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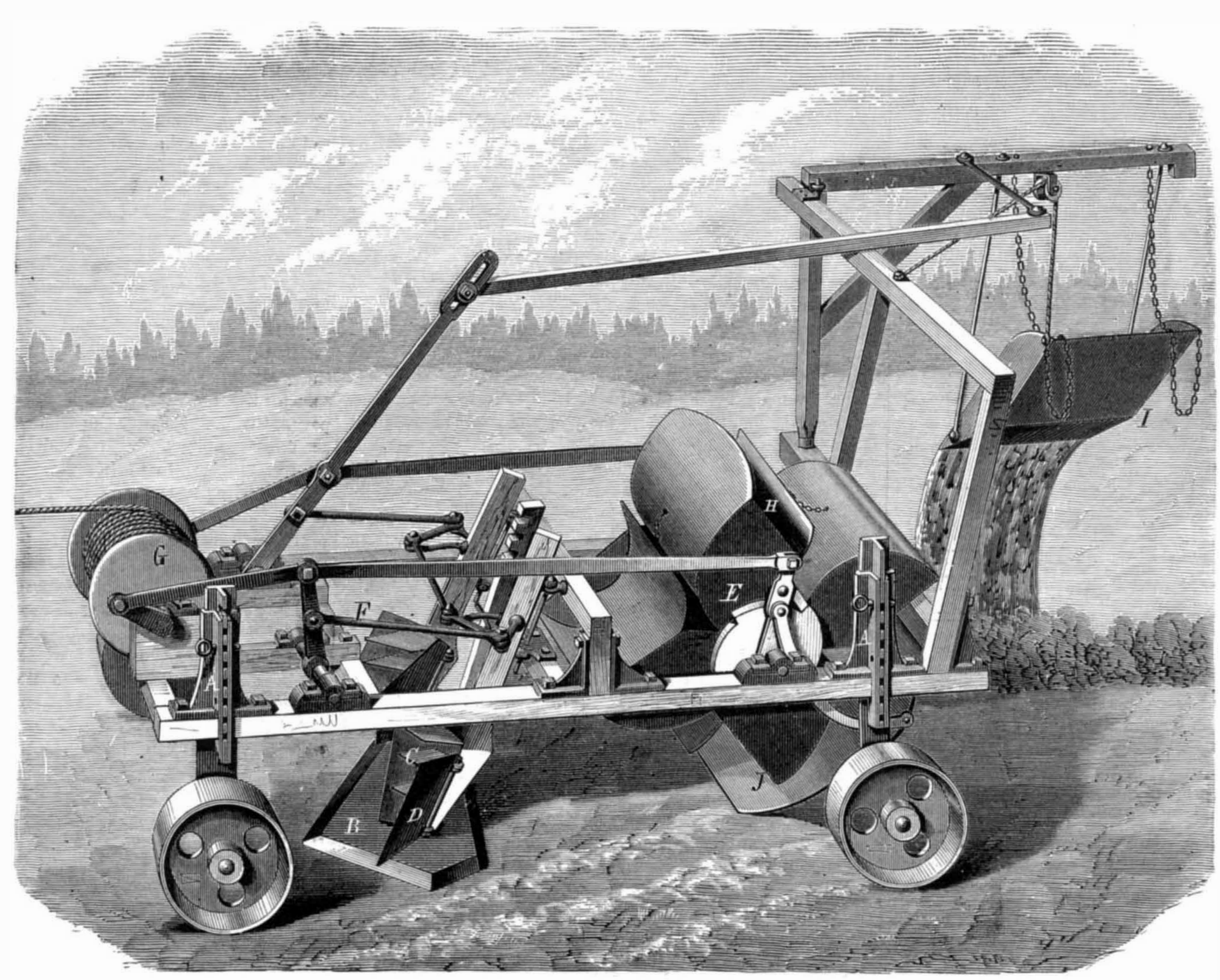
IMPROVED DITCHING MACHINE.

The improved apparatus illustrated in the annexed en graving can be constructed of any size, and hence may be used for ditching, dredging, or for railroad embankment making and leveling. It can be operated either by animal or by steam power, and is so designed as to perform the triple motion of a ditching hand. The earth is cut do n and loosened by the cutters and scrapers, then taken up by the buckets, and is received therefrom by the vibrating pan.

The frame of the machine is supported on wheels, which are pivoted to lower ends of rack bars, A, which slide in guides and are secured by pins passing through their notches, so that the apparatus can be readily lowered as the depth of the ditch increases. The slice of soil to be raised is separated by the plow, B, the standard of which is notched or perforated, and works in guides, so that it may be secured to adjust the plow to work deeper or shallower in the ground. In order to loosen the soil above the plow, colters, C, are provided, attached to an oscillating block, the latter also having hinged to it scrapers, D, which are curved forward and backward, so as to scrape off the soil from the forward end and sides of the ditch and throw it back so that it will be taken up by the buckets of the ditching wheel, E. The scrapers are supported to their work by a spring attached to the oscillating block. Said block is moved by the joint levers, F, which by suitable cranks commu nicate with the drum, G, which is turned by a rope unwound from it by the team pulley in the direction in which the machine moves. It will also be observed that, by a simple assemblage of jointed levers and pawls, the bucket wheel, E, is rotated so as to scoop up the earth and (by the tilting spoon, H, which is in each bucket) to deliver it to the pan, I. Said pan causes the spoons to be thrown out by being swung in so as to arrest the edge of each successive spoon in passing. The spoon in turn throws its load into the pan, which, by a series of levers, also connecting with the drum, moves out and back during two movements of the bucket wheel, so that a bucket is presented to the pan each time it moves back.

At J is a shovel, which is so arranged as to be drawn forward at each movement of the ditching wheel to scrape up any soil that may be dropped or missed by th buckets. As the earth accumulates on the shovel, the bucket wheel, in its revolution, scrapes it off. The machine is ingeniously constructed, and embodies many useful devices. It was patented through the Scientific American Patent Agency, April 4, 1876. For further information, address the inventor, Mr. Hyacinth Gonellaz, Vermilionville, Lafayette Parish, La.



GONELLAZ'S DITCHING MACHINE

Zinc as an Anti-Incrustant.

We have already noted numerous reported cases wherein pieces of zinc, inserted in steam boilers, seem to have prevented incrustation or scale. Some further and more extended investigations into the subject have recently been carried on by Messrs. Bruckmann & Son, manufacturers at Heilbronn, Germany, and the results given point strongly to the efficacy of the metal introduced.

In the first experiment, 66 lbs. of zinc, in the shape of shavings and small fragments, were inserted in a boiler of 307 square feet of heating surface, having, besides, two new superheaters. At the end of six weeks there was formed in the boiler a muddy, white-gray mass, easily withdrawn by a sheet iron shovel; and water forced in by a hand pump sufficed to render the interior of boiler and heaters completely clean. The iron of the latter retained its black color, and in the boiler not a trace of former incrustations was visible. The zinc had entirely disappeared, with the exception of a little *débris* in a state of disaggregation, and this remained in the locality where the mass had previously been deposited.

A second experiment was then made on a larger boiler, with but 37 lbs. of zinc, and at the end of four weeks the deposit was easily washed out. The third experiment was made on the boiler first mentioned, using well water, which was very hard and rich in calcareous matter ; 57 lbs. of zinc were used. Formerly this water produced the hardest kind of scale, which almost defied hammer and chisel. After four weeks' running the boiler was opened and merely a few easily detachable bits of lime were found. A part of the zinc was still in its normal state, and seemed fully capable of protecting the boiler for from two to four weeks longer. An average of several experiments shows that about 2·2 lbs. of zinc scrap per month and per horse power is the proper proportion. This, however, must be increased or diminished with reference to the known composition of the feed water.

Wages in England.

Complaints regarding the inflated state of wages in England are becoming both bitter and frequent. At a recent meeting of the Manchester, Sheffield, and Lincolnshire Railway Company, the chairman said that at the present day the cost of mining coal in Great Britain is 15 per cent higher, as a matter of wages, than it was eight or nine years ago. He pointed out that the English iron trade is seriously affected, and that it is now impossible for it to compete in American or other markets of the world. He further stated, however, that the diminution of wages paid in England was already nearly $10,000,000 weekly, and expressed the hope that, after another year of such discipline in the way of financial stress, England, by reducing the inflation of wages and doing more work, would outbid all other producers in the world in the cheapness of her products.

Novel Folding Scissors.

Many travelers who return from abroad bring home to their friends, as a novelty, a pair of folding scissors. But travelers can no longer astonish their friends with this novelty, for Marx Brothers, of 430 Broadway, New York city, are manufacturing, under patent issued May 28, 1872, a superior quality of folding scissors, which are five inches long when in use, but fold into a length of two and a half inches for the pocket, highly finished and neatly put up in leather cases, which they offer in competition with the imported articles

Walking in the Fiery Furnace.

In London, on August 8 last, experiments were made in the grounds of the Alexandra Palace with an extraordinary invention, by which results somewhat analagous to those recorded as miraculous in Jewish history were achieved. Mr. Oersberg, a Swedish mechanician, claims to have invented, and Captain Ahlstrom, a compatriot, to have matured and fitted for practical use, a dress which will enable the wearer to dash with impunity into the fiercest fire for the purpose of saving life and property. At the east end of the Palace, between the circus and the banqueting hall, huge piles of old dried wood were heaped up, intersected by narrow avenues, and the wood was drenched with petroleum. The consequence was that, the moment a light was applied to the pyre, the whole blazed up with a flame so fierce, and sending forth a heat so intense, that the thousands who had gathered around to witness the scene were forced to retire to a more respectful distance. The sun's rays, which had hitherto been inconveniently felt from above, were quite forgotten in the glow which now flamed up from below, and it really seemed as if there was malice in the tongues of fire that spat out on every current of passing air. Standing 40 yards to the windward of this fierce fire, the heat was all but intolerable; and even the firemen of the Palace brigade, under the command of Captain Archer, the chief officer, were fain to give a wide berth to the burning center. Then it was that Captain Ahlstrom, clad in a dress not at all unlike that worn by Captain Boyton when he paddled himself across the Straits of Dover, made his appearance on the scene. His costume consisted, so far as it was possible to ascertain, of an overcoat of fustian, covering an inner garment of wool and felt. Between the two skins, so to say, is a network of veins, through which are pumped continuous supplies of air and water, the main air tube, before it reaches the body, being enclosed in the larger water tube, and by such means kept perfectly cool. The escape for the cool air is through orifices in front of the face, and the current so made forces back the flames, and leaves perfect breathing space. Assurance was given that the clothing itself is in no way chemically prepared, and is simply protected against the action of the flames by the torrents of water that pour over the man from head to foot. With the greatest possible nonchalance Captain Ahlstrom walked into and through the fiery furnace, not only free from discomfort, but apparently with enjoyment. After spending about ten minutes in about the warmest climate it is possible to imagine, enveloped at times so as to be hidden by flames, he carried out a chair which was on fire, sat coolly down upon it, and, to the amusement and astonishment of a crowd of spectators, smoked a cigar.

New Artesian Well, Charleston, S. C.

A new artesian well is in progress and has now reached a depth of nearly three hundred feet. The drills are still digging their way through the eocene marl of the Ashley River beds, and at a depth of two hundred and sixty feet a stratum of silicious rock, about three feet in thickness, was struck and passed through without much difficulty. In this stratum are found millions of little microscopic shells, which are almost invisible to the naked eye, but upon being viewed through a magnifying glass are clearly seen as beautiful nautilus-shaped shells, perfect in formation and color. The work is creating much interest, and numbers of scientific gentlemen visit the well every day for the purpose of inspecting the fossils.

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(Illustrated articles are marked with an asterisk.)

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 37.

For the Week ending September 9, 1876.

With 83 Figures and Engravings.

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THE GREEN FIELDS OF THE MOON.

When the moon is at the full, the unassisted eye readily distinguishes on her face certain dark gray spots more or less sharply separated from the brighter portions. Through the telescope these spots appear as broad level spaces, resembling terrestrial seas. Indeed the earlier observers mistook them for seas, and by that name (Latin, *mare*) they are known to this day. They are not seas, however, but ancient sea beds, now probably nearly, if not quite, destitute of water: vast arid basins like the Sahara, or the great interior Utah basin of our own continent.

Examined more closely, these dried-up sea beds—to which Neison applies the irregular but convenient plural *mares*—are seen to have a rolling surface like some of our western prairies, or to be traversed by numerous long ridges, resembling the wave-like sand hills which give so marked and peculiar an appearance to the deserts of Western Australia, the leveler portions being dotted with low mounds interspersed with small crater pits. In many places formations of an apparently alluvial character abound, while the ancient coast lines show distinct traces of water action. Two of these lunar plains—*Mare Humorum* and *Mare Chrisium*—are walled in completely by lofty mountains, presenting stupendous precipices to the vanished sea. The larger mares are more like ocean beds. They run together as terrestrial oceans do, and sometimes merge into the brighter continental regions, without a distinct line of demarkation. In other places they show a rugged coast line, rising into cliffs and peaks, and pierced at times by valleys and ravines.

One of the most conspicuous of these lunar ocean beds, also one of the deepest, is known as the *Mare Serenitatis*. Its area is nearly 125,000 square miles. Within its dark gray border, from thirty to eighty miles wide, is an extensive inner plain which at times presents a fine clear light green tint with a central streak of pure white, the green area lying lower apparently than the gray exterior. The green tint is difficult to catch, except under favorable conditions, and is much weakened by the effect of numerous small white round spots and gray ridges.

Another of the moon's green plains was discovered by Mädler in the *Mare Humorum*, already mentioned. This is one of the smallest as well as most distinctly bordered of the dark gray plains. Its area is 50,000 square miles. The greater portion of its interior is distinctly tinged a dusky green, sometimes very marked, affording a strong contrast with the pure gray of the borders and high enclosing ridges. On the west the green area extends nearly to the edge of the *mare*, but elsewhere, as in the *Mare Serenitatis*, it is separated from the border by a narrow darker gray fringe, except on the northwest, where the gray and green areas merge insensibly into each other.

Still another area of green is observed in the *Mare Chrisium*, one of the most conspicuous of the moon's dark plains. It is completely enclosed and is, perhaps, the deepest of the lunar *mares*. Its area is 78,000 square miles. Its general tint is a gray mixed with an unmistakable tinge of green, especially under high illumination. This verdant hue is seen to best advantage for several days before and after the moon is full.

These and other color changes on the face of the moon—as, for instance, the darkening of the great ring plain of Plato with increasing light, and like changes in certain long winding lunar valleys—led Beer and Mädler to suggest that they would indicate vegetation, were vegetation possible on the surface of the moon. But having accepted Bessel's conclusion that there could be neither air nor water on the lunar surface, and consequently no life, those much respected selenographers could not entertain the hypothesis of lunar vegetation, however strong the evidence might seem.

But Bessel's opinion, as our readers already know, is inconsistent not only with the conditions on which he based his calculations, but also with the results of more recent studies of the state of the moon's surface. So far from being an airless, waterless, unalterable desert, a changeless mass of dead matter, like so much volcanic scoria, the moon is now known to have an atmosphere of considerable volume and density, to present abundant evidence of physical activity and change, and to have in all probability water enough to make life easily possible on its surface.

The moon is dying, but very far from dead. Being so much smaller than the earth, it has run its course more rapidly, but is still a good way off from that goal of ultimate deadness to which so many astronomers have theoretically assigned it. There is not the slightest adequate evidence, Neison says, of the popular view, and "its truth would be admitted by no astronomer who had devoted sufficient attention to selenography to enable him to thoroughly realize the probable present condition of the moon."

Such being the case, the hypothesis that the moon's green plains derive their color from vegetation ceases to be impossible or absurd. The evidence is not of a character to justify a positive assertion that the mythical man in the moon may have abundant pasturage for his cattle; but his case ceases to be absolutely hopeless when a thorough-going selenographer can say, as Neison does, that the moon may possess an atmosphere that must be regarded as fully capable of sustaining various forms of vegetation of even an advanced type; that it does not appear how it can justly be questioned that the lunar surface in favorable positions may yet retain a sufficiency of moisture to support vegetation of many kinds; and that in a very considerable portion of the entire surface of the moon, the temperature would not vary sufficiently to materially affect the existence of vegetable life.

Who can tell but that the aforementioned man in the moon may not follow the plan of the African tribe which Livingstone tells of, and keep himself and his cattle in extensive lunar caverns, where the temperature is uniform and water abundant; driving them forth upon these great green fields for a fortnightly feed when the sun is up for its long days and the grass in good condition? Jules Verne ought not to neglect so inviting a field of exploration.

WORKMEN AND THEIR TEACHERS.

For examples of the lack of definite knowledge upon simple practical subjects, by those who act as judges of workmanship, we need not look far. For instance, if we find in a mechanical newspaper a discussion on the proper manner of putting wheels upon axles, we shall perhaps read as follows: "Make them parallel and bore the hole parallel." "We have tried that, and we had more wheels come loose than we do now when we put them in taper," says another. The truth is that "make them parallel" is correct for good workmanship, and "make them taper" is suitable for inferior workmanship. Who ever heard of a properly designed and constructed parallel axle becoming loose in its wheel, unless from a fracture of the one or the other? If the boring and turning were either out of parallel or out of round, if the tool marks were left too deep, or if the sizes had not allowed the proper amount for shrinkage or the hydraulic pressure, as the case may be, the parallel shaft will come loose; but these defects have no business to exist, and can only exist from a lack of either surveillance or practical knowledge on the part of those in charge of the work.

Another cause for the common ignorance of certain and accurate methods is the unwillingness of a great many of our expert mechanics to impart their knowledge to others. This undoubtedly exists to a deplorable extent, and we have heard it defended upon the plea that business men are not in the habit of bruiting to the world any advantages they may happen to possess in their business facilities; and why should mechanics do so in their business? This is indeed a difficult question to answer upon a business basis, and brings us to the main question, which is how to utilize the knowledge possessed by our most expert artisans, and, by imparting it to our apprentices for their guidance, make superiority and rapid workmanship the rule and not the exception. Much effort has been expended in this direction by various publications, but we regret to say that we very rarely find a book in a machine shop; and need we look far for the reason, which lies not in the backwardness of the press in utilizing the materials at hand, but in the quality of the materials themselves, which do not as a rule commend themselves to those they are intended to benefit? The reasons for this are that, as we have before remarked in these pages, we must look for the science of practice to those who are known from their practical skill; and this course we have endeavored to take in the SCIENTIFIC AMERICAN and the SCIENTIFIC AMERICAN SUPPLEMENT, which have drafted into their service the best known talent in each branch of practical education upon which they have treated. That our efforts have been appreciated is attested by the freedom with which the scientific newspapers of both the United States and of England have drawn upon our columns.

Of the importance of imparting to others the results of the experience of the skilled workman, we will cite the following: Some four years ago there was introduced, from England, a special tool steel, possessing the peculiarity that it did not require any hardening. It was however difficult to forge, since it would crumble to pieces if heated to more than a bright red, and also if hammered at a very low red heat. The writer was one of the first men in this country to try it, and found no noteworthy advantage possessed by it for light lathe or other work. It had no advantages, in fact, as a finishing tool, and but very few for such roughing purposes as the shop in which it was tried afforded Its cost, too, being sometimes as great as that of ordinary tool steel, its use was not considered advisable. A year afterwards it became known that a certain printing press manufactory had adopted this steel, and had speeded up its machinery faster in consequence of the superiority of the new steel. A visit to the establishment failed to elicit from its manager any data or opinion; but first the speed and feed of some of the tools, communicated to the writer by workmen, disclosed that there was "nothing in it," as mechanics say, and a tool made of that steel and at the manufactory in question, lent by one of the artisans to the writer, showed upon experiment that its superiority was confined to heavy cuts on hard metal, circumstances sufficiently unusual to show that the steel was suitable for special purposes only; and hence it was no surprise to learn that its general use had at that factory been discontinued at a subsequent date. However, it was tried, at the suggestion of the writer, upon pulleys, by Messrs. Laffan and Edgar, of New York, who, finding it served excellently well, applied it to turning shafting, and they were so well pleased with its adaptability to their purposes as to adopt it and recommend it to others. On another occasion, the writer was requested to visit one of the United States navy yards to see the excellent results obtained from a certain brand of American tool steel, for which universal merits were claimed; but on inspection, he found the cutting speed on small work to be only about 25 feet per minute, and that on larger work to range between 9 and 12 feet per minute; so that in neither case was the duty obtained from the tools sufficient to form any criterion of their cutting value.

If we turn to written instructions, we shall find tha for no kind of iron work is a speed of more than 25 feet per minute recommended, while in most cases 23 feet per minute is not exceeded. On small work, however, 35 feet per minute is easily attainable, and is by far the most economical. Two out of every three "authorities" give the cutting speed for cast iron as being less than that for wrought iron, whereas the exact contrary is the fact. Now wherein does the fallacy lie? We have been asked that question by expert workmen, many times over, and we could find no reasonable answer, except that they did not properly forge or temper their tools. No doubt that, in many cases, defects in the shape of the tools may have had something to do with it; but be the cause what it may, one thing is painfully apparent, that the author of the information was ignorant of his subject: as ignorant as the mechanical correspondent who visited Sheffield in England, and came back and exposed his mechanical ignorance a few weeks ago by writing a long article upon the want of progressive ideas among Sheffield manufacturers, adducing as proof that they forged the blades of fine cutlery instead of rolling them, all unconscious of the fact that to the forging belonged a superiority of quality that can under no circumstances be attained by rolling processes.

IS RARE BEEF DANGEROUS?

For several years past hygeists and pathologists have been closely studying the progressive invasion of the *tæniodea* or tape worms in the human species, in order to discover all the causes which lead to the presence of these terrible parasites and the means of preventing them. While many vital points relating to the subject are still in controversy, it has been demonstrated that we are attacked by the armed tænia (*tænia solium*) and by the non-armed tænia (*tænia medio canellata* or *inermis*), that the germs of these two entozoa are introduced into the intestinal canal through flesh food, and that the germs of the first usually come from pork and those of the second from beef and mutton. It has furthermore been pointed out, by M. Régnault, that, while the number of attacks of the armed tænia has not notably augmented, those of the non-armed worm are becoming more and more frequent.

The cause attributed to this increase is first the therapeutic use of raw beef, and second, the habit of eating that meat, as well as mutton (the latter, however, in a less degree than the former), in a very rare state. Both beef and mutton contain morbific germs, which might well escape the scrutiny of a much more rigid inspection of market food than obtains here: and these, lodged in some organ of the body, speedily develope into the mature worm. Cooking the meat through thoroughly is a sure safeguard; but on the other hand, there are many who have no relish for well done beef or mutton, and, among the Germans especially, the meat is prepared in various ways without being cooked at all. We have frequently seen raw beef steak served and eaten with the simple accompaniments of pepper, salt, and vinegar. Butchers in New York city chop finely the good meat which is trimmed from joints or bones, and sell it in its hashed state, at a low price, to the poorer classes, who likewise eat it raw, and thus save the fuel required for cooking. As indicated above, physicians often prescribe raw meat to the weak and debilitated, and it is no very uncommon thing to see infants sucking tender pieces of raw steak. Of course all this is dangerous, and the fact, we have reason to believe, is not entirely unknown to those who favor the practice; but on the other hand, there is a general idea that if meat be cooked ever so little, merely warmed through, all peril is obviated. That this is a subtle error will be clear from a brief consideration of the cooking process.

The *rationale* of broiling is the subjection of a large surface of meat to a sudden high temperature. Coagulation of the exterior albumen succeeds, and the juices are prevented from escaping, so that they are cooked with the fibrous part of the meat, enclosed as it were between two shells. Roasting, or rather baking, as it is practised in this country, is virtually the same process, the hot oven being substituted for the coals. Frying accomplishes the same end by the action of highly heated fat. Boiling is just the reverse, as the heat in that case is applied gradually, so that the albumen can be coagulated uniformly through the mass. Now albumen coagulates at 142° Fah., and further heat reduces it to a firm transparent body, so that a piece of beef which is left "unbasted," that is, unmoistened, during the cooking process, and its exterior temperatures not thus kept down, or a steak allowed to cook slowly over a slow instead of a brisk fire, is likely to become encased in a close crust, not inaptly termed "leathery," which tends to prevent the further penetration of heat. It will readily be perceived that thus, although the meat has been subjected to cooking a proper length of time, and although its exterior may appear overdone, a part of its interior may be practically raw, and may never have reached the temperature of 140°, beyond which it has been proved germ life cannot exist. Hence, in such portion of the meat thus prepared, the germs are none the worse for their warming, and enter the body in an active state.

It does not follow, however, from this that we are to interdict that most noble of all dishes, the rare cut of sirloin, but it does follow that we should exercise some greater care in its preparation. And in this respect we have a very safe and simple guide in the two temperatures noted above, or rather in their close approximation. Everybody knows the difference in color and general appearance between meat nearly raw and meat cooked, and is capable of observing the glairy, flabby condition of the former as compared with the firmness of the latter. In one case the albumen has not coagulated, in the other it has. But in the latter instance we know that a temperature of 142° has been attained, and that that is two degrees higher than the germ death point; hence we are thus rendered certain that the danger is obviated, on simple inspection of the condition of the meat, which still is rare enough to satisfy any healthy taste.

It is not difficult to perceive that the ravages of that other fearful parasite, of the hog, the *trichina spiralis*, have been the cause of greater care in the preparation of pork; and as the same thorough cooking which destroys the *trichina* likewise destroys the tænia germ, both evils are obviated at once. Hence we find another cause for the diminution in cases of armed tænia noted by Régnault, while the prevalent neglect of precautions regarding beef and mutton may likewise account for the spread of the affliction attributable to those meats.

It is a curious fact in this connection that a prominent French medical journal (the *Abeille Médicale*) strongly recommends horse flesh to be used raw therapeutically, and asserts that it is much more nourishing than either beef, mutton, or pork. We doubt whether this last assertion will meet with general acquiescence; but if it appears, as our contemporary states, that the horse is not subject to the parasitic affections common to the cattle now used as food, there can be no question but that, from a sanitary point of view, the food value of our superannuated chargers is greatly enhanced. At all events, for some reason the consumption of horseflesh in France is rapidly increasing, as recent statistics show that nearly 30 per cent more of the animals have been slaughtered, for the markets in Paris, during 1876 than were killed last year.

THE "THUNDERER" EXPLOSION.

It will be remembered that, in our recent account of the disastrous boiler explosion on board the new English war vessel Thunderer, we stated, on the authority of the London *Times*, that the casualty was owing to the gross carelessness of not removing the wedges which had held down the safety valves during a previous hydraulic test. Such negligence seemed almost inconceivable, and therefore we are glad to welcome the flat contradiction given by *Engineering* to the *Times* report. The valves were not wedged down, and the similar valves in the unexploded boiler were all in working order when tested cold. Our contemporary points out that the valves of the burst generator, when cold, were $\frac{1}{100}$ inch free in their seats. Around the latter, except at the steam connection, there is a broad flange not heated by direct contact with steam, its under surface being in contact with the air of the fire room, and its upper surface forming the inside of the bottom of the valve weight box. This cool flange, therefore, tended to prevent the expansion of the cast iron chamber. So that the brass valve seat must have had an increased radial expansion inwards. Now taking into consideration the dimensions of the parts, the temperature of the steam, and the coefficient of expansion of brass, it is found that the valve, after the seat had expanded inwards, would be 0 005 inch larger than its seat. The valves were thus obviously fitted too nicely, and through the unequal expansion they set fast. In addition to this the stop valves were shut, and it is known that the steam gage was badly out of order, and these three causes are, in *Engineering's* opinion, amply sufficient to account for the explosion.

LIGHTNING RODS.

"Professor Wise, the balloonist, who has had rare opportunities for studying and observing storms as well as calms, has repeatedly expressed his convictions that lightning rods are useless in electrical storms, but that metal roofs are an absolute protection. He says that during a recent storm several flagstaffs were shivered down to the point of contact with the metal roofs, when the damage ceased, the fluid dispersing over the expanse of metal. This corresponds to hundreds of other cases that he has examined; and he declares his conviction that 'the lightning rod, as a protection in itself, is of no more value than a bodkin would be to ward off the ball fired from a Columbiad.'"—*American Architect and Building News.*

A metallic roof may, in some cases, avert damage to an unrodded building, by facilitating the passage of the electricity to the best wetted portions of the exterior of the structure, to the water leaders, etc., down which the lightning may pass to the earth; a well wetted wooden roof may assist to the same result. Hundreds of unrodded houses, with and without metal roofs, have been struck, and not seriously damaged. But it is nonsense to assume that a good lightning rod, properly connected with the roof and with the ground, has no value. Although unrodded buildings may by chance escape, they are always in danger, and the lives of inmates are in jeopardy.

On the other hand, all experience, the world over, from the year 1752, when rods were first invented by Franklin, to the present time, has shown that conductors are an essential means of safety in thunderstorms, that they preserve human life, and prevent the destruction of property whenever properly applied.

Formerly, when ships sailed without rods, the loss of life and property at sea was appalling. Nearly all vessels now carry rods, and such an occurrence as serious damage to a rodded vessel by lightning is almost unknown. If, like ships, our dwellings and buildings could have the broad expanse of the sea for their rod terminals, they would be as universally exempt from injury by lightning.

We except, however, buildings and vessels containing petroleum, or other substances from which inflammable gases exude. The latter mix with the surrounding air and form an explosive atmosphere of large extent, often reaching above the points of the electrical conductors; and such mixtures will be set on fire by the electricity on its way to and before it can reach the conductor.

In nearly all cases, our house rods are defectively connected with the ground. They are simply stuck down for five or six feet into dry earth; whereas they should be soldered to a water or gas pipe, or be connected with some large extent of conducting material placed underground.

The following valuable and practical hints, as to the proper arrangement of lightning rods, are given by Mr. John T. Sprague, in his excellent treatise upon "Electricity; Its Theory, Sources, and Applications:"

"It must be remembered that lightning is not a mere thread of flame, or confined to the visible line; a large space all round the line takes part in the discharge, and gives up the force previously accumulated in it as tension.

"These principles settle conclusively all questions as to the construction of lightning conductors. Their object should be to connect to earth every portion of a building; and as this is actually possible only with metal buildings, they should connect every salient point and as much of the surface as possible, so as to extend around the building the area of low tension, or artificial "earth" surface opposed to the cloud. Chimneys require especial attention, because they are tubes lined with conducting material, containing warmer air: and if with fires, then extending a comparatively good conducting column of warm air towards the cloud and so inviting a discharge; hence it is that lightning almost always enters a house by the chimneys. All doors and windows causing currents of air should be closed during a thunderstorm.

'The prime essential is a good connection to water; water and gas mains provide the best if the conductor is well secured to them; next to them is the metal shaft of a good pump, in a well constantly supplied by springs; then ponds or ditches. What is required is a large metal surface terminating the conductor, and in contact with a stratum of moist earth, so that a hole sunk into wet gravel, into which the conductor is led, and surrounded with a quantity of coke to increase its surface of contact, will answer, but dry clay, or rock, is not safe. This connection should, if possible, surround the building by means of rods from its various corners, either led to different earths or else continued by a rod round the house to one earth connection. Every piece of metal work above the building should be utilized, such as ridge caps, guttering, and water pipes. They cannot be trusted as conductors because of the joints in them, which offer great resistance, and therefore prevent reduction of tension, but they will help to form a protecting network around the building. especially if strips of copper are soldered across each joint. For the same reason a connection should be led from the bottom of the down pipes from the gutters to the nearest suitable earth, though a very good but variable earth connection is set up from these by the water itself during heavy rain. The lower parts of the bell wires may also be advantageously connected to an earth, such as the nearest gas or water pipes, as several accidents have occurred from their having either received a direct charge through the walls, or having a violent current induced in them.

"The terminals should be attached to all high or salient points, most particularly chimney stacks; if these are wide, and contain several chimneys, it is safer to have two points, though usually one is sufficient; but the kitchen chimney, or any one commonly used, and therefore lined with soot, and containing warm air, should be specially attended to. The points may be made of rods of 1-inch iron drawn out to a point, rising 2 or 3 feet above the building; they are better also for galvanizing. There is no advantage in any of the fancy points, patented or otherwise. The conductor depends upon the size and hight of the building. A factory chimney or church steeple should have a copper conductor of at least ½-inch section, either as a rod or as a wire rope, well protected against injury; for smaller buildings, iron rod may be used instead of copper. In ordinary cases galvanized iron wire of about ¼-inch diameter (such as is used for telegraphic purposes) will answer perfectly, if led separately from various salient points, and carried down the different sides of the house and connected as above described, to the guttering, etc., but for a single conductor at least ½ inch rod should be used. Solid rod is best, as it exposes least surface to rust, for it is the mass or weight of metal which conducts, not its surface, as some suppose; but every joint must be carefully made and soldered, to secure metallic continuity and low resistance.

"It will be seen that conductors should never be insulated from the building, but, on the contrary, as much of the surface as possible should be connected to the conductor. Electrometers, etc., are often surrounded with a cage of wire connected to the earth or to the negative pole of the active source of electricity, in order to prevent them from being affected by external electric disturbances. That is exactly what we require to do with our buildings; an iron house well connected to earth would not only be perfectly safe, but its inmates would scarcely feel any of the effects usually produced on the nervous system by "thundery" weather, except so far as these are due to heat. The object aimed at in a lightning conductor should be to approach that condition as nearly as possible; to obtain an enclosed area within a conducting envelope provided with points and connected to earth."

Life on the Earth.

Professor P. G. Tait, of the University of Edinburgh, in his lectures on recent advances in physical science, lately published, considers the question how long life has been possible on the earth. He concludes that ten millions of years is "the utmost that can be allowed from the physical point of view for all the changes that have taken place on the earth's surface since vegetable life of the lowest known form was capable of existing there." Opposed to this is the view of the most eminent modern geologists, that at least three hundred millions of years have passed away since terrestrial life began.

BREECH-LOADING FIREARMS.

We publish the third and last series of illustrations of breech-loading fire arms, which we select from the pages of E. H. Knight's "American Mechanical Dictionary."* It shows three American and one Swiss inventions, the latter being a bolt needle gun.

U U′ are two positions of the Remington gun; the left hand figure shows the gun when fired, the right hand ready to load. The breech block, *b*, swings upon a strong pin within a mortise of the stock. *c* is a tumbler which braces the breech piece against recoil at the time of firing, and forms a part of the hammer which strikes a firing pin which passes through the tumbler and is driven against the cap or part of the cartridge case containing the fulminate.

The breech piece, *b*, and tumbler, *c*, are so formed that when the former is closed the rounded upper portion of the tumbler works in a concavity in the back of the breech piece, as shown in Fig. U; and when the hammer is drawn back to half cock or full cock, the rounded back of the breech piece works in a concavity in the front of the tumbler, as shown in Fig. U′. This mode of matching the breech piece and tumbler prevents the possibility of the hammer falling until the breech piece is perfectly closed, and so obviates the possibility of premature explosion of the charge. The extractor, by which the discharged cartridge shells are drawn out from the chamber of the barrel, works between the receiver and the breech piece, and is operated by the opening movement of the latter. The breech piece is opened by a thumb piece. A guard lever, *d*, prevents the trigger being drawn when the breech piece is open.

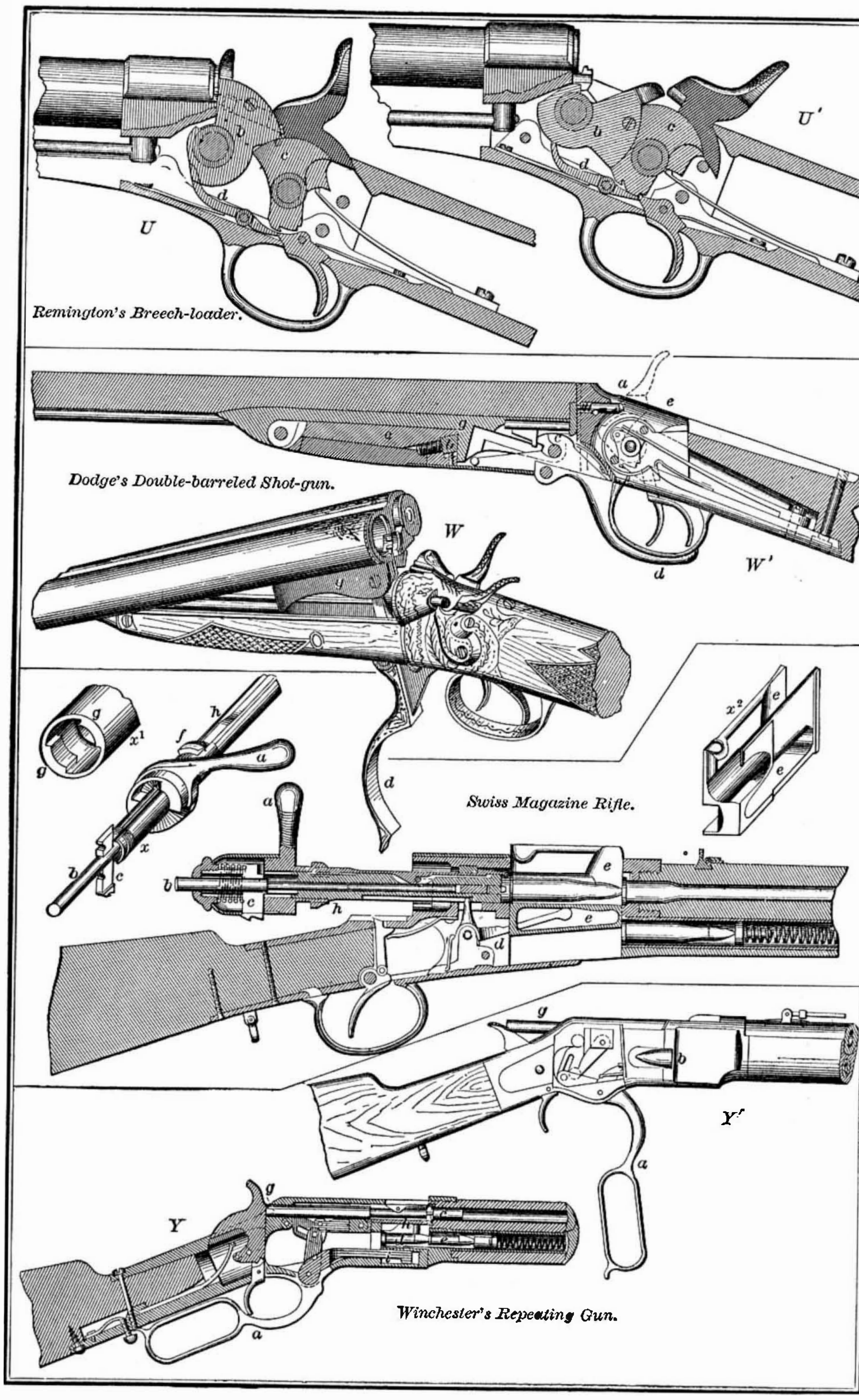
W W′ are two views of the Dodge breech loader, shown as a double barreled breech-loading fowling piece. W is a perspective view, and W′ a sectional view. The barrels are hinged to the front end of the stock, so as to tilt upwardly at the rear and nearly balance upon the hinging point, the motions being made by means of the pivoted lever *d*, which laps over the trigger guard and locks the barrels in firing position by engagement of a hook, *c*, with a pin passing through the lug, *g*. The front end of the lever extends beyond the pin on which it turns, and works in a slot in the center of lug, *g*, beneath the barrels, which it serves to elevate and depress. As the barrels are elevated, the front end of the lever strikes against a projection on the stem of the extractor, and retracts the spent cartridge capsule. The frame, *e*, is made of a single piece of metal extending from the front, where the barrels are hinged, to the grip in the rear of the breech; and the locks are fitted in recesses therein, dispensing with separate lock plates. The locks are rebounding, that is, they go forward and fire the cap and return to half cock. The hammers draw back the firing pin when fully cocked. The barrels are adjusted on the frame, and wear is compensated by means of the block, *b*. In use, the left hand need not be moved from where it is in firing; the breech is brought under the right arm, the lever thrown down, a fresh cartridge inserted, the lever returned, the hammer cocked, and the piece is ready to fire.

The gun adopted by the Swiss Federal Government has the magazine and cartridge carrier of the Winchester, with the needle exploder and bolt breech. The large figure is a longitudinal central section; *x* is a perspective view of the bolt, firing pin, and lever detached; x^1 is a view of a piece of the breech cylinder; x^2 is a view of the cartridge carrier detached.

The motions are as follows: the lever, *a*, is raised, rotating on the firing pin, *b*, and cocking the latter by the pressure of a cam upon the transverse trigger bar, *c*; the bolt is then drawn back, carrying the firing pin and the hook, which retracts the spent cartridge; the motion eventually rocks the bell crank lever, *d*, and raises the carrier *e*, which brings another cartridge in line with the barrel. The bolt, *h*, is then pushed back, pressing down the carrier, *e*, and driving the cartridge into the barrel; a partial rotation of the bolt, by means of the lever, *a*, locks it firmly by the catching of studs, *f*, on the bolt behind lugs, *g*, on the breech cylinder. The firing pin has remained on the cock since the first motion of the semi-rotation of the bolt, and is now pulled off by the trigger. The combination is known as Vetterlin's.

Y′ is the Henry magazine rifle, now known as the Winchester repeating gun. It may be used as a single loader or a repeater. As a repeater the motion of the lever, *a*, withdraws the spent shell of the previous charge, raises the hammer, recharges the gun, and relocks the breech mechanism. The magazine contains seventeen cartridges, which can be discharged in as many seconds. With single loading, the cartridge is placed in the carrier block, and a single motion puts it in order for firing. The cartridges are placed in the magazine by pressing them through the trap, *b*, on the right hand side of the gun, the magazine being easily filled while the gun swings at the side. They are fed from the magazine into the carrier block by a spiral spring.

Y is a section of the gun immediately after discharge; *c* is an empty shell; *d*, one in the carrier block; *e*, one in the magazine; by the forward motion of the lever, *a*, the links take the position shown in Y′, the piston, *g*, is withdrawn, raising the hammer to the full cock, and extracting the empty shell, *c*, which is thrown upward at the same time the carrier block, *h*, with the carriage which it contains is raised by the lever, *i*, placing the cartridge opposite the chamber. This position is seen at Y′. The returning motion of the lever drives the piston forward, leaves the hammer at full cock, forces the cartridge contained in the carrier block into the chamber, drops the carrier block to receive the following cartridge from the magazine, and places the arm in readiness to be fired.



Remington's Breech-loader. Dodge's Double-barreled Shot-gun. Swiss Magazine Rifle. Winchester's Repeating Gun.

BREECH-LOADING FIREARMS.

*Published in numbers, by Messrs. Hurd & Houghton, New York city.

Plant Anæsthesia.

The curious discovery has recently been made that anæsthesia may take place not only in animals but in plants, and, in brief, in all forms of life. It has been demonstrated that etherisation acts finally on all the tissues of animals and on the central nervous system. Hence, if plants have tissues, the anæsthetic should equally act on them. This substantially appears to be the case; and every vital act, whether occurring in animal or vegetable, may be anæsthetised. In plants, M. Claude Bernard, to whom is due the credit of the discovery, has found that germination ceases under the influence of ether. He introduced water cresses, which germinate from day to day, into two precisely similar tubes. In one tube he placed a little ether. The plant therein on the following day was found not to have germinated, as the other had; but after being removed from the anæsthetic, the first went on and germinated in a natural manner. The plant had literally been put to sleep.

The same is true of ferments; for beer yeast, after contact with ether for twenty-four hours, completely loses its activity, and yet regains it as soon as the etherization is stopped.

EXHIBITION NOTES.

PAPER MAKING.—The papermaking machinery is among the most attractive features of the hall, and, to most visitors, also among the most novel. It is exceedingly interesting to them to see the rags come out of the great iron drums, where they are churned and ground, in the form of a milky fluid; to watch the deposit of the snowy pulp, and to see the pulp carried forward on broad belts and between successive rollers, until, growing always thinner and drier, it finally is rolled on a drum as firm, white printing paper. The machinery is said to be the best for the purpose made.

NOVEL TYPE WRITER.—A Russian inventor, M. Alissoff, of St. Petersburg, shows a type writer which, for excellence, of mechanical structure, cleanness of impression, and ability to do printing in different characters, leaves the American type writer far behind. It cannot be made to work nearly as fast, however, as its American rival; and as speed is what most people seek in such a machine, it is doubtful if it will ever come into extensive use. M. Alissoff says that he first turned his attention to making a machine for speed, but finding by observation that few men can think faster than they can write with pen or pencil, he concluded that such an invention was not what was needed, but something that would make as accurate and legible copy as a printed page. In this undertaking he has fully succeeded. His machine writes in the Russian and English characters, makes capitals, small capitals, figures, signs, punctuation points, and all the French accents. As the types are movable, it can be arranged to print Greek, Hebrew, or any other written language. The manner of working it is to move a lever on a dial to the letter desired, and make the impression with the foot upon a pedal. The speed is about that of ordinary writing. M. Alissoff also exhibits an invention for photolithographing music. The staves notes, and signs, printed on thin paper, are kept in small boxes, from which they are taken and pasted upon a large plate of glass, regularity being secured by lines on cardboard at the back of the pane. Thus the composition is built up much more rapidly than could be done with types. A negative is then taken of any size desired—the light passing through the glass—and when transferred to stone the printing is done by the usual process.

CURIOUS SEWING MACHINE CONTRIVANCES.—A French machine has a universal feed, which enables the operator to give the cloth any direction desired, without touching it—a very useful device for embroidering on stamped patterns.

Still more ingenious is an American invention for embroidering set figures automatically. By a curious arrangement under the table, the feed is set so that the machine goes on of itself, reproducing the pattern. About a dozen different simple patterns can be embroidered by changing the apparatus.

Another noticeable invention is a machine which sews with either one or two needles, as may be desired. It is especially useful for embroidery, as threads of two colors can be used and double work performed.

Three kinds of machines are shown that sew from the spools, and thus dispense with the troublesome shuttle and bobbin.

The Visit of the French Working Men.

About fifty French mechanics, who have been selected by the Government of France to visit the Centennial, recently arrived in this city. They are to make a critical examination of the Exposition, each man devoting himself to the display presented in his particular branch of art or industry, and, on their return to France, are to prepare reports of the progress exhibited in each separate branch of manufacture. Nearly every class of French industry has its representative in this commission, and the members themselves appear to be intelligent and wide-awake mechanics. There is nothing political in their mission; and in this respect they differ from a body of reputed French artisans who lately visited us, but who deservedly received no special attention, owing to their affiliations with that unfortunate class of men who are always at the head of labor agitations and communistic disturbances. We trust our American working men will give their French brethren a cordial welcome, and spare no pains in affording them every facility for acquiring the knowledge they seek.

IMPROVED PIPE CUTTING AND THREADING MACHINE.

Messrs. Joseph B. Eaton and Charles Latham, of Shamokin, Pa., have patented (July 4, 1876), through the Scientific American Patent Agency, an improved pipe cutting and threading machine, that may be worked effectively in a very narrow space, so as to produce a saving in time and labor in the digging and the working of the machine. Fig. 1 is a top view of the cutter and threader, and Fig. 2 a sectional end view of the same.

The shell or casing, A, is made of two hinged sections, which are applied around the pipe to be worked upon, and locked firmly together by a suitable device. The threading dies, B, and the cutters, C, are guided in interior recesses of the shell, and adjusted or fed forward to the required depth of cutting by means of set screws worked from the outside of the shell. The shell is cast at the ends with raised ratchet teeth, D^1, along which an operating handle, D, is guided at both ends by an outer arc-shaped part, *b*, and an inner concentric piece, *d*, that slides in a recess of the shell below the ratchet. The outer guide pieces of the handle, D, lock, by spring pawls, D^2, into the ratchets, to take hold of the shell, and turn it in one direction, while releasing it when turned back in opposite direction. A drawing pipe, with threaded end, fits into the threaded end of the shell, and is attached by clamp screws tightly to the pipe to be threaded, drawing by the screw the threading machine forward for cutting the thread on the pipe.

When the pipe is threaded, the machine is returned for clearing the thread by a semicircular handle with hook end, that is inserted into the small socket holes, *e*, of the shell.

It is claimed that thus a deep or shallow thread may be cut on water and gas pipes of different sizes with ease and rapidity while the cutting is done in perfect manner without leaving a shoulder at the end of the pipe.

Fig. 1.

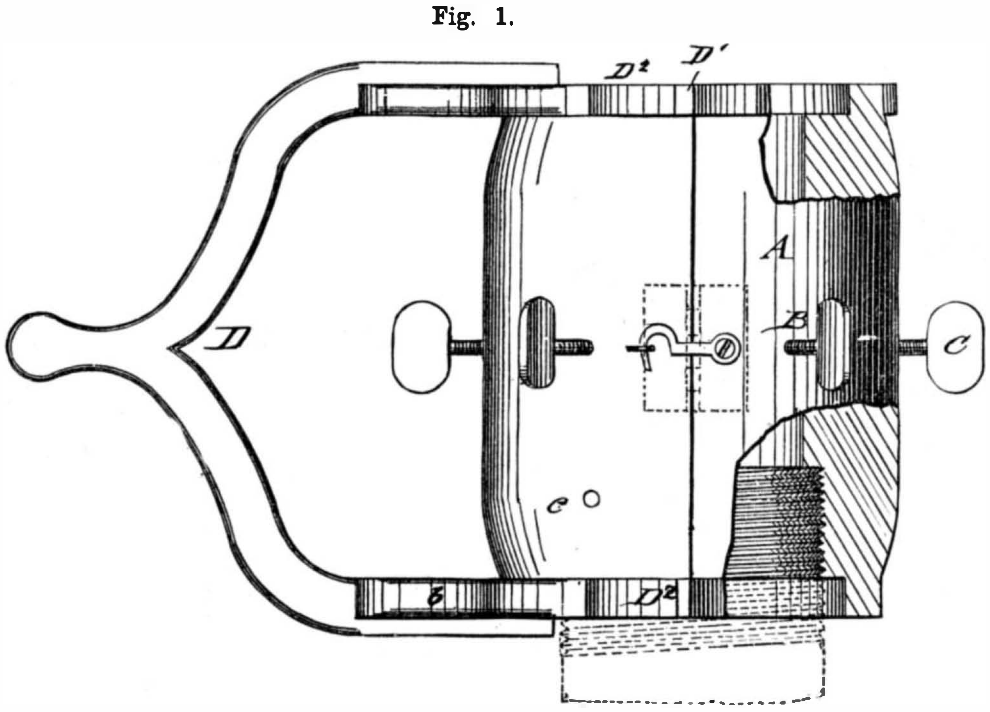
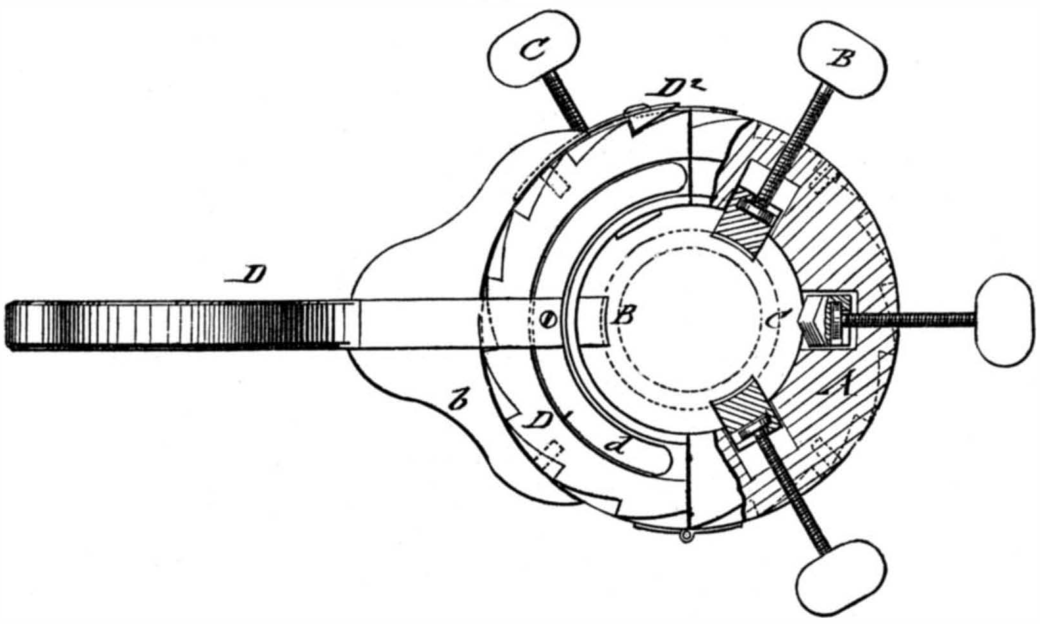


Fig. 2.



EATON & LATHAM'S PIPE CUTTING AND THREADING MACHINE.

South African Railways.

A line of railway 120 miles in length was recently opened between Cape Town and Worcester, South Africa. The road is an extension of the Cape Town and Wellington Railway, purchased by the government some years ago, and is part broad and part narrow gage. It is intended eventually to make the whole line of the latter description. Railway work in other parts of the colony is being vigorously prosecuted; 65 miles of road are nearly complete on the eastern line from Port Elizabeth, 60 miles on the border line, from East London, will be ready by the end of the year, and a similar distance on the Midland line will shortly be finished. The estimated cost of the new works was about $30,000 per mile, but this has been exceeded by as much as $3,500 per mile in some cases, the increase being accounted for chiefly by the deficient supply of labor, enhanced rate of wages, and high cost of provisions.

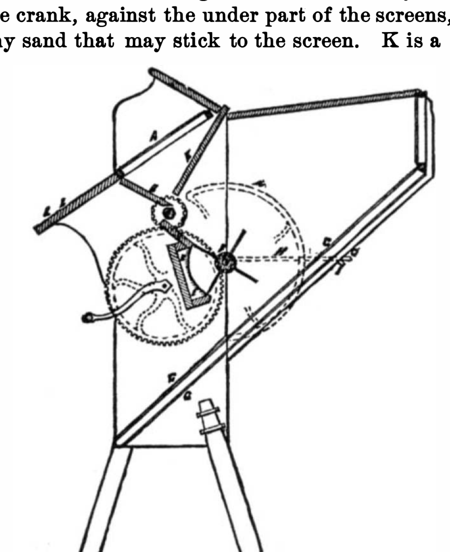
Meteoric Iron in our Church Steeples.

On August 10, the earth passed through the great belt of meteors; and on about November 13, it will again plunge into the midst of these vagrant bodies. People who are curious about meteoric iron, or who desire to investigate that substance, will probably therefore find the present a good time to look for it. M. Tissandier has lately shown that the metal is constantly found in the cosmical dust, which often may be collected from rain, and which exists in the atmosphere of elevated regions. Most of the meteors which strike our atmosphere are at once dissipated by the heat of intense friction, and the iron, melting, falls like shot, in the globular or nearly globular form in which M. Tissandier has found it, and which, he thinks, is one convincing proof of its celestial origin. M. Yung recently told the French Academy of Sciences that the best places in which to look for meteoric dust is an old church steeple. Collect all the dust which has become deposited in out-of-the-way corners, where the wind has not been able to reach it, and examine it under the microscope. Apart from learning how many curious things are floating about invisible in our atmosphere, the student may be able to get together sufficient of the iron to examine it by chemical means.

IMPROVED SAND AND GRAVEL SEPARATOR.

Builders, masons, roadmakers, contractors, and others will doubtless be interested in the invention herewith illustrated, which is adapted for screening sand and separating gravel, overcoming the slow and tedious process now in use. It is claimed to screen sand, no matter how wet, when it cannot be screened by any other process. It separates the gravel entirely from the sand, and deposits the roofing gravel and coarse gravel for walks, etc., in separate places from the sand, thus saving the necessity of a second screening when roofing gravel is in demand. It can be worked to screen thirty yards a day, by one man throwing the sand and a boy to turn the crank. It works rapidly, and will supply any grade of sand.

A is a coarse screen on which the sand is thrown and which keeps large pieces from passing into the machine. The sand passes down to the feeder, B, which carries it down to the cylinder, E. The latter is made with four rows of pins, and revolves with velocity, spreading and separating the sand and gravel and throwing it against the screens, G G. These screens are placed one over the other. The roofing gravel and sand pass through the upper screen (which is made of half inch mesh or any other size needed) to the lower, which is six meshes to the inch, or any size required. The roofing gravel passes down between the legs, which are inclosed, and the sand through the fine screen. The coarse gravel passes down in front of the machine. H is a wrapper or beater, which strikes eight times with every revolution of the crank, against the under part of the screens, and loosens any sand that may stick to the screen. K is a feed



board which can be raised or lowered to regulate the flow of sand to the machine. L is a shelf for carrying off coarse gravel. A single screen is made of four meshes to the inch, or any other size required, to be used for screening sand when roofing gravel is not wanted, allowing all the gravel to pass down in front of the machine.

The manufacturers also make a large-sized machine to be run by horse or steam power, having one elevator to raise sand and another to carry the sand into bins, cars, or other places of deposit.

For further information address the manufacturers, Messrs. Chambers & Quinlan, Decatur, Ill.

The Human Voice Transmitted by Telegraph.

Several weeks ago we gave a sketch and description of the thread telegraph, consisting of two small tin or wooden cylinders, each having a membrane stretched over one end, the two membranes connected by a stout thread. Two persons may readily communicate the sounds of the voice by means of these instruments over a thread fifty or a hundred feet in length. The person sending speaks within one of the cylinders, which causes the membrane to vibrate; the vibration passes along the stretched thread to the membrane of the other cylinder; which being held to the ear of the ear of the person receiving the message, the vibration is duly heard, or, in other words, the voice of the sender is made audible.

Professor Graham Bell, by a device somewhat analogous, has succeeded in transmitting the tones of the human voice by telegraph. Instead of the thread he connects the membranes of the two cylinders or drums with the armatures of the electro-magnets, one drum being placed at each end of the telegraph wire. In fact, he not long ago demonstrated the possibility of conveying vocal sounds by means of the ord nary telegraph wires and special appliances for transmitting and receiving the sounds. The apparatus used by Professor Bell is thus described: Two single-pole electro-magnets, each having a resistance 10 ohms, were arranged in circuit with a battery of five carbon elements—the total resistance being about 25 ohms. A drumhead of goldbeater's skin, about 2¼ inches in diameter, was placed in front of each electro-magnet, and a circular piece of clock spring was glued to the middle of the membrane of each drumhead. One of these telephones was placed in the experimental room, and the other in the basement of an adjoining house. Upon singing into the telephone the sounds of the voice were reproduced by the instrument in the distant room; and if two persons sang simultaneously, the two notes were audible at the other telephone.

At the time of the lecture, an experiment was made to show the transmission of articulate speech, an assistant going into the adjoining building where one of the telephones was placed. Several familiar questions were, it is said, understood after a few repetitions. The vowel sounds alone are those faithfully reproduced; dipthongal sounds and rotund vowels are readily distinguished, but consonants are generally unrecognizable. Now and then, however, a sentence comes out with almost startling distinctness, the consonants as well as the vowels being clearly audible. Professor Bell stated that telephonic effects can be produced with three varieties of currents—the intermittent, the pulsatory, and the undulatory. The first are characterized by the alternate presence and absence of electricity in the circuit; the pulsatory current by sudden changes in intensity, while undulatory currents are obtained by gradual changes analogous to the changes of density of air produced by vibrations of a pendulum.

The most recent trial of Professor Bell's instrument was at his residence, Brantford, Canada, August 11. The Toronto *Globe* states that instruments were placed, one in the porch of the residence and the other in an outhouse on the grounds, and communication between these made by ten miles of wire. Musical notes, the human voice, and songs spoken and sung before one instrument were plainly audible by placing the instrument to the ear at the other. By this invention, too, any number of messages can be conveyed over one wire in either direction, provided they have a different pitch; the tones of the voice can pass over the electric wire, enabling the hearer at any distance to hear distinctly what is said, and to distinguish the voice of the speaker. On August 10 the professor had communication made with his instrument on the common telegraph wire between Brantford and Mount Pleasant (five miles), and was spoken with, while in Mount Pleasant, by Professor D. C. Bell and Mr. Griffin from the *Dominion* office in Brantford. On the evening of August 12, the professor tried a new experiment, having had an instrument made so that three persons could sing different tunes or different parts of the same tune into the instrument at the same time. The trial was perfectly successful, the different voices coming distinctly over the wire at the same time, so that they could be separately distinguished by the listener. The practical exemplification of the lately discovered system of telephony made by the professor afforded much pleasure and information to those present.

Correspondence.

The Moon's Longitude and Solar Retrograde Motion.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN SUPPLEMENT (page 492, volume I), you state that a paper by Professor Newcomb, on "Inequality of the Moon's Longitude," was read at the June meeting of the Royal Astronomical Society, and that several of the more notable members of that scientific body expressed themselves as being at present quite unable to tell the cause of the phenomenon. Allow me to advance the following, which, I think, points to the cause.

The sun, his planets, and their several satellites are all distinct members or wheels of the great, grand celestial machine called the solar system; and unless we look upon the whole as a machine, and trace the effects which the retrograde motion of the largest one has upon the smaller ones, and these upon the smallest ones, we shall never be able to tell the cause of the phenomenon now under consideration, nor the cause of kindred phenomena in other moons; for they all move more or less ahead of their times while in one side of their respective orbits, and lag behind while on the other side, just as the earth herself and every other planet does, and must do, although practical astronomy has not yet discovered the facts.

To explain. We take the sun, or main wheel, first: His orbit is to be considered the rim of the wheel; the center of his orbit, the center of the wheel; and he (the sun) fixed, as it were, on or in the rim. That wheel turns on its axis retrogressively; and the rim, and the sun, of course, retrograde at the rate of nearly 50¼″ annually. Now, by virtue of the earth being carried retrogressively by the sun, she, too, retrogrades annually, as it were in her own orbit, nearly 50¼″. Could we stand at the center of the sun's orbit, and view clearly the longitude of the earth at the moment she reaches 180°, we would find that she had fallen behind her sidereal place in the heavens, that is, the point at which she was when she came to 180° the previous time, say 50¼″; and when she came to 0°, she would be 50¼″ retrogressively in advance of where she was at the moment she came to the same point in her orbit one exact year before. In other words, she would be behind time on one side of her orbit, and in advance of time on the other side of it.

And it is exactly so with the moon. In one exact terrestrial year the moon retrogrades in space to the same exact amount; or, in other words, her orbit, as a whole, is carried retrogressively in space nearly 50¼″, annually, or about 4″ for every revolution she makes. It seems easy to see, then, that, in consequence of her retrogression in space, caused by the retrograde motion of the sun, she must be behind time, while on that side of her orbit which is outside of the sun's orbit, and *vice versa*.

I submit the above to the consideration and amendment of the wise and learned.

Gloucester City, N. J. JOHN HEPBURN.

Professor Crookes' Radiometer.

To the Editor of the Scientific American:

On page 116 of your current volume, Mr. Joseph Delsaux, of Louvain, Belgium, presents some interesting experiments upon the radiometer. As I have not a radiometer at hand, I assume that the described tests were correctly made; and feel that there is good cause to suspect a coaction of forces to move the electrometer vanes. Could it not be settled beyond a doubt by charging the radiometer globe from an electrical machine, to the same tension and with the same kind of electricity as the globe contained after being submitted to the radiation of the sun or any source of light, and then ascertain if the action of the radiometer were the same?

Some other phenomena could be investigated in this connection. For instance, it is well known that selenium varies in electrical resistance from 15 to 100 per cent, inversely as the intensity of light to which it is subjected. It is also an established fact that on telegraphic circuits the speed of signaling is decreased during the middle portion of the day, and improved at night. Mr. R. S. Culley, the well known English electrician, called attention, in 1872, to this retardation, and said that the cause was not clear, but attributed it to "the ordinary diurnal variation of earth currents and to the increased resistance of the wires from increased temperature." As Mr. Culley has drawn no line between warm and cold weather, it would be well for Mr. Delsaux and other skillful experimenters to take the matter up, and apply the electrometer to things in the light and in the dark. We may perhaps thus be informed of what we are seeking to know.

Chicago, Ill. F. W. JONES.

Test Colors.

To the Editor of the Scientific American:

In No. 7 of your current volume, I notice a report of a discovery of new test colors from the iris and violet. I have found the blue convolulus major, or morning glory, of considerable practical value as a test for acids and alkalies. In the first place, the flower itself is very sensitive, indicating the trace of nitric acid in rain water after a thunderstorm. The flowers show red spots wherever the rain water has wetted the surface after a shower during the night. A few of the flowers rubbed in a glass of water will give a bright blue liquid, which will instantly redden if a drop of nitric or other acid be put in; and the blue will be restored by neutralization. But if the alkali is much in excess, it will turn green and return to blue on neutralizing again. Water colored by the red convolulus will turn blue on the addition of an alkaline salt, but is not so sensitive as the blue.

Milledgeville, Ky. M. W. VENABLE.

Some Notes on Potato Beetles.

To the Editor of the Scientific American:

It is not often that you are caught napping, and you are more apt to be so caught when lounging in the field of natural history than in any other. In your issue for July 29, you copy an article from the SCIENTIFIC FARMER, entitled "Facts about Potato Beetles," in which, among the prominent statements offered as "facts," we are told that the potato beetle (by which of course is meant the well known immigrant from Colorado, and not any of the other beetles that affect that plant) does not fly till night and does not eat. Both these statements are incorrect. The *doryphora 10-lineata*, like most of the species of its family, flies readily in the daytime, but not at night; and it feeds freely upon the various plants of the nightshade family besides the potato, and sometimes does considerable damage in spring long before the larvæ appear; though it is not as voracious as these and seldom abounds on a plant to the same extent. Reasoning from his "facts," the writer of the article goes on to say that "any mode of destroying the beetle, practised by the farmer here and there, is only lost time * * * therefore let the beetle alone"—an erroneous deduction naturally following from the erroneous premise, and very unsound advice. It is in fact all important, from the practical view, to destroy the first beetles and thus prevent the laying of eggs and the subsequent injury; for while it is true that they may continue to fly in from neighboring fields, the fact nevertheless remains that the more you kill the less you have. Many experienced farmers in this part of the country justly consider the destruction of the early beetles important enough to warrant the laying of traps before the potatoes begin to put out of the ground; and they do this by dipping slices of the tuber in Paris green and laying them about a field where no domestic animal can get at them.

There are other errors in the article in question, but of minor importance. For instance, every one who has had much experience knows that the third or last brood of beetles is fully developed and flies around for weeks or even months before seeking winter quarters, and that they hybernate in the perfect state, ready to awaken in the spring and fly about again for a few weeks before procreating. The species is, also, northern, not southern, in habitat, and, while spreading east along certain parallels, has not extended south. The talk, therefore, about the insects remaining dormant through the winter merely "because the temperature is too low to perfect the insects," and about the probability that, if they reached a tropical climate, their "transmigration (transformation) will be uninterrupted"—is "misty," to say the least. The hybernating state is induced not alone by cold, and many insects prepare for it and cease multiplying months before winter sets in; and doryphora is one of them.

St. Louis, Mo. C. V. RILEY.

[For the Scientific American.]

THE CALORIMETER OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Among the drawings displayed by this institution at the Centennial is one of the calorimeter used in the mechanical laboratory of the school, and a description of it by the professor of engineering may be found on one of the tables. A courteous attendant is usually on duty also, who takes pleasure in answering the questions of visitors. Profiting by these sources of information, the writer has prepared a description of the apparatus, which will doubtless be of interest to engineers.

The general use of the calorimeter is to measure the quantity of steam condensed in it in a given time, and the amount of heat imparted to the condensing water by the steam. In this connection it is valuable for determining the quality as well as the quantity of steam evaporated by a boiler, the steam required per horse power per hour by an engine, the condensation in the cylinder, the total and latent heat of steam at different pressures, the transmission of heat by different conductors, and numerous other problems of a similar character. Its great value in teaching the students right methods of investigation will be obvious, and at the same time practical questions of importance to steam users can be examined. The calorimeter to be described was used by Mr. Dixwell in his experiments on condensation in steam cylinders, a notice of which will be found in the SCIENTIFIC AMERICAN for March 11, 1876.

The essential features of the instrument are a tank containing a condensing coil, a tank for the condensed steam, scales for determining the weights, and thermometers for ascertaining the temperatures. Steam enters the condenser, which is arranged so as to drain thoroughly, and after being condensed is discharged into a small tank where the weight and temperature are noted. The large tank is filled with water, the weight and temperature of which are noted at regular intervals. The small tank is closed at the top by a floating cover, secured to the edges by a rubber diaphragm. The large tank is also closed at the top, but provision is made for expansion by an expansion tank placed above, and having a floating cover. Each tank rests upon a pair of platform scales, and all connections to the tanks are made by means of rubber pipes, which only change their direction slightly during an experiment, and consequently do not sensibly affect the weights. The large tank has a circulating pump which is worked at intervals during an experiment, so as to make the temperature of the condensing water uniform in all parts of the tank. To illustrate the use of the apparatus, suppose the exhaust pipe of a steam engine to be connected with the condenser, and that the consumption of steam per indicated horse power is to be determined. The large tank is filled with water, until the cover in the expansion tank floats, and the weight and temperature of the water are noted. The engine is then started, and at regular intervals indicator diagrams are taken, and the weights and temperatures of condensing and condensed water are noted, the temperature of the water in the large tank being equalized by the aid of the circulating pump before it is recorded. The result of a series of operations shows that a certain weight of steam of a known pressure imparts a definite amount of heat to the condensing water, and from these data the quality of the steam can be calculated.

The reader is doubtless familiar with other calorimeters, as they are frequently used by engineers. A large one was employed for two years at the fair of the American Institute in tests of steam boilers, the weight and temperature of the condensed water being noted, and a somewhat similar apparatus was used on a later occasion for testing the amounts of steam required for several rotary engines. The difference between these calorimeters and the one described above seems worthy of notice. In the one case the calculations are made by observing the successive changes in temperature of a definite weight of water which is used throughout the experiment, and in the other the condensing water flows away continually, so that the temperature of the discharge does not vary much during a test. It will be seen that, where a definite volume of water is heated by condensing steam, the amount of heat thus measured is not all that has been given up by the steam, since some of the heat is absorbed by the apparatus; while in the other form of calorimeter, if a definite temperature is reached before commencing an experiment, and is afterwards maintained, no more heat will necessarily be absorbed by the apparatus. Of course, in the form of apparatus used at the Massachusetts Institute of Technology, the amount of heat absorbed under various conditions might be determined, and the necessary corrections applied. Perhaps this has already been done, but it does not appear in the account given by the professor of mechanical engineering, who is quite minute in describing the tests of gages and thermometers. It may be, however, that the correction would generally be unimportant.

As appears from the descriptions of the use of this apparatus, the students are well drilled in some special tests of testing apparatus. This is one of the most important points in the engineer's practice, and it seems to be duly appreciated at the school. Experience shows that physical apparatus cannot be made free from defects, but that, if the amount of error is determined, corrections can be applied which will give accurate results. R. H. B.

Philadelphia, Pa.

A Useful Tree.

Mr. Morgan, an English consul resident in Brazil, cites, in a recent report to his government, the carnouba tree, a species of palm (*copernicia cerifera*) as one of the most valuable vegetable productions of the country. It flourishes without culture at Bahia, Rio Grande do Norte, and other well known localities, resists drought, and always appears green and luxuriant. Its roots possess properties similar to those of the sarsaparilla. The trunk furnishes a superior fiber. When the tree is young, it yields wine, vinegar, a saccharine matter, and a species of gum closely resembling sago. Its wood is excellently suited for the manufacture of musical instruments, as well as for tubes and conduits for water. The pulp of the fruit is very palatable, and the oily nut roasted and pulverized is a good substitute for coffee. The trunk also yields a flour similar to maizena. With the straw, hats, brooms, and baskets are made, and over half a million dollars worth of it are exported to England yearly. Lastly, a wax, used in the manufacture of candles, is extracted from the leaves

The Cause of Asphyxiation.

Dr. Blandet, in the French *Gazette Medicale*, denies that carbonic acid gas has any toxic effect in cases of asphyxiation, and claims that it simply suffocates by filling the lungs to the exclusion of oxygen. Persons partially asphyxiated by carbonic acid gas can usually be restored by inhalations of oxygen. The true cause of bad air poisoning, Dr. Blandet thinks, is carbonic oxide, which is disengaged prior to carbonic acid. This does not diffuse itself in the blood like the latter, but remains and destroys the hemoglobine and the hematine.

The best remedies are not only inhalations of oxygen, but friction of the skin with oxygenated water and decomposible oxides, such as those of manganese and of cadmiun. It is also suggested that sulphydrate of ammonia, administered hypodermically, might decompose the carbonic oxide.

A CANADIAN sportsman declares that the speckled trout in Ontario have been killed by warm water. The woods have been cut down, and the sun, shining upon the water from morning till night, heats the streams. He asks the farmers to plant willow limbs along the water's edge to shade the brooks and give the trout a chance—to be caught by anglers.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES—Number X.

PATTERN MAKING—THE FOUNDERY

It has been already remarked that the operations of the molder are, to a large extent, predetermined by the pattern maker; hence it becomes necessary that the latter shall have a knowledge of foundery work, otherwise he is likely to make the patterns very expensive and awkward to mold. In learning the trade, an apprentice is usually put to work and distinctly instructed as to the required form of his work without knowing anything of the reasons therefor. In this way he attains a practical knowledge of how different classes of patterns should be, or are, usually made; but it takes him years to become an expert mechanic, for the reason that, having learned by rote, he is incapable of meeting new conditions to the best advantage, until his experience has included both observations in the foundery and, in some cases, consultations with founderymen. Before entering, therefore, into the method of putting together different kinds of pattern work, it will be well to take a glance at the foundery, and examine the contrivances and the operations of the workmen, so that our operations in pattern work may be intelligently made from the beginning.

The floor of the foundery first demands our attention. It is composed of a layer of molding sand of sufficient depth to imbed patterns of the size usually cast in that foundery. For exceptionally large work, there is usually a place where the natural earth has been excavated to a greater depth; the cavity is filled with molding sand. This place is usually within easy reach of the cr ne (which commands almost every part of the floor) and the threshold of the melting furnace or cupola. We next observe the capacious oven for baking cores and drying molds for such special work as may require these operations; but the particular contrivance with which the patternmaker has now to concern himself is represented in Fig. 67. It is called a flask, and is composed of two or more parts (two only being shown in the engra-

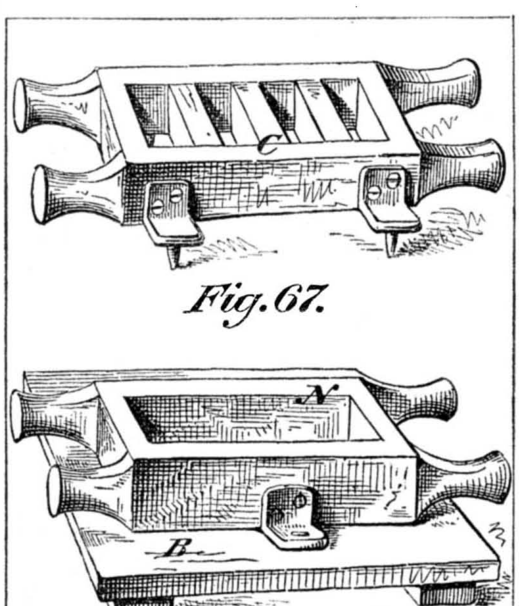


Fig. 67.

ving). The lower part is called the nowel, and the upper the cope. Each part is simply a strong rectangular frame of wood or iron. The sides, being continued past the rectangles, are roughly shaped for use as handles. The cope is provided with several crossbars, which embrace the pattern as it were, being roughly shaped like it in contour and approaching it in size, being about half an inch larger all round. These bars, by their adhesion, support the body of the sand in the cope, and in this they are frequently assisted by nails driven in nearly half way into them. When an intermediate part is used with the two parts shown in Fig. 67, the contrivance is called a three-part flask; with two intermediates it is called a four-part flask, and so on. As the cope is provided with crossbars, so also the intermediates, having to lift a ring of sand, are provided with wings; that is to say, as much crossbar as will extend from the sides to within about half an inch of the pattern. The parts are guided, in their position one to the other, by taper pins on one part fitting into eyes fixed to the other part, as shown in Fig. 67, in which the cope is shown with the side having the two pins exposed to view, while the opposite side of the nowel, having one eye, is visible. In many cases and for large work, the nowel is dispensed with, and the foundery floor is used in its stead, in which case the cope is guided to, and retained in, its place by stakes driven into the floor sand, as shown in Fig. 68, so that, when lifted to admit of the pattern being drawn from the mold, the cope may be returned again to its exact proper and former position. In Fig. 68, A represents the pattern whose impression in the floor sand, at M, forms part of the mold. B represents the cope ; for the word cope is usually applied to the upper part of the mold as well as to that portion of the flask which contains it. The top print, C, of the pattern, has formed its impression in the cope at P. R is a round taper peg, which leaves a hole in the cope at *r*, through which hole the molten metal is poured. It also leaves an indentation at *r'*; and from this latter a gutter is made by the molder to communicate with the mold, M, as shown. The stakes referred to above are marked S. The dots, shown around the impression of the top pattern print, C, in the cope, are small holes made in the sand (after the molding is finished) by a piece of fine wire, and are for the purpose of giving vent to the air and gases which must escape when the metal is poured in.

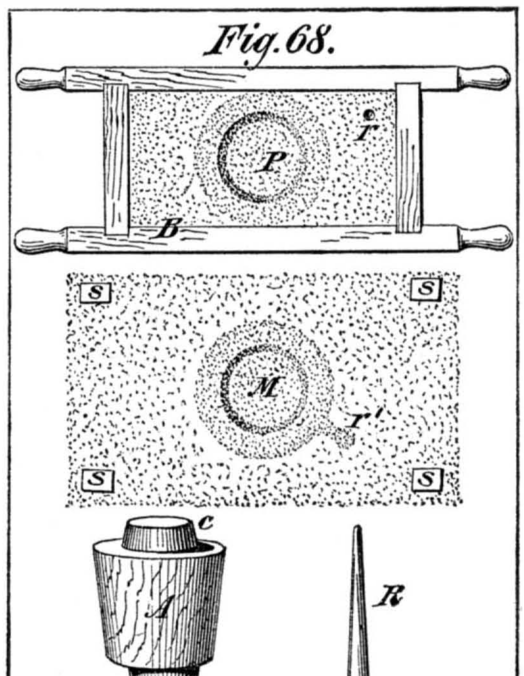


Fig. 68.

It will be seen that, when a mold is made in the flask we have described, it can perform no further duty until the casting has been made; for every mold, therefore, we require a flask, and hence the pile of these appliances we always see in a foundery. For light work, however, a comparatively modern and greatly improved device has come into general use. It is termed a snap flask, each part having a hinge at one corner and a latch at the diagonally opposite one; so that, after the mold is made, it can be detached from the perfected mold and can be used to make another. For the details of its construction and use, the reader is referred to page 111, Vol. XXVIII., since it is not our purpose to here discuss the merits of such contrivances. Sometimes, though rarely, it happens that a casting is required of such form that the patterns cannot be constructed so as to be molded with a flask of the ordinary kind. The flask requires to come to pieces and the mold to be parted sideways; this adds greatly to the labor of the molder, and the patternmaker should so construct the pattern as to avoid this whenever he can devise any means of so doing. Even when the pattern is molded in the floor, the mold is sometimes of necessity made to part on one or more of its sides, and these partings are termed drawbacks. An example of this class of work will be given hereafter.

By matching the operations of a molder, we shall observe that, in the case of a solid pattern, that is to say, a pattern not made in halves, he always endeavors to have as little of the pattern in the cope as possible, and in this respect the patternmaker should supplement his efforts. The reason is obvious: the cope has to be lifted while as yet there has been no opportunity to loosen the pattern in the mold. It is true that, in some cases, a bar is passed through the cope and driven into the pattern, and by rapping it the loosening is accomplished; but it is not well to have recourse to such an expedient, because, wherever the bar passes, the cope is damaged, and must be mended; and when a mold has to be mended, it is doubtful if the correct form, such as

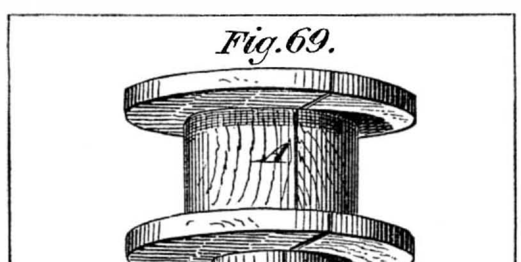


Fig. 69.

the pattern would have given it, will be left. Furthermore, it is all work in the dark; for the effect or extent of the rapping cannot be scrutinized, and it may therefore produce an undue distortion in one direction, while in another it may not have been effectual. Perhaps the bar may have descended at a place in the pattern where it is comparatively weak, from crossgrain of the wood or from some other cause. This measure is, therefore, on account of these difficulties, seldom resorted to; and it may be generally disregarded in the calculations of the pattern maker. The cope, then, being,

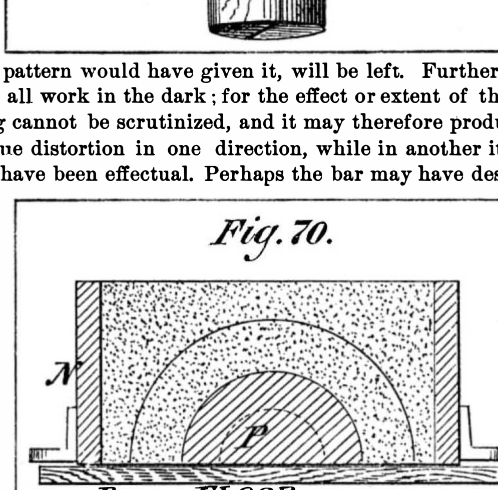


Fig. 70.

as we may say, a dead lift, and with nothing to guide the operator in moving it, either horizontally or vertically, any part of the mold contained in it is much more liable to break down than is the other part of the mold. In extracting the pattern from the lower part of the mold, the eye lends to the molder great assistance. The pattern can be loosened in the sand before extraction, and is furthermore less cumbersome to handle than is the cope: all of which circumstances tend to preserve the lower part of the mold from damage during the extraction of the pattern. Rapping a pattern tends to alter the form of the mold from that calculated upon. A circle becomes slightly oval, a square becomes an oblong, and so on: and this cannot in most cases be avoided, because it is necessary to rap the pattern so as to enable the molder to extract the pattern without drawing out the sand with it; all that can be done in this direction is to rap the pattern as little as possible, and equally in all directions.

When a flask nowel is used, the labor involved in making a parting of the mold is facilitated. Fig. 67 shows a board cope and nowel for an ordinary straight parting; but it is evident that the parts of the flask may be made to show a crooked, a curved, or irregular line at the joint, if it is required, in which case the bed board must be made of similar conformation. The process of molding with a flask independently of using the floor, instead of a flask nowel, is illustrated in Figs. 70 and 71. If it be required to mold the pattern illustrated in Fig. 69, which is made in halves, the joint being denoted by the line, A A, one of the halves is taken and laid with its flat face upon the molding board, B, shown in Fig. 70. The nowel, N, is then placed upon the board, so that the half of the pattern will be in about the middle of the flask nowel. Sand is then rammed tightly in the nowel; and when the latter is filled with the sand, it is turned upside down, showing the flat face of the half pattern, the rest of the half pattern being imbedded in the sand. The other half of the pattern is then placed upon the one in the sand, its proper position being determined and regulated by pegs fitting into holes, provided in the first part, to receive them. The next operation is to put on the cope, as shown in Fig. 71, the taper pins being fast to the cope lugs shown on the sides, fitting into holes provided in the nowel lugs, similarly shown, serving to hold the cope in position and prevent it from moving. The cope is then filled with

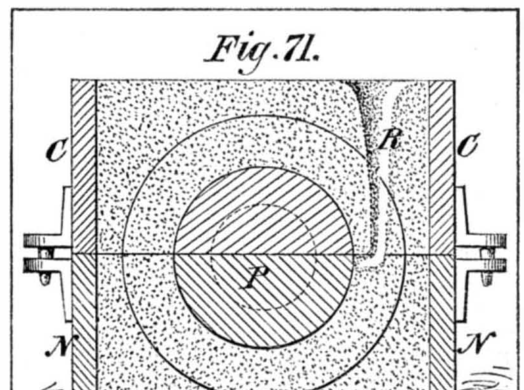


Fig. 71.

sand, lightly rammed, the taper pin, R, Fig. 68, being inserted to leave in the mold the hole, R, Fig. 71, through which to pour the melted metal. The cope is now lifted vertically; and as the pattern is made in halves, the top half lifts with the sand in the cope. In some cases a screw is fixed into the top half of the pattern, the head of the screw projecting into the cope: the object being to insure that the top half of the pattern shall lift with the cope. The next procedure is to extract the two halves of the patterns from the molds, and perform any trimming or repairing that the mold may require, after which the cope is again placed upon the nowel, and the mold is complete, ready to have the metal poured in.

Simian Sagacity.

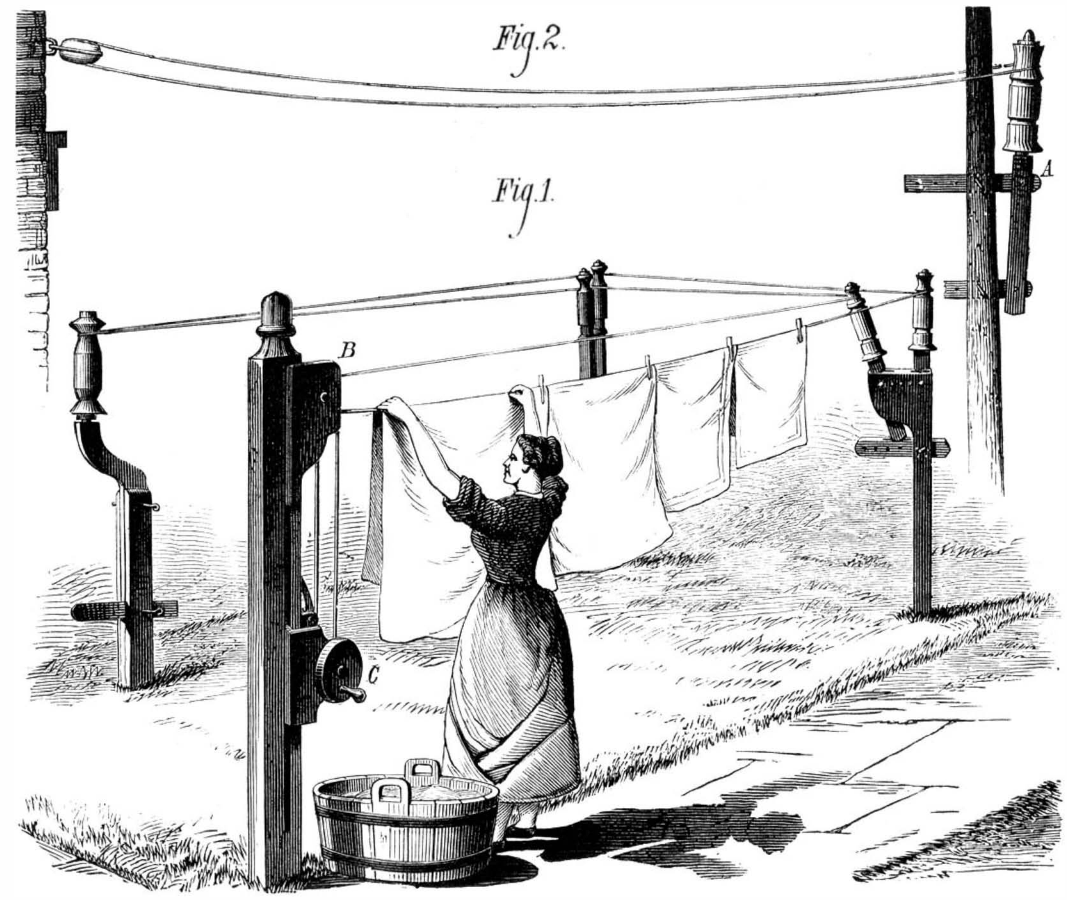
The sagacious monkey, who, according to the time-honored story, used the reluctant paw of a cat to withdraw hot chesnuts from the fire, is outdone by the performance of another member of his tribe, which is recounted by a French resident of South Africa, in a letter to *Les Mondes*. The writer is the possessor of a large coffee plantation, and his crops have suffered severely from the ravages of a large species of baboon, which greedily devours the fruit of a small tree which grows among the bushes. The best safeguards against the depredations are the wasps which make their nests in the lower part of these trees, for, of the fierce attack and painful stings of these insects, the baboons have a wholesome fear. One morning, a hideous chorus of yells and howls was heard from a portion of the plantation where the wasps had most thickly congregated, and where the fruit trees consequently were heavily laden. On searching for the cause, the writer saw from afar a venerable and ancient baboon busily engaged in throwing infant monkeys at the trees. These living projectiles thus knocked down the nests and of course were objects of the keen attentions of the infuriate occupants. Meanwhile the baboon quietly made his way to the apper branches, gorged himself, and then added insult to injury to the badly stung monkeys by pelting them with the rinds and pits of his repast.

THERE is no royal road to learning; its acquisition without study is like the acquisition of wealth without labor. It is as necessary for the mechanic to study out his problem, when it comes to him to be studied, as it is for him to finish his task by his handicraft.

IMPROVED CLOTHES LINE FASTENER.

We have had washing machines innumerable, sadirons, ironing tables, etc., in endless variety, until we had almost reached the conclusion that there was nothing connected with the laundry but that some ingenious inventor had, of late years, improved upon its construction, and that the end of improvements in this line was near at hand. The present device shows us, however, that, in one respect at least, the laundress's work has not been perfected. namely, in the operation of hanging out the clothes to dry.

The invention illustrated herewith offers a way of doing this easier than any previous plan that has come to our knowledge, and we recommend it to the favorable consideration of our housekeeping readers.



ALMONT'S CLOTHES LINE FASTENER.

With the tenement houses of large cities, where building space is economized to the utmost, there is very little or no yard in which clothes can be dried. Consequently the roof is utilized, and where its accommodations fall short, as usually is the case, since professional washerwomen, as a rule, dwell in such localities, the expedient adopted is to reeve lines leading from the various windows to through pulleys on adjacent buildings, and to fasten the clothes on these. It is obvious, however, that only one part of the endless rope can be utilized; and that as soon as that is full, the nearest garment enters the further pulley, and so chokes it. Hence just half the double line is empty. The present invention supplies a means by which both parts of the rope can be utilized, by simply substituting, for the block which may constitute the distant pulley of the endless rope, a roller so constructed that the clothes, while attached to the line, can easily pass around it. The shape of this roller is shown at A, Fig. 2, where it is represented as attached to a post by simple devices which allow of its angle being adjusted so as to tauten the rope. This thus doubles the capacity of the drying accommodations afforded, and may, for this reason, prove a really valuable invention in the localities we have noted.

The lower engraving, Fig. 1, represents more clearly how the device is arranged both to economize room as well as to save labor. The line, instead of being attached rigidly to several posts, passes over the pulleys of the shape shown, on their summits. The arrangement of two pulleys on one post is shown on the right. The line again forms an endless cord; and as the clothes easily pass around all the pulleys, it follows that the laundress can stand still and fasten on one piece at a time, pull the rope along for a short distance, fasten on another, and so on until the line is full, when the first garment, after traveling around all the pulleys, will have returned to its starting point. This saves carrying a basket of heavy clothes, for the circuit of a yard during hot or very cold weather. To render the endless rope easily moved, its bight passes over a horizontal roller at B, which is turned by a belt from the drum, C. This part of the device may, if desired, start from the kitchen window or just inside the same, so that the operator need not go outdoors at all, but, standing in the house, may fill the line without risking injury to health caused by passing suddenly from a warm laundry to the cool outer air. There are various minor details for adjusting the pulleys and tautening the line, which are plainly shown in the engraving, and need no further description.

Patented through the Scientific American Agency, July 18, 1876. For further particulars address the inventor, Mr. George Almont, 604 Grand street, Jersey City, N. J., where the device may be seen in operation.

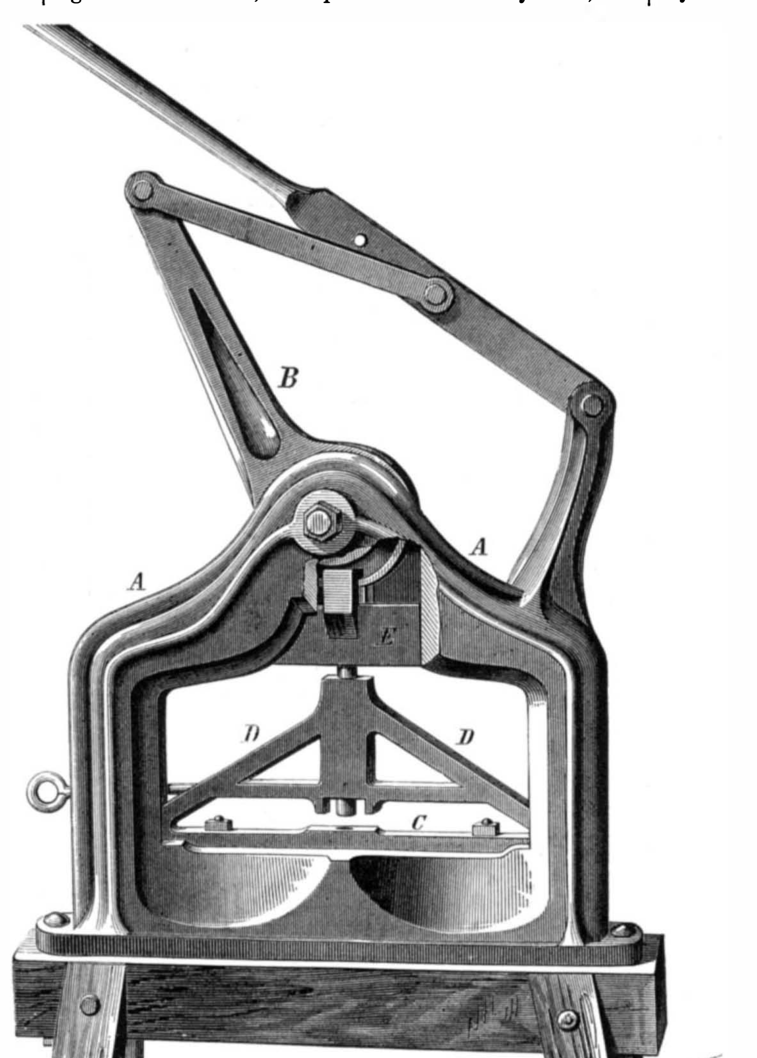
IMPROVED METAL-PUNCHING MACHINE.

The invention herewith illustrated, besides being of novel mechanical construction, includes a simple and efficient arrangement for putting in and removing interchangeable dies and punches of different sizes. It is sufficiently powerful, we are informed, to punch readily a five-eighth inch hole in plow steel, and it has been practically tested with excellent success during the year which has elapsed since it was patented.

The operation is as follows: At A are the housings, near the top of which a cam lever, B, which forces down the punches, is pivoted. C is the die block, which slides freely in between the housings and is locked by a suitable spring pin. D are guide plates for the punch over the die. A head block, E, serves to connect the punches to the cam lever, the attachment being effected by lugs which engage the lever by its grooves. The punch is secured in place by sliding the head into a channel above the slotted plate through which the shank hangs, the lower end being in the guide plates, D.

It will be observed that the mechanical power is very advantageously applied, that the punch and die, although easily removable, are tightly held, and that the general construction of the device is strong and durable. Two sizes of the machine are made, weighing respectively 175 and 275 lbs. They are excellently adapted for use in ironing wagons and blacksmiths' ordinary jobbing work.

Patented July 13, 1875, by Mr. Daniel W. Baer. For further particulars address Clayton Bush, Sextonville, Richland county, Wis.



BAER'S METAL-PUNCHING MACHINE.

To Analyze German Silver.

Take a weighed quantity of the clippings or trimmings of the alloy, and dissolve in a limited quantity of aqua regia (one part nitric and three parts of hydrochloric acid) at a temperature of about 70° Fah. When complete solution is effected, add sulphureted hydrogen water until, after standing for half an hour, the liquid smells distinctly of it; then filter, and wash the precipitate on the filter with distilled water containing a little sulphureted hydrogen several times, and dry. When dry, remove it as completely from the filter paper as possible, and boil until completely dissolved in strong nitric acid. Then dilute the acid with water, filter from the yellow sulphur that has separated in the operation, add solution of pure soda or potassa (in water) until no further precipitate forms, boil the suspended precipitate with constant stirring until it is of a brownish-black color, then filter it, wash several times with distilled water, and dry. When the oxide of copper thus obtained is perfectly dry, remove it completely from the filter paper, place it carefully in a previously weighed porcelain crucible, and beat to reduce gradually over a spirit or gas lamp. Then suspend it in the crucible over strong sulphuric acid in a tight glass vessel until cold, when it is ready for weighing. The weight thus obtained, multiplied by 0·79849, will give you the weight of the pure copper contained in the given weight of the alloy. The zinc and nickel, which were contained in the alloy, are to be found in the first filtrate from the first sulphureted hydrogen precipitate. To separate them from each other, add to the solution some pure ammonia until the solution is quite alkaline, and then sulphide of ammonium; heat gently for a short time, filter, wash the precipitate with water containing a little sulphide of ammonium; dry, separate from filter, and heat for some time with aqua regia. When the solution is effected, dilute considerably with water, and add drop by drop a strong solution of pure carbonate of soda, with constant stirring, until evolution of gas ceases (be sure you add sufficient); then boil for a few minutes and allow to subside. When this has taken place, decant the supernatant liquor (through a filter, so as to avoid loss), and wash the precipitate several times with water, decanting, as before, each time; gather the precipitate on to the filter, wash with hot water, and dry perfectly at a temperature of about 212° Fah. When dry, dissolve the precipitate (in an excess of pure acetic acid) by the aid of heat, and to the solution add some strong sulphureted hydrogen water, and allow to stand at a gentle temperature for several hours. By these means the zinc will all be precipitated, and the nickel will remain behind in the solution. To separate the nickel, evaporate the filtrate, from the last zinc precipitation, nearly to dryness in a porcelain vessel, add some nitro-hydrochloric acid (aqua regia), and heat gently until a clear solution is obtained; then mix the solution with pure potassa or soda in excess; heat for some time nearly to boiling, decant three or four times, boiling up at each time; wash the precipitate thoroughly with hot water, and dry perfectly. Then place the precipitate in a porcelain crucible, heat to redness, place the crucible with its contents in a desiccator to cool, and finally weigh. The weight obtained, *minus* the weight of the crucible, multiplied by 0·78667, equals the amount of nickel contained in the given weight of the alloy. The weight of the copper, *plus* the weight of the nickel deducted from the given weight of the alloy, equals the amount of zinc it contains.

Mocking Birds at the Centennial.

Two hundred and fifty mocking birds from Texas lately arrived at Agricultural Hall, Philadelphia. These birds were raised by Miss Antoinette Christi, of Denison, Texas, and made the journey in about two weeks. After a ride of five hundred miles to Galveston, they were transferred to a steamer and brought two thousand miles by water, without accident, until the ship encountered a gale off New York, when, as the cages were on deck, over fifty of the birds died from the effects of the sudden change of temperature caused by the storm. All the rest, however, reached here in safety, and evidently in perfect health. Though most of them are young and can be taught any tune desired, there are among the number many trained birds which whistle all the popular airs of the day.

Rubber Shoe Making.

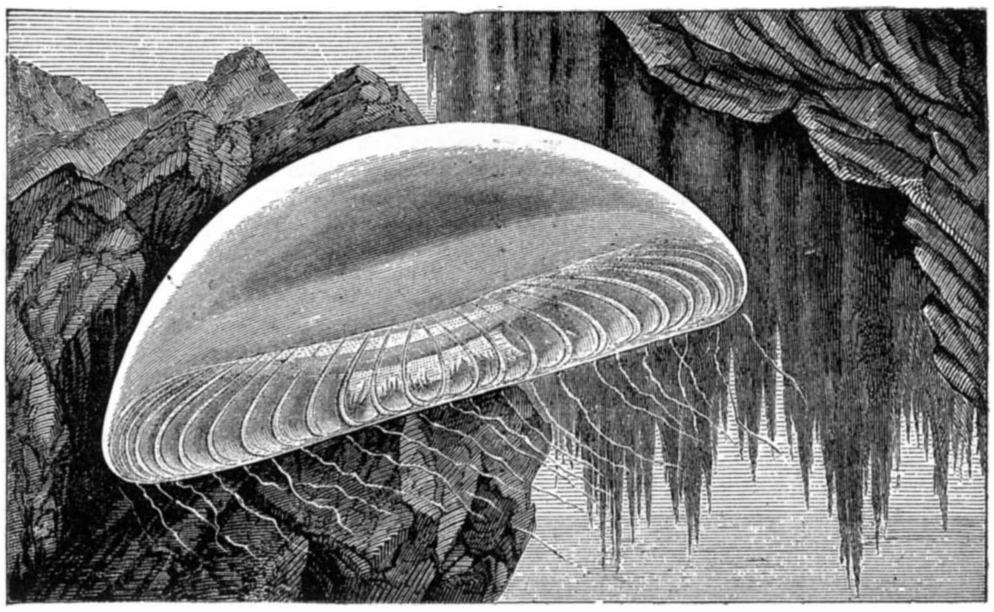
Among the interesting processes shown in the Centennial is the making of india rubber shoes. The operation consists in stretching the flat patterns upon lasts, joining them together at the heels, and pasting on the soles. The shoes are left on the lasts until they take shape. Machinery for purifying the rubber, by passing it between toothed rollers under water, and for rolling it into sheets, is shown in operation.

THE RADIATA.

The zoölogical class termed the *radiata* was comparatively unknown until within the past century, and its species were considered to be connecting links between the animal and vegetable kingdoms, being known as zoöphytes; and Linnæus defines them as "composite animals which appear to rank between animals and vegetables; though they are true animals, and possess sensation and voluntary motion."

The radiata are entirely aquatic, and are mostly marine. They are divided into three classes. These are: 1. Polyps—sea anemones, nearly all the corals, etc. 2. Acalephs—jelly fishes, medusæ, Portuguese men-of-war, etc. 3. Echinoderms—sea cucumbers, star fishes, crinoids, etc.

The structural plan of all the polyps is so nearly similar that a single illustration will answer for all, although they differ greatly in size, shape, and minute particulars. Let us suppose an orange with a small portion of the stem end removed, and a hole descending to a little past the center from this end. Now the skinny partitions which, like longitudinal planes, extend through the fruit will divide it into chambers. We must suppose a similar wall surrounding the cavity which runs down from the end of the fruit, but communicating freely with all the inner portions of the orange, through the lower end of this opening. Polyps have but this one orifice, which is the mouth. Into this all the food is taken, and from this all rejected matter is thrown out. The digested food passes from an opening in the lower portion of this cavity or sack into all the chambers of the polyp, and finally into the delicate, hollow tentacles with which the upper part of the body is fringed. This is the general form of life of all the polyps, some of which, like the corals, are stationary, while others are nomadic, and still others are parasites, living in the mouth folds of still larger radiata. The polyps vary quite materially in shape, some being almost saucer-like, others pyramidal, cone-shaped, etc.

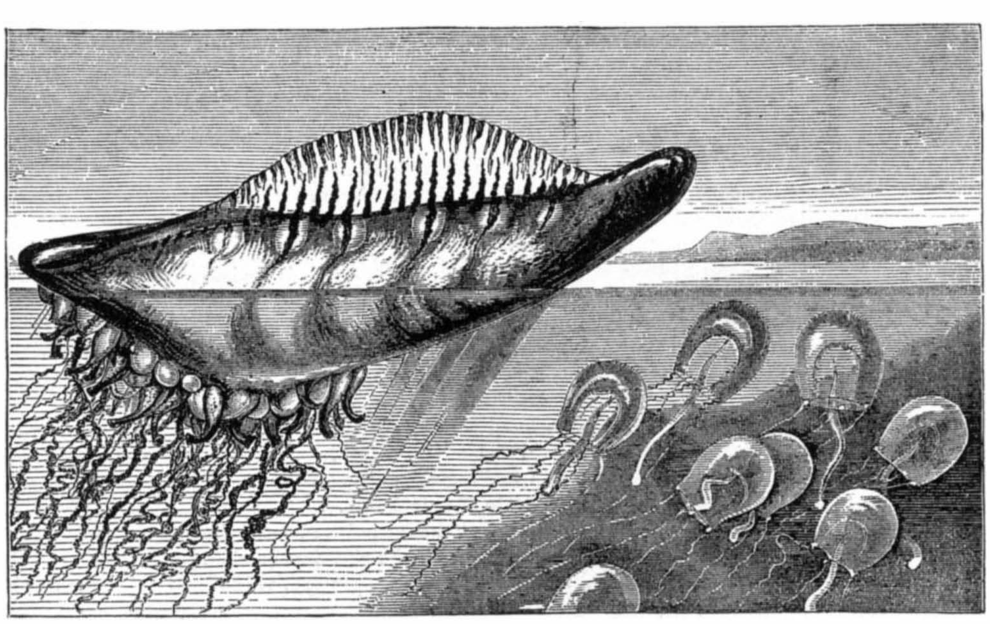


THE DISK-BEARING JELLY FISH

In the lower polyps the eggs are formed on all the inner edges of the vertical partitions, and when these are ready for exclusion they drop to the bottom of the digestive sack, whence they pass outward through the mouth. In the higher order of polyps not all of these partitions are fruitful, the limitation increasing as the species rise in organic superiority. Some of the polyps also increase by buds similar to fruit buds, others by subdivision. Polyps may be cut into several pieces, and the majority of these will each become a perfect animal. They vary in size from a foot in diameter to mere microscopic mites.

From what has been said of the growth of these polyps it will be seen that coral insects have too long enjoyed the fellowship of bees, ants, etc., as hardworking creatures, with some knowledge or method of architecture. They produce coral no more ingeniously or laboriously than a fish produces bones, and cannot help it if they would. Coral is only what is left after the death of a whole community—a village of individuals whose bones, not their houses, are fashioned by cunning artisans into such beautiful adornments for our fashionable belles.

The acalephs are perhaps more interesting to the student and naturalist than the polyps. In these we find exemplifications of the curious law of alternate generations. The egg of a butterfly produces a caterpillar, which in turn becomes a chrysalis, and from this the perfect fly is in due time hatched. In some of the jelly fishes different but no less wonderful changes take place, while in others the method of reproduction is similar to that of the budding polyps. In some cases two generations intervene between the parent and a progeny which resembles it in form or mode of life.



THE PORTUGUESE MAN-OF-WAR AND THE SEA BLUBBER.

The jelly fishes, with few exceptions, are short-lived in comparison with other radiates, some of the polyps living many years, while star fishes and sea urchins are sometimes ten or a dozen years in attaining their maturity. The acaleph's cycle of existence is only about twelve months. The eggs, laid in the fall, become hydroids in the winter, jelly fish in the spring, and, having made the necessary arrangements for a continuance of the species, die during the autumn. Great numbers of jelly fishes are annually killed by the severe storms of that season, and are washed upon the beach, where they almost literally melt into jelly, and leave no trace behind, there being none but the most perishable elements in their physical construction, nearly the entire animal being water. Mention is made of one specimen, which when alive weighed thirty-four pounds, being left to dry for some days, and then weighed five and one half ounces. The radiate partitions of the polyps are changed into tubes in the jelly fishes, but the general law of radiation is strictly followed. Excepting a few species they are all jelly-like in their construction; the *discophora* have a trifle more solid structure, but all are exceedingly soft and frail.

Very many of the more delicate species are so transparent that the casual observer often fails to see every portion of a specimen. even in the still water of the aquarium, until a movement of the animal presents its parts in a different light.

A great variety exists in the shape of these animals, and they vary no less in size, some being so small as to be entirely overlooked by the casual observer, while Agassiz mentions one, a *cyanea arctica*, a sea blubber, whose umbrella-shaped disk measured seven feet across, while the tentacles which streamed behind him measured roughly about one hundred and twelve feet. The parent of this monster is one of many from a single egg, transformed first into a stalk not unlike a cabbage stump in shape, but which subsequently changes into a tolerable representation of a pile of saucers, open side up. Each saucer, when cast off, turns over and is then a perfect cyanea. Yet the stalk which produces all these, when fully grown, is but an inch or so in hight. Were it not for their delicate structure these creatures would be as dangerous as sharks, for each of these long tentacles is capable of producing a severe smarting sensation by mere contact, while their nearly perfect transparency renders their noiseless approach almost imperceptible. Bathers along the coast of the Atlantic often encounter these unawares, and lose no time in extricating themselves from the dilemma, while large, red swellings, not unlike those produced by nettles, attest the truth of the contact. It sometimes happens that the jelly fishes which are possessed of these stinging threads—for many of the species are without them—find themselves entangled with a too formidable antagonist. In such an event they drop or shed the tentacles, and escape with all possible haste; but notwithstanding their separation from the body of the jelly fish, contact with the dead tentacles is equally painful as when living.

The stinging property is used by the jelly fish not only for defence but also for the purpose of paralyzing and retaining its prey, which consists of small crustacea, fish, and other jelly fish, or polyps. Captured individuals often show the remnants of a meal, their transparency affording the most perfect study of their internal organisms. These tentacles are covered by minute cells, lasso cells as they are called, each one of which contains a whip finer than the finest thread, coiled in a spiral within it. These are thrown out at the will of the animal, and their movements are so instantaneous that their irritating power is very great.

The Portuguese man of war is also an acaleph, belonging to a prominent genus. This individual, *physalia arethusa*, is one of the most remarkable of the group. The pear-shaped sack, ornamented with a sort of shirt ruffle fringe or crest, and filled with air, gracefully floats upon the surface of a calm sea, while beneath it trail numerous appendages of various functions. These may be compared to the members of a military or communist organization. Each pendant has its own peculiar duty. Some are the providers, commissaries; others are the locomotive organs, while still others are charged with the duty of growing new medusæ buds for the perpetuation of the race. Those tentacles which belong to the transportation department often extend to a distance of thirty feet from the main body of the animal, which is usually but five or six inches in length. This hydroid is properly an inhabitant of the tropical seas, but occasionally, having drifted into the Gulf Stream, it is borne along the shores of the Atlantic far away from its native home.

The hydroids are not all free to move about at will. Agassiz and Vogt have thrown the two together, this simple difference not warranting distinctive groups in which earlier naturalists had placed them. Many of the hydroids bear a close resemblance to some species of vegetation growing on the bottom, where at low tide they are taken by the casual observer for marine plants. Some of these are exceedingly minute; and the little bells or buds, in which the diminutive embryo creatures are imprisoned, are, to all casual observers, flower buds or seed vessels. This is also true of the polyps, which, in structure and colors, resemble nearly every form of vegetable life.

The colors of the jelly fishes are as varied as are their forms and dimensions. In the *bolina*, for instance, there is a marked resemblance to a beautiful white flower. The *cyanea* is a dark, brownish red with a milk-white margin, and tentacles of purple, yellow, and pink. *Idyia* is mostly of a bright pink, while red, yellow, orange, green, and purple chase each other rapidly along its undulating fringes. Other varieties appear in no less beautiful and different shades of beauty; while at night, if the sky be overcast or the moon is not a disturbing witness, the slightest movement, of the depths where these delicate beauties are, brings out the most resplendent flashes of green and gold and liquid phosphorescent flames that seem almost to kindle the entire waters. Myriads of the lesser varieties, scarcely noticeable in the bright light of day, thus disturbed, become globes of brilliant gold, and the oars of the boat, as they rise from the water, drip with liquid flame given out by these and other minute inhabitants of the deep, while the glistening particles extend far in the diverging wake of the passing craft.—*Home and School.*

Cheese Factories in England.

British farmers are notoriously slow to accept innovations, and this may be said without fear of hurting their feelings, as they are well aware of it, and in fact rather pride themselves on their conservatism. But they are now moving in a direction which possesses some interest to Canadian farmers. The United States and Canada may be said to have absolute possession of the British cheese market except for certain fine brands with which we do not compete. Our factory system has already made its way into Britain, and is as successful there as it is here. And now they are going to adopt another of our institutions, the Dairymen's Association. Certain leading spirits think it a shame that English cheese makers can be beaten in their own mar kets, and they are going to leave no stone unturned in the attempt to regain possession. Dear land and high taxes will operate against them just as distance will against us. The future will show whether the new British Dairymen's Association, which was formally instituted at Birmingham recently, will enable the farmers over the water to drive us out of their markets. We opine, says the *Canadian Farmer*, that it will not. Nevertheless, it is never well to have only one string to one's bow. The move of our English brethren should teach us to be on the alert for new markets. And if it should also direct our energies more to the manufacture of butter by the factory system, it will benefit us as much as it will them.

AMERICAN CREMATION.—A citizen of Washington, Penn., has built a large stone house on a hill for the reception of dead bodies, and a furnace scientifically constructed, in which they are to be burned. He has given strict injunctions to his executors that his own body be burned in the furnace.

[For the Scientific American.]

CHEMICALS AT THE CENTENNIAL.

It is generally admitted that the German section at the Centennial Exposition is far inferior to what it ought to be, and does not adequately represent the present state of manufacture and industry in that empire. Be this true or not, it certainly does not apply to the chemicals, for in this department Germany is *facile princeps*. She supasses France, is far beyond England, and finds a worthy competitor only on this side of the ocean. In quantity, Philadelphia chemists far excel; but in rare chemicals, new compounds, and interesting preparations, Germany leads. Entering by the main entrance on Elm Avenue, and passing up the center cross nave, we have on our right the magnificent display of Powers & Weightman, Rosengarten, and Pease; on our left the smaller black show cases of the German exhibitors, Brohme, Trommsdroff, and others.

THE GERMAN EXHIBIT.

This department has an advantage over all others in having a complete and instructive catalogue, which enables the visitor to examine with greater ease and understand more readily what is to be seen here. An intelligent attendant is also ready at all times to explain more fully whatever is of interest The chemicals in this department may, for our convenience, be arranged under three heads, namely, chemicals largely employed in the arts, rare and curious chemicals chiefly of theoretical interest at present, and coal tar products, including the aniline colors. This division is, of course, very imperfect, because new substances are so rapidly passing from the second to the first class, while the third class belongs to both the others.

The most interesting of the commercial exhibits, because the newest, are the samples of carbonate and bicarbonate of soda made by Moritz Honigmann at Aix la Chapelle, by the ammonia soda process of Solvay (see SCIENTIFIC AMERICAN, June 24, 1876). This establishment employs 35 men and 3 steam engines of 25 horse power in the aggregate, producing 6,600 lbs. of soda ash per diem. The operations are performed in large wrought iron vessels at a pressure of $\frac{1}{4}$ to $\frac{3}{4}$ atmosphere. Chloride of sodium obtained from the saltpeter works (SCIENTIFIC AMERICAN, January 22, 1876) is decomposed, at a temperature of 95° Fah., by carbonic acid and ammonia, into bicarbonate of soda and chloride of ammonium. The ammonia is recovered from the latter by means of unslaked lime, at a temperature of 212° Fah.; the lime is obtained by burning mountain limestone with coke, and the carbonic acid utilized for converting the salt into a bicarbonate of soda in the presence of ammonia, as above stated. No use has yet been found for the waste chloride of calcium. The calcined soda ash contains 98 to 99 per cent of the carbonate; and, being free from iron, sulphur, and sulphuric acid, is largely employed in dye works and glass houses. This process will attract our notice again in the chemical sections of France and Belgium.

Vorster and Grueneberg, of Kalk, exhibit potash and saltpeter made from the Stassfurt salts.

There are several exhibitors of glue, gelatin, and phosphates from animal refuse.

Xanthate and sulpho-carbonate of potassium, the new insect destroyer, is exhibited by J. F. Hayl & Co., the well known manufacturers of bisulphide of carbon. This establishment, which covers over 7 acres and employs 12 men, is chiefly occupied in the extraction of fatty oils by means of bisulphide of carbon. They exhibit oil cake and oils. They claim for the oil cake that it contains 6 to 15 per cent less oil than those which have been pressed, but are better as fodder because the nitrogenous principles remain in the residues.

Paraffin and paraffin candles made from peat are exhibited by two stock companies, one at Rehmsdroff, the other at Halle.

The Nuremberg Ultramarine Works have a pyramid over ten feet high, around and on which their products are arranged. Green, blue, and violet ultramarines are exhibited. Several smaller exhibits of ultramarine, both blue and green, were also noticed.

The exhibition of mineral colors, although varied and pleasing to look at, requires but little to be said about them Zinc and cadmium yellows, umbers, ochers, siennas, lampblacks, etc., filled the list.

Brohme & Co., Bergen, exhibit soda and potash water glass in solid and liquid form, composition for artificial stone, water glass whetstones, etc.

Oxalic acid and oxalate of potash are exhibited by R Koepp & Co. and Kunkeim & Co. The latter also exhibit the rarer substances, tungstate of soda, naphthaline yellow, and phthalic acid.

The largest exhibit of alkaloids is by Fried. Jobst, Stuttgart, and includes also opium grown in Würtemberg and Silesia. Here we notice a dozen different salts of quinine, including the anetholate, and several salts of other cinchona alkaloids. The new preparations made since the Vienna Exposition of 1873, and never before exhibited, are the muriate, sulphate, and salicylate of phenyl-quinine, sulphate of phenyl-cinchonidine, oxalates of cinchonicine and of quinicine, santoninic acid, cotoine, echicerine, chinamine, echitine, and echi eine.

The exhibit of alcoholic preparations, by C. A. F. Kahlbaum, Berlin, is deserving of special notice, showing as it does how soon chemical compounds pass from the class of rare and curious chemicals to commercial articles. These works, which are under the direction of Drs. G. Krämer and Bannow, were the first to manufacture artificial mustard oil (from allyle alcohol) on a large scale, and now it is capable, by excellence and cheapness, of competing with the natural oil. The other staple productions are methyl, ethyl, and amyl alcohols, iodoform, acetone, aldehyde, ether, acetic acid, and acetates The most interesting portion of this exhibit is, however, a series of scientific preparations, made in the laboratory connected with these works, and in many cases from waste products. A list of these curious and new compounds would exceed our present limits, and we may only mention a few, such as metaldehyd, a white solid crystaline substance having the same percentage composition as common aldehyde, and convertible into it by heat at 112° to 115° in a closed tube. Paraldehyd, a liquid isomer of aldehyd, which boils at 124° and crystalizes below 10°, is also exhibited. Resorcin, phenylacetic acid, phloron, phthalic acid, azobenzol, methyl and ethyl iodides, zinc methyl and ethyl, sulpho-butylates, methylates, propylates, and vinates are among the things seldom, if ever, seen before in America.

In the case adjoining Kahlbaum's exhibit is the far smaller but equally interesting one of Dr. Wilhelm Haarmann, Holzminden on the Weser. Here is exhibited the new artificial vanillin, discovered by Drs. Haarmann and Tiemann; also a glass of coniferine, a glucoside contained in the cambium of coniferous woods, and from this the vanillin is made. The latter is identical in composition, melting point, flavor, and all other properties with vanillic acid from the vanilla bean. Vanillinic acid (a by-product), vanillinic sugar, vanillinic alcohol, and vanillinic glycerin are also exhibited. These works were established in 1875, and employ in the summer months about 46 workmen.

Next to this is the exhibit of the Berlin Stock Company, formerly E. Schering. The exhibit is large and handsome, including salycilic acid in large quantities, salicylates of ammonium, quinine, sodium, and zinc, also chloral hydrate, both in cake and crystals. Just around the corner is the curious little exhibit of Dr. F. Wilhelm, Reudnitz-Leipsic. He exhibits the artificial bitter almond oil (not, he says, nitrobenzol), of which he claims to be the inventor and only manufacturer. He also exhibits benzoic acid, Niobe essence (?), benzyl chloride, and some manganese salts.

The well known house of H. Trommsdorff, Erfürt, makes a very large and interesting show. It includes 50 different alkaloids, glucocides, and bitter principles, 30 organic acids, various physiological preparations, such as glycocoll, allantoine, cholestrine, taurine, etc. Among the rare metals and metallic salts, we noticed selenous, tellurous, and vanadic acids, sulphate of beryllium, cæsium, and rubidium alums, sulphates of cerium, lanthanum, and didymium, biebromate of rubidium, bivanadate of ammonium, and metallic tellurium, thallium, titanium, tungsten, molybdenum, etc.

Another fine display, in close competition with Trommsdorff and Kahlbaum, is that of Dr. Theodor Schuchart, Görlitz. There are 110 preparations of purely scientific interest, and 20 for technical purposes. Among the former are included nearly all the rare metals and their salts. One of the most beautiful things here is the double cyanide of yttrium and platinum, which consists of dichroitic (red and green) crystals. We also noticed some handsome crystals of boron, also specimens of nitrate of roseo-cobalt, chloride of purpureo-cobalt, sulphate of xantho-cobalt, crystals of nitrate of uranium, metallic chromium, nickel salts, sesquichloride of titanium, chloride of niobium (columbium), and blue oxide of tungsten. A few organic preparations, thymol, anthracene, alizarin, etc., completed the list.

Salicylic acid and its derivatives are exhibited in large quantities by Dr. F. von Heyden, Dresden, who manufactures, under Professor Kolbe's patent, from the best English carbolic acid. The collection contains wintergreen oil, pure and crude salicylic acid, crude and pure salicylicate of soda, and sodium phenylate.

Dr. L. C. Marquart, Bonn, has a very good display, including salicylic acid, cæsium, and rubidium alums, ethyl sulphate of lithium, ethyl benzol, bibrom-benzol, and dichlorhydrine, the curious chlorine derivative of glycerin.

Chloral hydrate is the specialty of Saame & Co., Ludwigshafen. The works cover 17 acres, and originally were devoted to the production of chloral hydrate only; but since the fall in price of that article, they have begun the manufacture of the mineral acids, of which they produce 13,200,000 lbs. annually. They also manufacture and exhibit chloroform, made from chloral and absolutely free from other chlorine compounds, chloral alcoholate, chloride of sulphur, bisulphite of soda, used in making the new reducing agent hydrosulphurous acid, chlorate of potash, etc.

The third class of chemicals, coal tar products, form the most beautiful and interesting part of the chemical section. (See SCIENTIFIC AMERICAN SUPPLEMENT, page 496, volume I.) There are several exhibitors of these goods, the largest and best being those of Fried, Bayer & Co., at Barmen and Elberfeld, and the *Actien Gesellschaft für Anilin-Fabrikation* at Berlin. The former is especially interesting, as showing all the steps of the process, and all the intermediate products from the coal to the finished dye, all numbered and labeled, the formulas being given, too, in most cases. Among the rarer substances, we noticed the new and beautiful cosine and silks dyed with it, also fluorescin, resorcin, phthalic acid, benzyl chloride, cumol, xylol, rosolic acid, iodide of ethyl and methyl, coralline, and a full series of anthracene derivatives, bibrom-anthracene, anthraquinone, sulphanthroquinonic acid and its barium and sodium and sodium salts, alizarates of sodium, potassium, barium, and aluminum, alizarine itself, and samples of dyeing. The Actien-Gesellschaft present even a better show of the aniline dyes and dyed specimens, many of the dyes being in much larger quantity, and the whole well mounted and catalogued. The Frankfurt Anilin Color Works exhibit 25 specimens, including cosine, phosphine, indigotine, phenyl-yellow, indigo carmine, aniline blue, green, and violet. Taken as a whole, the exhibit of German chemicals does credit to the manufacturers and to the committee who organized and executed this difficult work. E. J. H.

[For the Scientific American.]

BOILER NOTES.

We have just received the last annual report of the Hartford Steam Boiler and Insurance Company, and, in accordance with our usual custom, proceed to present a synopsis of it to our readers.

The present report is one of unusual interest, as the President, in honor of the completion of the first decade of the company's existence, gives a review of the work done since the organization. The task undertaken by the company, as most of our readers doubtless know, is to institute such a system of inspection of the boilers under their charge as to render them reasonably secure against explosion, agreeing to pay the owners the amounts of insurance stated in the policies, in case explosions do occur. The company's record for two years shows a list of 848 boiler explosions in the United States, by which 1,768 persons were killed, and 1,904 injured. Of these boilers that exploded, 18 were insured by the company, and a careful examination of the causes shows them to have generally been such as no inspection could have prevented. Thus, in one instance, a boiler being under repairs, the workman drove a plug into the steam pipe, and neglected to remove it when the work was completed. As might naturally be expected, in getting up steam in the boiler, it exploded. Several other cases of explosion occurred with long boilers, supported only at three points of their length, and fired by the waste gases from iron furnaces. The President states that it cost the company $10,000 to learn that such boilers should have supports not more than 10 feet apart—though, if we mistake not, considerable attention has been paid to this subject in England in former years, resulting in the adoption of a method of supporting long boilers which seems to give good results. During the period covered by this last report, from August 31, 1874, to December 31, 1875, the company have made 44,763 inspections, discovering 24,040 defects, of which 5,149 were classed as dangerous, requiring immediate attention. Some of these defects may be briefly recounted and discussed. Their nature is clearly illustrated in the report, by a series of well executed engravings.

Furnaces become distorted, and plates are fractured, chiefly by bad management, such as suddenly introducing cold water into an overheated boiler. These distortions and fractures are frequently hastened by the method of construction, the plates being overstrained by using drift pins to bring the rivet holes in line. A sheet may be nearly fractured by this mal-construction, and yet appear to be uninjured, when viewed from the outside.

Plates become burned from forcing the fire too fiercely, or on account of the deposition of scale or sediment. Comparatively few manufacturers seem to realize the danger of using a boiler that is too small for the work, and forcing it to the utmost extent. When a blister forms on a plate, it is generally due to the uneven character of the iron, and the whole plate should be renewed, the application of a patch being only a temporary expedient. Sheets may be corroded on the outside by leaks at the seams, in places which are not readily accessible for examination. Such defects can only be discovered by careful inspection. The use of impure water frequently causes the rapid destruction of a boiler by internal corrosion; and unless this is discovered by internal inspection, a so-called mysterious explosion may be the result.

Careless engineers allow water gages to become clogged, blow valves to leak, and safety valves to stick fast. The following simple rules should be observed by every one in charge of a boiler.

Blow through the water gage at least once a day, and several times, if the water is dirty.

Before starting the fire in the morning, always try the water in the boiler, and do not raise steam until assured that it is at the proper level.

Raise the safety valve, at least once a day, and observe whether it works freely. Attach a stop to the lever, so that the ball cannot possibly be moved out beyond the proper position; and never hang any additional weight on the lever.

Among the steam gages examined by the company, 649 were found to be dangerously defective, having errors ranging from —45 to + 70 with inoperative safely valves. What splendid chances for "mysterious explosions" were presented!

A number of boilers were found without gages, and 19 of these were considered dangerous, because a high pressure was carried.

Several boilers were examined, in which there were no hand holes for removing the sediment, and in many boilers the bracing was very insufficient. When such boilers explode, there ought to be little difficulty in finding the cause. The experience of the company, with boilers in which some of the sheets were made of Bessemer steel, seems to show that this metal is quite as reliable as iron, all cases of distortion or fraction of steel plates being traced to overheating or sediment.

During the time covered by the last report, 139 boiler explosions were reported in the United States, by which 191 persons were killed, and 267 injured. An investigation of a number of these by the company has served to clear up all mystery in reference to their causes.

In the above brief synopsis of this interesting report, we have endeavored to give prominence to such matters as will be of especial interest to those in charge of steam machinery. We think the operations of this company show clearly that safety from boiler explosions can be obtained by careful inspection at frequent intervals, and careful management at all times, neither plan by itself constituting a sure preventive. Not the least among the results of the company's work is the clear demonstration of the fact that the hydraulic test alone will not reveal all the defects of a boiler; and, as we have frequently pointed out, when it is made with cold water it sometimes produces defects which did not formerly exist.

[For the Scientific American.]

OCCUPATION AND THE DEATH RATE IN ENGLAND.

A comparative study of the death rate in seventy-three of the principal employments in England and Wales has lately been made in the British Registrar-General's office, based on the mortality returns of three years. The results show, among other matters of interest, the mortality among all the males aged fifteen years and upwards, in each of the specified employments, and also the relative mortality in each, the mean death rate of the whole being taken as one hundred.

For example, in the three years under examination, the deaths among grocers amounted to three thousand one hundred and sixty. Had their death rate been equal to the mean death rate for all the employments during those years, as many as four thousand one hundred and seventy-three grocers would have died. The relative death rate of that class, therefore, in comparison with the whole, was only seventy-six.

But the grocers were surpassed in healthfulness by the members of two learned professions, the lawyers and the clergymen. The barristers head the list, with a death rate of only sixty-three; the clergy of the Established Church follow, with a death rate of seventy-one, while the independent Protestant denominations stand at seventy-five.

It is scarcely probable that the immunity of the barristers is altogether due to the lightness or wholesomeness of their work. That counts for much, but we must not forget to allow for the fact that in England a large number of independent gentlemen adopt that calling, not to make a living out of it by hard work, indeed not to work at all in it; but simply for the nominal professional rank it gives. If the working barristers only were counted, it is doubtful whether the class would stand so high in the sanitary list. Perhaps the refuge which the Established Church affords for many men of culture and leisurely regular life may similarly help to account for its lower death rate as compared with that of other Protestant clergy.

Next after the barristers and the Protestant clergy come the grocers, already mentioned, followed by men of the combined occupation of grocer and shopkeeper, with a death rate of seventy-seven. After these we find gamekeepers, with a death rate of eighty; farmers, one of eighty-five; civil engineers, eighty-six; booksellers and publishers, eighty-seven; wheelwrights, eighty-eight; silk manufacturers, eighty-nine; carpenters and joiners, and common laborers, stand together in the list, at ninety-one; bankers at ninety-two; domestic servants, ninety-three; sawyers at ninety-five; musical instrument makers, paper manufacturers, and brass workers, at ninety-six; blacksmiths and gunsmiths at ninety-seven; tanners and curriers, shoemakers, and workers in iron and steel, ninety-eight; and bakers at ninety-nine, completing the group of occupations in which the death rate is below the mean.

Machinists and woolen workers die at the mean rate for all, one hundred. Then follow half a hundred employments, more and more destructive to life. Manufacturers in iron, copper, tin, and lead, with bakers and confectioners—probably what would be classed as fancy bakers here—exceed the mean mortality by one. The schoolmaster's calling, and the solicitor's, rank next in unhealthiness, their death rate being one hundred and two. Millers and Roman Catholic priests stand next, with a death rate three above the mean, and thirty-two above that of the clergy of the church of England: a notable circumstance, to say the least.

Why should the mortality among the Roman Catholic priesthood exceed so largely—nearly fifty per cent—that of the English clergy? Are celibacy and asceticism the unsanitary conditions? Or shall we attribute their higher death rate to a more arduous and exposed life among the sick and squalid poor?

After the priests come watchmakers, one hundred and four; tobacconists, one hundred and five; physicians and shipbuilders, one hundred and six; messengers and porters, coach makers and rope makers, one hundred and seven; drapers, one hundred and eight; tailors, one hundred and nine; and workers in cotton, flax, and silk, the same. Chemists, druggists, and commercial travelers exceed the mean death rate by ten; clerks, insurance men, and butchers, by eleven; carvers and gilders, by twelve; farriers, by thirteen; miners, printers, and manufacturers of cotton and flax, by fifteen. It will be noticed that weavers and workers in silk are much the most healthy of all who have to do with textile fabrics, their death rate being eleven below the mean. Those that handle wool exhibit an average vitality, compared with all grades of working men. With the addition of cotton and flax to the fiber used the death rate rises to one hundred and nine; while those who handle flax and cotton without silk or wool die at the rate of one hundred and fifteen. Which is the more destructive to life in its working, cotton or flax, the statistics do not show.

Bookbinding is a degree more unhealthy than printing, the death rate of this class of workers being one hundred and sixteen. In glass manufacturers and fishmongers it rises to one hundred and nineteen; and in printers and plumbers to one hundred and twenty. Quite a number of callings show a death rate of one hundred and twenty one; namely, railway employees, dock laborers, tool makers, file makers, and saw makers. For the diverse causes of high mortality in their occupations, it is not needful to enquire. In hatters, coppersmiths, and needle makers, the rate rises to one hundred and twenty-three; and in manufacturing chemists, and dye and color manufactories, to one hundred and twenty-four. In hair dressers the mortality is more than double what it is in the legal profession, that is, one hundred and twenty-seven. Bargemen die at the rate of one hundred and twenty-nine, or twenty-nine above the standard death rate. The employments of carmen, dray men, horse-keepers, and grooms are still more fatal, the death rate being one hundred and thirty-one. In the next group, embracing potters, innkeepers, licensed victuallers, the mortality is thirty-eight above the standard; while in cabmen and coachmen (not domestic), the death rate rises to its highest, one hundred and forty-three, or twice that of the English clergy.

These figures show with practical accuracy the comparative mortality of the men engaged in these various employments. To considerable extent also, they represent the comparative healthfulness of the several callings; but the reader will readily see that many outside conditions conspire to affect the death rate in each. An easy and healthful calling may show a high death rate, simply because it is easy and comparatively favorable to life, and consequently attracts to itself the feeble and disabled. For example, the statistics of the Medical Department of the Provost Marshal General's Bureau, during our late war, shows that proportionally more watchmen were rejected for physical unfitness than men of any other employment. Yet the watchman's work is easy and not specially unhealthful: so easy, in fact, that the worn-out and crippled and diseased naturally gravitate to it.

That cabmen should show excessive mortality is rather to be expected. Their working hours are long and irregular; and they are exposed to all weathers under unfavorable conditions. It is not so apparent why the unexposed innkeepers and victuallers should die almost as rapidly. The clever author of "Diseases of Modern Life" charges their high death rate to drink. No doubt excessive indulgence does cut short the lives of very many. But we are inclined to think that the selective action of the business has much to answer for. A large proportion of the English innkeepers are men whose working days are past: men who have earned a little money as butlers, stable keepers, small traders, and the like, and find the inn, or "saloon," as we would call it, a sort of hospital for the physical incapacity.

Again, the mortality of hair dressers is relatively high, thirty per cent higher than that of blacksmiths. It can hardly be that their business is in itself so much more killing, notwithstanding the hot and ill ventilated rooms they usually occupy. It is another case, we think, of natural selection. Out of a hundred boys fated to be blacksmiths and barbers, there is little doubt that the majority of the sturdy ones will gravitate to the blacksmith shop, the majority of the undersized and feeble ones to the barber's.

In another article we propose to examine the relative healthfulness of the different employments of men in this country. The results are in many respects curiously unlike those derived from the English statistics. R.

The Meeting of the American Association for the Advancement of Science.

The annual meeting of this association convened at Buffalo, N, Y., on August 23. There is a remarkably large attendance, not only of American scientists, but of scientific men from Europe, who are on a visit over here to the Centennial. The proceedings were formally opened in the Common Council Chamber of the City Hall by a speech by the retiring president, Professor G. S. Hilgard. This was followed by a brief address by the new president, Professor William B. Rogers, after which a formal welcome was extended to the Association by the Mayor of Buffalo and influential citizens. These proceedings, together with the work of electing a standing committee and the reading of a few papers, which will be referred to in the abstracts which we shall publish next week, occupied the attention of the scientists for the first day. On the ensuing morning Professor Huxley arrived, and, after receiving an enthusiastic welcome, addressed the assembly substantially as follows. After gracefully returning thanks for the reception accorded him, he stated that he had no scientific matter to communicate, and in that respect was unprepared, but that, to satisfy a curiosity which he had noticed to be especially developed among us, he would state briefly his impressions of the country.

PROFESSOR HUXLEY'S ADDRESS.

"Since my arrival," he continued, "I have learned a great many things, more, I think, than ever before in an equal space of time in my life. In England, we have always taken a lively interest in America; but I think no Englishman who has not had the good fortune to visit America has any real conception of the activity of the population, the enormous distances which separate the great centers; and least of all do Englishmen understand how identical is the great basis of character on both sides of the Atlantic. An Englishman with whom I have been talking since my arrival says: "I cannot find that I am abroad." The great features of your country are all such as I am familiar with in parts of England and Scotland. Your beautiful Hudson reminds me of a Scotch lake. The marks of glaciation in your hills remind me of those in Scottish highlands.

"I had heard of the degeneration of your stock from the English type. I have not perceived it. Some years ago one of your most distinguished men of letters, equally loved and admired in England and America, expressed an opinion which touched English feeling somewhat keenly—that there was a difference between your women and ours after reaching a certain age. He said our English women were "beefy." That is his word, not mine. Well, I have studied the aspect of the people that I have met here in steamboats and railway carriages, and I meet with just the same faces, the main difference as to the men being in the way of shaving. Though I should be sorry to use the word which Hawthorne did, yet, in respect to stature for fine portly women, I think the average here fully as great as on the other side. Some people talk of the injurious influence of climate. I have seen no trace of the "North American type." You have among you the virtue which is most notable among savages, that of hospitality. You take us to a bountiful dinner and are not quite satisfied unless we take away with us the plates and spoons. Another feature has impressed itself upon me. I have visited some of your great universities and meet men as well known in the old world as in the new. I find certain differences here. The English universities are the product of Government, yours of private, munificence. That among us is almost unknown. The general notion of an Englishman when he gets rich is to found an estate and benefit his family. The general notion of an American when fortunate is to do something for the good of the people and from which benefits shall continue to flow. The latter is the nobler ambition.

"It is popularly said abroad that you have no antiquities in America. If you talk about the trumpery of three or four thousand years of history, it is true. But, in the large sense, as referring to times before man made his momentary appearance, America is the place to study the antiquities of the globe. The reality of the enormous amount of material here has far surpassed my anticipation. I have studied the collection gathered by Professor Marsh, at New Haven. There is none like it in Europe, not only in extent of time covered, but by reason of its bearing on the problem of evolution; whereas before this collection was made, evolution was a matter of speculative reasoning, it is now a matter of fact and history, as much as the monuments of Egypt. In that collection are the facts of succession of forms and the history of their evolution. All that remains to be asked is how, and that is a subordinate question. With such matters as this before my mind, you will excuse me if I cannot find thoughts appropriate to this occasion. I would that I might have offered something more worthy; but I hope that your association may do what the British Association is doing—may sow the seeds of scientific inquiry in your cities and villages, whence shall arise a process of natural selection by which those minds best fitted for the task may be led to help on the work in which we are interested. Again I thank you for your excessive courtesy and, I may almost say, affectionate reception."

The Traveler Ropes of the Brooklyn Bridge.

The joining of the two ends of the first traveler rope, whereby the material for constructing the East River Bridge is to be transported over the river, was recently accomplished. The endless chain is now complete, passing over grooved pulleys on the towers. It is operated by the engine formerly used to elevate stone during the process of erection of the piers. At the time we write, the first section of the second traveling rope is about to be carried over the river. This is made fast to the rope now in position and run over by it. It is lashed to the first rope at regular distances of 50 or 60 feet, as it leaves the Brooklyn anchor pier; and when it is across, these fastenings will have to be cut. This is done by a man sent over in a "buggy," which is a small platform hung upon the traveler rope by deeply grooved wheels. It is surrounded by a railing, inside of which the workman will stand, cutting the lashings as he rides across. The ride down to the center of the traveler rope will be controlled with a hempen rope, and the "buggy" will be hauled up the opposite incline with another. There will be nothing perilous in the process if the workman can keep from dizziness, nor more danger than in a great many other stages of the work.

In order to inspire confidence in the men who are to perform the undertaking, Mr. E. F. Farrington, master mechanic of the bridge, recently crossed from the Brooklyn anchorage to the New York pier, seated on a boatswain's chair, or swing, attached to the moving rope. The trip was rapidly and safely accomplished in the presence of a large and enthusiastic crowd. Mr. Farrington, now the first man who has crossed the bridge, was also the first who traversed the spans at Cincinnati and Niagara.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVEMENT IN FEEDING PULVERIZED FUEL TO FURNACES.

Allin Cockrell, Lamar, Mo.—This consists of a fan blower combined with a furnace in such manner as to feed it with a constant and regular supply of fnel, and having a conveyer for supplying the fuel to it from a mill in which it is ground, or from a feeding hopper to be supplied with previously pulverized culm, tan bark, sawdust, or the like.

IMPROVED EXPANDING METAL DRILL.

Patrick Duffy, New Bedford, Mass., assignor to himself and James F. Powers, same place.—Two cutters, fixed in the stock to slide forward and backward transversely, are slotted obliquely and reversely to each other. The fastening bolt by which they are secured to the stock is fitted in said slots, and also fitted in a vertical slot in the stock, so that, by shifting the bolt along the slots in one direction, the cutters will be adjusted onward; by shifting the bolt the other way, they will be adjusted inward.

APPARATUS FOR CUTTING AND ORNAMENTING SHOE UPPERS.

Edwin B. Stimpson, Brooklyn, N. Y.—This consists essentially of a series of small punches, one or more large punches, a bed die, and a stripper, contrived in the ordinary way of punching machines, for making ornamental figures in the uppers of shoes. The steel die plate is riveted to an iron plate, the object of which is to combine with the die plate a sufficient body of metal, that will not crack in cooling. The stripper is suspended from the head of the press by springs to raise it out of the way of handling the goods after the goods are cut. The marking plate has small points for marking imitation stitches, and there are broad punches for cutting out long strips made concave on the cutting end.

IMPROVED LUBRICATOR.

Simon Smith and Isaac S. Collins, Mauch Chunk, Pa.—This is a horizontally feeding oil cup for parts of steam engines, which can be regulated to feed a greater or less quantity of oil when the engine is in motion, but which discontinues the oil supply when the engine is stopped. It consists of a horizontal cup of cylindrical shape, with tightly seated glass head. The feeding mechanism consists of a horizontal reciprocating pin, guided in suitable manner, and having recesses that take up the oil from supply perforations and convey it to the feed tube at each oscillation of the part of the engine to which the lubricator is attached.

IMPROVED GRINDING MILL.

Enoch Moore and David Moore, Mooreville, Iowa.—These inventors propose to provide a supporting plate, with a recess, on which they locate the rocking plate resting on the pivots in the bottom of the recess. The stone on the under side of it rests on other pivots. By this arrangement, sufficient space is secured between the beams without cutting or weakening them.

IMPROVED COMBINATION LOCK.

Isaac D. Sibley, Huntsville, Ala.—This consists of two systems of bars and springs, arranged one on each side of the guard bolt to slide toward and from it, and so contrived that the bars of one side being adjusted against the block lock it, and in that position are unlocked by sliding up the bars of the other side.

IMPROVED LARD PRESS.

Pusey Pemberton, Newark, Del.—Devices are provided whereby the follower may be held level, and may thus be kept from binding, even should there be more scrap or cracklings in one side than in the other, and the mechanical construction is new and well calculated to render the machine efficient.

IMPROVED LEATHER-TAPERING MACHINE.

John Settle, Lebanon, Oregon, and George W. Settle, Oakland, Oregon.—This invention relates to certain improvements upon the patent granted the same inventors, January 19, 1875, for a machine for tapering leather, in which a pivoted frame carrying a knife moves over a hinged adjustable curved block to taper the end of a strap, belt, or other piece of leather, preparatory to attaching the same to another piece, and it consists in the construction and arrangement of a device for clamping and holding the piece of leather in a convenient and effective manner.

IMPROVED TWEER.

Mark Lester, Bellaire, Ohio.—The object of this invention is to prevent the accumulation of sediment in the annular water space of a tweer for blast furnaces, and to prolong the life and utility of the latter. To this end the invention consists in providing the overflow pipe of the tweer with an outlet cock, located near the bottom of the water space, through which the mud and sediment may be washed out, and extending the supply pipe to the nose or hottest part of the tweer, whereby the cold water is first brought in contact with the part of the tweer which most needs the cooling effect, and whereby also the accumulated mud and sediment may be readily washed out by the natural passage of the water.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVEMENT IN ORNAMENTING BUTTONS.

Samuel S. Moyer, Berlin, Ontario, Canada.—This process consists, first, in printing the figures upon the face surface of the button by means of type coated with an impermeable composition, then applying the coloring matter, after which the composition is removed by polishing or otherwise.

IMPROVED DIFFUSION APPARATUS.

Charles Neames, New Orleans, La.—The object of this invention is to improve the Julius Roberts diffusion apparatus, in such a way as to secure a more perfect extraction of the saccharine matter from the material used, and at the same time simplify the apparatus. It consists in a diffusion vessel of a diffusion apparatus, gradually increasing in size from its top or inlet, opening to its bottom or outlet opening; in the wood packing interposed between the rim of the doors and the door frames of a diffusion vessel; in a division plate extending from the top to the bottom of the vessel to form the heating chamber, and having its lower part perforated with numerous small holes to serve as a strainer. Finally, heating pipes are placed within the diffusion vessels of the apparatus; and there is likewise a combination of the circulating wheel and its pipe with the diffusion vessel.

IMPROVED CUFF AND COLLAR BOX.

Ernest Scheel, New York city.—This consists of a box divided by a lateral partition into two sections or compartments, of which one is intended for the cuff, and provided with a central tubular post with sliding top. The other is divided by horizontal supports into two parts for inserting a receptacle and storing the collars, neckties, and other articles.

IMPROVED HOMINY KNIFE.

John Outcalt, Spotswood, N. J.—This consists in improved knives of hullers for hominy mills, made with their blades curved with a constantly increasing curvature from their forward to their rear ends. They are also made wider toward their rear ends, inclined upon their upper sides, flat or inclined upon their lower sides, and provided with rasp teeth above, and file or rasp teeth below.

IMPROVED HARNESS SADDLE.

Robert Spencer, Brooklyn, N. Y.—The object here is to afford a broader bearing for tree plates of a given size. The under bearing of wood is made broader than the tree plate, and the flap and jockey are attached to the margins of the face or outer side of the pads. The tree plate is made of sheet metal, with a transverse ridge and corresponding groove or depression.

IMPROVED PACKAGE FOR PAINTS, ETC.

George Sidey, Brooklyn, N. Y.—This invention consists in causing the upper edge of the can body to bear in a groove and against the center of a strip, and providing a flat headed screw working in a nut on the bottom of the can, in order to form a close joint. The article placed in the can is thus hermetically sealed.

IMPROVED PAPER BAG FASTENINGS.

Henry S. Gillette, New Preston, Conn.—A string of suitable length and strength is attached to the bag by means of a piece of paper which is pasted to the bag over the string. This little clip of paper secures the string permanently, so that the clerk need waste no time in seeking for a string to tie the bag.

IMPROVED TOY MARBLE RAKE.

Alfred Gurny, Robert H. Piper, and Henry E. Waite, Bridgeport, Conn.—This is a rake or notched bar employed in marble playing for determining the gains by the numbered notches through which the marbles pass. There is a spring tablet to each notch, with the number of the notch upon it, and contrived to be set in the way of the marble passing through the notch, so as to be tripped by the striking of the marble against it. On being raised, it exposes the number of the notch to view, thus showing the count toward game, the number being concealed while the tablet is set.

IMPROVED AWNING.

Anthony Hessells, New York city.—This consists of a swinging stretching frame and outer curtain, that is wound up by a roller and cord. The roller is supported on a second swinging frame, to be lowered and adjusted to any position for regulating the hight. When the awning is lowered entirely, it serves to close the window like a curtain, forming a protection against heavy rain, hail, etc.

IMPROVED CIGAR BOX.

Simon Hood, New York city.—This cigar box admits the convenient arranging of the cigars in bundles, the exhibiting of the same, and the ready taking out for selling them. The body is made of diagonally tapering shape, with steps and guard strips, and is closed by hinged side and front parts and lid.

IMPROVED SHEARS AND SCISSORS.

George H. Taylor, New York city.—This invention consists in constructing shear or scissor blades with a curved shoulder at the rear end of the cutting edge of the blades, to adapt them for use in ripping goods.

IMPROVED HARNESS BUCKLE.

Benjamin F. Frazier, Grand Rapids, Wis.—By suitable construction, when a strain comes upon the strap, the tendency is to draw a frame back, and clamp the said strap between cross bars. The strap is thus held securely without holes being punched in it.

IMPROVED CAMP STOOL

Charles M. Lungren, Toledo, Ohio.—This invention consists of a double ferrule and hook attachment for the top of the legs, comprising in one casting the hook and the ferrule for connecting the hook to the leg, and also a socket for the attachment of the back support. This forms a stool which may be folded into small compass, and which, nevertheless, when extended, gives a comfortable seat. At the Centennial Exposition, where chairs or seats of any kind are few and far between, portable devices of this type are found very useful.

IMPROVED BEER PUMP.

Philip Krumscheid, Boston, Mass., assignor to himself, J. Krumscheid, and John R. Foley, same place.—This invention consists of a beer pump in which a float shuts off, when raised to a certain hight, the water supply, and draws off a certain quantity of water, sufficient to lower the float and re-establish the water supply. The air is forced through and retained in the barrel by a check valve, and drawn into the pump through an air pipe with another check valve, on the falling of the water level.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED GIN SAW FILER.

Frank Charter, Little Rock, Ark.—This is a machine for filing gin saws without removing the saw shaft from its frame, and in such a way as not to leave angular or wiry edges upon the surface of the saw teeth, to cut, chop, or nap the cotton fiber, and thus injure it. The novelties lie in the mechanical construction.

IMPROVED PILE SAW.

David Bean, Le Sueur, Minn.—This consists of a standard for supporting the saw frame, with a clamping device for attaching it to the upper end of the pile to be sawed off under water. There is also a vertically adjustable arm, on which the frame swings, and on which arm the frame is adjustable to feed the saw up to the pile as the work progresses, and to measure its depth in the water.

IMPROVED BILLIARD TABLE LEVELER.

Samuel May, Toronto, Ontario, Canada.—This consists of a long nut, with an enlarged head at the lower end, screwing on a rod projecting from the bottom of a socket in the end of the leg, in which the nut works so as to conceal the screw rod. Said rod is either a short one, screwing into the leg at the bottom of the socket, or it is formed on the rod used to screw the leg to the table. In both cases it has a collar screwing against the bottom of the socket, and is secured by wood screws screwing into the wood through notches in the edges of the collar.

IMPROVED WHIFFLETREE CONNECTION.

George W. Ingersoll and Harvey L. Fisher, Toledo, Iowa.—This consists in an inclined whiffletree coupling, composed of two unequal bars connected by an eye bar. The inclination of the coupling causes either end of the whiffletree that may swing back to pass above or below the double tree, according as the longer arm is placed above or below the shorter arm, so that there can be no rubbing and wear between said double tree and whiffletree.

NEW HOUSEHOLD INVENTIONS.

IMPROVED MEAL BIN.

John Hunter, Ashland, Pa.—This consists of a kneeding trough, kneeding board, and a flour sieve, contrived in connection with a flour chest, so as to be more convenient and easier to use than as commonly arranged.

IMPROVED BED SPRING.

John Reardon, New York city, assignor to Orville D. Lovell and Frank H. Lovell, of same place.—This is a bed bottom spring formed of a rabbeted U-frame, a flanged crosshead, a guide pin, and a spiral spring, constructed and arranged so that the bedstead can be put up, taken down, and carried from place to place with as much ease as if the slats rested upon cleats, and the various parts of the spring are so arranged that they cannot cut or injure the mattress.

IMPROVED CARPET STRETCHER.

Lewis W. Rivers, Salt Lake City, Utah Ter., assignor to himself and Hanson J. Rivers, of same place.—In using the device, the carpet is placed between jaws, and a lever is arranged with its sharp lower end resting upon the floor, and its upper part inclining forward over a bar. The upper end of the lever is then forced back or from the carpet, which draws the said carpet to its place. When the carpet has been strained sufficiently a pawl, holds the lever in place until the stay tacks can be driven.

IMPROVED SNOW SHOVEL.

Eugene Campbell, South Westerlo, N. Y.—This shovel is provided with a face plate extended beyond the edge of the shovel plate. It also has, on the under side of its front end, and in one piece therewith, the runners arranged to keep the edge of the plate from coming in contact with the surface upon which the shovel is being used.

IMPROVED WEATHER STRIP.

William Watkins, West Joplin, Mo.—This weather strip is formed of a metallic plate, having its edges bent over upon themselves to form grooves to receive a strip of flexible metal, said flexible strip is made wider than the said metallic plate, to give its middle part a U-form.

IMPROVED WASH BOARD.

John S. Washburn, Yonkers, N. Y.—This invention consists in an improved washboard formed of grooved side bars, over which a rubber plate is passed, so that a rubber surface and a wooden surface may alternate with each other to form the rubbing surface of the board.

NEW TEXTILE MACHINERY.

IMPROVED TENSION DEVICE FOR TWISTING MACHINES.

Paul A. Chadbourne, Williamstown, Mass.—This is a contrivance of guide eyes and a roller with the spool stand, from which the threads are supplied to the twister, whereby the tension of all the threads is more uniform than in the common arrangement.

IMPROVED FEEDER FOR CARDING MACHINES.

William C. Bramwell, Terre Haute, Ind., assignor to himself and Edwin Ellis, of same place.—The invention consists of a tilting scale for weighing the wool deposited upon it by a toothed traveling apron, the two (scales and apron) being so connected by a clutch mechanism that the apron is stopped intermittingly, thus shutting off further supply until the scale has deposited or discharged the wool which it already contains. The wool having been thus deposited on the feed table, and the scale returned to its original position, and while the elevating apron is delivering a fresh supply to the scale, a loosely pivoted rotating scraper is at work removing the pile of wool just dropped by the scale, and pressing it up to the edge of that which has already been fed on and is about to enter the feed rolls of the carding engine. By this operation the wool is removed out of the way, and a clear place given to the next lot, so that it may not, by piling up, obstruct the proper action of the tilting pan of the scale, and that all the wool may be dropped each time. The tilting and emptying out of the wool from the scale is entirely independent of the time it may take the scale to turn its balance, as this time is constantly varying. It is by this means that the apparatus is caused to run itself out of wool when desired, and yet keep the work even to the last.

NEW AGRICULTURAL INVENTIONS.

IMPROVED PLOW STOCK.

Lemuel H. Davis and Irvin Aycock, Morgan, Ga.—This consists in a plow stock formed of three iron bars, constructed and combined with each other, and with the handles, so as to form a strong and serviceable device.

IMPROVED COMBINED LISTING PLOW AND SEED DRILL.

Alonzo M. Coston, Maryville, Mo.—This is an improved machine for preparing the soil and planting the seed at one passing over the ground, which is left in a deep furrow and ridge alternately. The subsoiler runs in the rear of the main plow, thereby loosening the soil in the bed of the furrow, forming a suitable place to deposit the seed, and dropping the seed and covering it.

IMPROVED CORN PLANTER.

Nathan H. Meeks, Salado, Tex.—This consists of a circularly vibrating dropper slide contrived to be attached to a plow beam or other object to be drawn by a single horse, and be worked by the whiffletree, which has the requisite vibratory motion from the shoulder of the horse.

IMPROVED HOG TROUGH.

Newton A. Clark, Harveyville, Kan.—The object here is to keep the hogs away from the trough when putting in food, to prevent the hogs from putting their feet into the trough when feeding. The mode of operation is as follows: A lever being raised into a perpendicular position, boards are thrown against the back of a frame, so as to allow the hogs to have access to the trough by passing between ribs. On the other hand, when the lever is brought to a horizontal position, or nearly so, the boards are thrown out in front of the trough, so as to exclude the hogs therefrom.

IMPROVED FERTILIZER DISTRIBUTOR.

David C. Brown, Log Town, La.—This is a device for attachment to the rear end of a wagon body for distributing cotton seed as a fertilizer. It may be used for distributing other fertilizers, and which will enable the material to be placed wherever desired. In using the device, a man is placed in the wagon to keep the hopper filled with the fertilizer. The amount of fertilizer distributed may be regulated by increasing or diminishing the number of pins which feed out the material, and by varying the relative size of the driving pulleys.

IMPROVED ANIMAL TRAP.

Homer S. Davis, Camp Brown, Wyoming Ter.—This improves the well known spring trap used for catching animals of large size, such as beavers, foxes, otters, etc., so as to prevent the throwing out of the leg or foot, or the breaking of the same by the action of the spring, in consequence of which the animals frequently escape.

IMPROVED CORN-PLANTING ATTACHMENT FOR SOD PLOWS.

Sanford M. Scott, Stockbridge, Wis.—This is an attachment for breaking-up or sod plows, so constructed as to plant the corn as the sod is turned, and close to the outer edge of the furrow. The corn will thus come up between the sods of two furrows. The device is not in the way of turning the plow over to file or sharpen the share.

IMPROVED POTATO PLOW.

Tubal C. Baxter, Monticello, Kan.—This consists of a forked beam, with a landside and cutter to each branch of the fork, between which is a shovel plow fixed on an easy incline, for the potatoes and the earth to be forced along over the rear end. From said end extend a number of rods, suitably arranged to let the earth sift through, and to carry the potatoes back and discharge them in a row on the top of the earth.

IMPROVED PLOW.

Alva A. Preston, New Troy, Mich.—This is an improved iron beam plow, light, and at the same time strong, which may be easily adjusted to take or leave land, and to run deep or shallow, as may be desired.

IMPROVED MILK PAIL.

Newton McKusick, Stillwater, Minn.—This is a pail with a cover having an opening closed by a strainer, and a detachable funne with a second strainer, through which the milk passes into the pan. The double strainers prevent any foreign substances, however small, from passing into the milk.

IMPROVED HARROW.

William C. Moore, Cairo, Pa.—This is formed in three sections hinged to each other by bolts and straps. The middle section is made rectangular, and the side sections oblique, having their forward corners beveled off. Shoes are attached to the forward sides of the front cross bars.

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

W. H. H. will find directions for preventing rust on iron on p. 169, vol. 33.—C. W., Jr., will find directions for calculating the proportions of compound gears on p. 107, vol. 34.—A. K. will find that good glue is the best material for fixing sand on belts.—W. A. G. can make and use leather pulp by following the directions on p. 105, vol. 25.—R. S. will find a description of a cold tinning process on p. 154, vol. 34.—J. R. C. should consult the makers of his fan.—E. G. A. is informed that the sand blast (see p. 195, vol. 27) has been used for cutting iron; but whether it is now in practical use for that purpose, we do not know.—C. W. L. will find directions for making artificial meerschaum (not ivory) from carrots, etc., on p. 307, vol. 34.—H. H. L. can make a good indelible ink for stamping by following the directions on p. 129, vol. 28.—H. S. can polish Britannia ware by the method described on p. 57, vol. 34.—N. S. W. will find answers to his queries as to the SCIENTIFIC AMERICAN SUPPLEMENT on p. 124, vol. 35.—H. W. C. will find a recipe for a hair stimulant on p. 138, vol. 33.—J. P. G. will find directions for tempering springs on p. 11, vol. 34.—E. H. B.'s query as to eggs is a schoolboy's problem, of no practical value.—C. E. C. can clean rust from tin by following the directions on p. 57, vol. 34.—E. W. H. will find a recipe for artificial coral on p. 307, vol. 34.—C. B. R. will find a description of phosphor bronze on p. 315, vol. 30.—C. A. will find directions for etching on glass on p. 203, vol. 33.—H. H. L. will find directions for gilding on glass on p. 313, vol. 34.—B. will find a recipe for a depilatory on p. 186, vol. 34.—J. M. will find full directions for stuffing birds on p. 159, vol. 32.—H. T. will find directions for making fulminating powder on p. 250, vol. 31.—J. D., Jr., will find directions for japanning tin ware on p. 132, vol. 24.—D. M. L. can cement glass to brass with the preparation described on p. 117, vol. 32.—R. I. G. is informed that there can be no such instrument at a needle that will point to buried gold.—F. W. S. will find a description of the underground telegraph wires in London and elsewhere on p. 294, vol. 30.—G. K., of Highgate, London, England, will find directions for nickel plating on p. 235, vol. 33.—A. F. will find directions for getting rid of fleas on p. 217, vol. 27.—C. & S. will find directions for making pickles on p. 155, vol. 31.—J. H. K. can prevent mildew on sails by the process described on p. 90, vol. 31.—A. D. L. will find a formula for calculating the centrifugal force of a body on p. 378, vol. 30.—J. O. S. can render his windows opaque by the process described on p. 264, vol. 30.—H. W. G. will find an article on chlorophyll on p. 247, vol. 29.—W. A. D. will find directions for making artificial stone on p. 124, vol. 22.—H. J. can silver brass and copper, without a battery, by using the preparation described on p. 299, vol. 31.—D. D. W.'s letter has been placed in the hands of several chemists, who may take action in the matter.—A. H., E. W. M., F. C. L., W. J. B., C. F., W. M., N. J. O., C. J. C., H. M. L., W. B. W., B. H., R. B., C. R., J. W. F., W. B. E. P., W. H. B., 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) F. R. Jr. asks: How can I find the diameter of one of four equal circles inscribed in a large circle, of given diameter? A. Multiply the given diameter by 0·414213.

(2) W. H. S. says: I enclose a specimen of deposit taken from my heater reservoir, which I am unable to get rid of and which is very troublesome. The heater is 14 feet long and 22 inches in diameter, and in it are three pans 12 feet long by 14 inches wide, with partitions in middle. The cold water runs into the top pan on one side at end, and along the length of pan; it returns and falls through holes into next, and so on through, lastly falling on bottom of heater, and is then conveyed to a reservoir 6 feet deep and 22 inches in diameter. The exhaust comes up into my heater at the end at which the cold water comes in and goes out at the opposite end, so that the water gets boiling hot before it leaves the heater. I use water from the top of the reservoir, and the deposit seems to float on top, and will not mix with the water after it is precipitated. Can you suggest any means of getting rid of it? A. By the use of a surface blow, you could probably discharge the most of it. It would be still better to filter the water after leaving the reservoir. Probably a box filled with sponges would answer every purpose; and the sponges could be removed and washed, from time to time, as they become stopped up.

(3) A. O. says: I have an engine of the following dimensions: Cylinder 3 inches in diameter, stroke 6 inches. The boiler is 5 feet long by 2½ feet in diameter, made of ¼ inch boiler iron, single riveted. It is to run, if possible, at about 200 revolutions per minute. Is it big enough to run a cylinder journal printing press, generally run by hand power, and a printing press run by foot power? Is the boiler big enough to generate steam enough to run the engine and heat a building of 30 x 60 feet? A. We think the machinery will answer, and that you can heat the building with the exhaust steam. It must be evident to you, however, that an opinion, based on the data you have sent, cannot be of any great value. It only amounts to saying that if the machinery is properly designed, constructed, and set, it will give satisfaction.

(4) J. H. B. asks: What should be the diameter of a propeller shaft, to transmit with safety an actual thrust of 10 tuns, the strain to be a pulling instead of a pushing one, as is generally the case? Length of shaft after leaving propeller boss to connection with engines is only 4 feet. Propeller is supposed to revolve in water constantly, never to be thrown out of it and thus subjected to the undue strains of racing on its return. Material is to be steel. A. A shaft 2 inches in diameter will answer for the conditions stated.

Suppose cold water to be kept in constant circulation on the exterior of a cylinder with shell 1½ inches thick. What is about the highest temperature to which the interior may be exposed as long of that of the interior circumference of shell does not exceed 700° Fah.? A. There is no limit to the temperature, if, as we understand you, it is assumed that the temperature of the iron can be kept at or below 700°

(5) P. R. asks: Please give me a simple rule for calculating how much weight a horizontal spruce beam will bear. A. If the beam is rectangular, and supported at both ends, the breaking weight, applied at the middle, will be:

$$\frac{(\text{Depth in inches})^2 \times (\text{breadth in inches}) \times 400.}{\text{Length between supports in feet.}}$$

If the load is uniformly distributed over the beam, it can be twice as great as the above.

(6) C. C. asks: How can I make a dark colored chalk, suitable for lining purposes on light colored wood, having the same cohesion as the common white chalk used for that purpose? A. Grind the pigment into an impalpable powder, thoroughly moisten with a little dilute solution of dextrin in hot water, knead the mixture well, and dry thoroughly at a gentle heat.

(7) T. M. H. asks: Can any use be made of dross from tin and lead? A. If there is any considerable quantity of the material it would probably pay to treat it for the recovery of the metals in the following manner: Mix thoroughly with almost an equal weight of anthracite coal, spread evenly on the bed of a small reverberatory furnace, and smelt, with a gradually increasing temperature, until the reduction of the metal has begun. Then throw in a little lime, increase the temperature for a short time, draw off the reduced metal into a large iron vessel, and stir with a piece of wet wood to raise the impurities to the surface; remove these by skimming and pour the metal into a stone or iron mold to cool.

(8) C. G. L. asks: Is there any way of getting a press copy from thin writing ink, or from writing too old to copy from moisture only? A. Try the following: In a half pint of water dissolve about a tablespoonful of white sugar, and to the solution add a sufficient quantity of the ferrocyanide of potassium to distinctly color it, also about half a gill of pure muriatic acid (free from iron). Moisten white tissue paper with this, partially dry it with a blotter, place the writing to be copied in contact with it, and keep under pressure for about five minutes. With most inks this recipe will give very good results.

(9) H. A. P. L. says: Would an electrical machine with one glass cylinder and two round silk cushions, electricity being conducted to a Leyden jar or a prime conductor, be powerful enough for experiments? A. As far as we may judge from your description, the machine is properly constructed; but to obtain good results, it will be necessary to rub on the cushions an amalgam, which may be prepared as follows: Melt together in a crucible 2 ozs. zinc and 1 oz. tin; when fused, pour the alloy into a cold crucible containing 4 drachms dry mercury; when cold the amalgam is ready for use. Before applying the above amalgam, the cushion should be rubbed over with a mixture of tallow and beeswax. In pouring the fused metals into the cold mercury, do not inhale the mercurial vapors that may be formed, as they are very poisonous.

(10) C. A. R. asks: Is there a cement or fluid which will fasten together two straps of sole leather a yard long, which will not be affected by moisture? A. Melt together equal parts of pitch and gutta percha. Apply hot.

What will remove stains from a shirt bosom? A. Try touching the spots with a little benzole, and afterwards pressing for several hours with warm pipe clay.

(11) A. B. says: Some plumbers use muriatic acid with no zinc in it. I would like to know what effect this acid has on iron and brass. A. Dilute muriatic acid will answer, but a strong acid solution of chloride of zinc is much better, as it not only cleans the metallic surfaces but protects them, by the formation of a coating of the fused chloride, which excludes the air.

(12) J. S. M. asks: How large a pipe will it take to give sufficient blast to a cupola 22 inches in diameter, distant 80 feet from a common fan? A. About 2 or 2½ inches in diameter.

(13) A. F. J. asks: Can water be raised by an ordinary suction pump below a level of 33 feet by the aid of check valves placed below the suction? If so, how far? A. If, as we understand it, reference is made to the hight to which water can be raised by atmospheric pressure, 33 feet is about the practical limit, and one which is seldom reached by ordinary pumps.

(14) J. F. asks: What is the rule fo ascertaining the proper amount and form of space underneath and at the back end of the boiler? A. There is no definite rule for this proportion, so far as we know.

(15) C. & T. ask: If you found that the piston of your engine was striking the bottom or top of the cylinder, what would you do to stop the pounding? A. If the pound were serious, we would put linings in one of the connecting rod boxes. In case it was not possible to stop, we would work the engine slowly, and cushion the steam, if any means for so doing were available.

(16) R. asks: How can I cheaply, easily and cheaply, the inside of an iron pipe so that the water passing through may not be affected by the metal? A. Try melted paraffin.

(17) P. V. T. and others.—There is no specific for catarrh. Temperament, habits, etc., must be taken into account, for which reason a course of treatment suitable to one person would be entirely unsuited to another. We cannot advise anything but continuance under the care of a regular practitioner.

(18) J. G. Q. asks: In what non-freezing liquid can phosphorus be kept from combustion? A. In naphtha.

(19) S. W. T. says: How can I make a first class waterproof blacking, that does not require brushing? A. Vinegar 1 quart, ivory black and molasses, each 6 ozs., oil of vitriol and spermaceti, each 1½ ozs. Mix the acid and spermaceti first, and then add the other ingredients.

What is the best way to clean a copper boiler? It is used in a kitchen; the boiler is 18 inches diameter and 5 feet high, the burnish on the outside gets dull and of a mauve color. A. Clean with a little dilute oxalic acid solution, wash, dry, and polish with a little tripoli.

How can I make soap bubbles so that they will last long, or at least not break so soon as those made with soap and a pipe in the ordinary way? A. Use a fatty soap, preferably one made with fish oil, and to the solution add a little glycerin.

How can I find a number which, multiplied by its half, will make 20? A. Let x=the number; then $(\frac{1}{2}x)x=\frac{x^2}{2}$, $\frac{x^2}{2}=20$, $x^2=40$, $x=6{\cdot}32455$, $\frac{1}{2}x=3{\cdot}16228$, $x\times\frac{1}{2}x=19{\cdot}99999719$. If you carry out the square root of 40 until you obtain the root complete, and multiply this number by one half itself, then the result will be 20 instead of the result given.

How can I darken my hair, which is a light red, without using a dye? A. You cannot.

What is a good substitute for gum arabic for sticking on labels? A. Use a boiled solution of dextrin in water.

Is there anything that will keep the snow from lying on the ground in winter? It is a patch 40 yards square that is required to be kept clear. A. No.

(20) H. A. G. says: I have a coat which was originally of a dark blue color; but owing to exposure to the sun's rays, it has faded to a reddish hue. How can I restore the original dark blue color? A. Try treating the fabric with strong ammonia water for a few minutes, and then wash thoroughly with clean water. If this does not suffice, it will be necessary to have the material re-dyed.

(21) W. C. W. says: You published a recipe for making black varnish by mixing oil of turpentine and sulphuric acid. I tried the experiment, which cost me a loss of some clothes, nearly the loss of an eye, and about two weeks' labor, brought about by an explosion which burnt my face severely. I purchased what a druggist said was oil of turpentine (spirits of turpentine). I mixed the ingredients in various ways, with no results as predicted; and then, having a phial partially full of each, I poured one into the other, and then shook the mixture, when an explosion took place. What was the matter? A. The recipe, as given, is perfectly correct; and if you had closely and carefully followed its directions, all would have been well. Instead of dropping the sulphuric acid into the turpentine, it would, perhaps, be better to slowly drop the turpentine into the strong acid. The only precautions necessary are to mix the reagents slowly, so as to avoid a too rapid rise in the temperature of the mixture, and to keep the mixture cool by surrounding the vessel with cold water during the operation. The viscous and dark red body obtained consists principally of a mixture of terebene and colophene. The proper proportions are about 1 part of strong sulphuric acid to 20 of oil of turpentine.

(22) I. N. R. R. says: I have charge of some coal mines, in which there is a great deal of gas. In one part of the pit the gas shows a blue flame on the safety lamp gauze; and in another part there is a fault in the coal, and the gas shows the blue flame, and on the top of the blue flame a white flame. Please explain this. A. It may be due to some peculiarity in the oil, an unusual quantity of carbonaceous matter in the atmosphere, or to the fire damp itself becoming intermixed with some higher carburet of hydrogen. You do not furnish sufficient data to enable us to answer the question more positively. In case the latter suggestion should prove the correct one, and, inadvertently, the mixture should become ignited, the explosion that would follow would be very severe, much more so than that of ordinary fire damp.

(23) A. K. says: We have a small stage and want to supply it with gas, using 4 cubic feet per hour. How large a pot would it take to produce this amount, and how much coal would it take to produce 4 cubic feet per hour for three hours without refilling the pot? Can the gas be led to the purifier and from that right to the burners? A. This is not practicable, as, when the temperature reaches a certain point, the gas comes over quite rapidly and not at all uniformly. It will be necessary to pass the purified gas to a reservoir (a large gas bag will answer your purpose) that will adapt itself to the volume of the gas and maintain a steady pressure. In order to avoid reducing the luminosity of the gas, it is requisite that the distillation should not proceed under pressure.

(24) R. F. asks: What is the best, cheapest, and most effectual means of removing salt water rust from boiler plate iron? A. Steep it in a weak pickle of oil of vitriol in water, and dry immediately with sawdust. It is better before placing it in pickle to go carefully over the surface with a good stiff wire brush, so as to remove as much of the oxide as possible. Brushing after removal from the acid is, in some cases, also advisable.

(25) S. D. asks: What will clarify a solution of 5 lbs. of Irish moss, boiled in 20 gallons of water, long enough to extract the gelatin? I want to get rid of the small particles, which give it a cloudy appearance. A. Mix with clean paper pulp, place in a fine linen bag, and strain. The paper and gelatin should be mixed and well stirred together while the gelatin is hot and as liquid as possible.

(26) H. S. S. C. asks: Will a house 30 feet by 30, covered with tin and having a water conductor at each corner connected with the roof, each conductor being connected with the ground by a copper wire, be sufficiently protected against lightning without a lightning rod? A. The water conductors, not being in the form of a compact body of metal, would hardly be so good as a rod: but, if provided with a pointed rod at top in connection with each, extending about three feet high above the roof, and a like rod extending some distance into the ground at the bottom, they might be considered safe.

(27) O. A. W. asks: Is there a chemical that, when rubbed on the hand, enables one to handle red hot iron or melted lead with impunity? A. No; but if the hand be damp with perspiration, or slightly moistened, it may for an instant be dipped in melted lead or white hot melted iron without burning or discomfort. The moisture is thrown into the spheroidal condition, and presents an effectual barrier against the intense heat.

(28) W. M. M. asks: How is a bichromate battery made? A. It consists usually of a large glass jar having within it a cup of porous unglazed porcelain. The intermediate space, between the sides of the vessels, is filled with dilute sulphuric acid (1 to 20), and contains a sheet of zinc shaped so as to conform to the curve of the inner cup, which it completely surrounds. A stick of gas carbon is placed in the porous cup, and surrounded with a fluid made by adding strong sulphuric acid to a saturated aqueous solution of bichromate of potassa until the chromic acid begins to separate in flakes, it is afterwards diluted a very little in order to redissolve the precipitate. The proportion of the several ingredients in this mixture should be about as follows: to about 10 ozs. of bichromate of potassa in 1 gallon of water, add 1 pint of strong oil of vitriol.

(29) S. asks: Is the common arsenic of the drug stores the kind that can be fused with block tin? A. No, use metallic arsenic.

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

W. Z. J.—No. 1 is blue clay. No. 3 is a piece of slate. No. 4 is a variety of steatite. No. 5 is basalt. No. 6 is a piece of bituminous shale. No. 7 is chalcopyrite (sulphide of copper). A smaller specimen numbered 6 is an agate. No. 2 did not arrive.—P. & B.—It is nodular iron pyrites.—B. M. R.—No. 1 is a limestone fossil, but has been so badly damaged that we cannot classify it. No. 2 is a piece of shale.—S. S.—It is a broken quartz crystal.—S. L.—It is partially reduced oxide of copper.—W. E.—The color on the window blind does not contain arsenic. It is an organic pigment.—C. C.—They are garnets, of considerable value when large and perfect.—J. A. C.—It is a bituminous shale, and might be used for heating purposes.—S. J.—The sand might, if properly screened, find a limited employment for scouring, grinding, and polishing purposes, as well as in the manufacture of glass and glazes.

S. G. C. asks: Is there anything which will restore drawing paper, which has become soft from age and use so that ink runs on it, sufficiently to ink on a few lines at a time when necessary?—O. S. says: Can you inform me what is the yield of oil to the bushel of peanuts, and what are the means of extracting the oil?—J. L. R. Jr asks: Please tell me where the character $ came from originally.

COMMUNICATIONS RECEIVED.

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

On Weight on and in the Earth. By E. B. W.

On the Polarity of the Compass Needle. By D. Y. M.

On a Rope Swing. By J. S. P.

On the Monjolo. By C. J. W.

Also inquiries and answers from the following:
A. S.—J. R.—J. A. P.—J. H. E.—C. C.—G. T. D.—J. M.—T. J. B.—J. McC.—W. B. P.—C. H. P.—H. H—T. I. H.

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.

Enquiries 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 makes machines for pressing stove blacking? Who sells electric telegraph apparatus? Who sells propeller wheels? Who makes cast steel bells? Who makes labeling machines?" 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

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 8, 1876,

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.

Acid, making hydrated sulphurous, W. Maynard	180,901
Aerometer, C. Godfrey	180,760
Air-compressing machine, J. Sturgeon	180,958
Animal-weaning bit, Ingersoll & Fisher	180,885
Anvil vise, J. Bolt	180,834
Auger, earth, C. D. Pierce	180,787
Auger, earth, W. Poole	180,920
Bag holder, E. G. Bates	180,826
Bale tie, W. S. Davis (r)	7,252
Bale tie, D. C. Lowber	180,897
Bale tie lock, D. Olmsted	180,910
Bale-tying attachment, S. D. Purdy	180,788
Ball and socket support, H. Howson	180,881
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Bed bottom, spring, J. R. Newman	180.909
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Bedstead, invalid, F. E. Sawyer	180,935
Bedstead, sofa, J. A. Bigger	180,829
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Beveling machine, plate, Pedder & Abel	180,915
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Boat coupling, automatic, T. D. & G. E. Husband	180,883
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Boiler, steam, Galloway & Holt	180,863
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Car starter, E. Salomon	180,792
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Churn dasher, M. L. Traver	180,963
Churn power, S. Weaver	180,737
Clay retorts, carriage for, W. D. Cliff	180,845
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Clothes stick, D. B. Pond	180,919
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Earth-boring machine, S. R. Owen	180,912
Eaves trough hanger, Abbott *et al*	180,817
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Elevator, rotary water, J. C. Garretson *et al*	180,864
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Gate, farm, W. W. Gift	180,866
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Grain drill, J. D. Jones (r)	7,255
Grain grits, making, F. Schumacher	180,797
Grain, machine for drying, A. W. Roper	180,931
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9,433.—TYPE.—J. M. Conner, New York city.
9,434.—BRACELETS.—I. Rice, New York city.
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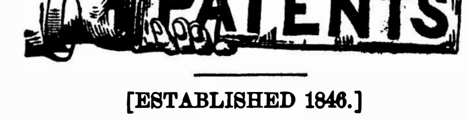

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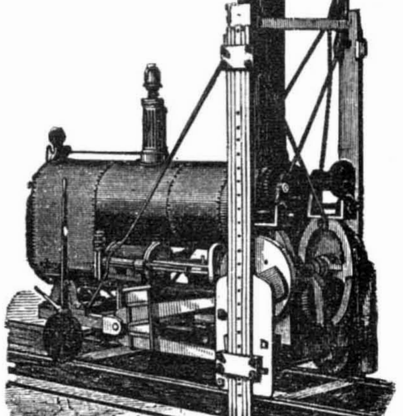

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