr Frischen, Inspector of Telegraphs, states, in a communication to the Berlin Polytechnic Society, that the destruction of sheet zinc may often be referred to iron nails employed with it, and also to particles of charcoal falling on to it in the neighborhood of chimneys, owing to the galvanic action developed. For the same reason copper tubes soldered with zinc require renewal of the joints every few years, and gas and water pipes become leaky on account of the lead employed in joining them. Copper strips used as lightning conductors, fastened with iron nails, corrode rapidly; and the ends of lightning rods embedded in charcoal, as generally recommended, are rapidly destroyed in the same way. In the combination of cast and wrought iron in a system of pipes, a decided current of electricity can be detected, indicating that more attention should be paid to this fact in laying them. It has also been noticed that zinc corrodes readily in contact with lime.

Tomatoes Preserved in Water.

Choose fine ripe tomatoes free from spots or bruises, says M. Bazin in *Les Mondes*, wipe them carefully with flannel and place them in a large-mouthed vase, until the vessel is full to within an inch and a half of the top. Pour on clear filtered water until the tomatoes are just covered, and then paste a sheet of paper over the mouth of the jar. It is absolutely necessary that the tomatoes be free from any spot or bruise whatever, and care must be taken to remove from the water any which in course of time show signs of injury.

What Becomes of Old Greenbacks?

About two years ago it was customary to destroy the immense amount of mutilated and dirty paper currency, which was redeemed in new bills by the Treasury Department in Washington, by burning it. This plan is now superseded by a much more effective and economical operation. A new subdepartment has been added to the Treasury called the Macerating Department, and here the literally filthy lucre is made into pulp ready to be transformed into clean fresh paper. The following interesting description of the operation we clip from the *Washington Chronicle*.

In the first place the fractional currency is subjected to a most rigid scrutiny, and counted for the purpose of detecting counterfeits, and *then it is turned over* to men who, with a machine, cancel each note so effectually that by no possibility could it ever be used again; another count is then gone through with for the purpose of checking the operators of the machine, and preventing them from appropriating any of the condemned money. After the canceling the money is next cut in half, and once more the separate halves are counted, and when ascertained to be all right are placed in boxes for the purpose of removing them to the macerating building before alluded to. These boxes are securely locked while in transit from the Treasury to the macerating establishment, where they are opened in the presence of three representatives of the Treasury, one acting in behalf of the Secretary, another for the Treasurer, and the last for the Register, and each batch is usually accompanied by a quantity of bonds. From the boxes the bonds, which are cut and canceled thoroughly, and the fractional currency are emptied into the macerating cylinder, which is also locked with three separate locks, the keys of which are held respectively by the officers named above. The process of macerating is very simple. The macerating cylinder is revolved by a sixty horse power engine, and at the same time jets of steam are injected into it, which speedily soften the mass of paper. The moistened paper by its own gravity keeps dropping, and is reduced to a pulp by the sharp ridges which form the inside of the cylinder. After being subjected to this treatment for about thirty-six hours the cylinder is unlocked by the three officials and the pulp is then allowed to fall on an elevator, which conveys it to a large tub, where it is thoroughly cleansed, and all fatty matter removed by the agency of quicklime and soda.

The washing of the pulp completes the process, and it is finally dumped in a heap to lie until purchased. Recently about $4,500,000 worth of fractional currency was placed in the macerater. This was an unusually large batch, the average "burnings," as the macerations are called, being much less. There is now an immense quantity of the pulp on hand, probably several hundred tons. This will be sold to paper manufacturers. The rate usually paid for the pulp is in the vicinity of $5 per ton, and the principal purchaser manufactures from it a very nice article of paper. An approximate estimate of the quantity of pulp annually made out of the fractional currency or bonds at this establishment is 650 tons. The proceeds resulting from the sale of this may be counted as a net gain over the old method, as the burning of the money or bonds required the expenditure of as much labor as does the present macerating system, and consumed a great deal more coal.

The National Bank notes are converted into pulp by the centrifugal process inside the Treasury building, the method adopted being almost in every respect similar to that pursued with the fractional currency and bonds, as described above. The improvement on the burning plan is too obvious to need extended mention. Extraordinary precautions were required to keep the destroyed money from flying out of the furnace chimney, and the odor of the burned money was an intolerable nuisance, and was very injurious to the health of those residing in the neighborhood of the place where it was carried on. This last reason would have been a sufficient one for changing the method, if the additional one of making an absolute saving to the Government did not suggest itself.

LEATHER belts when new are not quite of the heaviness of water—say about 60 lbs. per cubic foot; but after having been for some time in use, they become thinner and denser by compression, and are then about as heavy as water. The weight of single belting may be approximately estimated at 0·068 lbs. per foot length and inch breadth.—*Rankine.*

THE BASILICA OF ST. PETER'S, ROME.

No one ever viewed the interior of the great Cathedral of St. Peter's in Rome otherwise than with a feeling of disappointment. At this first sight begins that series of ocular deceptions which pursue one throughout the vast edifice. The illusion is sedulously enhanced by the architectural construction. The size of objects that are at a distance above the eye is clearly increased in far more than may be called the just proportion of their remoteness; where the vault of the nave springs from the side piers, the upward lines are broken by a heavy cornice and by a broad transverse architrave; and further to baffle and expel all possibility of continuity with the marbled and fluted pilasters, the ceiling is composed of small richly gilded panels. In fact, without entering into further details of the interior, the whole illusive architectural effect depends on every line, whether straight or curved, being broken at every available point, on exaggerated dimensions of remote objects, and on the wonderful finish even of the minutest details.

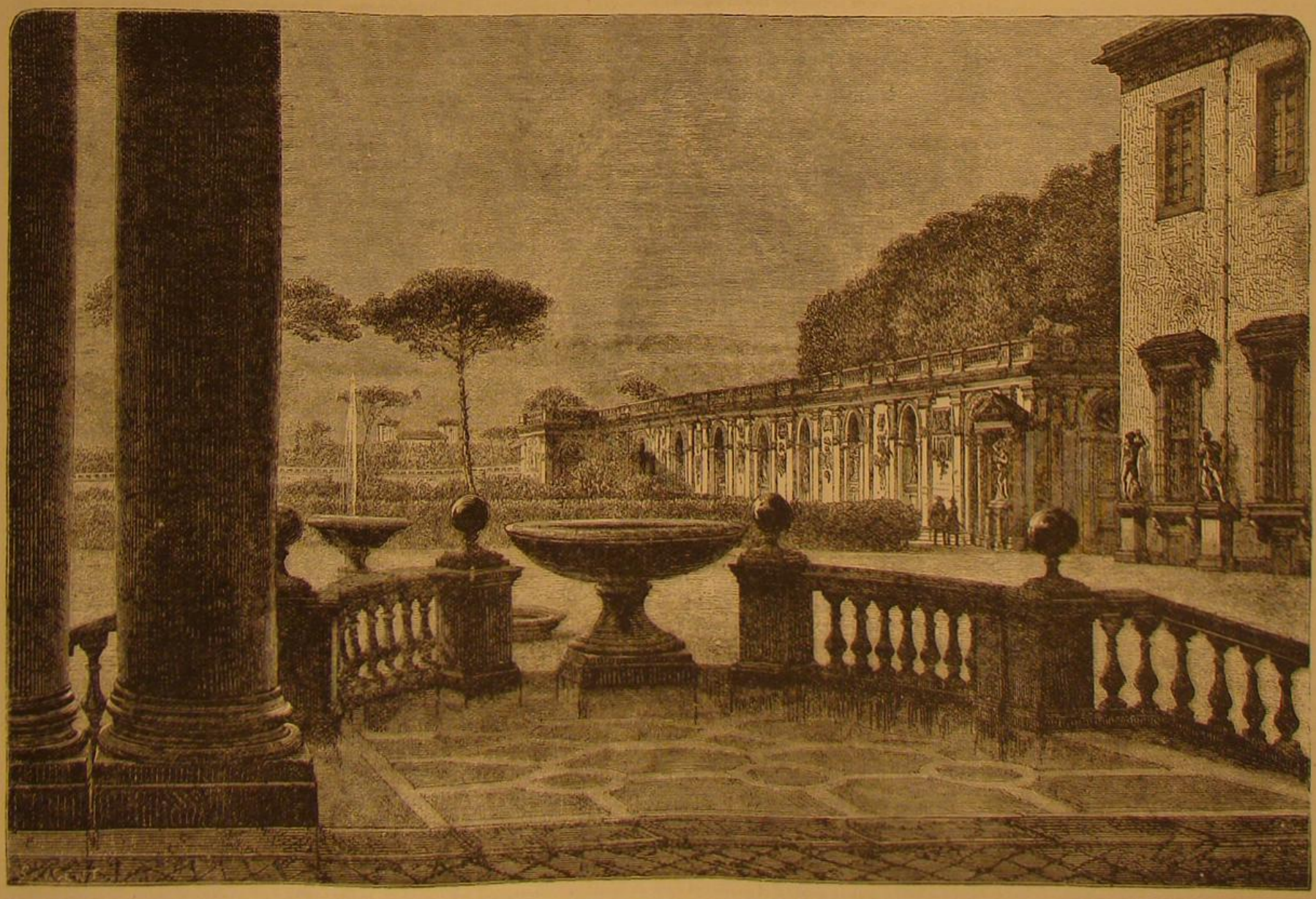
With this brief reference to the optical puzzle of the interior, we may turn to some other wonders of the great structure. It was three centuries and a half in building, it was superintended by forty-three popes, and its cost was $49,840,000.

The shape of the church is that of a Greek cross 720 feet long, 510 feet broad, and about 500 feet high to the summit of the cross over the dome. The dome is double, and was thus constructed as an expedient to satisfy views from within and without. Looking up from within, were there but the outer dome, the proportion would be bad; similarly, viewing from without, were the dome reduced to suit the interior aspect, the effect would again be disproportionate. Hence the two domes, one covering the other, and the outer one 159 feet high above the roof.

ST. PETER'S AND THE VATICAN, ROME.

To ascend to the roof is like visiting an aerial village. The high parapets conceal all view of the Roman streets below; while at every hand are the dwellings of workmen who are constantly repairing the stonework. From the midst of the small houses rises the vast dome, larger than an ordinary church; for it is 405 feet in diameter. Entering the intermediate space between the outer and inner domes, the visitor traverses a gradually narrowing and winding staircase until finally he emerges in the golden ball below the cross. Here sixteen persons may find room; and from the loopholes there is a view, of broad Campagna, and sea, and purple mountains, such as none but poets can describe. Within, Saint Peter's is finished in exquisite marbles, and in the mosaics for which Roman artificers are famous. Outside, gigantic statues abound. There are 192 figures, each twelve feet high, over the porch alone. On the Piazza are two equestrian figures of Constantine and Charlemagne, and in the center is the famous obelisk brought from Egypt. It was in the erection of this stone that a great engineering blunder was brought to a successful result by a timely thought of a bystander. There was a great crowd on the Piazza, watching the slow ascent of the stone as it gradually was lifted to its place. Suddenly its movement stopped. Somebody had miscalculated, the ropes had stretched, and there the great mass hung within an inch or so of its destination. It was impossible to move it further with the apparatus at hand. The engineers were despairing, when a sailor amid the crowd shouted: "Wet the ropes!" This was at once done, the cables contracted, and Nature lifted the stone the rest of the way.

Our second engraving represents the villa and garden of the famous Medici family of Rome, remarkable for the magnificent statues with which the grounds are adorned, and the many art treasures of its interior. It is now occupied by the French Academy of art students.



GARDENS OF THE VILLA MEDICI, ROME.

Finishing Lace and other Fabrics.

A correspondent having asked us several questions on this subject, we have pleasure in stating that cotton lace, after going through the processes of gassing, or the passing it with the requisite velocity over flames, so as to remove the slight exterior fibres, has acquired a much darker color than is natural; but bleaching restores the article to a perfect whiteness. A piece is often returned soundly bleached within twenty-four hours after delivery. In Nottingham we have seen a machine by which, instead of being wrung or pressed and hung up in a hot room to dry, as is the mode, the article was wrapped round in a kind of coil between two copper cylinders, the outer one of which is perforated with holes. The apparatus is made to rotate perhaps a thousand times in a minute, so that by the centrifugal force thus obtained the damp is quickly driven off. The dressing of lace, so as fully to extend the meshes to their proper shape, and by stiffening the fabric prevent its collapse, is a most important operation, and of course requires care and experience on the part of the class known as dressers, of whom there are almost forty having extensive premises in or near Nottingham. It is performed, first, by passing the bleached or dyed and purified lace through a hot mixture of gum and starch and other materials, and then submitting the lace to the action of revolving cylinders, which squeeze out the surplus stiffening fluid. Next, the piece, in a wet and heavy mass, is taken to the stretching room, which extends from 40 to 120 yards in length, and is wide enough usually to allow of two frames being placed at a sufficient distance to be worked side by side. The heat required is seldom under eighty degrees, and often much more. By means of the side of the frame receding, the lace is gradually extended to its full width; the utmost care being taken not to disturb the mesh either in length or width. On this point will absolutely depend the quality and salable value of the article. Attention has to be paid to the amount of dress in regard to stiffness and weight for single, double, treble, or even quadruple stiffness; and also as to color, clearness, crispness, and elasticity, on which particulars, together with the peculiar ingredients used, depended the preference so long given French over English dressing of plain black silk. Then, to secure freedom from small blotches of stiffening and impurities clinging to the meshes, the pieces are lightly and carefully rubbed with flannels to equalize the stiffening, and then beaten by switches and rods as they are distending; and to promote rapid drying, and consequent clean face and elasticity in hand of the dressed article, the piece, when fully dressed, is fanned with broad, spade-like implements, which produce powerful currents of air. When finished, each is carefully rolled up and folded, preparatory to its being sent to the finishing warehouse, where, the selvedges having been placed exactly even in rolling off the dressing frame, it will, if a wide, plain piece, be cut off, without unrolling, into suitable widths for sale.

The business in chemicals and dyestuffs for bleachers and dyers, in starch, gum, and other materials used for dressing, has necessarily become very large. A piece of cotton net weighing, in an unbleached state, 15 lbs., will increase in proportion to the dress required, so that, if "Paris" dressed it will become 60 lbs. weight, and the edges will cut through the skin like a saw. All nets for foundations of articles of female attire are thus weighted and stiffened. They have been in large request as foundations for bonnets and similar purposes, but are subject to the fluctuations of fashion, or the rise of the materials used, and consequent advances in price, which may lessen or destroy consumption. The mere disuse of a trifling attachment to bonnets lowered the returns of one lace-finishing house some tens of thousands of pounds in one year.—*Textile Manufacturer.*

The Mediterranean Coast of France.

A contemporary, speaking of the geological changes which have taken place in parts of Southern France since the time of the Romans, says: "The French shore of the Mediterranean divides into two distinct parts, which offer a strange contrast to each other. From Genoa to Marseilles all is life and beauty; all the world goes there for pleasure or health. From Marseilles to the coast of Spain, one finds everywhere solitude and desolation. The latter region was at one time highly prosperous, but it has been entirely changed by the immense quantities of sand and mud brought down by the rivers. Narbonne, in the time of the Romans, communicated directly with the sea. It had its lagoon, like Venice, and a deep canal afforded passage to heavy merchant ships and the triremes of the imperial fleet. The lagoon is now blocked up, and the commerce, wealth, and activity are all gone. Arles was another very important city; it had two ports, like Alexandria, and was so rich and powerful that a poet of the fourth century spoke of it as the Rome of the Gauls. The Rhone, with its annual 22,236,000 cubic yards of sediments, has been its ruin. So with other cities; but while they have become separated from the sea, agriculture is gradually taking possession of the land won from the water, and the vine and olive may yet restore a part of the ancient prosperity."

Winter Dressing Fruit Trees.

Even a tyro in gardening, says a correspondent to the *Journal of Horticulture* knows that the brown or peach aphis is active upon the shoots of the peach and nectarine during the winter as the summer months; that brown scale remains through the winter upon shoots which it has obtained a footing upon during the summer; that mussel scale holds tenaciously to the bark of apple and pear trees; that mealy bug and spider, when plants they infest become leafless, seek out the rough parts of the bark, beneath which they creep, shielded alike from cold and wet; that the whole tribe of aphides is more or less active during the winter months; and that the thrips are not more given to pass the winter in obscurity than slugs. Against such insects the following recipes will be found useful: Soft soap half a pound, to which add a wineglassful of spirits of turpentine, and with a stick mixing thoroughly with the soft soap, having ready boiling tobacco juice, and adding this a little at a time, so as to incorporate the whole, the tobacco juice that is to be added being a half a gallon. This small quantity will suffice to dress a dozen vines or four average sized peach trees. Apply the mixture with a brush to every part of the trees, after it becomes cooled to 120°, taking care to brush it into the angles and crevices of the bark, and not to injure the eyes or dislocate the buds, which, however, should be coated with the stuff. The sooner it is applied after the leaves have fallen the better, as the pests remain as long as possible before retiring for the winter. The mixture is only applicable to ligneous plants, and to those only when at rest.

For destroying white or brown scale and mealy bug upon growing plants, mix 8 ozs. of soft soap with a wineglassful of spirits of turpentine, adding gradually half a gallon of boiling water, stirring so as to thoroughly incorporate. Apply with a brush to the parts infected, or with sponge to leaves, at a temperature not exceeding 120°. The plants must be syringed with water immediately after they have been dressed with the solution, taking care not to allow the mixture to run down the stems in full strength to the roots.

The Manufacture of Milk Sugar.

A. Sauter, in a communication to the *Schweizerische Wochenschrift für Pharmacie*, gives an account of a visit to Marbach, in the canton of Luzern, Switzerland, where half a dozen refiners are said to make a handsome income from the manufacture of milk sugar.

The raw material used for the recrystallization comes from the neighboring Alps, in the cantons of Luzern, Berne, Schwyz, etc.; a considerable quantity is supplied also by Gruyères. It is the so-called *Schottensand* or *Zuckersand*, the French *déchet de lait*, obtained by simple evaporation of the whey after cheese making. Notwithstanding a continual rise in the price, consequent upon the demand and the increased cost of labor and fuel, the manufacture continually expands, and now amounts to 1,800 to 2,000 cwts. yearly, corresponding to a gross value of about $60,000, certainly a handsome sum for a small mountain village with but few inhabitants.

The manufacture is only carried on in the higher mountains, because there the material can no longer be used profitably for the fattening of swine, which are found chiefly in the valleys; and the wood required for the evaporating process is cheaper in the highlands.

The crude material is sent to the manufacturer, or refiner, in sacks containing one or two hundredweights. It is washed in copper vessels, and dissolved to saturation at the boiling temperature over a fire; and the yellow brown liquor, after straining, is allowed to stand in copper-lined tubs or long troughs to crystallize. The sugar crystals form in clusters on immersed chips of wood, and these are the most pure, and therefore of rather greater commercial value than the milk sugar in plates which is deposited on the sides of the vessels.

In ten to fourteen days the process of crystallization has ended, and the milk sugar has finished growing. The crystals are then washed with cold water, afterwards dried in a cauldron over a fire, and packed in casks holding four to five hundredweights.

As the *Schottensand* can only be obtained in the summer, the recrystallization is not carried on in the winter, hence a popular saying that the milk sugar does not grow in the winter. The entire manipulation is carried on in a very primitive manner, it being a matter of astonishment to find a specific gravity instrument in any place. The author is of opinion that with a more rational method of working a whiter and finer quality of sugar could be produced.

Effect of Heat on Carriage Woodwork at the Centennial.

The *Carriage Monthly*, a most excellent publication, calls attention to the failure of many of the foreign carriages exhibited at the Centennial to withstand the excessive heat of last summer. Our contemporary states that, after careful examination, it found a large number of carriages in which not only the grain showed, but in which the work generally exhibited signs of shrinkage and coming to pieces. Panels were checked and shrunk, joints opened, parts had warped out of square, spokes were loose, and in fact the vehicles seemed to need prompt relegation to the shop and a thorough overhauling.

On the other hand, it is gratifying to learn that these deficiencies were confined to foreign carriages, and that the wagons of American make withstood the trial perfectly. One *coupé* was exhibited destitute of paint or priming, and yet, after the six months' subjection to heat and damp, every joint was solid and firm. The journal we quote from, which, it should be remembered, is published in the interest of our carriage manufacturers, and therefore its statements may be taken with a grain of allowance, adds: "The Americans have gained a well earned victory over European makers, both in quality of stock and in workmanship, and we shall not be surprised to see orders in large numbers received for American carriages, to be shipped to all parts of the world: also an increased demand for American woods, which enter into the construction of bodies, wheels, and gears. The American poplar and basswood are superior to the mahogany and cedar used by the French and English for panels, while our wheel stock is acknowledged by all to be the only timber suitable for wear and lasting qualities."

Kaolin.

Kaolin, or china clay, is a product of the decomposition of granite, and in its preparation for commerce has to be separated from the other constituents—quartz and mica. If this occurs on a hill side, stopes will be cut in the hill, and a stream of water will be made to flow over the face of the stope. The water, aided by a little work with a broad pick, breaks down the clay, and carries forward the kaolin and the mica, but very soon drops the quartz or gravel. This gravel is partly thrown away, partly used for the floor of the evaporating pans to be referred to. The great point is to do as much work as possible with water, and to save manual labor. The water then passes into a number of small pits, where it is brought almost to stagnation; and as it passes slowly along backwards and forwards it deposits the mica, and is then taken into the collecting pit. From this it is allowed to run into a number of evaporating pans, where it is left slowly to evaporate, leaving behind a deposit of pure white kaolin, free from silica and mica. When the sediment in these pits has accumulated to a depth of 8 or 10 inches, it is dug out before it hardens, and is then the china clay of commerce. For the purpose of expelling a great deal of the water, it is placed under sheds in the dry season, and in later years it has been dried artificially by means of heated pipes. The selling price is only from $5.00 to $10.00 per ton, yet under favorable circumstances, plenty of water, etc., it can be manufactured at such a rate as to be very profitable.—*Professor Smyth.*

The Man of Business and the Business Man.

The man of business and the business man both have business to do; but the business man is the one who does it. The business man thinks, moves, acts, and makes himself felt in the world. If a thought comes into his head, it is one of breadth and compass—it does not center on self and its narrow world. It reaches away and embraces others. It has a wide range, and does not stop till it touches and affects for good the interests of all. Nor are the thoughts of such men immobile. They became acting, living realities in the wide and busy world. The authors of them make of these business thoughts actualities, give them "local habitation and a name," and steamboats are built, and ocean is navigated, and distant climes and nations brought together; an electric telegraph springs into being as by enchantment, and lightning becomes garrulous and voluble, and thought out-travels the winged winds; and in a twinkling the bands and shackles of trade are loosened. Such are the workings produced by the business man. He awakens the drowsy and helpless multitudes, puts life and thought, energy and action, into them, and makes the world leap rejoicing along the path of ages. Where its step before was but a single year, now it strides by scores and fifties.

"Men of thought, men of action,
Clear the way."

And they do clear the way—their thoughts become tangible, moving, demolishing forces, that break down and crush all opposing barriers, opening a pathway of progress, into which the more sluggish and timid portion of humanity may securely travel.

But the man of business is emphatically what the name indicates. His business is always on his hands. He does not do it. He does not know how to go to work in the right way. His thoughts are all measured and slow. He weighs self-made doubts and supposed contingencies, and before he moves the business man gets up and runs away from him and wins the race. The man of business won't go ahead, he only eddies round and round—he does not progress—his path is a circle. He does not find himself at night many miles on his journey's way, but, like the hour hand of a clock, just where he started. He is not clear and decided in what he does, but often stands hesitating and puzzled. He ventures and falls back: has a stout heart in fancy, but none in fact.

A New Source of Illumination.

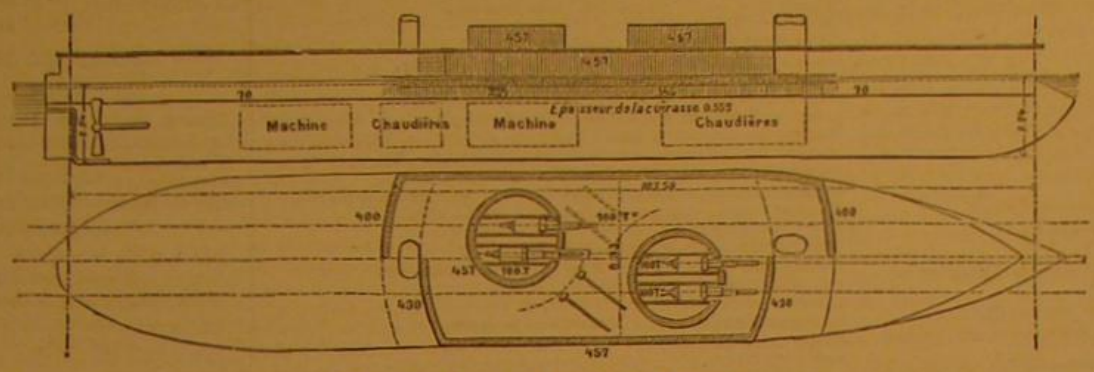
Between Bordeaux and Bayonne, in France, there is a large stretch of sandy desert, whereon there is little vegetation save here and there patches of pine trees. From these trees there runs a resinous matter, which is collected and sold by the inhabitants of the region. This substance has recently been studied by M. Guillemare, and he now announces, to the French Academy of Sciences, that he has produced three kinds of oil from the material, all rich in carbon containing respectively 80, 90 and 92 per cent. of that element. The light yielded on burning the oils is remarkable for its whiteness and steadiness and is said to be suitable for lighthouse illumination and even for photography.

Whitewash your Shops.

An exchange offers the very sensible suggestion that a little water applied to factory windows, and some of the same liquid mixed with lime and applied to walls and ceilings, will not cost much: while at the same time, during these murky winter days, it will render workshops lighter, conduce to the health and comfort of operatives, and perhaps save some gas bills.

THE STRONGEST WAR VESSEL IN THE WORLD.

The most powerful ironclad vessel at present in existence is the Duilio, which was recently constructed by the Italian government. She is not yet entirely completed, and but one of the four 100-ton Armstrong guns has been delivered. The general design of the vessel will be understood from the accompanying engraving. Her length is 331·2 feet, breadth at water line 58·4 feet, and depth of hold 25·2 feet. She has two turrets, which, instead of being in the center line of the ship, are placed toward the sides, so as to get a clear fore and aft fire from each turret. The inside diameter of each is about 26 feet, and the outside 32½ feet, while the two turrets, with the armor plating and the two guns, will weigh about 6,720 tuns. Each turret makes one complete revolution in a minute, and when in position for firing is stopped by hydraulic locking bolts. The vessel is built in compartments, and is provided with a novel system of pumps, which discharge water from her in case her skin is pierced by a shot. There are no masts, and all the machinery and the rudder are entirely under water, so that the vessel exposes no vulnerable portion.



THE ITALIAN IRONCLAD DUILIO.

The immense guns are loaded by hydraulic apparatus. Upon opening a valve, the ram head capped by a sponge advances rapidly into the bore of the gun, the latter being suitably depressed and the sponge rising at an angle from beneath the deck. When the sponge reaches the bottom of the bore, a valve in the head is opened, and a powerful jet of water is brought to play in the powder chamber: thus at the same time aiding in cleaning the bore, and preventing any possibility of fire being left therein. After the sponge is withdrawn, the cartridge and shot are in turn raised by an hydraulic cylinder to their proper position in front, and on a line with the muzzle, this and the remaining operation being performed by one man without his moving from his seat beside the levers. Lastly the ram head advances and drives the shot home. Without machinery, it requires, in the United States navy, 24 men to manage an 11-inch Dahlgren gun, the shell fired by which weighs 135 lbs. With the hydraulic mechanism described, four men can serve a weapon which throws a shell weighing 2,000 lbs., or a shot weighing 2,500 lbs.

It has been calculated that the work developed by the immense projectile is equal to about 39,000 foot tuns; so that, if all four of the Duilio's guns were fired at once, her effective power would be equal to that exerted in raising 156,000 tuns one foot high per minute.

A NEW STEAM CARRIAGE.

The novel steam carriage herewith illustrated is provided with improved mechanism which enables it to be readily steered and conducted around curves. Fig. 1 is an elevation and Fig. 2 a view from beneath. The hind axle is revolved by a suitable steam or other motor, that is secured to the supporting platform, and connected by transmitting mechanism to the axle. The hind wheels are placed loosely on the axle, and secured rigidly thereto by clutches, C^1, that are forced by suitable springs into hub plates of the wheels. The clutch mechanism, C^1, of each wheel may be readily withdrawn by a lever and swivel connection, C^2, operated by levers arranged near the driver's seat. On turning ordinary curves in roads the clutch mechanism is arranged to allow the outer wheel to make a greater number of revolutions than the inner one. On turning very short curves, by withdrawing the clutch from the inner wheel all the power is thrown on the outer wheel, and thereby the carriage allowed to turn easily on a space a little larger than its own length. The guide wheel, E, at the front part of frame, A, is connected by its axle, supports, and springs, with a horizontal turn table, F. The turn table has a circumferential groove, and is connected by a belt with a pulley, d', and steering wheel, G, in front of the driver's seat. The hind wheels are further provided with suitable brakes, worked by a treadle.

The carriage, it is claimed, may be propelled at considerable speed, steered with facility, and carried readily around curves.

Patented through the Scientific American Patent Agency, October 10, 1876, by Mr. Jacob M. Lauck, West Milford, W. Va.

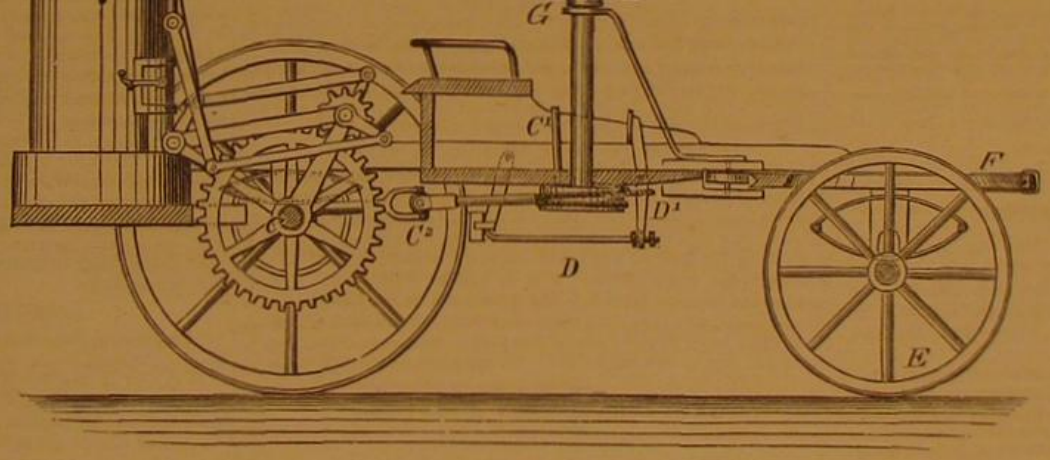


Fig 1.

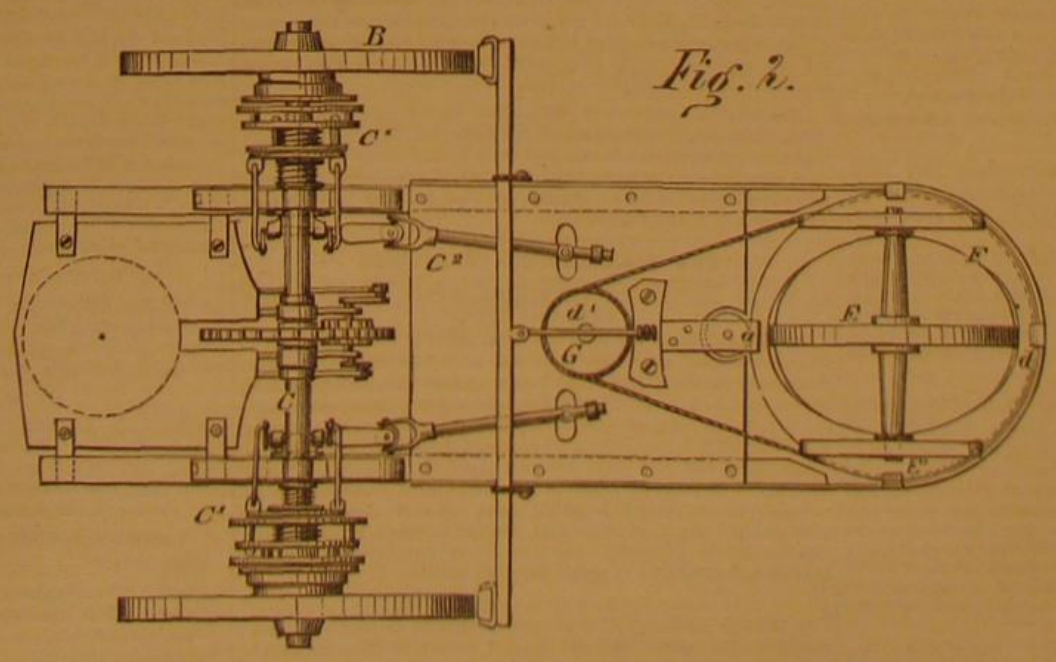


Fig. 2.

LAUCK'S STEAM CARRIAGE.

The Decrease of the Petroleum Supply.

There has been a marked diminution in the oil product of Pennsylvania of late. It is reported that, for some months past, the supply has not exceeded 28,000 barrels per day, while not more than two years ago the daily average was 40,000 barrels. The price also has more than doubled. The decrease of the supply is attributed to the cessation of flowing wells; and the fact that most of the pumping wells, refineries, and railroad lines are controlled by a single company which exacts high profits has probably much to do with the increase in the price.

Most persons have an idea that the Atlantic telegraph cable is a ponderous affair, while in fact its circumference is that of a five cent piece.

Lead Poison in Sewing Silk.

Invention and discovery have their evil no less than their beneficent aspects. A French contemporary, the *Moniteur d'Hygiène*, startles its readers with the revelation of an ingenious fraud, not generally known, but likely to be in the long run very dangerous to the health of tailors, sempstresses, and others who use silk thread in sewing. Nothing is more pernicious to the system than lead, and yet it may be constantly introduced into the stomach by those who use sewing silk. According to our French authority, certain manufacturers have adopted the plan of soaking their silk thread, of all colors, in acetate or sugar of lead, and exposing it, after drying, to the action of sulphurous vapor, which vapor, it is said, transforms the acetate into sulphate of lead, increasing the weight of the silk. The resulting gain may be imagined when we state that sugar of lead is worth considerably less than 25 cents a lb., whilst silk thread fetches from $10.00 to $11.00 a lb. in the market. It is alleged that some samples of silk have been proved to contain as much as twenty-three per cent. of sulphate of lead.

There is some mistake in the mode of stating the case, says the *Sewing Machine Gazette*, as the fumes of sulphur would certainly not convert the acetate of lead into the sulphate. Nevertheless, on mentioning the statement to our tailor, he at once declared that the fact of lead impregnation in silk is well known; indeed, he said that the sugar of lead can be detected by the smell in some samples, and not only in silk, but also in other thread, which is also sold by weight. Some adulteration, then, is practised, various matters being used to give weight to the articles; and, as a consequence, all thread rapidly deterioriates on exposure to the air. On this account the best sewing silk is usually well wrapped in wash leather.

It is easy enough to detect the adulteration by chemical process, and, although the result is not conclusive as to the presence of lead (as stated by the French writer), it proves, at any rate, the presence of some metal. Put a few pieces of silk thread at the top of a test tube filled with water containing a few drops of acetic acid or vinegar. As soon as the silk gets moistened, let fall into the test tube a few drops of a solution of iodide of potassium. Then, if the silk contain lead or other metal, an iodide of the metal will be formed, sinking with a violet tint into the tube.

We have tested several samples of silk thread in this manner. With the exception of one sample, all the fine sewing silk was proved to be free from lead or other metal. But we found metal very abundant in what is called "tailor's twist" and "hatter's twist," especially the latter.

The fact is important if lead be the metal used for giving weight to silk. Lead acts very surreptitiously on the system; it is essentially "a slow poison," and it is very difficult to combat its effects. It acts on the teeth and on the intestines, in which it produces paralysis, frequently followed by death. "We have seen," says the writer in the *Moniteur d'Hygiène*, "among other cases, that of a lady who keeps a large sewing establishment, who, by the use of such silk thread, was, together with her workwomen, attacked by lead colic, some of them losing their teeth—the result of the habit of putting the ends of the silk into the mouth before passing it through the eye of the needle. Such is the way in which the lead poison is directly absorbed, whilst, by continually handling the silk, the fingers may retain a portion of the lead, to be indirectly introduced into the system with the food that may be touched by the hand. The poison may be avoided by refraining from putting the silk into the mouth—dipping it in gummed water instead—but perhaps the best remedy will be found by the large dealers refusing to buy silk thread by weight unless it is proved to be free from metallic adulteration.

According to a recent writer in the London *Times*, the "French dyers have attained such extraordinary skill, that they can color up inferior qualities of silk so as to make them look far better than they are. In some cases they are able to charge the silk with lead and iron, which adds as much as one hundred or one hundred and fifty per cent. to the weight of it! All such artificial additions disappear when the tissue is exposed to any wear, however slight, and sometimes even when it is only exposed to the atmosphere. Let us admire and beware. Never have tissues looked so lovely as now; they charm the eye. But, also, never was beauty more deceitful; and, if our women cannot resist the temptation of lovely tints, let them at least take care to buy new silks from houses which are thoroughly to be trusted." If silk for dresses is open to this grave suspicion, how much more probable is the adulteration of sewing silk which is always sold by weight, although done up in skeins, or on bobbins and reels.

DECISIONS OF THE COURTS.

United States Circuit Court—Western District of Pennsylvania.

PAPER ROOFING.—JAMES HOWARD *vs.* ROBERT CHRISTY.

[No. 8, May Term, 1879.—At Law.—Decided November 13, 1876.—Before McKennan, C. J.]

The plaintiff was the first and original inventor of the inventions described and claimed in his patents No. 91,133, June 8, 1869, for method of preparing paper for roofing purposes, and No. 95,689, October 12, 1869, for a machine for carrying out such method. The original application was filed March 1, 1850, rejected April 9, 1850, withdrawn May 4, 1850, and afterward repeatedly renewed with the allowance of the patent No. 91,133. The plaintiff did not intend to and did not in fact abandon his said invention to the public. Nor was it in public use or on sale with his consent and allowance for two years before his original application.

MCKENNAN, C. J.:

This is an action at law for the infringement of two patents granted to James Howard, the plaintiff, as follows:

1. Patent No. 91,133, dated June 8, 1869, in which the invention claimed is—The method described (in the specification) for preparing paper for roofing purposes—to wit, by passing the paper through liquid asphaltum, heated to that degree which will cause the paper and the asphaltum on it to dry as fast as it is drawn from the reservoir of liquid asphaltum.

2. Patent No. 95,689, dated October 12, 1869, in which the invention claimed is—

The arrangement of the reservoir A, windlasses B and C, adjustable rollers D, scrapers *i* and *h*, and rollers *e* and *f*, constructed, arranged, and operating substantially as described in the specification and for the purposes therein set forth.

The parties have stipulated to waive a jury, and that the issues of fact in the case be tried and determined by the court, and the evidence on both sides has been taken in writing and submitted to the court.

Upon the evidence thus submitted the following facts are found:

1. The inventions described and claimed in said patents are novel and useful.

2. The plaintiff was the first and original inventor thereof, and the date of his invention is referable to the date of his original application for a patent—to wit, the sixth of December, 1849.

3. This application was filed in the Patent Office March 1, 1850, accompanied by a specification and by a model on March 5, 1850, was rejected April 9, 1850, and was withdrawn May 4, 1850.

4. It was afterward repeatedly renewed, (when does not appear,) and resulted in the allowance of the patent aforesaid.

5. During the interval between the date of his application and the allowance of the patent, the plaintiff did not intend to, and did not in point of fact, abandon his said invention to the public.

6. The said inventions were not in public use or on sale with the consent and allowance of the plaintiff for a period of two years before his original application for a patent.

7. The defendant has practised the method described and claimed in Letters Patent 91,133 on a machine of similar construction to that described in Letters Patent 95,689, and is, therefore, an infringer.

These findings embraced all the material issues of fact raised by the pleadings.

Several questions of law have been suggested touching the alleged defectiveness of the specifications, and the presumptive abandonment of the invention from delay in the procurement of patents, but as the objections to the plaintiff's title on these grounds have no warrant in the well-settled principles of the law of patents it is only necessary to say that they are unsustained.

Upon the whole case the court is of the opinion that the plaintiff is entitled to recover, and, as the damages have been assessed by stipulation at $100, judgment will, therefore, be entered upon the findings in favor of the plaintiff for that sum.

[*James J. Johnston* and *George H. Christy*, for plaintiff.
Joseph M. Gazzam, for defendant.]

NEW BOOKS AND PUBLICATIONS.

BRYANT'S BOOK-KEEPING: a Treatise on the Science of Accounts, Elementary and Practical, containing a Thorough Explanation of the Principles and Practice of Double Entry Book-Keeping, adapted to the Use of Universities, Business Colleges, etc. Price $3. Buffalo, N. Y.: Published by the Author.

Mr. Bryant's long experience as a teacher of the science of commercial accounts has enabled him to compile a work of the highest value for simplicity and practical value. The book is a thorough and complete treatise, written with clearness and illustrated with numerous specimen pages of account books. We recommend it to all young men desirous of acquiring a knowledge of the useful and indeed indispensable art of book-keeping.

RURAL HYDRAULICS, A PRACTICAL TREATISE ON RURAL HOUSEHOLD WATER SUPPLY: giving a full Description of Springs and Wells, Pumps, Hydraulics, etc. By W. W. Grier. Price 75 cents, free by mail. Philadelphia, Pa.: Henry Carey Baird & Co., 810 Walnut street.

A practical little work on an important subject, free from technical and abstruse phraseology.

NOTES ON LIFE INSURANCE. WITH APPENDIX. By Gustavus W. Smith, late Insurance Commissioner of Kentucky. Price $2.00. New York city: D. Van Nostrand, 23 Murray street.

The subject of this volume is an inexplicable mystery to many, and we think that the book will meet a great necessity. The author is evidently a gentleman of great skill and knowledge; and the wise principles he lays down so clearly will enable persons of limited education to acquire sufficient knowledge to judge for themselves as to the trustworthiness of the multitude of insurance companies which are now claiming the confidence of the public.

ELEMENTARY ARCHITECTURAL DRAWING. Edited by Charles Babcock, Professor of Architecture in the Cornell University, Ithaca, N. Y. Nos. 1 to 8. New York city: D. Appleton & Co., 549 and 551 Broadway.

Messrs. Appleton are now publishing Krusi's courses of examples in free hand and mechanical drawing. Six series are announced, each edited by a professor of well known ability and reputation. The eight parts of the architectural series, now before us, comprise an extended course of examples of great variety and excellence, calculated to form the taste as well as train the hand and eye of the student. The occasional use of free hand work in depicting the various building materials is singularly effective and correct.

THE QUARTERLY JOURNAL OF INEBRIETY. Published under the auspices of the American Association for the Cure of Inebriates. T. D. Crothers, M. D., Secretary, Binghampton, N. Y. Subscription $3.00 per year.

The name of this new comer in the field of periodicals is rather puzzling. By a parity of reasoning, a paper printed by a prison association might be called a journal of petty larceny—or bigamy—which would startle people. This aside, the new magazine is an excellent and useful publication, and, we have no doubt, will do great good in disseminating correct and scientific views regarding the sad disease of drunkenness and its best mode of cure. The first number contains Dr. Beard's excellent address on the Causes of Inebriety, which we have already reviewed in full. There are besides the proceedings of the Association above named, beside clinical notes and other interesting articles.

Inventions Patented in England by Americans.

From November 21 to December 21, 1876, inclusive.

AERATING CHURN.—T. Simmons, Hartford, Conn.
AIR PUMP.—W. F. Garrison, Brooklyn, N. Y.
ARTIFICIAL STONE.—L. L. Leathers, Oakland, Cal.
BOX COVER, ETC.—W. L. Hubbell, New York city.
CAR BRAKE, ETC.—L. O. Rost, East Minneapolis, Minn.
CAR COUPLING.—H. G. Russell *et al.*, Lincoln, Ill.
CLEANSING CARPETS.—G. S. Norris (of Baltimore, Md.), London, England.
CLEANSING FABRICS.—W. Maynard, New York city.
EMBROIDERER.—A. Mason, New York city.
EXPLOSIVE.—E. Judson, San Francisco, Cal.
FLEXIBLE TUBING.—H. Wakeman, New York city.
FRYING PAN.—J. E. Bardell *et al.*, New York city.
GRAINING WOOD.—J. R. Cross, Cleveland, Ohio.
HARVESTER RAKE.—W. A. Wood, Albany, N. Y.
INKSTAND BASE, ETC.—Rosenfeld & Co., New York city.
LAMP WICK, ETC.—H. C. Scott, Clinton, Iowa.
LOADING HAY, ETC.—J. W. Foust *et al.*, Meadville, Pa
LOCK AND KEY.—M. Raskel, New York city.
MAKING ICE, ETC.—C. L. Riker, New York city.
MAKING NUT BLANKS.—S. S. Townsend, Philadelphia, Pa.
MAKING OZONE, ETC.—H. Milsom, Buffalo, N. Y.
MAKING SCREWS.—American Screw Company, Providence, R. I.
MAKING TUBES.—American Tube Works, Boston, Mass.
NAIL FEEDING DEVICE.—W. H. Field, Launton, Mass.
PIPE COUPLING.—L. Richardson, Brooklyn, N. Y.
PRESERVING MEAT, ETC.—A. Montgomery, New York city.
RAILROAD TIE.—D. S. Whittenhall, Chicago, Ill.
REDUCING ORES.—T. S. Blair, Pittsburgh, Pa.
REVERSING VALVE.—H. S. Maxim, New York city.
SCOURING GRAIN, ETC.—W. P. Clifford, Elmore, Ill.
SCOURING HIDES, ETC.—B. F. Larrabee, Lynn, Mass.
SPRING MATTRESS.—Howe Spring Bed Company, New York city.
SPRING MOTOR.—R. Rhett, Baltimore, Md.
STOWING COTTON, ETC.—M. J. Walsh, New York city.
STRAIGHTENING WIRE, ETC.—W. H. Paine, Brooklyn, N. Y.
TUYERE, ETC.—A. J. Haws, Johnstown, Pa.
UMBRELLA, ETC.—A. A. Valentine *et al.*, New York city.
UNLOADING GRAIN.—G. Milsom, Buffalo, N. Y.
VALVE.—N. C. Locke *et al.*, Salem, Mass.
VALVE, ETC.—E. Purvis, New York city.
VENTILATION, ETC.—J. S. Linsley, New York city.
WATER GAUGE, ETC.—W. Andrews, Lisbon, Me.

Recent American and Foreign Patents.

NEW HOUSEHOLD INVENTIONS.

IMPROVED CENTER SLIDING GASALIER.

Samuel B. H. Vance, New York city, assignor to Mitchell, Vance & Co., of same place.—By suitable construction, as the center light is drawn down, a cord unwinds from a drum L, which turns the said drum, and coils up a spring. The tension of the spring and the weights of the square tube and its attachments so nearly balance each other that the center light will be sustained in any position into which it may be adjusted, but may be raised and lowered with ease.

IMPROVED DESK.

Ernest N. Döring, New York city.—When the lid of the table is thrown back pigeon holes attached thereto are exposed. To the lowest pigeon hole a desk leaf is hinged which when the lid is opened falls into an inclined position, ready for use.

IMPROVED LAMP.

David Dickson, Raglan, Ontario, Canada.—The object of this invention is to do away with that portion of the chimney which is most liable to fracture from unequal expansion, and substitute therefor a metallic top, which may also answer the purpose of a reflector. The top shuts a small distance over the top of the glass cylinder, and is retained in place by the spiral springs, fastened to tubes which support the wick tube.

IMPROVED GAS OVEN OR SUMMER RANGE.

Benjamin Shourds, Philadelphia, Pa.—This embodies improvements in that class of ovens or summer ranges commonly known as gas ovens, because the draught, coal gas, etc., from the fire can be caused to pass through the oven when the lids in the bottom plate thereof are removed. The side thirds of the top plate are inclined at an angle of about 45°, and its central third is flat, and is provided with an angular brick work. Upright openings and dampers formed in the upper parts of the side plates of a summer range, above the lower edges of the inclined side parts of the top plate; and a flue is formed upon the rear plate. Dampers are provided in connection with an opening formed in the upper part of the back plate.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CULTIVATOR.

William B. Sturgis, Shelbyville, Ill.—The crank axles are secured in place adjustably in a bar, that is arched, so that the machine may be drawn over tall plants. There are also new devices to enable the plow to be readily guided, to prevent the standard being broken when striking an obstruction and also to support the plows away from the ground when turning around and passing from place to place.

IMPROVED GUIDE FOR BUILDING RICKS AND STACKS.

John Murdock and Henry Murdock, Poseyville, Ind.—This relates mainly to gates which travel on a vertical post being hoisted as the stack is built up to them by means of a windlass. They are so constructed as to contract as the top of the stack is reached, and when the latter is nearly complete they may be altogether removed.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED PROCESS OF PREPARING METAL SURFACES FOR PRINTING UPON.

Joseph T. Commoss, New York city.—The object of this invention is to form such a surface upon metal plates that it may be printed upon direct, without any transfer process, and which will enable the plates, after being printed upon, to be struck up with dies, and otherwise manipulated without cracking, chipping, or otherwise injuring said surface. A mixture of pale boiled oil, Benguela varnish, turpentine, and white lead ground in oil is first applied hot. The plates are then placed in an oven heated to 125° Fah., after which they are powdered with a mixture of magnesia and soap stone, and are then ready to be printed upon. We have seen some of the most beautiful samples of metal card printing in colors, by this process that have ever been executed. The work closely resembles chromo picture printing in the perfection in which the colors are laid.

IMPROVED QUILTING FRAME.

Ira M. Hope, Morocco, Ind.—The quilt is fastened to muslin strips attached to rollers, at two sides, and secured to bars at the other sides by cords. As the quilt is wound on the rollers, the cords stretching it to bars are disconnected. When thus wound sufficiently the bars are altogether detached, and the rollers are put into benches and held by ratchet wheels and pawls to stretch the quilt between them, while the hooks stretch it in the other direction.

IMPROVED WATCH PROTECTOR.

Henry A. Rosenthal, Brooklyn, N. Y.—This is an improved device for connecting a watchchain and watch with each other, so constructed that it may be set to prevent the watch from being withdrawn from the watch pocket by a thief. In a short tube, the upper end of which is closed, and the lower end of which is flared, is fitted a block, which slides up and down within it. The movement of the block is limited by a screw, inserted in it, and which passes through a longitudinal slot, formed in the side of the tube. The slot at its upper end is extended at right angles with the length of the tube, so that by turning the tube so as to bring the screw into the lateral arm of the slot the block will be locked in the upper end of the said tube. When the tube has been pushed down to the cap and turned so as to bring the screw into the lateral arm of the slot the watch may be drawn from the pocket as readily as if the device were not there; but to guard against having the watch drawn from the pocket by a thief, the tube is turned to bring the screw into the upper end of the longitudinal arm of the slot; then, if the watchchain is drawn upon, the tube is drawn upward upon the block, and springs force four or more or less hooks outward, which catch upon the sides of the pocket and prevent the watch from being withdrawn from said pocket.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED WATER WHEEL.

Lewis A. Struble, Salt River, Mich.—This water wheel is provided with hinged buckets supported radially to the axis of the hub by projections that extend beyond their pivots and rest on the revolving hub. The buckets are claimed to work always in a position radial to the hub, and thus to secure the greatest effect from the water.

IMPROVED MIDDLINGS SEPARATOR.

John J. Haller, Ripley, N. Y., assignor to himself and John W. Baker, of same place.—In connection with the beating and screening cylinder a fan blower is arranged with air inlets at its head and a narrow longitudinal slit at the side for spreading the blast in a thin sheet. Adjustable deflectors and a divider are provided, the latter serving to the flour that falls from the screen separate from the lighter particles that fall to the front of the case.

IMPROVED COMPENSATING PENDULUM.

Eben M. Corwin, Barry, Ill.—In this invention the variations of the length of the pendulum wire, due to different temperatures, are compensated by placing between the ball and its supporting and regulating nut a piece of hard rubber, which, being secured to the ball by a screw at one end, and resting upon the regulating nut at the other, keeps the center of gravity of the ball at a uniform distance from the point of suspension.

IMPROVED GAS METER.

Julian I. Alexander, Baltimore, Md., administrator of John H. Alexander, deceased.—This is an improved device that is claimed to measure the gas accurately as it passes from the service pipe to the pipe leading to the burners. It consists in an improved gas meter formed by the combination of a box, a tubular armed wheel, a spindle, and a register. In the rear side of the outer end of each of the arms of the wheel is formed a small hole, through which the gas escapes, and, by its reaction against the gas in the box, revolves the wheel, the number of revolutions of said wheel being recorded by the register, so that by calculating the quantity of gas that escapes at each revolution, and recording the number of revolutions of said wheel, the quantity of gas that passes through the machine can be accurately known. It is very simple in construction.

IMPROVED METAL CAR FRAME.

Frederick J. Kimball, Philadelphia, Pa.—This is a novel and simple construction of a car frame of channel bars, angle bars, iron and wood corner pieces, and wood beams, whereby great strength is secured without excessive weight, and with economy in the cost. The side and end pieces of the bed frame are of channel iron, with the channel arranged outside and filled with wood, except at the corners, where metal knee filling pieces are used to make string joints by riveting or oolting the bars to them. The back of one of the bars is also extended along the back of the other, and secured to it. Through these metal corner pieces longitudinal and transverse tension rods or bolts are arranged, for straining the frame up tight. The wood filling serves for nailing the siding to, as well as for stiffening the channel bars. Other channel bars are slightly curved outward, extending through

IMPROVED AUTOMATIC BRAKE.

Hugh McCalip, Hope, Bartholomew county, assignor to himself and Norton R. Champion, Shelbyville, Ind.—This invention is so constructed as to be applied by the momentum of the cars as they run together when the traction power is checked, and to be withdrawn as the traction power is again applied. By pressing on the bumper the brakes will be applied on one set of wheels as long as the bumper meets with resistance on the forward motion. During this time the opposite brake wheels are held firmly in the straps, but motionless, while the axle revolves in them, the pawls being off. When it is desired to change the direction of the car, the inner end of a push bar is changed from one lever to the other. When the pulling power of the engine is checked, the brakes are automatically applied to one set of wheels and the train is stopped. The reversal of the engine now will produce no effect upon the position of the brakes; but the change in the direction of the rotation on of the axle releases the pawls from one set of wheels and causes them to take hold on the opposite ones, when the train may be backed without further obstruction, the brakes remaining open as long as the pushing continues. When the pushing power of the engine is checked, the momentum carries the train away from it and the slack motion of bumper applies the brakes to the opposite wheels, thus braking backward as well as forward.

IMPROVED RADIAL DRILLING MACHINE.

Alfred Box, Philadelphia, Penn.—This is a contrivance of the devices comprising a radial drill, whereby the power is transmitted to the drill in whatever position it may occupy by a belt in the place of the bevel gears and shafting heretofore employed.

IMPROVED BALING PRESS.

William B. Duncan, Huntingdon, Tenn., assignor to himself and A. F. Estes, of same place.—This is a new press for bailing cotton, hay, and other articles requiring to be compressed into bales. The improvements are mainly in the construction of a novel pawl and ratchet mechanism in connection with the follower.

IMPROVED COUPON NIPPER AND TICKET PUNCH.

Frank Walker, Santa Barbara, Cal.—The operation of this device is as follows: A coupon is placed in an aperture when a motion of the handle detaches it. It is then forced against fingers, causing a tumbler to turn until the coupon slips from between the fingers into a receptacle. The tumbler being liberated, a spring returns it to its normal position, at the same time causing a hammer to strike the bell.

IMPROVED OILER FOR CAMS.

John Henry Beal, Canton, Mass.—This consists in the combination of a piece of oil-saturated felt, and its spring holder, with a cam. The elasticity of the spring holds the saturated felt always pressed against the cam, and thus keeps the said cam constantly oiled.

IMPROVED COMBINED ANVIL AND VISE.

William E. Canedy, Rochester, Minn.—This is a combined anvil and vise for the use of harness makers, tinners, farmers, and others. The vise is secured to the anvil between projecting side guides by a fastening screw, and bears, by a lateral shoulder, on the top of the anvil.

Artificial Butter.

To the Editor of the Scientific American:

Owing to the receipt of much correspondence concerning my article on artificial butter, which appeared in the SCIENTIFIC AMERICAN SUPPLEMENT, N. Y., Nos. 48 and 49, I wish to state that I own no patent on the process. The only patent held is Mage's, which is owned by the United States Dairy Company, 6 New Church street. All letters, therefore, should be forwarded to that address. The process I described in my article is simply an elaboration of that patented by Mege, and cannot be used without infringing on the United States Dairy Company's patent. HENRY A. MOTT, Jr., E. M., PH. D.

New York City.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Notes & Queries

C. A. B. will find directions for bleaching beeswax chemically on p. 299, vol. 31.—M. F. will find a description of the glacier theory on p. 90, vol. 31.—A. K. will find directions for lining casks with a waterproof tasteless compound on p. 11, vol. 34.—C. J. W. will find a description of the Solvay soda process on p. 404, vol. 34.—A. F. C. and others are informed that Mr. Seth Green's address is Rochester, N. Y.—A. L. M. will find on p. 360, vol. 34, directions for renovating clothing.—R. C. will find an explanation of the effect of the moon on the tides on p. 64, vol. 28.—A. J. B., J. K., B. L., H. K., C. F. S., N. J. W., H. A. T., B. M. S., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) R. D. L. T., of Uddevalla, Sweden, asks: Please explain the principle of Bourdon's manometer. Why does the tube straighten when the pressure rises? A. When pressure is applied to the interior of a tube having an elliptical or flat section, the tube tends to become circular. In thus changing its form, the outer portion is drawn away from the original center of the curve of the tube, and the inner portion is drawn nearer to the original center. The effect of this is to move the center of the curve, or to straighten the tube.

(2) B. R. T. says: We have a new feather bed that smells badly. Is there any remedy except renovating by steam? A. Steam renovation is the best and surest method. The feathers have been placed in the bedding while yet green. The objectionable odor may be got rid of by removing the feathers from the bed, sprinkling them with a little dilute solution of salicylic acid, and allowing them to dry in a warm room, or in strong sunlight in dry air.

(3) J. H. S. asks: What kind of ink or other substance could be used on tin (and not rub or wash off) with a rubber stamp? And what substance could be used in the same manner on porcelain or opal gas shades? A. Try a well triturated paste of dark-colored gum anime, ivory black, and turpentine. This should be prepared at a gentle temperature over a water bath.

I have tried, as you recommended, leather hose on a small force pump for pumping petroleum and its products through, and I find that the fluid penetrates the hose so freely as to render it useless. What could I use to close the pores of the leather? A. We do not know of anything that will answer these requirements. Can you not use a small leaden conduit? This would be impervious to the oil, and flexible to some extent.

(4) R. W. T. says: Please give me a recipe for waterproofing cotton rope, so that the rope can be used constantly under water, and yet impart no unpleasant taste or smell to the water? A. Saturate the materials of the rope with a strong solution of alum, dry, pass through a bath of dilute alkali (aqueous solution), and wash repeatedly in hot water.

How can I fasten galvanized iron balls or cylinders, with holes through the centers, on galvanized wire rope? A. If we understand you, a small screw provided with a set nut will answer; or you can make small knobs with wire, above and below the cylinder, on the wire rope.

(5) C. W. McM. says: The author of an engineer's pocket book, after giving the theoretical, gives the practical, amount of atmospheric air necessary for the combustion of 1 lb. bituminous coal as 891·18 cubic feet; and he then states, as the necessary area for the escape of this volume at the bridge wall, that it will be advantageous to make that area 2 square inches for every 13 lbs. of coal consumed, per hour, and so on in proportion. Am I correct in thus figuring: Given grate bar surface 4 feet long×4 feet wide=16 feet? Consuming 208 lbs. coal per hour, this gives 13 lbs. per foot square per hour. Multiplied by 2 square inches, the necessary area given, this shows 32 square inches. Is this correct? A. By the rule as given, the requisite area is 2×13=26 square inches; but the apparent meaning of the rule is to multiply the pounds of coal burned per hour by 2, to get the area in square inches. Of course we do not know positively what the author intended; but this is our understanding of his meaning. If you make the area between 2½ and 3 square feet, and the other parts are properly proportioned, we think you will secure satisfactory results.

(6) A. Y. McD. says: I have an upright tubular boiler; the grate is 2 feet below the flue sheet. Would it make steam more quickly if I raise the grate 8 or 10 inches? I cannot see how any heat can be lost, and yet I am told by a practical boiler maker that the nearer the fire is to the flue sheet the more economical is the boiler in full. A. If there is sufficient air space below you will not be likely to gain anything by the change.

(7) R. W. says: A 28 inch water wheel is put in under a 13 feet head; it makes 464 revolutions per minute, and drives one run of wheat stones and the necessary machinery, grinding 8 bushels per hour with ⅜ gate. An 18 inch wheel, under the same head, is constructed similarly in every particular, but it only makes 365 revolutions. I cannot find a satisfactory solution of the difficulty. Is there a way of calculating the speed derivable from any wheel? A. From the data sent we are not able to throw much light on your questions. If the first wheel is underloaded, and the second has an excess of work, the difference in revolutions is easily accounted for. It is quite possible, too, that the difference is due to design, and is intentional. It is not generally true that, of two wheels, the one that runs the fastest is the best. The best wheel is the one that gives the greatest effect from the water passing through it. For a given case, it can be shown that each wheel has a speed at which it will give the best effect; and manufacturers of successful wheels make use of this fact in perfecting their designs.

(8) A. C. asks: Is the shrinkage equal from middle to each end, in making a long iron casting on end? A. No; it is most at the top of the casting.

(9) C. T. McC. asks: What would be the power of a double engine connected at a right angle, 3 feet by 3 feet, cut-off half stroke, running at 120 revolutions, with 120 lbs. pressure? A. About 3,000 horse power. 2. What power would be exerted at the rim of a pulley 10 feet in diameter. A. Force at periphery of pulley about 25,000 lbs. 3. What size should a multitubular boiler be for such an engine? A. Boiler should have from 12 to 15 square feet of heating surface for each horse power of engine.

(10) T. H. Y. asks: Can you give me a recipe for checking, permanently, fermentation in wine and cider, that will not leave any flavor, as sulphite of lime does? A. Bottle the liquor, and immerse a number of the bottles, with the mouths only projecting, in a large vessel of water. Loosen the stoppers and heat the water until of a uniform temperature of 180° Fah.; then remove the bottles, stopper and seal them tightly, and place in an inverted position.

(11) T. O. M. asks: For a stern wheel boat, high pressure, what size boiler and engine do you recommend? The boat is 60 feet long, 18 feet wide, and 3½ feet deep. A. If you use a single engine, attached directly to the wheel, you may make it from 10 to 12 inches in diameter, and of 30 inches stroke. Use a locomotive boiler 40 inches diameter, 12 feet long, with from 400 to 450 square feet of heating surface in fire-box and tubes.

(12) J. F. E. asks: Can you give me a good recipe for making spirit copal varnish? A. Fuse 12 lbs. of colorless gum copal mixed with clean sand in a strong iron vessel capable of being closed airtight, and provided with a suitable stirring apparatus; close the vessel, and while the resin is still in the fused condition pump into the vessel a mixture consisting of 1½ gallons of strongest alcohol, 1 gallon oil of turpentine, and 1 quart of ether; heat for some time with constant stirring. The varnish is clarified by decantation, or, for the finest quality, by filtration through a tall column of granular animal charcoal (bone black).

(13) F. N. B. says: You say, as to winding magnets for telegraph sounders, "wind the magnet with No. 30 silk covered wire." How many feet or what weight of wire shall I use on a magnet for from 1 to 12 miles line? A. About 900 feet or a little over ½ lb. of No. 28 wire in each helix will answer very well for a line 12 miles long. 2. What kind of iron shall I use for the magnet and armature? The blacksmith's say that iron called nailrod is the softest. Would that work? A. Any kind of soft iron will answer. 3. What difference should be made in winding a magnet for a wire a few feet in length and one 12 miles long? A. About 250 feet of No. 22 copper wire in each helix will make a good set of coils for a magnet to be used in a short circuit.

(14) J. C. asks: How is tetrachloride of carbon made, and what is it used for? A. It is made from chloroform, by acting upon it with a current of dry chlorine gas, or by saturating chlorine with vapor of carbon disulphide, and passing through a red hot tube filled with fragments of porcelain. The products are carbon tetrachloride and sulphur dichloride. The last named is removed by treatment with alkalies. The method first given is to be recommended. Tetrachloride of carbon is said to be obtained as a by product in several technical operations. We do not know to what important technical uses it is applied.

(15) C. K., J. B. M., and others: There is nothing that can be added to silver or nickel electro-plating baths to so influence the deposition of the metal as to obviate the necessity of subsequent burnishing. The whole success of the electro-plater's art lies, first, in producing a smooth and, if necessary, polished surface to the particle to be plated; second, in so freeing the prepared surface from all traces of oil, grease, or metallic oxides that the metal may have absolute contact with the electrolytic deposit; third, that the bath be in proper condition and free from all dissolved, mechanical, and surface impurities; fourth, that the surface of the anode be proportioned to the surface of the cathode or object to be plated. The anode must be of the same metal as that of which the bath is a solution; and the batteries must be constant, and neither too strong nor too weak. The work should be connected with the battery at the moment of or before immersion in the electrolyte. If the current is too strong, the work will be "burned" (the deposit blackened); if too weak, it may be crystalline and liable to scale off. If the conditions are properly fulfilled, the work on coming from the bath, and after having been dried with a little sawdust and a cloth, will present a clear, smooth, metallic appearance, the luster of which is heightened by burnishing.

(16) T. N. H. says: On November 22, at San Francisco, the barometer marked 30·15 inches, at Portland 30·28, and at Salt Lake 30·24. I believe that there is a corresponding decrease in the height of the column of mercury from sea level to different altitudes, and Salt Lake is upward of 4,000 feet above the ocean. I do not understand this report of the barometer. Two years ago I obtained a glass tube of 30 or more inches in length, and from the open end carefully filled it with pure quicksilver; and having previously filled a small bottle with quicksilver, I put my finger firmly over the end of the tube, inverted it, and carefully inserted it in the bottle. There is a vacuum of some 5 inches, and the average reading of the height of the column of quicksilver are 26·5 inches. But the variations do not correspond with my ideas. For instance, it will storm when the mercury marks 26·75, and there will also be fine weather. Again, when the mercury marks 25·75, there will be fine weather and also storm. Again there will be no change or fall in the mercury until some little time has elapsed after the commencement of a storm. The altitude of this place is about 2,500 feet above the sea. Have I properly constructed my barometer? A. We think, from your account, that your barometer is somewhat defective in its action on account of the imperfect removal of air in filling it. We could not do justice to the subject in these crowded columns; but there are several works published by the Smithsonian Institution that will give you considerable information, and in the reports of the weather bureau you will find many facts relating to changes as affected by weather.

(17) A. C. R. says: I have a lump of green vitriol (sulphate of iron). When I placed it on the shelf it was clean but now it is covered with white spots. Please tell me the cause, and also what the white substance is? A. When protosulphate of iron is exposed for any length of time to a dry atmosphere, it gradually loses its water of crystallization, and is converted superficially into a dry white (or greenish white) powder. This may be avoided in great part by covering the crystals with a suitable glass shade.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

C. H. A.—It is pyrolusite. If free from iron and clay, it is worth from $10 to $20 per ton in New York city.—G. A.—It is apparently a portion of the vertebræ of some large animal. It is much broken, and we cannot classify it. The resinous-looking body is bitumen.—S. B. W.—It is sulphide of iron. See p. 7, vol. 36.—M. G. P.—The berry has been examined by several dealers in spices as well as by professional experts; but none of them are able to identify it. Send us a larger sample.—A. G.—No. 1 is trap rock, and contains nothing valuable. No. 2 is limonite, or hydrous peroxide of iron. No. 3 is partially decomposed sulphide of iron. See p. 7, vol. 36.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Railroad Accidents. By J. M. L.
On the Hell-Bender, etc. By W. S. A.
On Porcelain. By S. W.
On Boats at the Centennial. By J. G. S.

Also inquiries and answers from the following:

H. H.—J. P.—J. N. H.—R. K. B.—J. F. P.—C. S. W.—C. N.—G. G.—R. D. C.—A. B. W.—S. H. L.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells sail canvas suitable for ice boats? Who makes hardened glass tubes for water gauges? Who sells lactometers? Whose is the best electric engines? Who sells bisulphide of carbon?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

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AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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Wire frame for tile stands, G. D. Dudley... 185,733
Wood coloring composition, J. G. Cashin... 185,669
Wool combing machine, S. Metcalfe... 185,772
Writing, device for secret, A. Berghold... 185,621

DESIGNS PATENTED.

9,680.—CARPET FABRIC.—A. Heald, Philadelphia, Pa.
9,681.—CHAIR FRAMES.—T. J. Palmer, New York city.
9,682.—SOFA FRAMES.—T. J. Palmer, New York city.
9,683.—BOTTLE STOPPER.—C. R. Steele, Waukegan, Ill.
9,684, 9,685.—STOVES.—N. S. Vedder *et al.*, Troy, N. Y.

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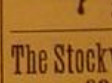

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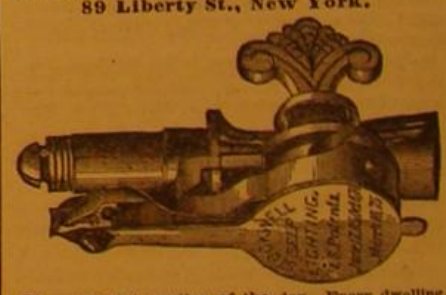

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Tempora Mutantur

M. EDOUARD FAVRE-PERRET was one of the Swiss Commissioners and a member of the jury on Watches at the Centennial Exhibition. On his return home there was a great desire to hear the result of his observations, especially in reference to American Watches. He therefore made an address at Locle, and repeated it at Neuchatel and Chaux-de-Fonds. These three places are the Watchmaking centers of Switzerland. The audience in each place was composed of watchmakers, and the orator is a distinguished member of the same craft. The facts which he stated were no doubt unpleasant to his hearers, but nevertheless true.

We will be happy to send a full report of the address free to any one who writes for it.

The following are a few extracts:—

For a long time America has been the principal market for our watches. To day we must earnestly prepare to struggle with the Americans on the fields where hitherto we have been the masters. * * *

The American Watch Company, at Waltham, was formed with a capital of $200,000. Soon this capital became insufficient, and it was increased to $300,000 before the war of Secession. This war, which seemed calculated to destroy such an enterprise, was, on the contrary, the cause of its prosperity. America put on foot a million of soldiers, and, as every one wanted his watch there was a great animation in the watch business. At this juncture, which might have been a lucky one for our industry, we failed to comprehend our real interest. Instead of sending good watches to the Americans, the worst trash was sent. Had mere skeleton movements been sent in cases, they would have been thought good enough! The Americans, however, went to work on an entirely different plan. The company increased their plant, and turned out a better ordinary watch than the Swiss watch. At the end of several years, and with the aid of patriotism, the American watch enjoyed a good reputation, while our own was discredited everywhere. In 1865, the capital was increased to $750,000, and the operations of the new company grew to immense proportions. * * *

The Waltham Company give employment to 900 workmen, and make about 425 movements per day. The company again increased their capital in 1872; it amounts to day to $1,500,000, besides $300,000 as reserve fund, or a capital of 9,000,000 francs. This watch factory is a real power; there is none like it in Europe. We have seen it in all its details, and we have admired its splendid organization. * * *

Still another and more important reason explains the growing prosperity of the American Company. Their tools work so regularly that all parts of the watch may be interchanged by a simple order on a postal card, without necessitating the forwarding of the adjoining piece. The question has often been asked whether the Americans can sufficiently supply the demands of their markets. Yes, they can. We are driven ut of the American market! * * * *

In 1860 the American Company produced only 15,000 watches; in 1865, 100,000. To-day they produce 250,000, and this figure can be easily doubled in case the crisis, which so seriously prevails there as well as here, should come to an end. And now that we know the figures of production in the United States, we can easily, with the aid of official reports, give an account of what is that country's consumption of watches. We have sent to the United States:

In 1870	320,000 watches.	In 1872	366,000 watches.	In 1874	187,000 watches.
In 1871	342,000 "	In 1873	234,000 "	In 1875	134,000 "

In 1876 we shall barely send there 75,000 watches; or, since 1872, a deficit of 300,000 watches. What a loss for Switzerland, and particularly for Neuchatel! * * *

The Americans have already commenced to send their manufactures to Europe. In England they sell annually from 20,000 to 30,000 watches. The American watch commences to drive from the English market the Swiss and even the English watch.

I sincerely confess that I personally have doubted that competition. But now I have seen—I have felt it—and I am terrified by the danger to which our industry is exposed. Besides, I am not the only one to think so: the "Societe Intercantonale" have sent a delegate to make inquiries, and his report perfectly agrees with mine. Up to this very day we have believed America to be dependent upon Europe. We have been mistaken. The Americans will send us their products since we cannot send them our own. * * *

In America everything is made by machinery; here we make everything by hand. We count in Switzerland about 40,000 workmen, making on an average each per annum 40 watches. In the United States the average is 150 watches. Therefore the machine produces three and a half to four times more than the workman. * * *

It has been said, and it has been complacently repeated, that the Americans do not make the entire watch, and that they are dependent upon Switzerland for several parts of the watch. This is a mistake. The Waltham Company make the entire watch—from the first screw to the case and dial. It would even be difficult for them to use our products, so great is the regularity, so minute the precision, with which their machines work. They arrive at the regulation of the watch—so to say—without having seen it. When the watch is given to the adjuster, the foreman delivers to him the corresponding hair-spring, and the watch is regulated. [Sensation among the audience.] Here is what I have seen, gentlemen! I asked from the director of the Waltham Company a watch of the fifth grade. A large safe was opened before me; at random I took a watch out of it and fastened it to my chain. The director having asked me to let him have the watch for two or three days, so as to observe its motion, I answered, "On the contrary, I persist in wearing it just as it is, to obtain an exact idea of your manufacture." At Paris I set my watch by a regulator on the Boulevard, and on the sixth day I observed that it had varied 32 seconds. And this watch is of the fifth American grade; it costs 75 francs (movement without case). At my arrival at Locle I showed the watch to one of our first adjusters, who asked permission to "take it down"—in other words, to take it to pieces. I however, wished first to observe it: and here is the result, which I noted: hanging, daily variation 1½ seconds; variation in different positions, from 4 to 8 seconds; in the "heated room" the variation was but very slight. Having thus observed it, I handed the watch to the adjuster, who took it down. After the lapse of a few days, he came to me and said, word for word: "I am completely overwhelmed; the result is incredible; one would not find one such watch among fifty thousand of our manufacture!"

This watch, gentlemen, I repeat to you, I took at hazard—out of a heap, as we say. You understand from this example that the American watch may be preferred to the Swiss. I have finished, gentlemen, and I have told you of things such as I have seen them. It remains for us to profit from this sad experience, and to improve our manufacture.

Prospectus

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