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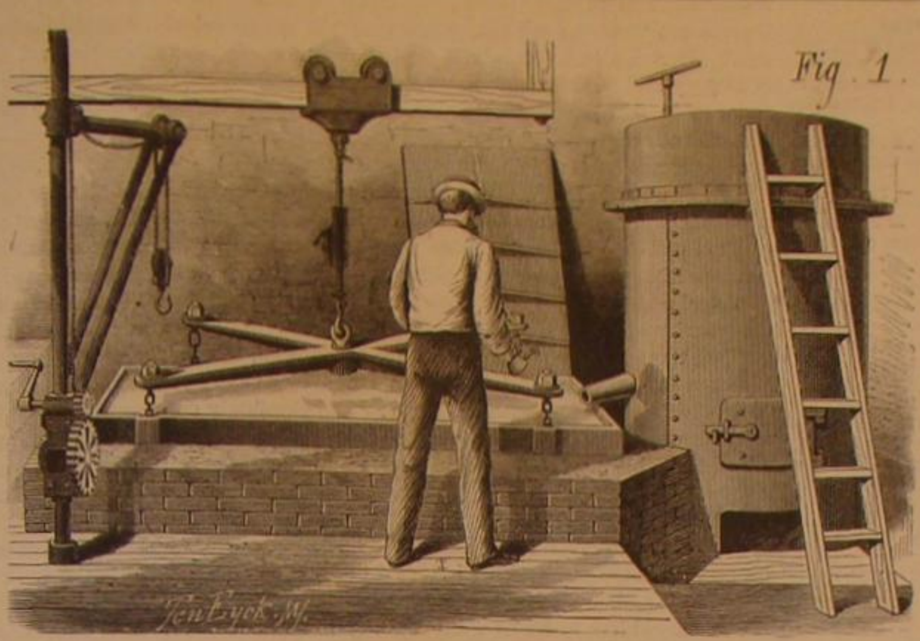
THE MANUFACTURE OF SHEET LEAD AND LEAD PIPE.

The principal manufactures of lead are sheet lead, lead pipe, and shot. The first two constitute the subject of the present article: the third we shall consider separately in a future issue. Lead enters into commerce in the form of pigs, varying in shape, weight, and fineness, as it comes from different sources. Spanish lead is imported in pigs weighing from 150 to 170 lbs. each, and is the pure metal, having been thoroughly refined before export. American lead, and especially that from the Mississippi valley, is commonly sent East for extraction of the silver, the baser metal being afterwards sold for about enough to pay the cost of the refinement. As a rule, manufacturers purchase their stock from bankers and other financial agents, to whom the metal is consigned in return for advancements, and who thus constitute a class of middlemen between producer and the class above mentioned.

As lead is made into sheets by rolling, the first process to which it is subjected is melting and casting into cakes of suitable size. The melting kettle and mould are represented in Fig. 1. About ten tons are melted at a time, and the liquid metal is, on raising a valve in the kettle, allowed to escape directly into the iron mould, which receives four and a half tons. Lifting hooks are previously adjusted in place under the cake so that the latter, when solidified, can be lifted out of the mould and carried by a crane upon the table of the rolling mill. The size of the cake is seven feet ten inches by five feet. After remaining in the mould some days to cool, it is lifted out, and the rough edges are trimmed off with an adze. It is then placed upon the rolling mill table in the direction of its least width; that is, so that the breadth of seven feet ten inches shall be invariable, while the five feet length is increased by the rolling.

The mill, Fig. 2, is a single cylinder of cast iron thirty inches in diameter and nearly nine feet long. It is geared directly to the main driving engine, and has the adjustments common to all rolls. The table is an assemblage of small rollers arranged in two parallel lines. Between them is a rack, the teeth of which serve as fulcra for the insertion of levers whereby the cake is pushed under the cylinder. The rolling once begun, the metal passes to and fro under the roll about a hundred and fifty times, so that it is finally reduced to a sheet thirty feet long and of the width above stated. It then weighs 30 lbs. to the square foot. This sheet is cut into smaller pieces by vertical knives, which are actuated by a screw, so that they move across the table and between the cylinders on which the metal rests. The smaller sheets are now rolled into eighteen foot lengths, and vary in weight from 2½ to 10 lbs. per square foot. These constitute the usual sheet lead stock—the variation being half a pound to the foot up to five pounds, and one pound per foot thereafter. Their principal utilization is in chemical works for lining acid-proof receptacles, notably sulphuric acid chambers and concentrating pans, and also for the interior of tanks, cisterns, etc. The thinnest sheet lead is that employed by the Chinese for covering the interior of tea chests. This, however, is produced in China by simple casting and pressure. The operation is performed by two men, one of whom pours the molten lead from a crucible upon a large flat slab, when the other quickly places a large stone on the fluid lead and presses it out to a thin flat plate, which is then removed and trimmed. Sheet lead is also used in the manufacture of the so-called tin foil. A sheet of lead is placed between two layers of tin, and the whole is rolled and re-rolled until the thin material with which all are familiar is produced. The tin serves in this case simply as a covering for the lead, and prevents the latter metal communicating its deleterious properties to the substance inclosed.



MELTING THE LEAD.

Lead pipe is made by forcing the partially congealed molten lead through dies in which a core is inserted by hydraulic pressure. The apparatus for this purpose is exhibited in the large illustration (Fig. 3); and in Fig. 4 a section of the essential portion of the same is shown. The die, A, is simply a metal disk in which is an aperture which fixes the outside diameter of the pipe to be made. This opening flares downward. The die is inserted in a collar which, in turn, rests in the bed piece, and is adjustable so as to bring the die accurately in line by means of the set screws, B. Resting above die and bed piece is the lead

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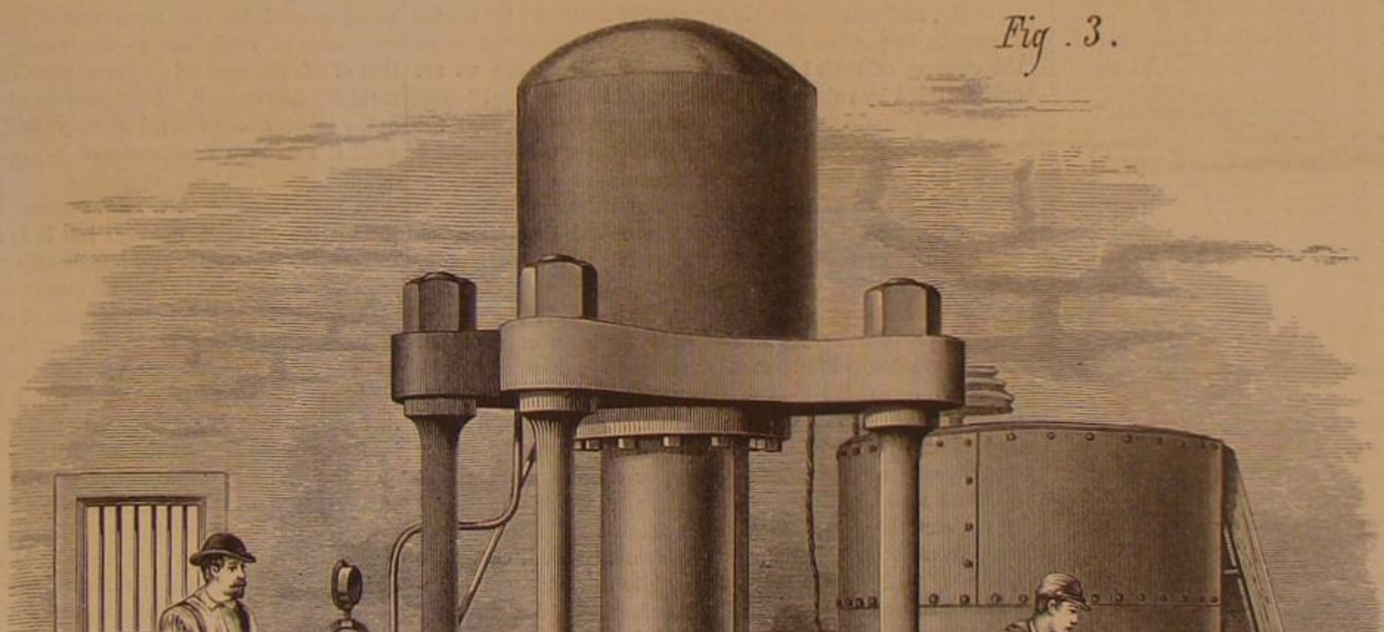

THE MANUFACTURE OF SHEET LEAD AND LEAD PIPE.

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NEW YORK, SATURDAY, JULY 21, 1877.

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AN INEXACT SCIENCE.

It seems to us that civil engineering—or at least the civil engineering practice of the past—has, if we are to credit the *dicta* of modern eminent theorists, fairly earned the above title. Here, for instance, are two important works before us, respectively dealing with two great branches of the profession, hydraulic engineering and engineering constructions. The first is entitled "The New Formula for Mean Velocity of Discharge of Rivers and Canals," by W. R. Kutter, translated by Mr. Louis D'A. Jackson, a well known authority. In the preface we are told that the whole of the old velocity formulæ of Eytelwein, Stevenson, Dubriat, Prony, and others, which have been used as "the bases of calculations of discharge for tables, which are still unfortunately believed in by the unreflecting," have no claim to general application, that, in short, said formulæ are altogether erroneous; and in some cases, tabulated velocities based thereon are "but the wildest guesses at the actual velocities." Herr Kutter's formula, founded on the experiments of D'Arcy and Bazin, Humphreys and Abbot, and others, is now absolutely correct; and the other formulæ, with the aid of which our engineering forefathers apparently managed to complete some substantial work, are proscribed.

Now also comes Dr. Weyrauch; and in the preface to his admirable work on "Strength and Calculations of Dimensions of Iron and Steel Constructions," we are told that "the methods hitherto employed in calculating the dimensions of iron steel constructions have been entirely wrong; and that the security of structures, in which their results have been applied, though with great expenditure of material, is much less than supposed." And thereupon Dr. Weyrauch gives us an excellent book, demonstrating new and absolutely correct formulæ, and also proceeds to proscribe the other formulæ which have been relied upon in the building of a great many structures in years past, structures which, unaccountable as it may appear, still manifest no inclination to fall down. Dr. Weyrauch's and Herr Kutter's formulæ are, we are given to understand, fully indorsed by the engineering profession, and, we have no doubt, with excellent reason; but we should like to know what is going to be done about all the engineering work which, in the absence of any other, must have been based on these now scouted and repudiated rules. Are we to leave standing bridges and buildings, the dimensions of every member of which has been calculated wrongly, and which are only apparently secure? Or are we to remain in passive indifference to our waterworks when the chances of their breaking down and drowning us are only fortified by rules based on the "wildest guesses?"

Seriously, and while we shall not presume to say that the two eminent engineers above quoted have proceeded a whit too far in their condemnation of the old rules, we may at least question the fact whether engineers in actual practice confine themselves so closely to theoretical deductions as these and most textbook writers would have us suppose. Indeed, we think it will be found that the average civil engineer—and we may as well include the mechanical engineer with his professional relative—will prefer his own judgment and the teachings of his own experience in matters of construction, especially if both qualities have been often successfully tested, to almost any one's theoretical *dicta*. Not that we mean to say that our engineers constantly prefer thumb rules to scientific accuracy, or dash at conclusions by guesswork. On the contrary, we think, in point of the care displayed in and the exactness of their construction, American civil engineering structures will compare favorably with any in the world, while our mechanical appliances are already renowned for perfection of design. But we believe that, in most instances, if the constructors or designers were asked whose or which formulæ they followed, the large majority would assert that their experience had been taken as the principal guide upon which to found their own theory. A noted civil engineer—one who has constructed perhaps more railway bridges than any other man in the country—recently said that he had never used the calculus in his work in his life. Yet almost any textbook on strains and stresses teems with formulæ based on that abstruse branch of mathematics. The calculus is invaluable to the mathematician; but here at least is one engineer who takes the responsibility of figuring his strains and selecting his sizes of material without its aid.

Another instance: We have before us a letter from a very eminent experimenter upon the strength of metals, etc. He informs us that, by his recent investigations, involving an immense number of experiments, the report of which before many months will be made public, the deductions of Rankine and other authorities as to strength of chain are wholly wrong: that the stud does not increase the strength of links, and the strongest links are not made from the strongest bars, besides other somewhat startling deductions. Theoretically at least, then, all our chain cables have been made under erroneous rules; practically, however, they have served their purpose. It cannot be conceived that new theories in chain construction, or in any other branch of science involving constructive work, can cause materials to do more than is expressed in the latter phrase.

The columns of this journal show perhaps most clearly how much our improved forms of machinery are due to constructive skill based on practice. Take any mechanical invention, adapted by its originator after long study to achieve a certain purpose, and observe its form as first published on these pages. Search for that device five years afterwards, and it is hardly recognizable. Experience has called for more metal here, less there. Actual tests have shown what modifications of the machine are necessary to render it most efficient in its duty; and these modifications have suggested others, and so on. It can be safely stated that, in hundreds of our best mechanical appliances, their capabilities were not known until they were tested. Furthermore, the rule, in nine cases out of ten here (we know it is not so abroad), is that a mechanic wanting a new special machine for a special purpose will design the apparatus which his experience tells him is best adapted to his ends, and test it to determine its duty, search for failings, improve it, and so work up to the desired point; and this he will do while his brother of the Old World is puzzling over his drawing board to discover how, by Greek letter formulæ and the differential calculus, he can produce a device that will give the wished-for results on the first trial. We have a profound respect for theory, for it should be the essence of a vast amount of practice. But if we had a bridge to build, we would prefer the man who had already built half a dozen successfully to the theorist and mathematician who had constructed none except on paper in his study, and those according to formulæ which may be repudiated a year hence.

THE GREAT PROBLEM.

That the earth was at one time incapable of sustaining life, and that at some time in the course of events life began to be, no one doubts for a moment. It is also pretty generally admitted among scientific men that the beginning of life was in all probability a natural event; and that the earlier forms of life did not embrace the more complex types now existing, but were of simpler structure, perhaps not unlike the lowly organisms now studied under the microscope.

Here the question arises: Was the beginning of life a phenomenon single and unique, and are the bacteria of today the unaltered descendants of the earliest forms of life? Or may life have began, and may it still begin, at any time by the concurrence of suitable conditions? This is by all odds the most important question now before the scientific world; and curiously the most strenuous opponents of the theory that life may begin now as well as ever, are found among those who, like Professor Tyndall, believe life to have been derived originally from purely material combinations. That matter should have lost any of its intrinsic "power and potency" in the course of ages seems altogether unlikely; so we must infer that the active opposition of the leading exponents of evolution to the theory of the recent evolution of life *de novo*, arises from pure loyalty to truth experimentally determined. Spontaneous generation is the logical outcome of evolution; but they will not admit the fact until it has been demonstrated beyond the possibility of a doubt.

At first thought this might seem to be a question of speculative interest merely: but it is far more than that. Some of these minute and apparently primary forms of life are among the most potent factors of human health and disease, and of the health and disease of the animals and plants most intimately connected with our sustenance and general wellbeing. Even the air we breathe seems at times to be contaminated by their presence; our blood is poisoned by them, and the struggle for existence rises or degenerates into a struggle against them. It is no wonder then that the question of their origin is one of the highest practical as well as popular interest, or that the foremost men in biological science have essayed its solution.

Years of critical investigation have stripped the problem of many confusing and irrelevant conditions until it stands nakedly thus: Can we take matter which contained no life, perfectly isolate it from possible impregnation, and subject it to conditions under which it will bring forth objects that live and multiply? If so, what kind of matter must be used, and what are the conditions favorable to such origination of life?

Thanks to the labors of many of the acutest minds in experimental science—among them Pasteur and Pouchet, in France; Huitzinga, Cohn, Klebs, Bilbroth, in Holland, Austria and Prussia; Mantegozza, Cantoni and Oehl, in Italy; Bastian, Lister, Sanderson, Tyndall, Dallinger and Roberts, in England; Wyman and others in our own country, with any number of less eminent investigators—the primary conditions of the problem have been satisfactorily mastered. It is admitted by all that by subjecting matter to a sufficiently high temperature it can be entirely freed from life and life germs. It is admitted that the all-pervading germs of life cannot pass through a sound plate of glass; consequently any substance to be tested can be kept perfectly isolated by hermetically sealing the vessel containing it. Other successful methods have been employed; but this is the most exacting, and is beyond question or suspicion when used with reasonable care. It is admitted also that the temperature at which putrefaction ordinarily takes place most actively is a proper temperature at which to keep the fluids under examination; and fluids must be used since they are the natural habitat of bacteria.

The question, What is a killing temperature? has been very hard to settle; that is, a temperature high enough to surely destroy life, yet not so high as to endanger the chemical composition of the solutions to be tested. A comparatively low temperature suffices to kill bacteria, and so far as positively known, bacteria multiply only by fission. They may, however, multiply also by means of invisible germs; and since many germs are known to withstand a higher heat than the developed forms, a higher temperature than suffices to kill bacteria must be insisted on in all experiments in this field. Precisely how much higher, the opponents of spontaneous generation leave an open question, and increase the demand with every failure of a supposed killing heat to prevent the development of life. A series of experiments made by Bastian some years ago, and never in any way invalidated by conflicting experiments, would seem, however, to have placed this question beyond further dispute, though his opponents are very apt to quietly ignore them. His method was briefly this: to take a test-fluid which never engendered life except when purposely inoculated with multiplying bacteria, and never failed to produce life when so inoculated; then after mixing the test-fluid with a bacteria-bearing liquid, heat the mixture after perfect isolation, and await the result. If life appeared, the heating was assumed to be insufficient to kill all the life introduced; if no life appeared, after repeated trials, the temperature was considered fatal. The heat which produced sterility in different fluids varied between 130° and 158° Fah., and the latter was found to be the maximum temperature which a growing and multiplying swarm of bacteria,—in all stages of growth and presumably including the hypothetical germs, if such there be,—could survive. When, therefore, this experimenter found other fluids (capable of spontaneous putrefaction in the open air) to swarm with bacteria after having been subjected to a temperature of 212° Fah. for hours, and thoroughly isolated from any possible contact with germ-bearing air, he claimed to be justified in the conclusion that there had been in such fluids a real origination of life not derived from antecedent life.

A great variety of animal and vegetable infusions, and some purely inorganic solutions have been used in such experiments, with varying results. While it has been found to be impossible to predict the behavior of any particular fluid from its composition, it appears from many observations that neutral or faintly alkaline fluids are more likely to putrify, after boiling and sealing, than acid infusions. Excess of alkali, however, prevents the development of life as well as an excess of acid; and some infusions are found to be almost always sterile unless exactly neutralized; yet positive results have been obtained in many instances, Bastian claims, with both acid and alkaline fluids. The fluids which he found to be most commonly successful were infusions of turnip and hay; the former fortified with a little cheese dust being almost certain to develop life.

It was with infusions of this character that the sceptical Dr. Burden-Sanderson tested Dr. Bastian's conclusions by a series of experimental tests made under his opponent's personal supervision; and failing to detect any flaw in the process, he frankly and publicly admitted that he had been mistaken in his previons doubts. The same experiments were thereupon repeated, and their results verified by Professor Huitzinga, of the University of Groningen, who afterwards made a series of fresh trials, using a mixture of grape sugar and soluble salts instead of the turnip infusion, and substituting soluble peptone for the cheese dust. In every instance, he declares, bacteria appeared when the ingredients were used in certain specified proportions. By altering the proportions of the ingredients he was able to keep his solutions sterile, although in other respects they were treated exactly as before; and he relied on this differential process to prove that any pre-existing germs in the liquid were destroyed and perfect isolation obtained, for the altered fluids were found capable of developing bacteria if once inoculated. Thus having two fluids, each capable of supporting bacteria, both were subjected to the same process of boiling and sealing. After repeated trials, in which one solution invariably swarmed with bacteria and the other as invariably remained clear, it was inferred that all germs had been destroyed by the heat and subsequently kept out by perfect sealing; and that the life developed in the one was due wholly to its proper chemical composition.

The only reply that the opponents of spontaneous generation can make to tests like these is that, in all cases where life appears, there has been either an insufficient exclusion of germs, or else that, owing to the composition of the solution, the contained germs were somehow protected and enabled to withstand a temperature which was fatal to those in the other solutions. Thus there always remains a possibility of doubt, and the result is disputed. A pretty illustration of the almost hopeless struggle which the spontaneous generationists have to wage with persistent doubt is seen in the last controversy between Bastian and Pasteur.

For a number of years Pasteur has held, in spite of Bastian's experiments in regard to the death-point of bacteria, that bacteria germs are not killed in acid fluids below the boiling-point of water, while in neutral or faintly alkaline fluids they are able to survive a somewhat higher temperature. In any case, however, he admits that a temperature of 110° C. is fatal; consequently no life can appear in fluids so heated and kept perfectly isolated. A short time ago, Bastian devised the following test of the alleged protective influence of alkalinity. He placed in a retort a measured quantity of urine of ascertained acidity; also in a small tube a quantity of liquor potassæ, somewhat less than enough to neutralize the urine—h.s experiments proving that a larger quantity was likely to overdo the matter. He then sealed the potash tube in a blow pipe flame, drawing out the sealed end so that it would break easily, and boiled the inclosed liquor potassæ to kill any possible germs it might contain. Then he placed the tube in the retort with the urine, which was boiled and hermetically sealed in the usual way.

The question to be decided was this: Acid urine does not putrefy (that is, develop bacteria) after boiling; alkaline urine sometimes does—the difference being attributed by Pasteur and his school to the protective action of the alkali. Now, if acid urine after boiling (by which process its inclosed germs are admitted to be destroyed) be neutralized by a liquor also made sterile by prolonged boiling, it ought not to develop life; if it does, the result cannot be due to any protective action of the alkali, which is not added until after the germs are killed.

After cooling, retorts as above described were shaken so as to break off the fragile end of the inclosed potash tube and allow the contained fluid to mix with and neutralize the boiled urine; then they were placed in an incubating bath kept at a temperature about 122° Fah., together with other retorts similarly treated, except that the potash tubes were not broken. After a day or two, the neutralized urine invariably putrefied, while the acid urine in the control flasks remained permanently barren. Having thus shown that the effect was the same, whether the acidity of the urine was reduced after or before boiling, Bastian insisted that the influence of the potash was not due to its alleged power of protecting the germs so as to enable them to bear a higher temperature, but to some vivifying chemical or molecular action, and claimed a victory for spontaneous generation.

Pasteur repeated the experiment with a like result, but was not satisfied; so he tried again, substituting solid potash for the liquor potassæ, and the result was negative; to which Bastian replied that the potash had been used in excess. Pasteur retorted with a charge of insufficient heating of the potash in Bastian's experiments, and challenged him to repeat the experiment with the single variation that the potash tube should be heated either for twenty minutes at 110° C., or for five minutes at 130° C.

Bastian did so, and more: he kept the potash tubes at the required temperature for twenty *hours*, and obtained life as before. To this Pasteur's only reply was a vehement protest that the alleged result was impossible.

The English opponents of spontaneous generation have more wisely endeavored to prove the impossibility of such a result by critical experimentation. Among these, Dr. Roberts, of Manchester, and Professor Tyndall, both claim to have repeated the experiments over and over again, and always without obtaining life. This is not the first time that Dr. Bastian's assertions have been flatly contradicted; and he knows from experience what it is to have his opponents afterwards admit, in the face of experimental evidence, that he was right and they were wrong. The issue has been so narrowed now that it ought not to be impossible for the opposing parties to agree to undertake together a series of crucial experiments. By mutual suggestion, skill, and watchfulness, the common charge of inexactness in manipulation, or prejudice in the interpretation of results, ought easily to be prevented, and the issue fairly and squarely met. Isolated partisan work, however skillful, will not force a conclusion nearly so quickly or satisfactorily as united effort; and to that test we hope, for the credit of science, the question will be speedily submitted.

THE PHYSICAL CHARACTERISTICS OF AMERICAN CHILDREN.

Some months ago we renewed the data relative to the height and weight of Americans, drawn from the records of the Provost Marshal General's Bureau, made during the late war. The conclusions reached were that, in point of stature, even the lowest mean obtained would entitle the American people to the first rank among nations. The results of measurements of nearly a million and a half of American born white men exhibited a mean stature of 67·646 inches. In the matter of weight it further appeared that Brother Jonathan is as heavy as the heaviest even in his youth: and the apparent slimness of his immaturity, due to his superior height, is fairly made up by the time he reaches his full development.

The above important series of investigations on the physical characteristics of Americans, has recently been supplemented by researches made by Dr. H. P. Bowditch, of Boston, Mass., in which the object of inquiry has been the growth of children. Both sexes are included, so that a direct comparison is instituted between them. About 24,500 observations were made upon the pupils of the schools in Boston and vicinity. These were tabulated according to nationality, etc., and from these tables graphic diagrams were constructed, exhibiting with great clearness the results obtained. Both tables and diagrams, together with Dr. Bowditch's report, are before us, in the recently issued Eighth Annual Report of the State Board of Health of Massachusetts. From the data obtained relative to the comparative rate of growth of the sexes, it appears that the greatest annual increase in height occurs for girls at 12 and for boys at 16 years of age, while the maximum increase in weight is, for boys at the same age, and for girls one year later than the maximum increase in height. In other words, at about the ages of 13 and 14 years girls are (during more than two years) both taller and heavier than boys at the same age, though before and after that period the reverse is the case. Dr. Bowditch points out, that on the principle enunciated by Carpenter and Herbert Spencer, that growth and reproduction are to some extent antagonistic properties, it may reasonably be supposed that at the age at which the organism becomes potentially reproductive, a period of excessive growth will not occur; and the data above noted seem to show that this is the case.

From the tables exhibiting effect of race on size and rate of growth, it appears that, almost without exception, American children are both taller and heavier than children of the same age and sex whose parents are of other nationalities. One of the most curious facts brought out by Dr. Baxter in the investigations referred to in our initial paragraph, was that natives of foreign countries enlisting in the United States, possessed a greater average height than natives of the same countries enlisting at home. Dr. Baxter explained this circumstance by a difference in the average age of the individuals mentioned, but Dr. Gould, through other statistical investigations, has shown that, even making allowance for this difference of age, the same result holds true. Now, Dr. Bowditch presents the opinion that the superiority of stature is owing to the greater average comfort of the people of this country, as compared to that of inhabitants of European States, and the observations of Quetelet, Villerme, and Cowell, which are referred to, seem further to show that in a given community the children of the wealthier classes are, as a rule, larger than those of the poorer classes.

But it is evident that an important question is, whether similar conclusions to those reached by Drs. Baxter and Gould for adults are applicable to growing children, and in order to eliminate the possible effect which comfort or misery may have on the rate of growth, it is necessary to select for comparison, sets of observations made upon children belonging to corresponding classes in the communities in which they live. To this end, the pupils of certain select schools in Boston were compared with those belonging to non-laboring classes attending English public schools and universities; and the two sets of figures show the marked superiority of the American boy, both in size and weight. Hence the superior size of American children may be taken as due partly to the greater comfort surrounding them, and partly to difference of race and stock.

One of the most interesting portions of the entire investigation is that which deals with the relation of height to weight in growing children of both sexes and of various races. Growing boys are heavier in proportion to their height than growing girls, until the height of 58 inches is reached. Above that point the reverse is the case. The difference between children of American and those of foreign parents is constant in one direction for all ages. Boys of German parentage, who are uniformly heavier in proportion to their height than American boys, form the exception to the rule. The deprivation of the comforts of life, curiously enough, exercises a greater tendency to diminish the stature than the weight of the growing child. And finally Dr. Baxter's conclusion "that the mean weight of the white native of the United States is not disproportionate to his stature," is, as far as boys are concerned, as applicable to growing children as to adults.

Dr. Bowditch appends to his report reference to the formulæ determined by Professor Lanza; and based on the observations of President Runkle, of the Massachusetts Institute of Technology, expressing the relation between the weight and height of growing children from five to eighteen years of age. In the case of boys ranging in height from 42 to 66 inches inclusive, the formula is $y=0·002428\ x^{2·49}$; and in that of girls ranging in height from 42 to 61 inches inclusive, the expression is $y=0·001277\ x^{2·73}$, y representing the weight in pounds, and x the height in inches, in both cases. These formulæ are quite accurate, as the greatest difference between calculated and observed values is, in the case of boys, 0·65 lbs., and in that of girls, 1·41 lbs., with one exception, where it is 3·01 lbs.

Dr. Bowditch's investigations are replete with suggestions for future statistical research, the results of which can scarcely fail to be of the highest value to the community. To those who may undertake the necessary inquiries, the following subjects are commended. Drs. Gould and Baxter having shown that the size of adult Americans is very different in different States of the Union, and even in different parts of the same State, it would be interesting to determine, by observations of children, how early in life this difference becomes apparent; in general, what is the influence of geographical and climatic conditions of growing children? What number of generations is necessary for the complete development of the influence of changed climatic conditions on the rate of growth of a given race? This examination might be conducted on emigrants and their descendants, coming from some limited region of the old world. What effect (if any) does the season of the year have on rate of growth? And what is the comparative effect of city and of country life on the same? What is the relation between diseases and the rate of growth? Dr. Bowditch suggests that it would be especially interesting "to inquire whether in the rapid growth, which is said to follow certain diseases, especially fevers, the height and weight increase in normal ratio: whether this accelerated growth *after* the disease is simply a compensation for a retardation *during* the disease; whether abnormally rapid growth causes a predisposition to disease, and whether any connection can be traced between the rate of growth and the frequency with which certain diseases of growing children (*e. g., chorea*) occur at different ages." Finally, by systematic comparative study of the physique of the growing population in different localities, the effect of local hygienic conditions might be determined.

IN our SUPPLEMENT of this week particulars and engravings are given of a remarkably powerful and fast little steam launch designed by H. S. Maxim. Boiler 26 inches length, 20 inches diameter. Test pressure, 450 lbs. per inch. Length of boat, 21 feet. Speed, 10 miles per hour.

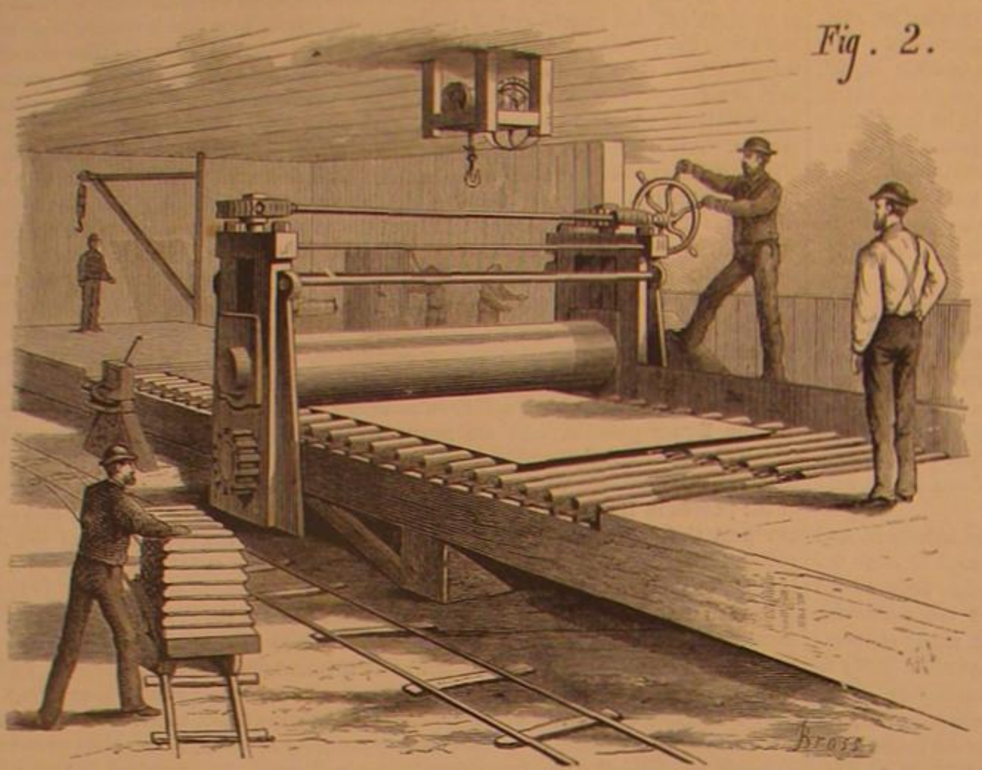
[*Continued from first page.*]

receptacle, C. This is a heavy cylinder having an annular chamber formed in it to receive the steam by which it is kept hot. D is the press plunger working downward, and in it is inserted the core, E, which enters the die aperture. The metal is drawn off directly from the kettle, and the plunger is at once brought down upon it, so that it may be kept under moderate pressure until sufficiently congealed. The press is then set in operation, and the lead is forced through the annular space between the core and die, and emerges in the form of pipe. The process is quite rapid, and there is nothing further to do but reel up the pipe as it is drawn. As soon as one charge is exhausted or rather partially so, as a portion is left in the chamber to which the new charge unites, more lead is admitted from the furnace, and the operation is repeated. The amount of pipe made at a single pressure depends upon the weight of the same when finished. Thus an extra light one-inch pipe weighs 2 lbs. to the foot, and the chamber may, for example, hold 135 lbs. Therefore $67\frac{1}{2}$ feet of pipe are produced at each descent of the plunger. Different sizes of pipes are produced by substituting suitable dies and cores. The die is easily reached by lifting the chamber, C, which is done by attaching the same to the press plunger and elevating the latter.

Tin-lined lead pipe is produced somewhat differently. Before the lead is run into the chamber, a mandrel is inserted, which closes the die aperture and extends up through the receptacle. This mandrel consists of a central stem, around which are grouped dovetailed sections, so that when the central portion is removed the sections are easily taken out, leaving a hollow space in the lead which is run in while the mandrel is in place. The sides of the mandrel are tapered, or rather crenelated, there being three or four shoulders and a different taper from each. The object of this is that after the mandrel is removed, the tin which is poured into its place may have several purchases against the lead which surrounds it. Of course before the tin is let in, the core, as already described, is inserted. Afterwards the pressure is applied in the usual manner, the result being that the pipe emerges with a thin lining of tin. Tin-lined lead pipe and plain lead pipe weigh the same.

There are some trade peculiarities about the sale of lead pipe which are worth remembering. That which is termed tubing measures from $\frac{1}{8}$ and $\frac{1}{4}$ inch in diameter, and weighs 2 and 5 ounces to the foot. Ordinary lead pipe varies $\frac{1}{8}$ inch in diameter from $\frac{3}{8}$ to $\frac{7}{8}$ inch, inclusive; then $\frac{1}{4}$ inch from 1 to $1\frac{1}{2}$ inches, and lastly there is a 2 inch size. Beginning at $1\frac{1}{2}$ inch, and ranging at $\frac{1}{2}$ inch increase to 5 and then to 6 inches, comes lead waste pipe. Of ordinary pipe there are, besides, several classes depending on weight and ranging from extra strong to "fountain" size. The Colwell Lead Company, of this city, has courteously offered us the facilities or the preparation of the foregoing description and illustrations.

Fig. 2.



ROLLING THE LEAD.

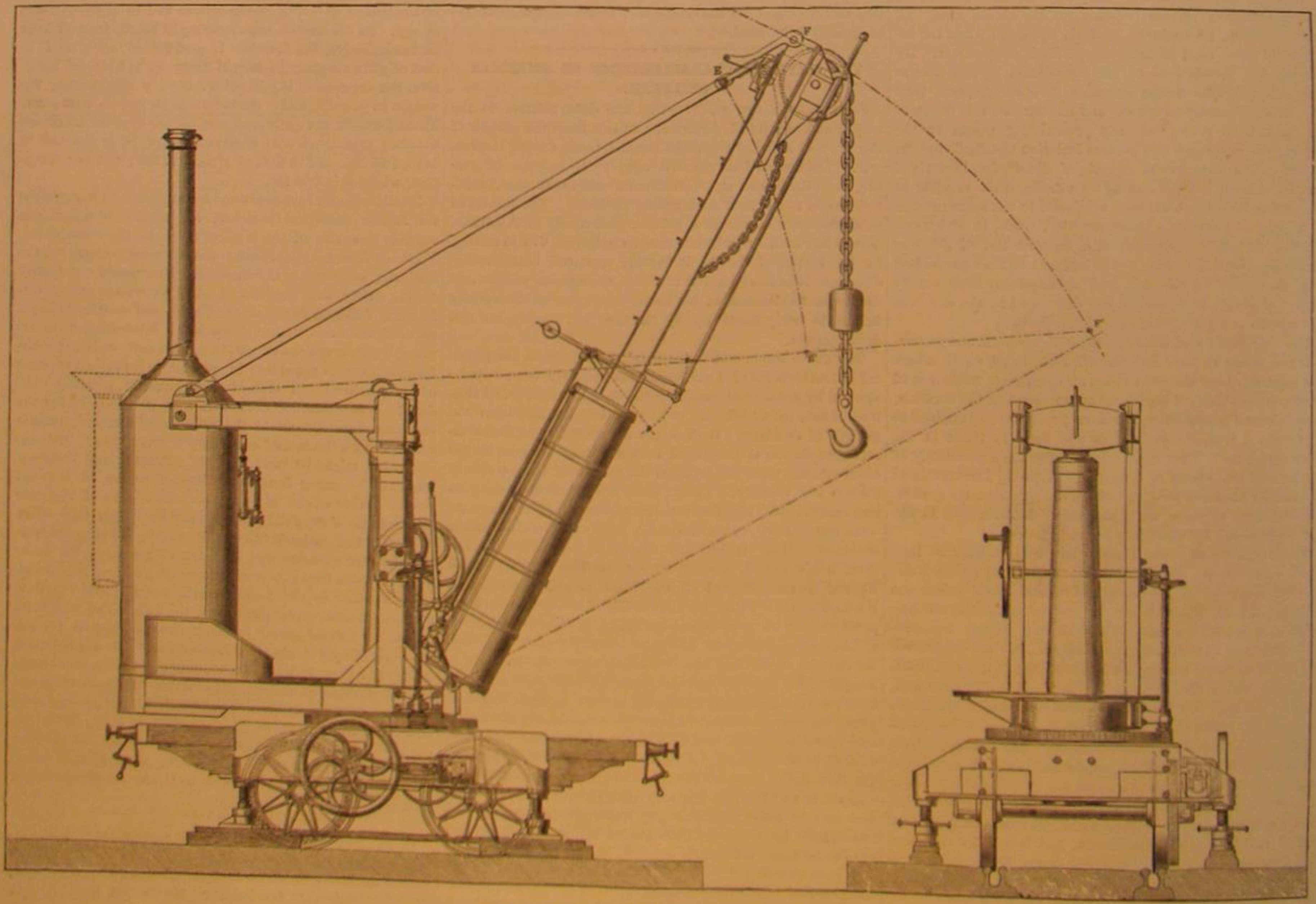
The following compound is recommended by the *Revue Industrielle* as an artificial fuel well suited for cooking purposes: To 176 lbs. of small charcoal made from light wood add 44 lbs. of pulverized charcoal, 11 lbs. of nitric acid, 4·4 lbs. of nitrate of potash, and 11 lbs. of gum arabic. The gum serves as agglomerating material. A rather expensive fuel this!

LARGE LOCOMOTIVE CRANE.

We illustrate herewith a new 10-ton locomotive crane, the invention of M. J. Chretien, and designed for use on the Northern Railway of France. The principal feature of novelty in the machine is that the load is lifted by the direct pull of the piston in a long steam cylinder, the piston rod being attached to the lifting chain or to pulleys of the same. A D slide valve admits steam and is changed automatically in time to prevent the piston meeting the end of the cylinder by a simple stop mechanism.

The machine consists of a strong cast iron frame mounted on wheels, and having at its center a column which serves as a pivot for the traverse which supports the turning portion of the crane. The boiler is placed in rear and serves as a counterpoise. The derrick arm consists, first, of a cylinder 15·6 inches in diameter, and 111 inches long, and a double T arm which supports the chain pulley. The apparatus may be used not only for handling heavy loads, but as a locomotive for hauling cars. Means are provided for lowering both smoke stack and derrick so that bridges may be passed under.

The locomotive engine is placed under the platform, as shown. It has a single cylinder connected with the boiler by a pipe passing through the crane pivot. Simple gearing serves for the transmission of power to the driving wheels. For rendering the apparatus stationary four jack screws, placed at the corners of the carriage, are employed. These press the traverse to which they are connected firmly against the ground, and thus render the machine immovable. For raising or lowering the arm, the mechanism for elevating the load is easily employed. When the arm is in normal position, as indicated in the engraving, the guys are retained above by two catches. Two small chains attached to the guys are pendant or fixed to retaining hooks. To lower the arm, the lower ends of these chains are taken to the piston, and there secured to hooks provided for the purpose. Steam is then admitted above the piston. As soon as the chains are tautened the arm rises slightly, and the disengaged catches lift. Then the steam is allowed to escape slowly, and the arm is thus permitted gradually to descend until stopped by the piston reaching the end of the cylinder. During this operation the point, F, travels to F', E to E'.



NEW 10-TON LOCOMOTIVE CRANE.

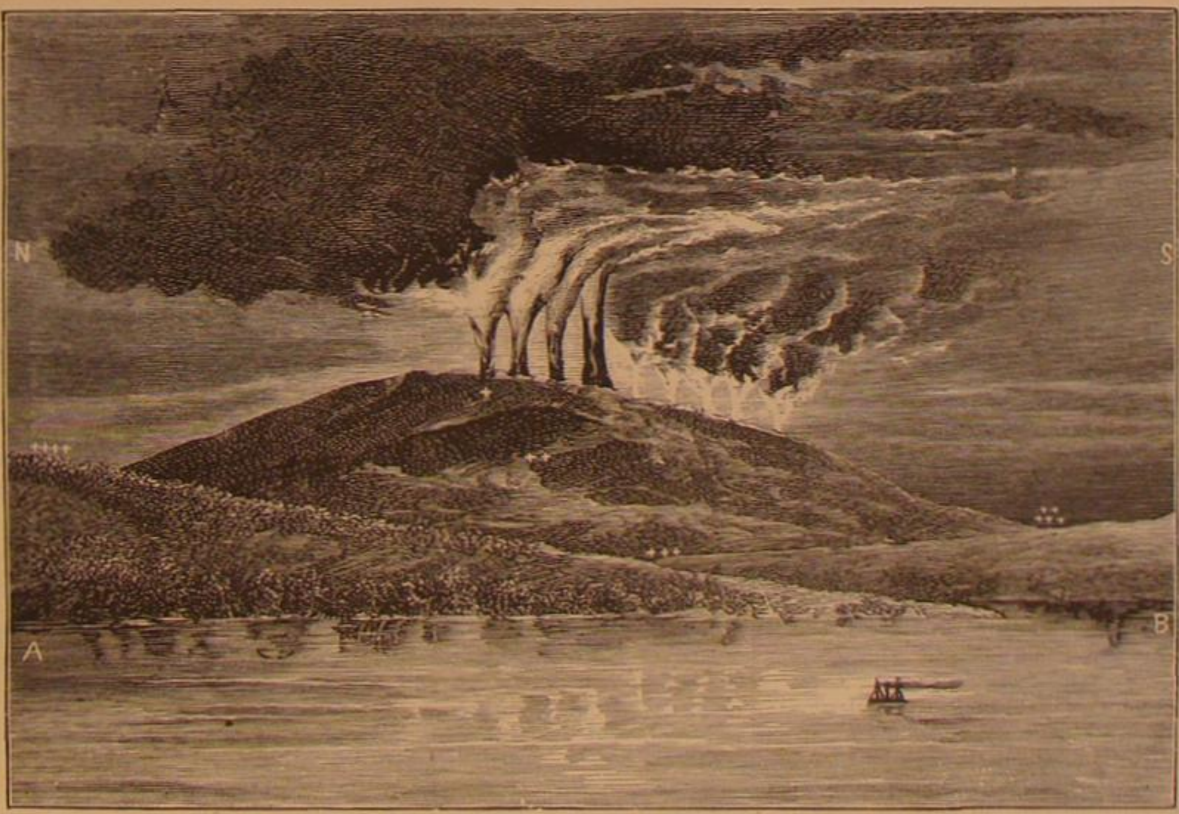
and the guys are elongated by the intermediation of the chains over the distance, E' F'. The arm is lifted by the reverse operation. Steam is admitted into the cylinder, and the crane is swung upward until caught as before by the catches. We extract our engraving from the *Revue Industrielle*.

Wrought Iron Girder Work.

Mr. Graham Smith, in a paper read before the Liverpool Engineering Society upon wrought iron girder work, stated that one of the first and principal requirements in designing wrought iron girder work, was to have a proper sense of the limits of application of theoretical deductions. He then showed that, in order to be able to design an iron girder, something more than proficiency in mechanical calculations was necessary, many circumstances having to be taken into account which experience has shown materially affect the structure, when exposed to variations of strain and temperature. In the designing of their bridges, American engineers compared very favorably with their English brothers. The life of an iron girder depended upon the strains to which it was subjected being kept well within the elasticity of the iron; and when engines and rolling stock were increased in weight beyond what was originally estimated, and this limit was passed, we ought not to be surprised if a bridge did give way now and then. Another point upon which the durability of an iron structure depended, was the state of efficiency in which the paintwork was maintained. He gave some valuable remarks upon preparing ironwork for painting, laying special stress upon care being taken with work for abroad, in situations where it would subsequently receive but little attention. Mr. Smith thought engineers did not sufficiently consider the sizes of iron to be employed in executing their designs. It was well known to manufacturers that iron above certain sizes and weight commanded extra prices, and it was shown that carelessness in this matter would sometimes double the cost of a structure. It was considered very desirable to test all the iron to be used in constructing girders; and he showed how this was to be done in an efficient manner. Various small matters connected with the riveting and construction generally, were brought forward in an amusing manner, fully demonstrating the necessity of having a working inspector always on the ground. Mr. Smith then went at some length into the preparing of drawings and specifications, and concluded by referring to Barff's process of coating iron with magnetic oxide.

THE GREAT ERUPTION AT HAWAII.

M. Ballieu, Consul of France at Honolulu, has sent to his government a detailed account of the great volcanic eruption which occurred in Hawaii on February 14 last. The phenomenon took place on Mauna Loa, at about nine o'clock in the evening. Nine great jets of flame and smoke burst from the crater of Mokuaweoweo, and united in an immense column which rose to a height of 16,000 feet. The nine fires appeared to form two groups—one of four, the other of five columns, the latter being the more brilliant. The scene is depicted in the engravings herewith given, which we extract from *La Nature*. Fig. 1 also conveys an excellent idea of the location of the volcano. N and S respectively indicate the north and south points, + is the crater of Mokuaweoweo, + + is Mauna Loa, + + + the central plateau, + + + + is the town of Kaw; A represents Kawaihe, and B Hualailai. Viewed from Hilo the jets all seemed joined in one vast spout of fire, as represented in Fig. 2.



GREAT VOLCANIC ERUPTION AT HAWAII.—Fig. 1.

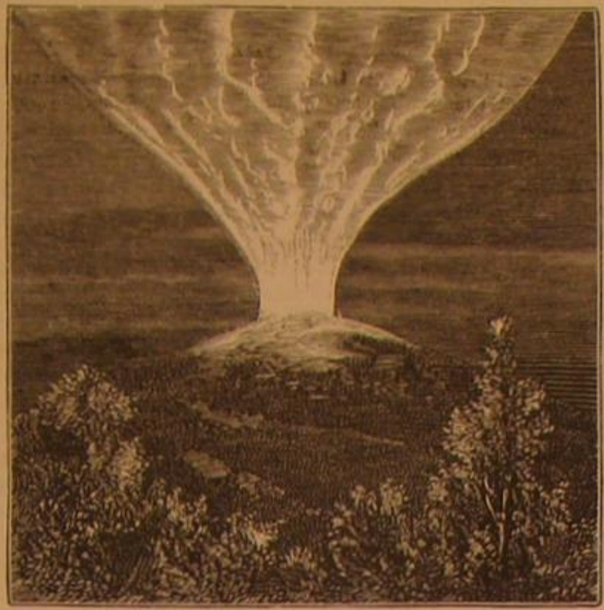
The eruption, a full description of which we published some time ago, lasted but six hours, and was followed nine days afterwards by earthquakes and a submarine eruption near Heei Point.

Singular Balloon Accident.

A fearful accident lately occurred at Hull, Eng., by which a large number of persons were seriously injured.

It appears that for several years a gala has been held every Whit Monday, in a large field in the Beverley Road, and this year one of the attractions advertised was the ascent of a balloon. Arrangements were made with the British Gas Company for a supply of gas, it being estimated the balloon would require for its inflation about 18,000 cubic feet. There being a strong wind at the time it was filled, the balloon, although securely fixed to the ground with ropes, swayed vigorously from side to side. We learn from the local papers that close to the ring in which the filling took place there was a "striking machine," against which, just as the ascent was about to take place, the balloon was driven, and a long slit was made in the silk, through which the gas began to escape rapidly. Close to the striking machine which had caused so much damage there was a stall for the sale of hot peas, a kind of refreshment greatly in demand at entertainments of this kind. Very shortly before the balloon drove upon this stall a naphtha lamp had been suspended thereon, and the escaping stream of gas coming in contact with this naked light, a fearful explosion followed.

Spectators of the scene state that what they saw was a vivid flash, as of lightning, followed by a dense white smoke,



VOLCANIC ERUPTION AT HAWAII.—Fig. 2.

this in turn being followed by a blaze which lasted so long as there was any of the varnished silk of which the balloon was composed remaining to be consumed. From the midst of this mass of smoke and flame there arose a mighty cry of anguish, and the excitement amongst the spectators was most intense. The policemen on duty at the gala, with many others who were not too much excited to act, at once rushed to the rescue, and soon one and another were hauled out from amongst the burning mass. When the balloon collapsed, owing to the escape and ignition of the gas, it fell upon quite a crowd of persons, who were completely covered by the silk and the netting in which it was inclosed, and these people, mostly young men and women and children, were rendered powerless to help themselves. Their position was, besides, rendered the more awful by the fact that the varnish with which the silk composing the balloon was covered, when it became heated, caused the burning material to stick to the hands and faces of the sufferers, and in numberless instances the skin was torn away from hands and faces as the unconsumed material was removed. Amongst the injured was a little girl, who was so frightfully burned that she expired the next day.

Five Centuries Buried.

The *Ariégeois* relates as follows the finding of the body of a bishop at Saint Lizier, France: "The discovery was made in the wall of the cathedral cloister. The skin is yellow, but not mummified. The arms were crossed over the breast, and the head slightly inclined to the left. The hands were still gloved, sandals were on the feet, and having been carefully removed, the members were found to be in a perfect state of preservation. No article of value was found in the tomb. A leathern cord around the neck must have carried the pastoral cross, which was sought for in vain. The body is proved to be that of Mgr. Auger II., of Montefalcone, Bishop of Couserans, who died in 1303."

New Method of Detecting Potash.

Ad. Carnot publishes a new and delicate test for potash. Dissolve one part (10 grains) of subnitrate of bismuth in a few drops of hydrochloric acid; then dissolve separately two parts (20 grains) crystallized hyposulphite of soda in a small quantity of water; pour the second solution into the first and add an excess of strong alcohol. If a portion of this reagent be brought into contact with a few drops of a soluble potash salt, a yellow precipitate is immediately formed; if the potash salt is not in solution a light yellow, but very distinct coloration is produced. All potash salts of the mineral acids give this reaction. Barium and strontium are the only metals that might be mistaken for potash, as they form white double salts with this reagent. As these bases seldom occur along with potash, it is easy to recognize and remove them. If a solution contains but a few grains of potash, it should be evaporated to a small volume or to dryness in order to obtain the reaction more distinctly. Another way is to saturate a strip of filter paper with this solution and dry it. The yellow color will be seen on the edges of the paper.

Owing to the remarkable solubility of all the simple and most of the double salts of potash, its detection has been quite difficult. The usual reagents hitherto in use were a solution of tartaric acid, which must be freshly prepared, and chloride of platinum, which is expensive and not very satisfactory, owing to the difficulty of perceiving a slight yellow precipitate in a deep yellow liquid.

The Preservation of Flowers.

A new method of preserving flowers, successfully adopted by Dr. Miergues, is reported in the *Gardener's Magazine*. Each flower, held by the extremity of the stalk, is plunged into a vessel of paraffin, quickly withdrawn, and twirled rapidly between the finger and thumb, so as to shake off the superfluous oil. Bouquets of flowers thus treated have been kept upwards of a twelvemonth without losing their shape or colors. Whether the smell of paraffin be equally persistent, the doctor has forgotten to inform us.

An Electrical Plant.

In a recent number of the *Hamburger Garten- und Blumenzeitung*, Levy describes a plant, which, if the statements of this traveler are true, must be a most remarkable wonder. It is one of the *phytolacca* which seems to be new, and has received the name of *phytolacca electrica*. The curious fact about this plant is its strongly marked electro-magnetic properties. On breaking off a twig a sensation is produced in the hand like that given by a Ruhmkorff induction coil. This sensation was so marked that he began to experiment with a small compass. The compass began to be affected by it at a distance of seven or eight paces. The needle vibrated on approaching nearer to it, and finally began to revolve rapidly. On receding, the phenomena were repeated in reversed order. In the soil where this plant grew, there was not a trace of iron or other magnetic metal, like nickel or cobalt, and there is no doubt that the plant itself possesses these peculiar properties. The strength of the phenomena varied with the time of day. During the night it is almost nothing, and reaches its maximum about two o'clock in the afternoon. When the weather is stormy the energy increases still more, and when it rains the plant appears withered. Levy also states that he never saw any insects or birds on or about this electrical plant.

Nathan R. Smith.

Professor Nathan R. Smith, the distinguished surgeon and medical practitioner, died in Baltimore in the eighty-first year of his age. For many years he had been the acknowledged head of the profession in that city, and up to within a few years past has been in full practice. The deceased was a native of Cornish, N.H. In 1825 he was appointed professor of surgery and anatomy in the University of Vermont, and organized the medical school of that institution. In 1827 he accepted the chair of surgery in the medical department of the University of Maryland, which he filled for many years. He was well known as a writer in various medical journals, and published a voluminous work on the surgical anatomy of the arteries, which was well received in this country and Europe.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American :

Mr. Hunt, the gentleman whose patent was withheld as mentioned in my previous letter, feeling himself aggrieved by the Commissioners in that matter, has issued a circular hinting at collusion between the Commissioner and his ex-partners, and denouncing the former for his action in the case. This has been followed by an order from the Commissioner, approved by the Secretary of the Interior, suspending Mr. Hunt from practice before the office.

After a contest of about two years between Faber, of Munich; Jacobson, of Berlin; Schwanhausen, of Bavaria; Batchelder, of Boston; the American Pencil Company, and the Eagle Pencil Company, of New York, as to the priority of the invention of what is known as the copying pencil, by the use of which a transfer copy can be taken by moistening the paper, the controversy has been concluded by a decision of the Commissioner in favor of the Eagle Pencil Company, as assignees of Charles Walpouski, who is adjudged to be the original inventor.

Gen. W. G. Le Duc, of Minnesota, has been appointed Commissioner of Agriculture. The papers here speak very highly of his knowledge of the science and practice of agriculture, and assert that he has always been prominently connected with the agricultural interests of his State.

The June reports of the Agricultural Department indicate a better prospect than usual for wheat. The report of June, 1876, made the average for the country thirteen percentum below the standard of normal condition, and the subsequent returns of condition and yield were still lower, forecasting the scarcity which has occurred. The average for winter and spring wheat together is one hundred this year, winter wheat being above that figure and spring wheat below it. There are 227 counties reporting winter wheat in full normal condition; 494 counties above one hundred, and 183 below it. Spring wheat in 92 counties is reported at one hundred, 117 counties above that figure, and 137 below. The reports from California indicate only half a full crop, from a deficiency of winter rain fall. Fewer injuries than usual from insects and rust are reported. In the Ohio valley nearly every return is favorable, but in Pennsylvania and Tennessee a slight depreciation is caused by the Hessian fly. The only serious injury is that caused by the grasshopper, which has been most destructive in Minnesota, hatching numerously through all the settled portions of the State. In the west of Iowa and throughout the wheat fields of Kansas and Nebraska the losses from the hopper are reduced to a minimum by the effects of wet and cold weather after hatching and subsequently by the successful warfare of the farmers. In some portions of Texas the destruction of wheat by grasshoppers has been quite heavy.

Reports to the Department from the South indicate that the total average of cotton planted this year is nearly four percentum in excess of that of last year. The season is stated to have been too wet at the time of planting, and too dry since in all of the cotton growing districts except Texas. The growth now, however, although small, is generally healthy, clean, and in a good condition for rapid improvement with favorable weather.

The prospects of the peach crop this year are exceedingly good. The Delaware growers are watching their trees with great interest, feeling certain that, without some extraordinary misfortune, the yield will exceed anything heretofore known, and feeling puzzled what to do to realize the most money from what promises to be a glut. Notwithstanding the great efforts made last season to find new outlets for the surplus, there remained a vast quantity of fruit which could not be utilized. Peaches rotted by the millions, and the hucksters in some of the cities had hard work to dispose of their stock at any price when the season was at its height. The experiment of sending fresh peaches to England was a failure, but fruit preserved by evaporation can be and has been sent in great quantities. For the year ending June 1876, dried fruits to the value of $600,000 were exported, while during the same period of time ending on the first of the present month this amount was increased to $2,500,000. By the new apparatus now in use for drying fruit, called "evaporators," the fruit is left in such a natural condition that England is calling for it in vast quantities; and France is also using large quantities of dried fruits, especially apples, which are made into wine and reshipped in that form to the American market. The Delaware peach growers are now preparing to dry their fruit by the "evaporators," and expect to find a ready and profitable market for it. Peaches dried in this way bring from twenty-five to thirty-five cents per pound, and each basket of peaches will turn out three and a half pounds of evaporated fruit—hence higher prices can be obtained from England than by glutting the market in this country. The only drawback to the use of these evaporators is their great cost, and there appears to be a demand for apparatus that will accomplish the same results at a less price.

Professor Baird, of the United States Fish Commission, is about to leave here for the purpose of collecting information and statistics in regard to the food fishes of the New England coast, between Salem and Portland, and will have his headquarters at the former place. Particular attention will be given this season to the collection of information in regard to the cod, mackerel, blue fish, tuntog, menhaden, sear herring, haddock, pollock cusk, and hake. During the past season the Commission have hatched out about 9,000,000 young shad in the Susquehanna, at Havre de Grace, over 1,000,000 of which have been distributed in Western and Southern waters, and about 1,000,000 are now *en route* to the waters of California. Active preparations are now being made to distribute a large number of salmon eggs and young salmon next fall throughout the country. Over 5,000,000 eggs and young were distributed last fall, but a much larger number will be sent off this season. The principal salmon hatching establishment is at MacLoud river, California, the species of salmon found there being most suitable for Eastern rivers, like the Susquehanna, Delaware, Potomac, and Cape Fear. Professor Baird has recently given considerable attention to importing carp from Germany, as the finest fish of this kind is found there. Four hundred and fifty large carp were recently imported by the steamer Neckar. They are now in the ponds of the Maryland Fish Commission for breeding purposes, and their young will be distributed throughout the South. Other importations will be made soon.

Major Powell, who has charge of the geological and geographical survey of the territories, has already sent out five surveying parties, all of which are at work in Utah. A triangulation party, under Professor Thompson, is located on the eastern slope of the Wasatch mountains; three geographical parties, under Messrs. Renshaw, Wheeler, and Graves, are at work on the Uintah, Price and Lower Green rivers; and a geographical party, under Captain Dutton, is located on the Sevier Plateaus. The major is about to leave for the field himself, but before starting will fit out two other parties, one of which will make a specialty of the subject of irrigation in Utah.

Preparations for an improvement in the devices on the coins of the United States have been going on for nearly a year, and the various dies are approaching completion. As soon as finished, specimen coins will be struck and submitted to the Secretary of the Treasury for appropriate action under the law. One of the objects in view is to have the devices, inscriptions, etc., so finely engraved upon the coins as will render successful counterfeiting almost, if not quite, impossible. At the request of the Committee on Coinage, the Secretary has instructed the Director of the Mint to have an experimental $50 gold coin struck. These dies are nearly finished, and will, it is said, make the largest gold coin ever issued by any government. While on this subject I may state it is estimated by a prominent Treasury official that the total amount of gold and silver in the United States is $225,000,000, and that the increase during the year ending June 30 is not less than $45,000,000. As the imports are expected now to nearly, if not quite, balance exports, and the balance of trade is in our favor, it is believed that the accumulation of specie in this country will be still more rapid hereafter. Dr. Linderman, the Director of the Mint, expects to spend some time in California and Nevada investigating the gold and silver mines, to determine upon the supply of the precious metals which the government can count upon for coinage purposes. From a recent official report it appears that no small amount of gold and silver is obtained from the Atlantic coast, as the amount deposited at the mint and assay offices to the close of the fiscal year ending June 30, 1876, is as follows: North Carolina, $10,335,-209.31; Georgia, $7,379,495.51; South Carolina, $1,381,521.06. Total $19,096,225.88.

An official comparative statement just issued of the exports and imports of the United States for the month ended May 31st, 1877, and for the eleven months ending at the same time, compared with like data of the corresponding year immediately preceding, in specie values, shows as follows: Excess of exports over imports, including merchandise and specie, for the month of May, 1876, $13,040,906. For the eleven months ending May 31, 1876, $103,109,473. For the month of May, 1877, $12,312,309. For the eleven months ending May 31, 1877, $166,372,093.

Recent railroad statistics show that 73,508 miles of road were in operation this year, against 71,759 in the previous year. The gross earnings, $497,558,000, against $503,066,000; the net, $186,453,000, against $182,506,000; dividends paid, $68,040,000, against $74,294,000.

There appears to be considerable doubt here about the Paris exposition being opened at the appointed time, although Secretary Evarts has received no official information as to postponement, but, on the contrary, all communications received from France give assurance that the exposition will be open next year as announced. Notwithstanding this, the opinion appears to gain strength in the State Department that a postponement will be decided on before long. In addition to the war now exciting all Europe, which is likely to prove an insuperable obstacle to holding a satisfactory international exhibition, there is now a new difficulty in the political crisis in France. The election which follows the dissolution of the assembly will greatly agitate the country, and would seem to make it impossible to develop that degree of interest in the exhibition essential to success in such a tremendous undertaking. In consequence of this no steps have been taken by the department toward organizing the provisional commission that has been heretofore proposed.

Mr. C. C. Andrews, our minister at Stockholm, informs the State Department that an agricultural exhibition will be held at Christiana, from the 2d to the 7th of October next, which will be open to foreign nations, and appropriate awards given to the successful competitors. The time of exhibition is short, yet it may be sufficient to introduce some of our agricultural implements to the notice of the farmers of that region.

Washington, D. C. OCCASIONAL.

Iron Bridges.

To the Editor of the Scientific American :

When a railroad train falls through an iron bridge, an iron truss sinks beneath the roof of a public building, and an engine boiler bursts at ordinary working pressure, all within a short period of time and each endangering, if not destroying lives—no wonder that some persons are led to ask whether we are not advancing too rapidly in the applications of art and without sufficient precaution. In perhaps no other branch of industrial science has a quarter century's research been so universally beneficial and of extensively practical a character as in metallurgy and uses of iron.

It is not unnatural, then, to suppose that iron would be the first of our artificial productions to come into too general use. Nor would it be anything but strange if some conservative voice did not rise to "brake up" our headlong rush to that unhappy state of things which would result in the mortification of science.

We have listened particularly to arguments (?) against the use of iron as a bridge material—against the replacement of the stone arch by the iron girder.

One remarks upon the loss of life by the Ashtabula disaster: "No such thing could have happened if that bridge had been a stone arch. Who ever heard of a stone bridge falling through?" Now the fact that stone bridges never fall (allowing such, for a moment, to be the case), while iron ones do, is no reason for abolishing iron as a bridge material. Let iron and stone bridges, under the same traffic, be built with the same safety factor, and the imperfection that will cause a downfall will, in nine out of ten cases, exist in the stone.

The fact that all iron before being used is molten, and therefore becomes homogeneous, is in itself a strong argument in favor of its use. Another is the ease with which a whole truss may be tested in one or two of its members before erection, while to test an arch would necessitate the awkward and tedious performance of testing each stone.

Stone bridges of long span, especially with us, are of comparatively rare occurrence. The voussoirs of a short span are, for looks alone, large enough to insure many times the requisite strength, and any mason who has an eye for symmetry and enough of that indispensable article known as "cheek" to style himself an engineer, may with safety to his own reputation erect an ordinary stone bridge.

The reason, then, why a stone bridge does not fall is because it is unnecessarily strong. Let iron be used as profusely and in correct proportions, and no iron bridge would ever fall.

Stone bridges as well as iron trusses, do fail when not securely built. An inspection of the Boston Railroad depots will show the remains of an arch whose load is supported by an iron girder. Even while we are many times safer in the railway car than in our own private carriage, we cannot doubt that iron, especially in trusses, is sometimes too sparingly used.

It is asked: "Is not some legislation necessary to prevent such rapid introduction of iron bridges upon our thoroughfares?" I say, "No."

But let us have legislation that will be a damper to the erection of cheap bridges by money-eyed corporations, and that will, without excessive material, as in the case of stone bridges, give the passenger over the suspension or truss bridge the same feeling of security as when over the arch. In the above-mentioned, as in all such cases, failure was due to incompetent or untrustworthy engineering rather than to the iron.

In what respect is iron inferior to any other bridge material?

Let iron be used, then, but let men use it who will prove it free from silicon, phosphorus, etc., before computing for pure bar iron.

Marston's Mills, Mass. H. V. HINCKLEY.

Instinct of the Swallow.

To the Editor of the Scientific American:

On page 407, vol. xxxvi., of THE SCIENTIFIC AMERICAN, Thos. Edward gives an account of the conduct of the tern. Having seen a similar display among barn swallows, I am prepared to believe the narrative.

A swallow, on rapid wing, thought to take an insect near the water. His wing dipped, and not being properly on his guard, he was turned on his back, and floated like a cork on the surface, feet up, and perfectly helpless. He uttered a few cries of distress, and almost instantly a multitude of deeply-sympathetic companions filled the air above and around him, each clamorous with excitement, and all running to realize the situation, and to comprehend what was required, but many fruitless efforts were made before he was successfully caught by the wings, raised, and partly turned over. They were finally successful, and I was left standing on the bank, meditating over the popular errors in regard to instinct and reason. S. L. N. FOOTE, M.D.

Yellowbud, Ohio.

Enemy of the Potato Beetle.

To the Editor of the Scientific American :

I send by mail a small box containing a bug which seems to be a new destroyer of the Colorado beetle, or potato bug: it has a proboscis somewhat resembling the house-fly, but seems to be of a hard nature like bone. The bug strikes the beetle with this proboscis, and seems to suck the life out of it, when he is ready for another. First, Would like to know whether it is an injury to the potato plant; Second, What class of beetle it belongs to, with its proper name. It seems to be a new discovery. I have not had time to watch it very much, but have seen it kill two bugs in ten minutes. Seems to destroy the most from three o'clock P. M. until dark. Would be pleased to have an answer through your paper.

Sandusky, Iowa. F. A. WHITNEY.

The rust-gray, angular, and somewhat flattened animal referred to in the above letter is not a beetle, but a genuine bug(order, *heteroptera;* family, *scutelleridæ*), popularly known by the name of the spined soldier-bug (*arma spinosa dallas*). It is an old acquaintance, and every reading farmer protects it as far as possible in his warfare with the potato beetle.

The specimen sent by Mr. Whitney was a female, and had just laid 22 eggs by the way. These eggs are pretty little cauldron-shaped objects, with a convex lid, around which ciliate from 15 to 20 delicate white spines. The color of the egg is at first pale bluish gray, but the shell being translucent, the black and red colors of the embryo within soon show through it, and give the egg a bronze hue. Carefully examined, the surface is seen to be studded, especially on the convex lid, with what, under the microscope, appear like blunt spines, and which give the egg a slightly specked appearance to the naked eye. The convex lid opens with a spring of marvelous delicacy, when the hatching period arrives.

SPINED SOLDIER-BUG—*a*, enlarged beak; *b*, bug with right wings expanded.

These eggs are neatly placed side by side, in clusters of a dozen or more, upon leaves and other objects, and are so much subject to the attacks of a minute hymenopterous parasite, that those who undertake to hatch such as are found out-doors will more often get flies than bugs.

The newly hatched bugs are broadly ovoid and swollen-backed creatures, which congregate together, and look quite unlike the parent. The color is polished black, except the abdomen, which is crimson, with transverse black bars on the middle of the back and at the sides.

In the full-grown larva, the black still predominates on the thorax, but some four yellowish spots appear, and the abdomen becomes more yellowish, though still tinted with red. In the pupa, which is readily distinguished by the little wing-pads, the ochreous-yellow extends still more, and finally, with the last molt, the black disappears entirely in the perfect insect. Throughout the immature stages the *shoulders* are rounded, and not pointed, and the antennæ, or feelers, have but four joints, instead of five as in the mature bug, while there are but two visible joints to the feet, or tarsi, instead of three.

SPINED SOLDIER-BUG.—*c*, egg; *b*, larva; *a*, pupa.

The writer thus speaks of this gallant little fellow in his work on "Potato Pests":

"This is one of the most common and efficient of doryphora's enemies, occurring in all parts of the country, and seeming to have a decided fondness for our potato-destroyer, especially for the soft larva. . . . Thrusting forward his long and stout beak, he sticks it into his victim, and in a short time pumps out all the juices of its body and throws away the empty skin.

"We have been taught to admire the muscular power of the lion, which is enabled to grip and toss an animal larger than itself with its powerful neck and jaws; but feats performed by these young soldier-bugs throw the lion's strength completely into the shade, for they may be often seen running nimbly with a doryphora larva, four or five times their own size, held high in air upon their outstretched beak.

"The spined soldier-bug by no means confines himself to potato-beetle larvæ, but attacks a great number of other insects."

Water Pipe Pressures.

A series of important experiments, having for their object the settlement of several important questions in connection with the extinction of fires, were carried out at Grays on behalf of the Metropolitan Board of Works by Sir Joseph Bazalgette and Messrs. Branwell and Easton, C.E. The experiments were classed under three heads, the first being to test the effect produced by a pressure of 40 feet (that being the greatest height above road level to which the East London Waterworks Company are required to deliver water under their Act), using various lengths of hose and sizes of jets. The second was to test the effect of varying pressures under differing conditions of hose and jets. The third was to experiment with jets of great height. The basis from which the experiments started was the assumption that the value of a jet for extinguishing fires will be according to the height to which it can be thrown and to the quantity of water delivered, both of which depend on the elevation or head of reservoir, the lengths and sizes of the mains and pipes, and the dimensions of the hose and jet. Thus three things had to be considered—namely, the pipe friction, the hose friction, and the ratio between the height of the jet and the pressure immediately producing it. The results of the experiments proved that in overcoming the friction due to driving 600 gallons of water per minute through one-eighth of a mile of 4-inch pipe, 225 feet of pressure would be exhausted. If these 600 gallons were separated into the four jets of 150 gallons, each with their 200 feet of hose, there must be added to the 225 feet the loss of 55 feet in delivering 150 gallons per minute; and to throw that quantity to a height of 50 feet by jet would exhaust a further 80 feet of pressure. The inevitable conclusion, therefore, is that to deliver these quantities through the stated lengths of pipe and hose, and to throw it to a height of 50 feet, would exhaust a pressure of 360 feet. It may be as well here to observe that one-eighth of a mile of 4-inch pipe appears to be a very long length for the delivery of so large a quantity of water, and, as shown by the second experiment, the reduction of the quantity of water to one-half reduced the pressure from 250 feet to 63 feet, 6 inches. A proportionate enlargement of the pipes to deliver the larger quantity of water would effect an equivalent reduction of pressure, so that with high pressures it is clear that at the same time there must be pipes of sufficient size not only for the delivery of water extinguishing fires, but also, at the same time, for supplying the domestic requirements of the surrounding district. It must also be borne in mind that if these high pressures are introduced into the metropolitan district, the whole of the house pipes and fittings must be strengthened so as to be able to withstand them. The cost of that alone has been estimated by Mr. Muir, of the New River Water Company, at £40 per house. As there are about 400,000 houses to be dealt with, that means an expenditure of somewhere about four millions of money.—*London Building News.*

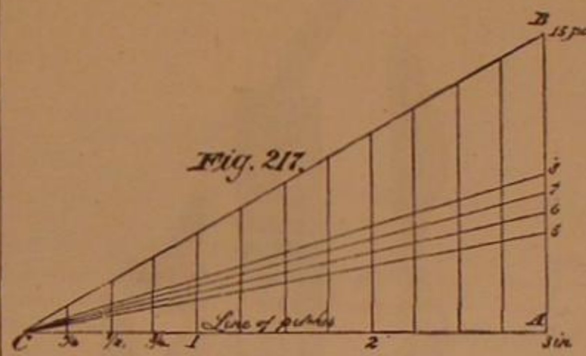
PRACTICAL MECHANISM.

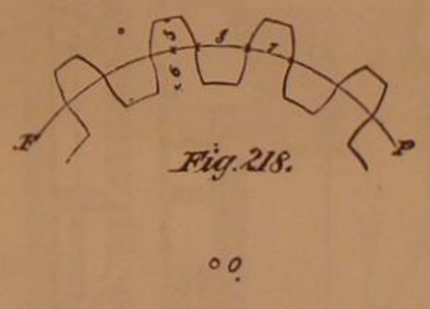
BY JOSHUA ROSE.

NEW SERIES—No. XXX.

PATTERN-MAKING.—WHEEL SCALE.

The accompanying illustration (Fig. 217) represents a very serviceable article for those who may be called upon to lay out gearing. It is not new to the mechanical world, but as the author never happened to meet with but one man who actually had made himself a scale of this kind, he considers it will prove a novelty to a large class of the readers of THE SCIENTIFIC AMERICAN.





Draw the lines AB and AC at right angles to each other. Make AB equal to three inches; the line AC may be any convenient length, say six inches, as by observing this proportion the scale will be in addition a very useful set square with the angles at B and C 60° and 30° respectively. Join BC; divide AB into 15 parts; from C draw lines to the fifth, sixth, seventh and eighth part, as in the figure. Divide AC into as many parts as there are inches in AB, number the divisions, and erect perpendiculars to AC. These are for the even inch pitches. To make the scale serviceable for the fractional parts, divide and subdivide again, and erect a perpendicular at each division. This process in our figure is carried out to quarter inches. It may, however, be further extended, if desired; but inasmuch as it is so little trouble to draw a perpendicular at any time for any fractional pitch required, it may be preferred by some that the scale should not be overcrowded with lines.

Brass is probably the most suitable material, as it takes the lines readily, does not oxidize, and is sufficiently hard to stand considerable wear.

The method of using this scale will be clear from the following example. Let O, Fig. 2, be the center of a tooth wheel or pinion, and PP the pitch circle, which we will suppose already divided off, and that the pitch is one inch; on the perpendicular marked take with the compasses the distance up to line 5, and set this off outside the pitch for the tops of the teeth; on the same perpendicular take the distance up to line 6, and mark this inside the pitch circle for the roots of the teeth. With center, O, and the points so found as distances, describe circles.

Make the thickness of the tooth equal to the distance on the scale up to line 7; the width of the space will then be equal to the distance up to line 8—all of course measured from the base line, AC.

Scales upon this principle may be made to accommodate any preferred proportions of the teeth of wheels.

Naphtha Explosions.

At noon, May 28th, an explosion and fire occurred on a barge which was discharging naphtha in front of the pier of the Metropolitan Gas Company, on the North River, near New York city. There had been about 95 barrels in the cargo, of which about one-half was pumped into a receiving tank, and the accident occurred just as the engineer, who was on the pier, was about starting the donkey pumps for work, after the dinner hour. The captain of the barge and two men were killed, and the engineer seriously injured. The barge and pier were damaged to an amount of about $3,000, but the receiving tank, which was not far off, most fortunately escaped. It was unusual to receive the naphtha in barrels—it generally having been sent in bulk, and pumped to this same receiving tank. Possibly a pipe or match used by one of the men killed ignited the inflammable gas evolved from the naphtha, or a spark may have originated from the iron implement used to remove the bungs, striking a nail.

June 2d, an explosion took place at the residence of C. B. Shoemaker, 1504 Swain street, Philadelphia. Mr. S. had procured five gallons of "benzine" to use as a moth preventive, and, with a watering-pot, had sprinkled the carpet and furniture of the parlor with the fluid. At 8·45 A.M., Mrs. Shoemaker and Mary Hall being in the parlor, a violent explosion occurred in the lower rooms, setting fire to the clothing of the two ladies, and causing the death of Miss Hall at noon of the same day, and of Mrs. Shoemaker about midnight of June 3d. The benzine in the can held by Mr. Shoemaker, in the second story at the time, did not ignite. There was no fire either in the parlor or dining room, and the only theory which seems possible is, that the volatile gas extending through the dining room to the kitchen—a distance of about 40 feet—and forming an explosive mixture with the air, ignited at the range in the kitchen.

At the coroner's inquest it was shown that Mr. Shoemaker had for four years past used benzine in a similiar way without accident. The can in the present case was labeled "Parlor Oil, Non explosive." The portion remaining in the can, upon being analyzed by Shippen Wallace, chemist, was found to be "a light naphtha, partaking, however, more of what would be termed gasoline, commercially, than naphtha." The specific gravity was only 75° Baumé. In his testimony, Mr. Wallace said:

"It is extremely volatile, giving off inflammable vapors at the ordinary temperature, and can be ignited when a flame is held within half an inch of it. By submitting the fluid to distillation, I succeeded in obtaining 64 per cent below the temperature of 170° F., and the balance between that and 205°. In the process of refining petroleum, the oil coming over from the still at a temperature below 170° F. is termed gasoline, and has a specific gravity from 80° to 90° B.; I would therefore call the fluid a light naphtha, partaking, however, more of what would be termed gasoline, commercially, than naphtha. By the name 'naphtha' is, at the present time, by chemical writers, embraced most of the inflammable liquids produced by the dry distillation of organic substances; commercially, as applied to the products of petroleum coming from the still, between 150° and 278°, and having a specific gravity of 71°–76° B., while the liquid obtained below 150°, and which generally has a specific gravity of 80° to 90°, is termed gasoline."—*American Exchange and Review.*

Priming.

Never prime a piece of wood, especially hard wood, unless certain there is no moisture in it. Run all wheels out in the sun, or dry by artificial heat before priming, and if painted as described in hurried work, they will not scale, crack, nor blister. Use more or less oil, according to the time required for finishing; on slow work oil will take the place of varnish. Do not put on one coat and let it stand a long time without sanding, and never put a thick coat on bone dry work. A job painted in this way, with an extra coat of rubbing varnish, allowed to stand a week or more, then rubbed out and well varnished, and kept away from mud and water for one month, will hold its gloss equal to oil work, and will not crack nor have the small-pox, and come off generally. If necessary to hurry it still more, use more japan and varnish and less oil, thinning well with turpentine.

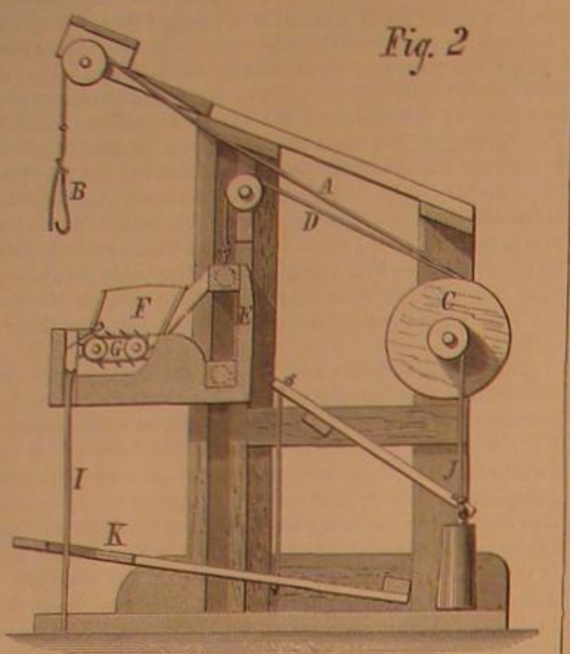
Do not put a dry flat coat on glossy oil, nor *vice versa.* Be sure your job is free from moisture, so that it will drink in the priming. Make your priming thin enough with turpentine, so that it is drink and not victuals. Make each coat as near like the last as possible, put them on as soon as dry, and they will form one solid coating; then if you have time, let them thoroughly dry before varnishing. For wood work to keep in stock a long time, prime with best pail lead, boiled oil and a little turpentine.—*Carriage Monthly.*

A Steel-Clad Bullet-Proof Car.

A car of this sort has recently been constructed at York, Pa., for the Spanish Government, for use in Cuba. The steel slides, which are pierced with loopholes for musketry, and which take the place of windows, have been so cunningly planned by the painter's skill to resemble the decorated ground-glass sometimes used in cars, as to deceive the unwary at a little distance. The car is 31 feet long, 8 feet wide, of the usual height, and is mounted on the Pennsylvania Railroad standard passenger car truck. Its weight is about 24,000 lbs. No finer work of the kind has ever been made.

IMPROVED HORSE COLLAR STUFFING MACHINE.

We illustrate herewith a new machine for stuffing horse collars, by means of which the work can be much more rapidly performed than is ordinarily the case. Fig. 2 is a sectional view, and Fig. 1 is a perspective view of the device.



HORSE COLLAR STUFFING MACHINE.

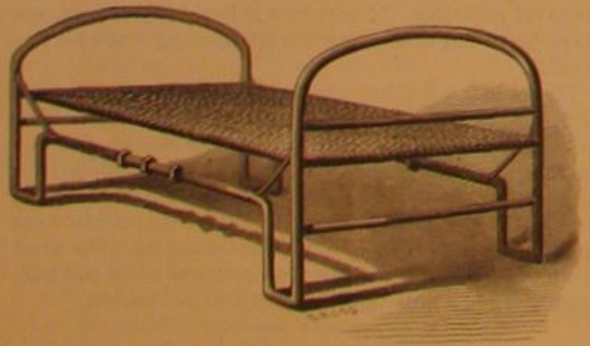
To the upper portion of the frame is attached an inclined bar which carries a pulley, over which passes the rope, A, Fig. 2. Adjustably fastened to said rope is a hook, B, which receives the collar to be stuffed, as shown in Fig. 1. The rope passes back and is wound around a drum, C, generally in the rear portion of the frame. To this drum is also attached another rope, D, which, after passing over a pulley in the frame is fastened to a carriage, E, the wheels of which move up and down in ways in the frame.

The straw or other material is received in the hopper, F, secured to said carriage. The bottom of this hopper is a short endless belt, G, provided with teeth to grasp the straw and carry it forward into a recess in the front part of the carriage. A small arm suitably arranged prevents clogging of the recess. Upon one of the journals of the rollers over which the belt passes, is a pulley, H, which is connected to the roller journal by a pawl and ratchet wheel, so that only when said pulley is turned forward, the roller and belt may be carried with it. Around the pulley, H, passes a strap, one end of which is attached to one extremity of a coiled spring, while the other end of the spring is secured to the carriage. The opposite end of the strap is attached to a segmental pulley, which has a projecting arm to strike against a stop on the frame whenever the carriage moves upward to operate the feed belt, and which is drawn back to its former position by the spring as soon as it is released from the stop.

The rod, I, passes through a hole in the carriage to take the straw from the carrier belt and force it into the collar. To the shaft of the drum, C, is secured a rope, J, which is wound thereon in the opposite direction to that of the ropes previously mentioned, and which carries a weight large enough to overbalance and raise the carriage and its attachments.

The mode of operating the machine is as follows: The workman hangs the collar to be stuffed, as shown in Fig. 1, by one end from the hook on rope, A, and places the straw or other stuffing material in the hopper. He then holds the open lower end of the collar over the hole in the carriage and presses the treadle, K, down with his foot. This, through the intermediate mechanism, raises the weight and allows the carriage to descend, the operator drawing the collar down with it. As the carriage comes down, the rod, I, forces the straw into the collar. The workman then raises his foot from the treadle, the weight is lowered, and the carriage is raised. The ascent of the latter operates the feed belt and feeds more straw into the cavity of the carriage ready to be forced up into the collar as the carriage again descends. In this way it is claimed that a collar can be quickly, easily, and thoroughly stuffed.

Patented through the Scientific American Patent Agency, June 19, 1877, by Mr. John M. Lichliter, Page county, Va. For further information address B. F. Grayson, Jr., Luray.



A GASPIPE BEDSTEAD.

Testing for Lead in the Glazing of Pottery.

The method employed by Ebermayer for this purpose is so simple that we give it entire. As we have previously stated, some of the so-called granite ware contains lead, and the same method may probably be adopted in testing utensils made of this ware. Ebermayer takes weak commercial vinegar, which he dilutes with four parts of water, and adds to each liter of vinegar 50 grains (or 5 per cent) of table salt. The addition of the salt might be entirely omitted, as the chloride of lead formed is but slightly soluble in salt water. If the glazing is good, it will not be attacked either by dilute vinegar or salt water; if it is poor, more lead will be dissolved by the vinegar than by the brine. The vinegar and salt is left in the vessel 8 to 12 hours. A measured quantity is employed, say ½ liter, or ½ pint, and in repeating the test, use a little less of the liquid, so that it will not stand higher than before, and dissolve fresh portions of the glazing. After 8 or 12 hours, the contents of the vessel are tested for lead with sulphide of ammonium. If no precipitate of sulphide of lead is formed, or at most a light yellow to light brown color is produced, the vessel is not to be considered dangerous to health. If, however, a black precipitate, or dark brown color is formed, from which a precipitate falls in a short time, the glazing of such vessel is suspicious.

These vessels are then rinsed out with water, and again filled with the diluted vinegar. After 8 or 12 hours it is again tested with sulphide of ammonium. Those vessels which no longer yield any precipitate are to be regarded as good and fit to use. In these vessels there is nothing to fear provided they are boiled with vinegar and water before using. If a precipitate is formed a second time, the vessel is totally unfit for use, and dangerous to health.

A GASPIPE BEDSTEAD.

An ingeniously simple bedstead can be made of iron pipe in the manner illustrated in the annexed engraving. Two

HORSE COLLAR STUFFING MACHINE.

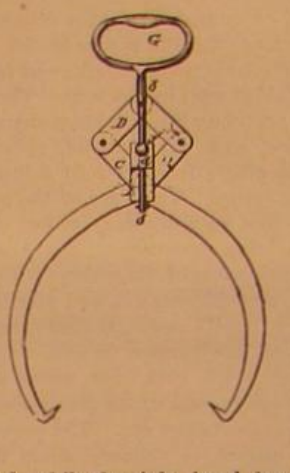
lengths of pipe are bent, each in the same manner, as follows: A distance equal to the desired width of the headboard is marked off at the middle of one of the pieces. Each end is then bent in U shape to form legs, and the arms of the U are bent at right angles to form side pieces. The other length of pipe is bent in precisely the same way. Then the two parts are joined by couplings on the side bars, braces are added as shown, a wire mattress is attached, and the bedstead is complete. This was patented April 24, 1877, by Mr. W. J. Myers, of Hartford, Conn.

Exportation of American Beef.

A statement is made by the Bureau of Statistics that during eighteen months ending with March, 1877, the total exports of fresh beef from the United States to Great Britain amounted to 34,278,810 lbs., the money value of which was $3,026,483. Of this amount 29,601,250 lbs. went from New York, and 4,677,560 from Philadelphia. The exportation has been gradually increasing, 36,000 lbs. only having been sent in October, 1875, and 6,707,855 in March last.

NEW ICE TONGS.

The annexed engraving represents a new tongs for grappling and hoisting or lifting any desired article. It consists of two bowed arms, pivoted together and provided at their lower ends with prongs. Above the pivot the arms form levers, C, crossing each other, as shown, and to the upper ends of these levers are pivoted two links, D, the upper ends of which are pivoted together to a shank, *b*, projecting downward from the handle, the parts together forming a toggle-joint. The handle shank, *b*, passes through a guide or projection, *d*, attached to a bar, I, which is pivoted to the tongs. From this guide or projection extends a knob, S, as shown. The tongs are operated by holding them with the handle, G, and striking them down upon the block of ice, for example, when the toggle joint spreads so as to open the arms and allow the jaws to take hold. Then, by raising the tongs, the ice is lifted by them, and the heavier the ice is, the closer the tongs hold it. By taking hold of the knob, J, with the left hand, while the right hand has hold of the handle, G, the arms can be opened easily and guided so that the jaws, B, can take proper hold of the ice.



This device was patented February 29, 1877, by Mr. Peter Euler, of Troy, N. Y.

New Metallurgical Treatment of Nickel.

M. Hersel proposes the following treatment of the oxides of nickel, and especially of the hydrosilicate of nickel and of magnesia. The nickel oxides are mixed with alkaline sulphides or persulphides, or with alkaline earths variable according to the composition of the ore and the nature of the gangue. The mixture is melted in a suitable furnace. The sulphides or alkaline earths react on the oxides and on the silicate of nickel formed by double decomposition of the nickel sulphide and the alkaline silicates. The gangue combines with the melted mass on the furnace hearth and produces scoriæ: from the latter the nickel sulphide is separated in the same apparatus. Fusion gives: 1. Sulphide of nickel freed almost completely from sulphide of iron. 2. Alkalies or alkaline earths in excess. 3. Silicates forming slag. It remains only to transform the sulphide of nickel into oxide and to treat the latter according to methods commonly known.

How the Chinese Make Tea.

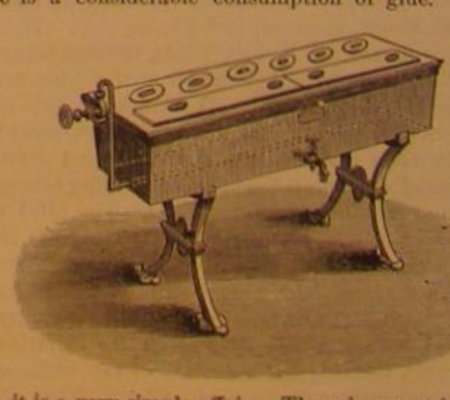
The upper classes in China, from very long experience in the matter, select the very choicest tea which they can afford—generally the young leaves from old trees. A few of these leaves are put into a cup, and water, a little short of the boiling point, is added. As soon as it is sufficiently cool, which does not take many seconds, for the cups are very small, the beverage is quaffed, much after the same manner as the Turks do coffee, so hot that it is commonly asserted they drink it boiling. By the above quick method, they skim, as it were, only the superficial flavor of the leaf, which is very capable of yielding up, when required, a bitter extract, which they avoid. This is the prime source where the "used leaves," spoken of by analysts, come from.

American Institute Exhibition.

The 46th Exhibition of the American Institute, New York city, promises to be of unusual value. Our inventors and manufacturers have at last learned the value of meeting the purchaser and consumer face to face. For rules, space, etc., address the General Superintendent.

STEAM GLUE-HEATING APPARATUS.

This apparatus has been devised by Messrs. W. Richardson & Co., of Darlington, England, to meet a want which has been felt in joinery shops and other establishments where there is a considerable consumption of glue. As will be



seen, it is a very simple affair. There is a cast iron pan or trough, which, when filled to about two thirds with water, receives a half-inch steam pipe, and when the water boils, the round covers on the top of the apparatus are removed, the glue cans being substituted. The oblong spaces in the top (also provided with covers) are intended to receive perforated zinc troughs for boiling the breakfast cans of the workmen. Hot water can always be had from the apparatus, and its use implies saving of material, trouble, and fuel.

TORPEDO WARFARE.

The Russian operations on the Danube are now inviting attention to this destructive arm of the service. We offer some illustrations of the chief of the present recognized systems. In so doing, it may be well to remark that experiments have rather been directed to the use of torpedoes at sea than to their employment for holding a river such as the Danube, about half a mile wide, against an immensely superior force. But the late daring feat of planting a torpedo against the side of a Turkish ironclad gunboat, will probably be followed by other equally hazardous and perhaps successful attacks, if the Turks are unwise enough to permit their ironclads or other vessels of deep draught to remain within those narrow waters. It will be observed, however, on the other hand, that the more recent failure of a similar attack on a Turkish ship at the Sulina mouth of the Danube, and the sinking of two Russian torpedo boats by the ship's guns, has moderated some of the opinions that were expressed a week or two ago concerning the irresistible power of this novel instrument of warfare.

In the annexed engravings, from the London *Illustrated News*, we illustrate several of the most improved forms of torpedo vessels. The Whitehead fish torpedo is separately depicted in Fig. 4. This machine is a cigar-shaped steel cylinder, 14 feet to 19 feet in length, and from 14 inches to 16 inches in diameter. It is to be sent, requiring no crew, against the ship to be destroyed; and if one torpedo fails to deal the death-blow, another and a third can be sent after the enemy without much trouble or expense. This torpedo consists of three compartments—head, center, and tail. The head contains the explosive, say 360 lbs. of gun cotton; the central chamber holds the machinery and mechanism for regulating it, so as to remain at the depth at which the torpedo is to travel under the water line; and the third part holds the supply of compressed air for the engine. The motive power is supplied by a small engine, capable of indicating 40 horse power, but so compact that it can be made to weigh only 35 lbs. The working pressure of the air in the tail is usually about 1,000 lbs. per square inch; and the quantity carried is sufficient to propel the large torpedo 200 yards at a speed of twenty-five miles an hour, or about 1,000 yards at a speed of seventeen miles.

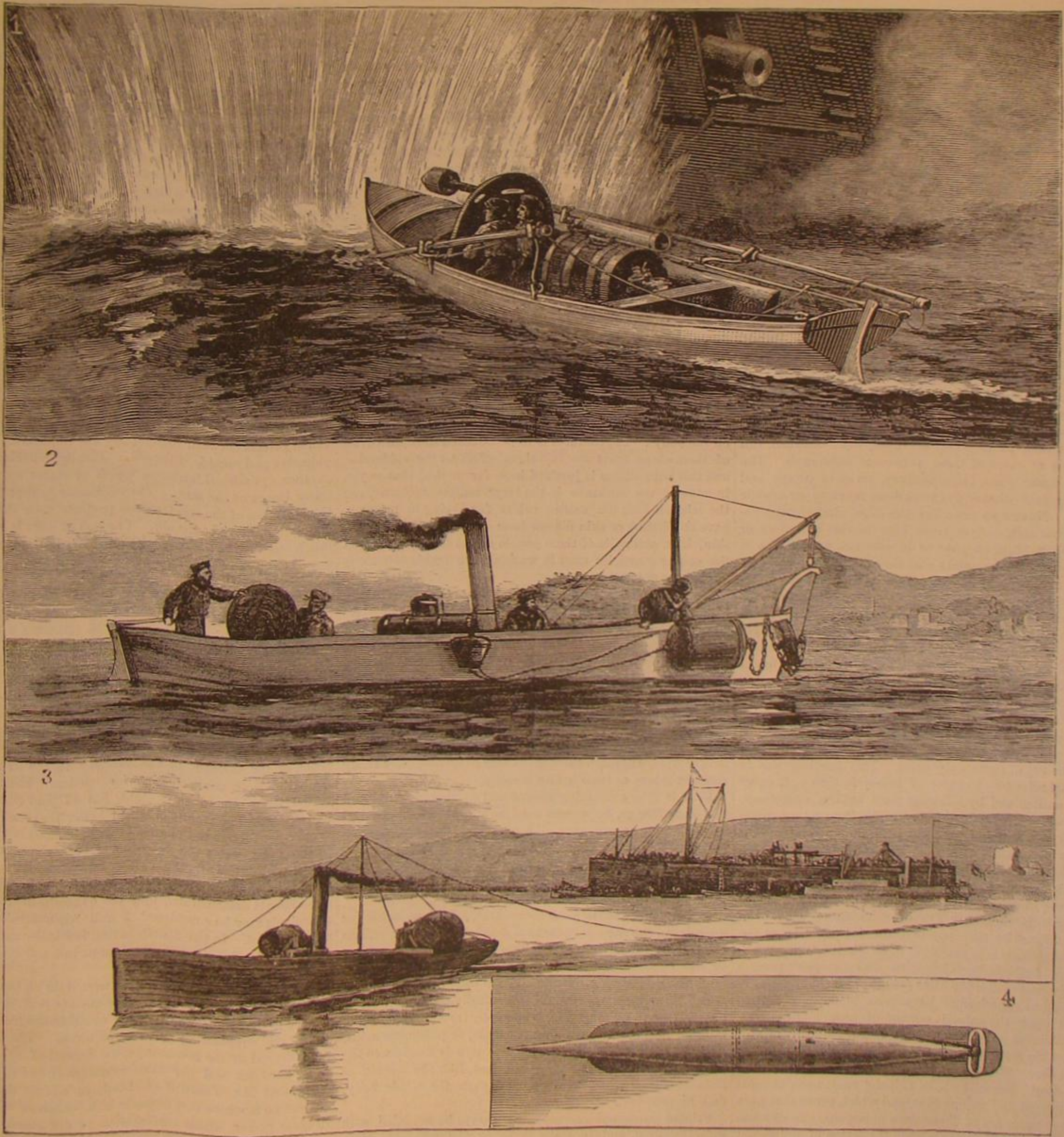
A fish torpedo should be capable of piercing the protective nets that are suspended from booms around an ironclad. Whether such nets, made of rope and wire or any other material, will effectually keep off the torpedo remains to be seen. But probably, if the net is sufficiently strong to keep out the Whitehead torpedo, or to divert its course, this net will be so heavy as seriously to impede the manœuvering power of the big ship, and expose her to the equally great danger of being rammed. Outrigger torpedoes, made of wood or steel, may be carried by large vessels over the bows or sides, either attached to booms above water or propelled through cylinders below the water line, as just described. They can be fired on contact, or at will, by electricity.

Small steam launches, Fig. 3, propelled by steam, or other motive power, and steered by electricity, either from the shore or from a large vessel, or by one man on board the launch, and carrying one or more of these torpedoes, will prove most formidable. They may be used even in a general fleet action, fought in mid ocean, if the water be sufficiently smooth. Generally they will be manned by a crew, and, under cover of gunsmoke or the darkness of night, will be likely to render a good account of their work.

It has been suggested that Holmes' distress signal, capable of emitting a very strong white light at a distance of more than a mile, or some other illuminating power, may be employed by the enemy's ships to discover the movements of torpedo attack. But it is most unlikely that any of the big ship's guns could hit one of these steam launches. And the mere fact of the big ship having to fire these shots would disclose her position, and would, instead of being a detriment, aid the approach of the torpedo boat armed with these infernal machines. It is difficult enough by daylight to hit one of these fleet little vessels; but in comparative darkness, or with a flickering light, it becomes the merest chance whether the gunner, even when thus forewarned, could bring his gun sights to bear upon them. As means, therefore, of defence against the most powerful ships of war, it may be sufficient for ordinary vessels to carry one of these torpedo boats either at their davits or in special compartments, with a few torpedoes, keeping them in readiness to detach at a moment's notice.

The explosive—usually gun cotton—held in a tin receptacle, and secured to the boom end of the torpedo, is fired on striking the vessel's side, Fig. 1, or by electricity, when within a few feet of it; the length of the spar being so arranged that the explosion does not injure the launch carrying it. For this purpose a bow screen is fitted to prevent the upheaved water coming on board the launch. A charge powerful enough to sink an ironclad can be fired at a distance of 20 feet from the bow of the launch without damage to the launch or its crew.

Another illustration, Fig. 2, shows a launch placing torpedoes or submarine mines. Such defences are of great use in protecting a harbor or shipping of inferior force from the



ILLUSTRATIONS OF TORPEDO WARFARE.

fire of an enemy. This class of torpedo consists of an iron cask, part of which contains the charge and fuse, and the remainder is the air space for buoyancy. It is held in position, a few feet beneath the surface of low water, by a chain, which is secured to an iron mooring block. Two or more lines of mines are necessary: they can be fired by the enemy striking them, or by electricity at the desired moment when two observers, stationed at points well situated for getting lines of intersection, note the enemy exactly over the position of a mine. Each torpedo might contain 250 lbs. of gun cotton. We may suppose 100 feet spaces to exist between neighboring mines on the same line, and some 500 feet spaces between each of the lines crossways, over which series of two or three independent lines an enemy would have to pass before entering the harbor. Should the first explosion fail, the torpedo on No. 2 line will be fired as soon as the vessel crosses, and finally, if necessary, the torpedo on No. 3 line. The inside line would usually be supplied with circuit closers in addition to the means of firing them on cross bearings and signal; these circuit closers being always rendered active when darkness or thick weather sets in. To insure the greatest accuracy in firing the torpedoes by cross bearings, telescopic firing keys have been designed, so that all that is necessary is for the observers to watch the approaching vessel through the spyglass, and, whenever its movement brings the firing key over one of the points, the position of a mine, to press it down to close the break in the circuit.

The only way to clear an entrance into a harbor through this defence is by means of countermines suspended from casks or buoys, drifting them either by the current or the wind into the desired position, and then exploding them. A charge of 500 lbs. of gun cotton is calculated to destroy all submarine mines within an area having a radius of 120 yards.

ARE THE ANILINE DYES INJURIOUS TO HEALTH?

This important and interesting question has been answered in various ways, affirmatively, negatively and equivocally. H. Seidler, technical director of the mineral water establishment at Riga, delivered a lecture recently before a scientific society of Riga, from which we abstract a few important points:

In testing whether aniline colors are poisonous the following questions may be asked:

1. Are the dyes made of materials which are of themselves poisonous?

2. Does a certain quantity of these injurious substances remain in the dyes when finished?

3. Can the chemically pure dye itself act as a poison?

4. Is food colored with the pure dye poisonous?

5. Do fabrics (such as clothing and carpets) dyed with these dyes, exert a poisonous influence on the body?

1. In answer to the first query, he says: In the manufacture of aniline dyes, or more correctly, of rosaniline dyes, crude products are employed which do exert a very poisonous effect upon the animal system. Nitrobenzol, aniline oil, and the different oxidizing agents, such as mercurial and arsenical compounds, are extremely poisonous substances.

2. By careless purification, the dyes, when finished, can contain one or more of these poisonous substances. The dye may, under some circumstances, act as a poison and produce forms of disease due to aniline, mercury, or arsenic poisoning. Numerous cases like this have already been noticed. If the aniline dyes come into market in a more or less amorphous state, *en pate*, or in solution, we can almost always assume with certainty that they contain more or less of those poisonous substances employed in their manufacture. If they are sold in a dry state, either in powder or beautiful crystals, they are more likely to be pure, although arsenic may always be present, as the purification of dyes made with arsenic acid is tedious and involves inextricable difficulties and expense. The most carefully purified brand of dye, the Oa of Gehe & Co., Dresden, contains $\frac{1}{80000}$ part, or .00125 per cent of arsenic.

A number of technical chemists have attempted to drive out arsenic acid and other poisonous metallic compounds from the aniline manufacture, and have sought to work without the use of these substances. This problem was in greater part solved by Coupier of Poissy in 1869. Coupier made the aniline red by allowing pure aniline, nitrotoluol, hydrochloric acid, and a little metallic iron, to act upon each other at a suitable temperature. Commercial aniline oil, which is a mixture of aniline and toluidin, mixed with commercial nitrobenzol and nitrotoluol, may be employed with the hydrochloric acid and iron. The red obtained in both cases is identical with ordinary red. Meister, Lucius & Brunnig in Höchet, near Frankfort-on-Maine, have overcome the difficulties that opposed the introduction of the nitrobenzol process into practice. The Berlin Actiengesallschaft fuer Anilinfarbenfabrication uses Coupier's process exclusively, and makes 200 kilos (440 lbs.) of rubin daily.

3. Numerous experiments have been made in regard to the effect upon the animal system of pure aniline dyes, which contain no poisonous substances mechanically mixed, and are not the salts of a poisonous acid combined with the base rosaniline. First of all must be mentioned the experiments of Prof. Sonnenkalb, in Leipsig, made upon animals with aniline red and aniline blue, and which prove that pure aniline dyes never are of themselves poisonous. Seidler has now repeated the experiments upon the action of aniline red upon the system, and indeed upon himself, for he did not then know that experiments had been made with aniline red upon human beings. In his experiments he employed aniline red (Rubin from Brueckner, Lampe & Co., Leipsig) made by the nitrobenzol process. A qualitative analysis showed the absence of any metallic compound whatever. Doses of 0.05 grains (.75 grains) or of 0.1 grain produced no uneasiness, and when $\frac{1}{2}$ grain was taken every morning for five weeks, not the slightest injurious consequences were perceptible. Experiments were made on two other persons with like results. This proves pure aniline dyes to be innocuous. The experiments permit of the supposition that Rubin (aniline red) passes through the animal system as indifferent matter, and is removed in a short time (two or three days) with the excrement undecomposed.

4. The answer to the query whether food colored with a pure aniline dye is poisonous is answered by the above. If the pure dyestoff is *per se* non-injurious, liquors and lemonade colored with it cannot exert any injurious effect upon the body. We have only to consider how extremely dilute these dyes are when used for coloring. Aniline dyes are never used to color drinks in such concentration that their consumption would approach any such quantity as that taken by Seidler, without injury.

The divisibility of this dyestuff is very extraordinary, a solution of 1 part aniline red in 1,000 parts alcohol, is very dark red; 1 part aniline red in 10,000 parts alcohol, is very red; 1 part aniline red in 100,000 parts alcohol, is red; 1 part aniline red in 1,000,000 parts alcohol, is distinct pink; 1 part aniline red in 10,000,000 parts alcohol, is pale pink; 1 part aniline red in 100,000,000 parts alcohol, gives an imperceptible coloration, which can be seen by holding a white screen behind the vessel containing the solution.

This divisibility is employed for the greater part in coloring drinks, as lemonade, liquors, etc.

In 100 liters of lemonade, which contains 135 whole bottles of lemonade, there are 13 c. c. of a 1 per cent. solution, so that there is less than a milligram (or $\frac{1}{78}$ grain) of aniline red dissolved in a bottle of lemonade. Hence, a man would require to drink 100 bottles of lemonade to obtain as much aniline red as Seidler and another person took at once in a concentrated form.

The question involuntarily presents itself, can the arsenic in fuchsin be injurious, if the aniline colors are employed in such extreme dilution for coloring drinks, etc.? This is best answered by a simple example. Suppose a manufacturer colored his spirituous liquors with fuchsin containing 10 per cent. of arsenic, a case which never happens. A person that consumes 100 c. c. (nearly a gill) daily would take only 0.02 milligrams (.003 grain) of arsenic. This quantity cannot be considered injurious.

If a careless manufacturer colored his lemonade with analine red containing 1 per cent. of analine, each bottle of lemonade would contain ·01 milligram (·00015 grain) arsenic.

For coloring eggs, aniline red is employed in a concentrated form. Here it is ordered that the purest possible dye, free from arsenic, must be employed, and druggists are only allowed to sell pure wares for this purpose. The presence of 0·00125 per cent. of arsenic could do no harm.

5. Have fabrics dyed with aniline a poisonous influence on the body? In general it is to be assumed that pure dyes, of themselves, exert no injurious effect on the epidemics, and this supposition is justified in so far as this, that as yet, in none of the workmen in the large aniline factories, nor the laborers that use aniline colors for dyeing or printing, have any illness or skin disease been observed, although the skin, hair, and nails of these people are so deeply dyed that the ordinary articles used in washing are unable to remove the intense coloration.

We have farther to consider that the aniline dyes belong to the class of so-called substantive dyes, that is, themselves possess the power, without the aid of mordants, of attaching themselves to the fibers, and cannot be dusted away by mechanical means, as for example, ball dresses, curtains, carpets, etc., dyed with arsenite of copper—Paris green.

Farthermore, we have as yet no perfectly-well authenticated cases where experience could justify the supposition that wearers of clothing of wool, silk, or cotton, dyed with aniline dyes, although their use is very extensive, have really suffered injury to their health thereby.

Even if dyes containing arsenic and aniline are employed in dyeing fabrics, no danger need be apprehended. In dyeing, it is well known, that all kinds of goods are very carefully washed before they come in the market; and, farther, it does not seem probable that fabrics dyed with these would contain aniline as such, or metallic salts, after such washings, in quantities sufficient to injure the skin.

If the fabrics dyed with these dyes afford no cause for uneasiness, the same is not true of goods printed with aniline colors. In the latter case, the dye is employed in a more or less concentrated form, and it is quite possible that it might be rubbed off mechanically, and thus enter the mouth, stomach, and intestine canal. Chemically pure dyes are, of course, free from danger. If, however, the aniline dye contains a considerable quantity of arsenic, or poisonous acids, like picric or oxalic acids, or if the dye is fixed on to the goods by means of a poisonous mordant, like the arsenite of soda, or of alumina, the skin, and even the whole body, may be poisoned.

Printed goods and carpets must always be regarded with some mistrust, and in order to be on the safe side, their harmlessness must be proven by a chemical analysis.

If a chemist wishes to test an aniline dye, or fabrics dyed or printed with aniline colors, in regard to their effect on the health, he should not be satisfied with testing for arsenic or other metallic poison, but must also test whether the dye in question is not combined with a poisonous acid, like oxalic or picric.

Novelties Before the French Physical Society.

At a recent session of the French Physical Society, papers, of which the following are abstracts, were presented:

RESISTANCE OF THERMO-ELECTRIC BATTERY.

M. Rolland has studied by Thomson's method the resistance of the clamond thermo-electric elements. His observations are represented by a curve having for abscisa the time and for ordinates the resistance of the element. During the first twenty minutes the curve rises, describing several sinuosities and then becomes parallel to the axes of abscisa. When the heating ceases the curve rises at first very rapidly and then descends oscillating. M. Rolland remarks that the method employed supposes the electro-motive force to be constant, and that consequently the curve may be the result of the variation of the resistance and of that of the electro-motive force. The progress of the temperature similarly observed on a copper-iron pile is represented by an analogous curve.

A NEW SYSTEM OF ELECTRIC TELEGRAPHY.

M. Thomasi presented a new system of electric telegraphy applicable to submarine cables of great length, which is essentially as follows: There is a new relay, the sensitiveness of which is such that 5 per cent only of the current of a single Minotto element, after having traversed a resistance equal to that of 2,520 miles of transatlantic cable, and a plate of wood lightly moistened (which represents a much greater resistance), suffices to cause it to act on the printing receiving instruments with the greatest rapidity. A second relay termed interrupter, automatically interrupts the current of the local battery after each emission, hindering a spark from being produced in the first relay. This spark, which may occasion inconvenience in a very delicate apparatus, such as the first relay, produces none in the second, because of the energy of the contact, which renders the consequences of the spark absolutely inoffensive. This relay acts in turn on the printing apparatus and on another local battery. The receiving instrument (Morse system, modified) is composed of two electro-magnets, which operate converging metallic points. One point impresses a red and the other a blue trace on the same band of paper, according as the operator transmits the Minotto current in positive or negative direction. Different combinations of these red and blue marks indicate numbers, letters, words, and even entire phrases. The transmitting apparatus automatically reverses the current after each emission, and the emissions are exactly of the same duration.

NEW STELLAR SPECTROSCOPE.

M. Mouton presented a spectroscopic telescope designed for stellar observation. The instrument is quite small, and may be adapted to telescopes of any kind. It consists essentially of a small telescope containing one or more direct vision prisms between the eyepiece and objective. Near the objective and outside is the slit. Finally, outside the slit is another cylindrical telescope which produces on the slit a linear image of the star. The collimator is suppressed and the objective of the spectroscope projects upon the eyepiece simply the image of the slit. The loss of light is said to be much less than is the case with ordinary spectroscopes.

New Investigations on Electro Deposition.

At a recent session of the French Academy of Sciences, M. Jamin presented, in behalf of M. Gramme, a note containing many new facts relative to the weight of galvanic deposits which may be obtained per unit of mechanical work by using the magneto-electric machines of which M. Gramme is the inventor. Four series of experiments are summarized. In the first the baths, in variable number, were coupled as for quantity. The results showed that the deposit per foot-pound of energy expended does not vary with the augmentation of the surfaces of the anodes. In the second series the baths were connected as for tension. Their number varied from one to forty-eight, but all had electrodes of like extent. The results obtained prove that the deposit of copper per foot-pound augments with the number of baths. In the third series the intensity of the cement was maintained constant, while the surface of the anodes and, at the same time, the number of the baths were augmented. These experiments demonstrated that the expenditure of work in eletrolysis may be considered as null when soluble anodes are employed. In the fourth series, insoluble anodes were used. A smaller deposit per foot-pound and considerable polarization resulted.

M. Gramme's note throws some new light on the question of galvanic deposits, and his experiments will be of much service to the industries in which magneto-electro-machines are rapidly supplanting galvanic batteries. The first apparatus densed by the inventor gave a deposit of 123 grains of silver per hour and per kilogrammeter (7·04 foot-pounds). At present Mr. Wohlwill of Hamburg reports that he has a Gramme machine that deposits 94 6 pounds of silver with 15 horse power, which corresponds to 616 grams of silver per hour and per kilogrammeter. M. Gramme considers that by the aid of his recent investigations he will be able to obtain a deposit above 3,080 grains per same units.

On Some Properties of Glass.

Glass—whether in the form of the lens in the camera or the support for the film in the negative, or, indeed, in any of the many shapes in which it is applied to photographic use—is looked upon as a substance of such complete permanency and unalterability that it is possible we may be thought guilty of exaggeration when we say that to find a glass which has a just claim to this popular opinion is very far from being an easy matter. That form in which the unblemished character of glass appeals most to the photographer is, naturally, the negative plate, of which some hundreds of thousands must be used annually; and so much does the common idea rule manipulative practice that it is scarcely too much to say that it is more than likely that the poor, much abused bath is credited with many a vagary when it is perfectly innocent, and some chemical alteration of the glass is the source of the evil.

That glass is so liable to be altered a little reflection upon the difficulties found in plate cleaning will show; for when a case arises where stains, etc., unmistakably point to the glass as the cause, it is evident its surface has not been mechanically abraded or scratched, and the change, whatever it is, must be of a chemical origin, though, possibly, mechanical in its immediate effect upon the deposition of the silver forming the image. We purpose to give some idea of the character of the metamorphosis likely to be undergone by glass when exposed to the action of air or water. Forewarned is to be forearmed, and the deeper we are able to dip into the source of failures the more power do we obtain to prevent them.

Glass forms an interesting example of the fact that, whenever special excellence in a particular direction is to be attained, it must usually be at the expense of some quality or other. The various characteristics of glass—its hardness, lustre, permanency, insolubility, impressibility, etc.—prove this. It is in the main a silicate of soda or potash, or both, having combined with it other silicates, such as those of lime, alumina, baryta, etc. There is a glass made (silicate of soda) which is quite soluble in water—it has a beautiful sea green hue as generally found in commerce—and between it and the most insoluble varieties, containing silica and aluminium in large proportion, there are all varieties of solubility to be found. Silicates of lime or potash separately are acted upon by water and acids, but, fused together, they are insoluble. The greater the proportion of silica and alumina glass contains the more insoluble it becomes, and it is the manufacturer's province so to proportion the ingredients of his glass as to produce qualities most suitable for the object in view. In this country glass manufactured in Germany, France, and at home is to be purchased, and each has its peculiar characteristics. An extremely pale glass, almost colorless, was imported a number of years ago from Germany; but it gave way to the action of the atmosphere to a most remarkable extent, and we have for some years seen nothing of it.

It has frequently been stated that glass with an artificial surface—that is, one produced by polishing with abrasive powder—is less clean to work and more liable to stain than one with the natural surface first obtained after the sheet has cooled down. Though we believe it quite possible that more has been made of this difference of surface than the actual facts warrant, we can yet easily see why, apart from the supposed hardness of the hypothetical skin, artificially polished glass should be more readily acted upon by water or other chemicals. This surface being entirely given by a process of rubbing, or, as it were, minute scratching with a powder, it might be supposed that if it could be examined by a microscope it would be found rough like "obscured" glass, and thus offer a greater amount of surface to be acted upon.

The action of water upon glass is to decompose it, the potash and soda and a little silica being dissolved, and the greater the amount of alkali present the quicker is the decomposition brought about. The action of the atmosphere is of a similar nature, the moisture always present to a greater or less degree being the real active agent; the common result is to separate the soda and potash, and to leave the silica upon the surface sometimes in a manner that is only perceptible upon heating, when excessively minute flakes separate and leave a dull surface. It has been stated that glass buried deep in the earth has been, when dug up, so soft as to be cut with a knife.

The use of soda for cleaning old glass plates is often recommended, and in its way, and with proper precautions, it very useful; but it is to be remembered that it dissolves the silica of the glass, acting with greater or less effect according to its strength and temperature. If this be borne in mind many troubles will be avoided, numerous cases of ineradicable stains having been traced to overlong soaking in alkaline solutions. If proof were needed of the solvent and injurious powers of small quantities of water, if continued for a sufficient length of time, it will be only necessary to breathe upon one half of a piece of patent plate glass, and, after immediately covering the film of condensed moisture by another plate to wrap up the two, place in a cold place for a twelvemonth, and then examine. The moistened part will be roughened to such an extent as almost to take the mark of a blacklead pencil. We have seen packets of several gross of plates entirely ruined from this cause; glass plates brought up of a cold store room into a damp atmosphere had condensed the moisture of the air upon their surfaces, and the packer had packed them without wiping them, as, indeed, it was scarcely likely he would think of doing. They remained immersed for a considerable time, and when opened were found to have the surface visibly eaten into, not a glass remaining that was fit for use; and there cannot be a doubt that there must be large quantities of glass similarly injured, though, unfortunately, not visibly so, the mischief only being observed after taking the negative.

Again: if further proof were required of the solubility of glass—that is, its decomposition, which must result in disintegration and thus roughen the surface, if even microscopically, and render it liable to retain foreign matter—it would be found by boiling in a Bohemian glass vessel a weak alkaline solution in which litmus had been dissolved and acid afterwards added to produce a faint reddening. The result would be that sufficient alkali would be dissolved out of the glass to restore the blue color to the litmus. This same experiment can be proved in a homely way by adding a little red cabbage to distilled water, and boiling in such a vessel, when the distinct blue of the alkali would be given to the water.

We think we have advanced sufficient facts to show that glass is by no means the unalterable substance so commonly supposed. If it induce a little more care in the use of this necessary photographic adjunct our purpose will be served.—*British Journal of Photography.*

Stove Blacking.

We hope the following receipt for imparting to stoves a fine black polish, which will neither burn off nor give out an offensive smell, will prove acceptable to some of our readers: Lamp-black is mixed with water-glass (a solution of silicate of soda) to the consistency of syrup and applied with a brush as a thin and even coating, then left twenty-four hours to dry. Afterwards graphite, or black lead mixed with gum water, is applied, and a polish obtained by rubbing in the usual manner.

A CEMENT for meerschaum can be made of quicklime mixed to a thick cream with the white of an egg. This cement will also unite glass or china.

Inventions Patented in England by Americans.

June 15 to June 21, 1877, inclusive.

BOOT SEWING MACHINE.—G. V. Sheffield *et al.*, Brooklyn, N. Y.
CHECK REGISTER.—L. Von Hoven, New York city.
CUTTING SHEET METAL.—G. A. Perkins, Philadelphia, Pa.
INDICATOR FOR CAB FARES.—L. Von Hoven *et al.*, New York city.
IRONING MACHINE.—T. S. Niles *et al.*, Troy, N. Y.
METAL TUBES.—J. E. Folk, Brooklyn, N. Y.
NEEDLES.—S. Peberdy *et al.*, Philadelphia, Pa.
RIVETING MACHINES.—J. F. Allen, New York city.
SCAFFOLD FRAME, ETC.—W. Murray, Vicksburg, Miss.
STEAM AND AIR ENGINE.—W. Mont Storm, New York city.
TORPEDO PROTECTION.—J. T. Parlour, Brooklyn, N. Y.
TOY.—C. W. Frost, Philadelphia, Pa.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

OIL PATENT.—JOSHUA MERRILL, APPELLANT, *vs.* DAVID M. YEOMANS AND DANIEL J. GOSS, AS D. M. YEOMANS & GOSS.

[Appeal from the Circuit Court of the United States for the District of Massachusetts.—Decided October Term, 1876.]

A patent for a process is not infringed by the sale of an article similar to that produced.

The claims in a patent are to be considered as distinct from the description contained in the specification, and as representing what part of the matter described the patentee claims as his invention, and for which he asks protection.

Inventions or discoveries are usually improvements upon some existing article, process, or machine, and are only useful in connection with it. It is necessary, therefore, for an applicant to describe that upon which he engrafts his invention, as well as the invention itself.

When the invention is of a new combination of old devices, it is necessary to describe with particularity all the old devices, and then the new mode of combining them.

While it is essential that the specification should describe such matters, both old and new, as are necessary to an understanding of the invention, the claim must contain a distinct and specific statement of what the applicant claims to be new and of his invention.

One who proposes to secure a monopoly of certain inventions at the expense of the public should set forth with clearness and precision the thing which no one but himself can use or enjoy without paying him for the privilege of doing so.

In a claim to "the above described new manufacture of the deodorized heavy hydrocarbon oils suitable for lubricating and other purposes, free from the characteristic odors of hydrocarbon oils, and having a slight smell like fatty oil, from hydrocarbon oils, by treating them substantially as is hereinbefore described," the word "manufacture" may be used to express the process or the product thereof, but when taken in connection with the words "by treating them substantially as is hereinbefore described," it renders the claim in effect to the new mode of manufacturing hydrocarbon oils by treating them as hereinbefore described.

The inventor of an article is entitled to protection therefor, however produced, and there is no reason why an applicant for a patent, if he had in his mind a claim for the article produced, should limit his claim by a description of the process.

The courts are inclined to give a patentee the benefit of a liberal construction of the patent, and when it appears that a valuable invention has really been made, to uphold that which was invented, and which comes within any fair interpretation of the claim; but when there are three inventions described, and but two claims made, each of which is valid and for the invention described therein, the court cannot give effect to the third invention, which the patentee has failed to claim.

The developed and improved condition of the patent law, and of the principles which govern the exclusive rights conferred by it, leaves no excuse for ambiguous language or vague descriptions. The public should not be deprived of rights supposed to belong to it without being told what it is that limits these rights.

The interests of the public demand that the claims in a patent should clearly and distinctly define and limit the actual invention claimed by and secured to the patentee.

Mr. Justice MILLER delivered the opinion of the court:

The appellant in this case, who was complainant in the Circuit Court, obtained a patent, in May, 1869, for a new and useful invention, which relates to the heavy hydrocarbon oils, and he sued the appellees, who were defendants in that court, for an infringement of his patent.

The defendants were dealers in oils and not manufacturers of them. If the appellant's patent was for a new oil, the product of a mode of treating the oils of that character which he describes in his application, the defendants may be liable, for they bought and sold, without license or other authority from him, an oil which is proved to be almost if not quite identical with the one which he produced. If, however, appellant's patent is only for the mode of treating these oils invented and described by him—in other words, for his new process of making this new article of hydrocarbon oil—then it is clear the defendants have not infringed the patent, because they never used that process, or any other, for they manufactured none of the oils which they bought and sold.

The counsel for appellant here maintain that his patent is for the new article, and is not for the process, though he describes it fully, by which that article is produced. The appellees insist with equal earnestness that the patent is exclusively for the process by which the new oil is made.

The issue thus presented must be decided solely upon a correct construction of the plaintiff's patent, and the accompanying specifications, in which, as required by the act of Congress, he makes the statement of his invention.

No such question could have arisen if appellant had used language which clearly and distinctly points out what it is that he claims in his invention.

We use the word claim as distinct from description. It must be conceded that the appellant's specification describes with minuteness and precision both the instrumentality and the process by which he makes the oil in question. And in regard to a part of the apparatus which he uses he makes a distinct claim for its invention, and that is not in dispute here. He also describes with fullness and accuracy the process of distillation by which he produces this oil. He gives the temperature to be used, the mode of heating, the degree of rapidity or delay to be used in distilling the introduction, and the advantage of that introduction, of superheated steam into contact with the oils to be distilled during the process.

He also describes, though in short terms, the article produced, the main feature of which he declares to be its freedom from the offensive odor which, before his invention, seemed to be an inseparable quality of those oils; and he mentions some of the more important uses to which this deodorized oil is applicable in the arts.

It is fairly to be inferred from this statement that if all which is described as new in these specifications is really so, the inventor has a right to a patent for three inventions:

1. For a modification or improvement in the distilling apparatus.
2. For a new process or mode of distilling heavy hydrocarbon oils, by which they are deprived of their offensive odors.
3. For the product of this new process of distillation, namely, the deodorized heavy hydrocarbon oils fitted for use in the arts.

When a man supposes he has made an invention, or discovery useful in the arts, and therefore the proper subject of a patent, it is nine times out of ten an improvement on some existing article, process, or machine, and is only useful in connection with it. It is necessary, therefore, for him in his application to the Patent Office to describe that upon which he engrafts his invention, as well as the invention itself, and in cases where the invention is a new combination of old devices he is bound to describe with particularity all these old devices, and then the new mode of combining them, for which he desires a patent. It thus occurs that in every application for a patent the descriptive part is necessarily largely occupied with what is not new, in order to an understanding of what is new.

The act of Congress, therefore, very wisely requires of the applicant a distinct and specific statement of what he claims to be new and to be his invention. In practice, this allegation of the distinct matters for which he claims a patent comes at the close of the schedule or specification, and is often accompanied by a disclaimer of any title to certain matters before described, in order to prevent conflicts with pre-existing patents.

This distinct and formal claim is, therefore, of primary importance in the effort to ascertain precisely what it is that is patented to the appellant in this case.

In this part of his application he makes two separate claims, the second of which relates to a modification of the distilling apparatus, and is not in dispute here. Turning our attention to the first claim, we are compelled to say that the language is far from possessing that precision and clearness of statement with which one who proposes to secure a monopoly at the expense of the public ought to describe the thing which no one but himself can use or enjoy without paying him for the privilege of doing so. It is as follows:

I claim the above described new manufacture of the deodorized heavy hydrocarbon oils suitable for lubricating and other purposes, free from the characteristic odors of hydrocarbon oils, and having a slight smell like fatty oil, from hydrocarbon oils, by treating them substantially as is hereinbefore described.

The word manufacture in this sentence is one which is used with equal propriety to express the process of making an article, or the article so made. "The manufacture of hydrocarbon oils," means primarily the making of hydrocarbon oils. It may mean the thing made also. Are there other words in the sentence calculated to throw light on the meaning of this one?

I claim the above described new manufacture of hydrocarbon oils * * by treating them substantially as hereinbefore described.

It seems to us that the most natural meaning of these words is that—

I claim this new mode of manufacturing hydrocarbon oils by treating them as hereinbefore described.

This is the meaning which would first suggest itself to the mind. If the product is meant, the "by treating them substantially as hereinbefore described" are useless. They are not only useless, but embarrassing, for by the well settled rules of construing all instruments some importance must be attached to them; and if they are to be regarded at all they must either refer to the process of making the oils for which the applicant is claiming a patent, or they are intended to limit his claim for a patent for the product to that product only, when produced by treating the oils in the manner before described.

The counsel for appellant disclaim this latter construction, and allege that the patent covers the oil described, by whatever mode it may be produced. It is necessary to insist on this view, because it is made to appear in the case that the oils sold by defendants were produced by a process very different from that described by appellant.

We can see no reason why the applicant for the patent, if he had in his mind a claim for the article produced, should have intended so to limit his claim. If the *article* was the discovery which he sought the exclusive right to make, use, and sell, he was entitled to that monopoly, however produced.

If, however, he had in his own mind only a claim for the process of manufacture by which the article was made, then his reference to the mode of treating the oils from which it came was evidently proper and intelligible.

But the language in the specifications aids us in construing the claim. In the sentence next preceding this claim he says:

It will also be evident to those skilled in the art that *my invention* will be used, if the above mentioned process be worked, to produce the deodorized heavy oils above described from distilled hydrocarbon oils, etc.

It is very clear that what he here calls his *invention* is a thing which produces the deodorized oils, and not the oil itself. So, again, he says:

From the above it will be obvious that my invention consists *in producing* heavy hydrocarbon oils suitable for lubricating and other purposes, and free from the characteristic odor, *by distilling from them the volatile matter from which objectionable odors arise.*

Again, he says:

In carrying on my new manufacture of deodorizing heavy oils with this apparatus, I place the oil to be deodorized in the still and heat it by the fire beneath to the required temperature to commence the operation, the steam being shut off from the coil, and the outlet cock being opened to admit of the expulsion of any water from within the coil.

Here the word "manufacture" is used in the sense of the word "process," a word which could be substituted for it without a shade of change in the meaning. As it can here mean nothing else but process, we have a definition of the meaning to be attached to it in other parts of the same paper, if that meaning were otherwise doubtful.

But apart from these verbal criticisms, all of which are just, and tend strongly to show what was the invention claimed by appellant, it is impossible to read the four printed pages of specifications in which appellant minutely describes his invention without observing that they are almost wholly directed to the apparatus, the mode of using it, and the peculiar process of distillation, by which the more volatile parts of the heavy oils, which contain the offensive odors, are separated from the main body of the oil, pass over in that process, and leave the remainder free from this great drawback in its use in the arts. Why should this be so if the applicant for the patent was only looking to the products as his invention the deodorized heavy hydrocarbon oils? If the oil alone was to be patented, by whatever process made, this elaborate description of one particular process was unnecessary.

A strong appeal is made by counsel to give the appellant the benefit of a liberal construction in support of the patent. Cases are cited in which this court has held that rather than defeat a patent where it appears that a valuable invention has really been made, this court, giving full effect to all that is found in the application on which the Patent Office acted, will uphold that which was really invented, and which comes within any fair interpretation of the patentee's assertion or claim.

We are not disposed to depart from this rule in the present case. There is no question here but that the patent is good for the second claim, for the superheating coil, with its steam pipe, etc. And we are all of opinion that it is good for the process of distillation described in the specifications, by which the heavy hydrocarbon oils are deodorized. It is, therefore, a valid patent for two important matters well set forth and described. If the patentee is also entitled to a patent for the product of this distillation, and has failed, as we think he has, to obtain it, the law affords him a remedy by a surrender and reissue. When this is done the world will have fair notice of what he claims—of what his patent covers, and must govern themselves accordingly.

The growth of the patent system in the last quarter of a century in this country has reached a stage in its progress where the variety and magnitude of the interests involved require accuracy, precision, and care in the preparation of all the papers on which the patent is founded. It is no longer a scarcely recognized principle struggling for a foothold, but it is an organized system with well settled rules, supporting itself at once by its utility, and by the wealth which it creates and commands. The developed and improved condition of the patent law, and of the principles which govern the exclusive rights conferred by it, leave no excuse for ambiguous language or vague descriptions. The public should not be deprived of rights supposed to belong to it without being clearly told what it is that limits these rights. The genius of the inventor constantly making improvements in existing patents, a process which gives to the patent system its greatest value, should not be restrained by vague and indefinite descriptions of claims in existing patents from the salutary and necessary right of improving on that which has already been invented. It seems to us that nothing can be more just and fair, both to the patentee and to the public, than that the former should understand and correctly describe just what he has invented, and for what he claims a patent.

In consistency with these views, we are of opinion that the appellant in this case has described and claimed a patent for the process of deodorizing the heavy hydrocarbon oils, and that he has not claimed as his invention the product of that process.

The judgment of the Circuit Court is affirmed.

Mr. Justice Clifford dissenting.

I dissent from the opinion and judgment in this case upon the ground that the invention, when the claim is properly construed, is an invention of the described new manufacture, and not merely for the process as decided by a majority of the court.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED PISTON.

Robert M. Beck, Westminster, Md.—This invention is an improvement in steam pistons, and it consists in combining an expansible ring with two disks having beveled edges, which expansible ring is made continuous and entire without split or joint from a composition of metals, and when the beveled disks are adjusted together by means of a screw nut, is by reason of its soft character swayed or expanded so as to increase the diameter of the piston and compensate for wear, and which disks are provided respectively with a bar and a recess to guide the parts, and have between the same washers to limit the adjustment.

IMPROVED BREECH-LOADING FIREARM.

Victor Bovy, New York city.—This invention is to provide an improved breech-loading shotgun, in which the barrels may be readily removed from the breech piece and the different parts of the mechanism be taken apart and put together with great facility, without the use of screws, and without requiring tools to disconnect or replace the parts, which gun may be readily repaired and any injury ascertained. The invention consists of a breech-loading shotgun, operated by a lever that throws a bolt and locks thereby the hinged barrels to the breech piece, pushing the center firing pins backward on releasing the bolt. A fixed elbow piece of the frame operates the extractor and serves in connection with a recessed lug of the barrels to attach firmly the detachable forestock in position.

IMPROVED CAR BRAKE.

Edward Spencer Jones, Pulaski, Tenn.—This improved brake, for railroad cars of all kinds, may be operated by hand or steam power, so as to check the speed and stop the train in a quick and reliable manner; and the invention consists of brake shoes which are applied by pivoted lever arms to a crosspiece that is raised or lowered by a screw bolt and nut and suitable gearing, either by an endless chain connection with the locomotive, or by shaft and gear connection with a hand wheel at end of car. A suitable lever arrangement throws the brake mechanism either into gear with the handwheel or with the gear worked from the locomotive.

IMPROVED TOBACCO-HOISTING APPARATUS.

Clifton H. Slaton, Slaughterville, Ky.—The object of this device is to hoist tobacco up in a barn, and also to take it down, with great facility, the apparatus being worked by one man that stands on the floor and hoists, while another brings the tobacco from the wagon and places it on the hoister, they saving thus the work of other hands, and attending to the hoistering or lowering without climbing up and down in the barn. It consists of a top crossbar supported upon the top beams of the barn, and having a jointed upright suspended therefrom, with a crosspiece having hooks for supporting the stick of tobacco. The crosspiece is attached to a sliding box or carriage and hoisted by a rope applied thereto and passing over a top and bottom pulley of the upright.

IMPROVED BEARING AND BOX FOR VERTICAL SHAFT.

Levi Webber, North Vassalborough, Me.—This is an improved bearing and box for the shafts of waterwheels and other vertical shafts that support great weights, to prevent the steps from wearing or burning out so quickly. It consists in the combination of the box, made in two parts bolted together, provided with the lugs or flanges, the inner rim, the chambers to receive Babbitt metal, the outer rim, the oil chamber, and the oil channels, and the bearing, made in two parts, bolted together, and provided with set screws and a countersink, with each other, to adapt them to be connected with a vertical shaft to support its weight.

IMPROVED TRIGGER FOR FIREARMS.

Max Heuser, New York city, assignor to himself, Emil Welte, and Carlo Otto, Jr.—This invention consists in the combination, with a trigger, of a wheel, having arranged on its periphery oppositely arranged cam lugs and a tripping arm that is pivoted in the trigger, and carries two spring tappets that are engaged by the cam lugs of the wheel, so as to shift the tripping arm from one dog of the gunlock to the other as the trigger is worked. The trigger is provided with the usual spring for returning it to its normal position after it is pulled, and the device is connected with an ordinary double lock of a double barreled gun. By changing the relation of the cam lugs, the same device may be applied to guns having three or more barrels, or to revolvers or pistols.

IMPROVED NUT LOCK.

Samuel Caldwell, Greenfield, O.—In this invention, the head of a fastening bolt is recessed at one or more sides, and is provided with a washer having one or more upturned flanges as well as the nut. The washers are turned up at one or more sides, and extended over the top and bottom of the fishplate, so as to be tightly retained between the same and the head and base of the rail. The washers may also be extended back of the fishplate and turned over in front of the same, bearing on opposite sides of the nut, or the washer may be extended downward under the base of the rail, to produce the rigid position of the washer, and impart a double support or rest to the bolt and nut, which enables them to resist more effectually the vibration of the rails without any chance for friction and wear by turning or of getting loose.

IMPROVED EXPANDING ROCK DRILL.

Wellington R. Burt, East Saginaw, Mich.—This is an improved tool or drill for the purpose of enlarging the lower part of salt, oil, and artesian wells without enlarging the top of the same; and it consists of hinged and wedge-shaped expanding arms that are spread or closed by a wedge-shaped slide piece and operating screw shaft passing through the same, and turning in the head of socket of the expanding arms. By moving the wedge piece down, the arms are spread outwardly, so as to pass against the surrounding walls of the well and expand the same to some extent, obtaining thereby a larger sized hole than at the upper part of the well. By turning the screw shaft in opposite directions, the wedge piece is moved up and the arms are brought closer to each other, to be drawn up again through the bore hole.

IMPROVED WEIGHT MOTOR.

John M. Cayce, Franklin, Tenn.—The general principle of this invention rests in the transfer of a weight from one side of a pivoted frame to the other, and the utilization of the consequent rocking movement of the frame to communicate a rotary motion to a flywheel through a ratchet and pawl mechanism. The improvement consists mainly in arranging two weighted levers in a frame and gearing their inner ends together by cog-wheels, so that when the two weights are to be transferred from one side of the pivoted frame to the other, they move in opposite directions and describe upper and lower semicircles. The merit of this arrangement is that while the two weights co-operate with each other and impart to the frame their aggregate motive value for the given portion of their effective stroke, they also counterbalance each other while being shifted from one side to the other of the pivoted frame, so that a much less power is required to effect said transfer than is represented by the actual weight of the levers.

IMPROVED SAND PUMP.

William H. Birge, Franklin, Pa.—This invention consists in the arrangement of a sliding valve in the lower end of a sand pump, which is opened by the weight of the pump and closed by a spring. It also consists in the arrangement of an air valve in the top of the sand pump, which is closed by the water through which it passes, which acts on the fan-shaped end of the valve lever, and is opened by the weight of the fan-shaped end of the lever, and by the upward pressure of air created by the entrance of water in the sand pump. The object is to provide a valve which will open and close with a positive motion, not depending on the action of the water or sand.

IMPROVED WIRE SCREW AND NUT.

John T. Bruen, Brooklyn, N. Y.—To make the screw, two, three, or any number of wires desired are taken, and, by means of suitable tools, twisted together, so as to form a screw of even pitch, and the wires are fastened together at their ends by means of solder or otherwise. They may also be soldered together throughout their entire length, if desired. To form a nut for the screw just described, a thimble or section of pipe that will fit loosely over the screw is taken, and in it are formed slots corresponding in number and direction with the grooves between the wires of the screw, and in these slots are placed wires which extend through the sides of the thimble, which may be either straight or slightly curved, and set the metal of the thimble down around the wire to hold it firm in its slot, allowing it to project inwardly sufficiently to engage the threads of the screw.

NEW TEXTILE INVENTIONS.

IMPROVED LOOM TEMPLE.

James E. Waterbury, of Rensselaerville, N. Y.—This invention consists of a temple for weaving tubular goods, which is held in its position in the tube by means of rollers that act through the substance of the tube in supporting and moving it. The object of the invention is to prevent the contraction of the tube by drawing the filling, and also to prevent hard longitudinal streaks in the goods.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED BENCH PLANE.

Watson Wood, Chelsea, Mass.—This invention has reference to an oiling attachment to iron or iron-faced planes, by which the objectionable sticking or friction of the same on wood is obviated; and it consists of an iron or iron-faced plane, having an oil receptacle and feed device in front of the cutting iron. A small hole is drilled through the face of the plane in front of the cutting iron and in the center of the face. This hole is connected either by a small tube or directly with an oil receptacle that may be either cast on the plane inside of the knob, which is generally used as a handle, or otherwise attached to the same. The oil receptacle is closed by a knob that is secured or otherwise applied in an airtight manner thereto. A wick or piece of soft leather is arranged at the inside of the receptacle and in the feed hole, so as to prevent the oil from being fed too fast on the face of the plane. The wick or other device admits only the escape of a quantity of oil sufficient to allow the iron-faced plane to run smoothly and easily over the wood, giving the iron face sufficient lubrication to destroy the friction or sticking of the same on the wood without greasing the work or the hands of the person using the plane.

IMPROVED CAR STARTER.

John Marsden, Chester, Pa.—This invention is designed chiefly for horse-cars. Doubletrees are hitched to the drawbar in the usual way, and when the car stops the drawbar is drawn in by the action of a spring—link, pawl, and levers moving back with it. A shoulder on the pawl strikes a knee and throws it up out of the notches of the ratchet wheels, so that the pawl offers no impediment to the motion of the car in either direction. When the horses start, the first outward motion of the drawbar releases the pawl from the knee, when it drops into a notch in the ratchet wheel, and the further drawing of the horses results in starting the car by turning the axle and wheels. This action continues until the head on the drawbar formed by the joint strikes the guide, when the further pulling of the horses draws the car ahead in the usual way.

IMPROVED WAGON BRAKE.

James M. O'Neall, Fort Worth, Texas.—This brake is designed to be attached to the under side of a buggy or wagon body, in such manner that it may be operated by the foot of the driver applied to the bent arm of a lever projecting up through a slot in the bed or floor. The said lever has a sector-shaped toothed portion which meshes with a toothed sliding rack bar that is immediately connected with and operates the brake levers proper.

IMPROVED WHIP SOCKET.

James Lowth, Chicago, Ill.—This invention relates to an improvement in that class of whip sockets which are provided with a hinged jaw for clamping a whip. The novelty consists in making the hinged front jaw with a rigid extension, and providing the latter with a perforated lug, through which the bow of a padlock is passed to lock the jaw and secure the whip in the socket. The invention further consists in slotting the back of socket to provide for the operation of the hinged jaw and its rigid extension.

NEW AGRICULTURAL INVENTIONS.

IMPROVED SORGHUM MILL.

Edward A. Withers, Marietta, Ga.—This improvement pertains to the construction of the frame of the mill, and the manner of connecting the crushing rolls therewith, the object being to effect the utmost economy in dimensions, weight, and cost of the frame, and to enable the rollers to be adjusted, applied, and removed with the greatest facility.

IMPROVED HARROW.

Samuel J. Franklin, Fair Mount, Ga.—This invention consists in the peculiar construction and arrangement of teeth in a frame to form a harrow, the said teeth being made in the form of blades with a hooked upper end, which blades fit into slits in the frame, and when deflected to an angle of about 45° are securely held in said frame by means of their hooks, without the use of pin, screws, bolts, keys, or other devices for securing them.

IMPROVED CORN PLANTER.

John O. Bennett, Urbana, O.—In this machine the seed cut-off brush is held and adjusted vertically by a peculiar device; the discharge of seed from the spouts is controlled by centrally pivoted vibrating plates operating as valves, and connected in pairs by means of a rod; the foot of the seed spouts is so shaped and so connected with a curved runner, or sod cutter, which goes in advance, that it will lift and pulverize the soil better than the ordinary form of furrow opener.

IMPROVED PLOW COLTER.

Charles R. Thompson, Lebanon, Ky.—The object of this invention is to furnish colters which shall be so constructed as to cut the sod into narrow strips, separate it from the soil beneath it, and leave it in its place, so that it will be turned under with the furrow slice. It consists in the combination of two or more colters, provided with horizontal triangular cutters at their lower ends with the same beam.

IMPROVED FENCE.

Robert F. Ward, Senatobia, Miss.—The object of this invention is to improve the construction of the fence for which letters patent No. 143,478 were granted to the same inventor October 7, 1873, so as to secure the rails in place more firmly, keep them from being moved upward, and give additional support and strength to the fence. It consists in the notches or shoulders formed in the lower edges of the inclined strips to receive the upper edges of the filling rails, to keep the said rails in place, and in the upright strips attached to the inclined strips at the outer side of the filling rails.

IMPROVED FENCE.

Robert F. Ward, Senatobia, Miss.—This is a straight braced fence, so constructed that it can be laid rapidly and with a great saving of lumber over the old crooked fence, and so that it will stand erect and steady against strong currents of wind and water, and against unruly stock, and which is not liable to be disarranged. It consists in the combination of the filling-in rails having their ends laid upon the opposite sides of the adjacent posts, and overlapping each other, and the stakes driven into the ground at the opposite sides of the ends of the filling-in rails from the posts, and having their upper ends nailed to t.e inclined braces with the posts, the lower riders, the inclined braces, and the upper riders.

IMPROVED MACHINE FOR PRESSING CORNSTALKS, ETC., FOR FUEL.

Edgar P. Davis, James E. Davis, and John J. Fisk, Crete, Neb.—This is an improved machine for pressing cornstalks, hay, weeds, and other light material into bundles for fuel, which enables the material to be easily and quickly pressed into compact bundles. When the material has been compressed, bands are fastened around it in such positions as to be in the centers of the lengths or sections when sawed apart. The bands are each formed of two pieces of wire jointed to each other at one end, and having hooks and eyes formed upon them at the other ends—several eyes being formed in the said wires so that the same band may be used for binding different sized bundles. The eyes are formed in the band by forming small coils in the wire.

NEW HOUSEHOLD INVENTIONS.

IMPROVED DESK.

James R. Richardson, Majority Point, Ill.—This invention consists in the arrangement of movable sections in the top of the desk, which are raised or lowered by means of racks and toothed sectors, to accommodate the desk to books of different thickness, and to adjust it to different heights to suit different persons. Movable portions of the top of the desk are guided in slots at the sides of the opening in which they are placed. Racks are attached centrally to the movable portions of the desk top, and are guided by crossbars that extend across the under portion of the desk top. Toothed sectors mesh into the racks, and are secured to the inner ends of shafts which are journaled in the end rails of the desk, and in hangers that are attached to the crossbars. To the ends of the shafts cranks are attached carrying lock levers that engage the notched plates at the ends of the desk. By disengaging the lock levers and moving the cranks, parts of the desk top may be adjusted so as to accommodate the covers of a book that is opened at one side of its center. The two sides of the book thus supported present a level surface, which may be upon the same plane as the top of the desk, or above it, as circumstances may require.

IMPROVED VEGETABLE SLICER AND GRATER.

John P. Dunwald, New York city.—By this invention potatoes, beets, radishes, and other vegetables may be sliced in rapid manner, and horse-radish, nutmegs, and other articles may be grated with facility. It consists of a feed hopper and follower arranged in connection with a horizontally revolving tubular slicer or grater, composed of a detachable head, body, and interior clamping ring plate.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED GAME AND CARTRIDGE BELT.

Andrew A. Case and Elwin W. Bedell, Chetopah, Kan.—This consists of a belt hung from the shoulders by suitable straps and encircling the waist, and provided with hooks for carrying game, and with a flap having pockets for carrying cartridges.

IMPROVED FOLDING CRATE.

Gilbert Robinson, Jr., New York city.—The object of this invention is to furnish packing boxes so constructed as to be conveniently taken apart and packed together in small compass for reshipment, so as to save to the shipper the cost of making new boxes every time he has to ship goods. It consists in an improved packing box formed by the combination of top and bottom boards, side boards, end boards, angular strips, spring catches, strap hooks, and lugs.

IMPROVED METALLIC SEAL.

Frank A. Ferris, New York city.—This invention consists of two semi-sections or shells of corresponding shape, having recesses for the strings on the inner sides, facing each other, and being attached by studs of one section passing through perforations of the other section, which studs are then spread or flattened to connect the sections. The semisections or shells, of round, oval, or any other suitable shape, are cast, pressed, or stamped of lead or any other metal. They are provided with recesses for the strings at their inner sides, the exterior sides being, one or both, cast or stamped with the name of the firm, corporation, or person employing the seal. The shells may be made with extension lugs or ears, of which those of one shell carry studs or pins that pass through corresponding holes of the ears of the other shell. The studs and perforations may, however, be arranged in the body of the sections near the circumference, but at diametrically opposite points, and at right angles, or nearly so, to the direction of the strings to which the seals are applied. When the seals are to be fastened to the strings, the sections are to be placed at both sides of the same, so that the strings are seated in the recesses of the shells, the studs of one section being passed through the perforations of the other sections, and then compressed, by pinchers or other suitable implements, so that the ends of the studs spread and bind tightly on the perforated section. The seal sections are thus united in an instant in a very convenient manner, and are attached tightly to each other, and either tightly or loosely to the strings, as required.

IMPROVED STOPPER ATTACHMENT.

Barnard Arnold, Foster Centre, R. I.—This invention consists in making from wire a screw or spiral terminating at one end in a point and at the other end in a ring, and is screwed into the stopper and attached to an elastic band which surrounds the neck, the object being to provide a device by means of which the stopper may readily be extracted, and by which it is supported when out of the bottle, so that it does not come into contact with the bottle, and is not liable to become lost.

IMPROVED LETTER FILES.

Paren England, Lincoln, Neb.—This invention consists, first, in the particular arrangement of a clasp with respect to the backs of the file, which clasp is made in the form of the lazy-tongs, and is adjusted by means of a thumb screw that causes the bars of the lazy-tongs to be held rigidly together and at the same time forms a pivot for said bars. The second feature of the invention consists in giving to the hinged or back portion of the file an expansibility to correspond to the adjustment of the clasp, which is effected by means of metal tubes and an elastic spring arranged in the said tubes and passing through the indexed pages of the file.

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.

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Reliable information given on all subjects relating to Mechanics, Hydraulics, Pneumatics, Steam Engines, and Boilers, by A. F. Nagle, M.E., Providence, R. I.

Notes & Queries

F. B. N., who asks about the carpet-eating bug, see p. 307, vol. 35.—C. A. D. will find the answer to his query in any work on Natural Philosophy.—P. H. H. had better consult his family physician.—C. H. McK. will find full information about suction pumps in No. 20, first series of "Practical Mechanism."—A. K. Q. can ascertain how high the water will rise by survey. He does not state how much fall there is in the distance he mentions.—T. M. is informed that he will find the description and cut of the electric candle in vol. 36, No. 22. The candles are not made in this country.—O. H. Y. had better correspond with makers of band saw machinery.—Novice, London, Canada.—You can lay your tiles upon a floor of cement.—J. V. C. and H. B. are referred to "Smee's Electro Metallurgy."—J. H. S.—We know nothing of the instrument you mention.—J. L. G. is referred to his family physician.—W. H. P. had better insert a notice in the "Business and Personal" column for information concerning the market for mohair.—M. M. M. does not tell us how large a cylinder he wishes to cast. If small, brass or Babbitt metal would answer.—P. C. is informed that his article is too vague for publication.—Chemist is informed that we know nothing of the compound mentioned.—J. S.—You are probably correct. The tree protects the building from being struck by lightning.—J. V. E.—The powder you refer to is not yet manufactured in this country.

(1) W. G. S. says: I have among my photo-chemicals a bottle with the mark *Essence Grasse*. Can you tell me what it is, and what it is used for? A. We do not know of any reagent so called. The title refers to a thick, fatty oil or liquid.

(2) J. E. is informed that the vacuo method of filtration is entirely feasible; but where large bodies of water are to be filtered, as for the supply of cities, it has the objection of being very expensive, from the extra steam power required and the necessity of frequently changing the filtering materials. Besides this, water thus filtered is rendered unpalatable and unfit for immediate use by the removal of much of its dissolved gases, etc. For these reasons preference is generally given to the system of reservoirs, wherein the water is allowed to remain quiescent for a sufficient length of time to deposit most of the matter held in suspension, and admit of the more complete oxidation of such organic matter as it may contain by contact with the air.

(3) B. S. asks: Should boilers used only for heating be left with water in them during warm weather? A. No; the water should be drawn off in the spring.

(4) J. F. D. asks: Please give me a recipe for making a colored lime-wash, to be used as a substitute for paint for the exterior of a frame building. The color required is brown. A. Add to the lime-wash a strong solution of sulphate of magnesia, and color to suit with Vandyke brown.

(5) N. K. says: A favorite dog has put our family into possession of (in both senses) ten millions (estimated) of fleas. The dog has been given to a friend (with due warning, of course), but the dog's late companions are still with us in scarcely diminished numbers. Will you please say how we can best succeed in obtaining their room instead of their company. The dog was kept generally in the cellar, and the coal heap especially has "millions in it." A. Soap water; carbolic acid in dilute alcoholic solution; flowers of sulphur either used as a powder or mixed by agitation with water containing a little glycerin; dilute solutions of sulphate of magnesia—any powder or solution containing tannin, as dried sumac, tea, and Persian insect powder. These are the least objectionable exterminators. A little of the carbolic solution may be mixed in with the soap water, and this used as a wash, or sprinkled in infested localities. Flowers of sulphur contain sulphurous acid, which is fatal to the insect, but it must not be used on or near colored woolen fabrics, as it is liable to injure the colors. Sulphate of magnesia solution (in water) may be used as a wash. Sumac powder, etc., give excellent results. The sulphur mixture mentioned, or carbolic acid shaken up with about 20 parts of water, and sprinkled in the cellar, will soon depopulate the coal heap.

(6) An apprentice asks for the best method of laying tile pavement? A. If you have reference to tile laying upon floors, it is done by cutting in boards between the floor joists, and supporting them upon cleats nailed to the sides of the joists. A pavement of bricks in mortar is then laid upon the boards, finishing flush with the top of the joists. A bed of rich cement mortar is then spread over the whole, and the tiles carefully set in a thin grout upon the cement bed.

(7) D. W. Van B. asks: Can you inform me as to the time when the first movable steam fire engine was used? It is stated that a machine was used in Europe in 1851, and was used to supply hand engines. It was taken to the river and water forced through hose to the hand machines. Were steam engines used in this country prior to that time? A. Captain Ericsson built a steam fire engine at Braithwait shops about the year 1836.

(8) H. D. S. asks: Will a solution of chloride of zinc and sulphate of nickel, used for nickel plating iron and steel, serve for nickel plating brass or zinc. The process was described on p. 408, vol. 36. A. Not very well, unless the article is in contact with pieces of zinc, or, what is better, zinc powder, also immersed in the solution. Small pieces of brass work can be plated in this way.

(9) C. E. asks: How can I imitate silver gray in water colors? A. White tempered with a mixture of black and blue is commonly employed. Use flake white, ivory black, and Prussian blue.

(10) K. F. says: We use on our two horse cultivators a plow or plate that seems to be made of iron with a thin plate of steel welded or laid on the front, and made very hard. Our blacksmiths have difficulty in sharpening them. They sometimes crack when heating, and sometimes fly to pieces when put in the water after sharpening. Can you tell us how to manage them? A. Heat them to a low red heat, dip in water at 100° temperature and containing 1 lb. salt per gallon; dip edgeways, and hold quite still at the bottom of the water until cold. A depth of two inches of oil floating on the water would perhaps assist you.

(11) J. D. E. says: 1. I am making a plate electric machine, and have the plate already cut out. Do the edges need to be ground smooth? A. It is better to have them rounded. 2. Of what material should the rubbers for exciting the plate be made of? A. See (No. 9) p. 171, vol. 35. 3. Can you mention a good and short method for drilling a hole through plate glass? A. See Ans. No. 5, p. 186, vol. 36.

(12) D. M. F. says: I am using a small cast iron tank to contain kerosene. It has been japanned, but the oil works its way through the iron, notwithstanding the japan. Can you tell me what will stop this? A. Try a sizing of glue in acetic acid.

(13) H. L. L. says: I desire a cheap shelter for say 250 to 300 tons of hay or straw, and I wish to construct it at once. A. The usual graduated roof shelter will answer the purpose. This consists of a roof of thatch or shingles, pyramidal, on a strong frame, supported at each corner on stout pins, passed through holes in timber posts set well into the ground. The roof may be about 15 feet square, and the posts 20 feet high—these latter may have lateral braces or ties, extending diagonally across the square at the bottom. As the hay is removed from the top of the stack, the roof is lowered down and the pins shifted into lower holes, thus always affording a close shelter to the hay.

(14) S. H. asks: Is there any radiator or heater (steam) made which operates without the removal of the air from its interior? A. We do not know of any. It is essential to the success of a radiator that the dead air within it be displaced either by steam or water.

(15) J. A. B. asks: Can you give me a recipe for a cement to mend a broken marble slab? A. Take gum arabic 1 lb., make into a thick mucilage, add to it plaster of Paris 1½ lb., sifted quicklime 5 ozs. Mix well. Heat the marble and apply the mixture. You had better put supports under the slab.

(16) T. F. P. says: I have samples of the enamel which are used in enameling. How can I use them? A. Mix together equal parts of oxide of manganese, oxide of copper, and oxide of cobalt. Use a soft glass, and fuse enough of the mixture into it to give the desired depth of color; then grind this to a fine powder, and apply with water as a paste; after which dry and fuse. For white, fuse with the glass oxide of tin and antimony, as before. Alumina and oxide of lead may also be used.

(17) J. G. A. asks: Can you tell me where the difficulty is in launching a boat off a vessel at sea, and did the United States Government adopt any apparatus when they had the trial about two years ago? A. The difficulty lies in detaching the boat to keep it clear of the tackle when it strikes the water, for if one end detaches before the other, it is apt to swing from the detained end and turn over. We do not think that any boat detaching apparatus has been exclusively adopted by the United States Government, though several have been reported upon.

(18) E. E. L. asks: Is there anything that can be used in place of muriatic acid for soldering iron with soft solder? A. Sal ammoniac will answer.

(19) W. A. B. says: I recently saw a statement that the relative traction of a belt on a wooden or iron pulley was as 47 to 24. Now, is this a fact? Will a wooden pulley do twice the work of an iron one? If so, why? A. There is a difference in favor of wooden pulleys, but cannot state its amount.

(20) R. K. asks: 1. Can you give me a mixture of something that will stick a piece of lead in the centers of locomotive driving axles without burring them with a chisel, as doing so injures the centers. A. The lead will stick in of itself when well hammered in. 2. Is there any rule to get the throw of locomotive eccentrics, or can I find it in any book? A. See "Auchincloss" on the slide valve.

(21) W. T. asks: I would like to know what makes steel crack in hardening? A. Improper heating or dipping and taking the article out of the water too soon are the principal causes. Sometimes the steel is improperly forged, or overheated in forging. Much also depends on the shape of the article when finished.

(22) H. F. H. asks: What is the best preparation to put on a greenhouse floor of wood, so as to render it impervious to moisture and prevent it from warping and cracking? Also what is the preparation to paint hot water pipes in a greenhouse to prevent rust? A. Cover your floor with a thin layer of hydraulic lime or cement. Paint your pipes with a covering of asphaltum varnish, made by dissolving asphaltum in turpentine by a gentle heat.

(23) E. H. L. says: I am making a safe to keep valuable papers in, and wish to put in a filling that will make it fireproof. What is the best preparation for that purpose? A. The preparation usually employed for filling safes is calcined plaster of Paris mixed with water to the consistency of thick cream, and allowed to harden. It would be advisable to coat the surface that would come in contact with the wet filling with the asphaltum varnish recommended to H. F. H. This will prevent rusting the iron plates of the safe.

(24) F. M. says: Tobacco stalks or stems, as stripped from leaf tobacco by cigar makers, can be had very cheap in Cuba. Is there not some use or application for them, chemically or otherwise, beside the manufacture of snuff? A. We know of no extended use for such product.

(25) W. G. F. says: Please tell me how to braze with brass and use hard and silver solder with blowpipe? A. To braze with hard or silver solder, file the metal clean and smooth where the intended union is to be, bring them in close contact, apply the solder in small pieces and fuse, using borax as a flux. 2. How can I restore temper to spring steel when once drawn or heated? A. To restore the temper of steel, it must be hardened and then drawn to the requisite spring temper.

(26) D. L. asks: Can I ignite gunpowder by using a galvanic battery? A. If a fine platinum wire be interposed between the wires that are connected with the poles of the battery, it will be heated sufficient to ignite gunpowder.

(27) W. R. asks: How can I make a good branding ink for branding bagging—such as is used for baleing cotton? I have been using an ink made from lampblack and kerosene, but this blurs very badly and gives our bagging a dirty appearance. A. Try common bootblacking. Dampen your brush with water to use it. If there is acid in the blacking it will eventually injure your brass stencil plates.

(28) O. P., of Kosloff, Russia, asks: How can I color polished steel a dark blue? A. See reply to B. T., in this number.

(29) W. T., of Montreal, is informed that the address of the publishers of the work on Gravestones is A. T. Bickwell & Co., 27 Warren street, New York city.

(30) W. H. C. says: Perhaps the following mode of fluting reamers, cutters, taps, etc., may be new and useful to some mechanics, especially those that possess a lathe with slide rest. I leave a work to be fluted in lathe centers, and with tool of the desired shape of flute fastened in the tool post, work the slide rest back and forth, feeding the tool in to the required depth. Mine is a back geared screw cutting lathe, and I have very satisfactorily and with dispatch fluted reamers, etc. A snap catch fitting tooth of back gear holds the work while cutting. The gear also acts as index wheels which can be divided into 4ths, 8ths, 10ths, 16ths, etc. The heads of lathes that are not back geared can easily be divided up for all ordinary work.

(31) C. F. makes inquiry about seasoning lumber, and is answered that the most successful builders, piano manufacturers, etc., generally season their lumber in the natural way, by stacking it in their yards for two years or more, which in the majority of instances is the most satisfactory in the end. There are cases where water soaking is adopted to drive out the sap. The logs are left in the water for six months, then taken out and sawed into boards, and the latter stacked up to dry. In this case, it is claimed, the water rapidly dries out and takes the sap with it.

(32) F. M. says: Can you give me any cheap method for renovating tarnished gilt frames? Any color or material will do, provided it is simple and cheap. A. The cheapest is to cover the surface to be gilded with oil size thinned with spirits of turpentine. Gold, in powder, is then gently dabbed in with a little pod of soft leather. The work can be varnished.

(33) C. E. L. asks: What can I mix with asbestos that will make it as pliable as leather after it is pressed in any form? A. Try mixing it with rubber and then vulcanize.

(34) F. L. asks: Can you inform me how to tin small cast iron articles? A. Immerse the articles in a bath of sulphuric acid for a time sufficient to obtain a bright surface, then dip in muriate of zinc, remove and plunge in a bath of melted tin.

(35) J. R. asks: What is the number of locomotives built in the United States that have been shipped to Russia? A. We cannot ascertain.

(36) J. Y. asks: Please give me a recipe for making a good black ink that will copy? A. Add sugar 1 oz. to 1½ pint of good common writing ink.

(37) J. K.—A brass founder will give you the information relative to gongs. Oil can be colored by putting alkanet root into it.

(38) J. B. asks: What can I use to keep patterns from sticking in plaster of Paris moulds? A. If the patterns are so made that they have a sufficient draught, coat them with thin shellac varnish.

(39) H. Y. C. asks: Where do the oyster and other shellfish get the lime from which to make their shells? A. The lime salts are held in solution in the water, and derived from it by the animals.

(40) H. K. asks: Can you give me a recipe for straightening amber mouthpieces? A. Heated oil will soften amber and make it pliable. To melt it requires a heat of 517° Fah.

(41) W. E. T. says: Having seen a notice of Professor F. Sacc's (Neufchatel, Switzerland) process for curing meat by submitting it to the action of acetate of soda, I should like to know the *modus operandi*. A. The mode of operation is very simple. Arrange the meat in a barrel, deposit about and on it powdered acetate of soda to about the quarter of the weight of the meat. In summer the action takes place immediately; in winter it is necessary to place the vessels in a room warmed to about 68° Fah. The salt absorbs the water of the meat; after 24 hours the pieces are turned, and the lower placed uppermost. In 48 hours the action is finished, and the pieces are packed in barrels with their brine, or dry in the air. If the barrels are not full, it suffices to fill up with the brine made by dissolving one part (by weight) of the acetate of soda in 3 parts of water. The pieces may be of ordinary size, and when required for use may be freed from the salt by washing in running water. The dry acetate of soda may be recovered from the brine by evaporating off the water over a fire.

(42) G. M. C. asks: How can I color buck and goat skins black? A. Soft water, 5 gallons; bring to a boil, and add 8 ozs. of logwood extract, pulverized; boil three minutes, remove from the fire, and stir in 2½ ozs. gum arabic, 1 oz. bichromate of potash, and 80 grains of prussiate of potash.

(43) H. C. asks: Please give me directions for polishing shells? A. The outer skin of sea shells can be removed by washing with a rag dipped in hydrochloric acid, then wash in warm water, and polish with rottenstone or fine tripoli powder, applied with a little oil on a bit of soft rag. Where there is opportunity to do so, rub with lump pumicestone moistened with water, and finish as above.

(44) D. C. R. is informed that he can paint his smokestack with coal tar or *asphaltum* varnish. The varnish can be made by dissolving the asphaltum in turpentine with a gentle heat. Apply with a brush.

(45) J. D. P. & Co. say: We have a six inch belt which we gave two or three coats of lard oil, and now cannot use it because it slips on the pulleys. A. Wash your belt with a weak alkali or soda water, and then in clean water. Let it dry thoroughly before put-

ting on the pulleys. Some mechanics apply oil and powdered resin to belts to make them hug the pulleys, but the process is not cleanly nor beneficial to the belt. Dry powdered resin might do, but clean belts, tightened sufficiently to hold to their duty, are preferred by good workmen.

(46) B. T. says: Please give me a composition to put on pistol barrels to make them dark blue. A. No composition is used. The barrels are first nicely polished and then burnished. The work is then immersed in powdered charcoal, wood ashes, or even fine sand, heated over a fire. Keep the work equally heated, and after a sufficient time the required color will be obtained, when the work must be removed from the heating material. It would be advisable to send such work to some manufactory of firearms, where experts are employed.

(47) F. A. R. asks: Can you give me a simple way of making ice? A. See p. 82, vol. 33, for a description of Carré's freezing apparatus. The principle therein embodied is simple. It would probably meet your wants.

(48) T. A. informs M. A. that by dissolving 1 oz. cyanide of potassium in 1 quart of soft water he will have a dip in which he can wash his spoons and instantly remove the sulphide of silver. The solution must be kept in a bottle that is tightly corked and labeled poison.

(49) W. S. L. says, in reply to T. McC., who asked if there is any liquid that will dissolve glue without the application of heat or water, that whisky or alcohol will do this; and on the evaporation of the whisky the glue will become exceedingly hard.

(50) W. D. P. informs M. H. H. that he can make a good wash for brick walls of water lime or cement and skimmed milk, and says it will be good for ten years.

(51) A. E. S. is informed that hats are sized with lac solution and stiffened with a thin size of glue. For rubber cement see back numbers of the SCIENTIFIC AMERICAN.

(52) C. H. B. says: How can I etch on brass, and how can I join a brass tube, as I do not want to soft solder it? A. Dilute nitric acid may be used for etching on brass. The etched surface will not be of brass but of copper, as the zinc dissolves much more rapidly than the copper, and to some extent, by galvanic action, protects the latter. This cannot be avoided. To join the tube, braze it with spelter solder, using borax as a flux.

(53) J. R. B. says: I want a recipe for making a good lacquer for brass? A. Use shellac varnish tinged with saffron, annotto, or aloes, and apply with a brush to the work, which has been previously warmed. This will give a golden color to the metal.

(54) E. C. H. is informed that he will find an exhaustive article on cone pulleys in "Wrinkles and Recipes," p. 128. Exposing the saw to the heat of the sun will not cause the saw to lose its temper. In casting the Babbitt metal the trouble probably lies in there being no vent, and the confined air caused the imperfect filling. Drill a small hole in the upper portion of the box, so as to let out the confined air.

(55) P. R. says: Please give directions for plating small brass articles with either silver or nickel without a battery. A. A cheap method of silvering is to mix 1 part of chloride of silver with 3 parts pearlash, 1½ common salt and 1 part whiting. Clean the articles well and apply the plating mixture by rubbing it with a cork or a roll of soft leather. When silvered, wash thoroughly and wipe dry. For information about nickel plating without a battery see directions for so doing at end of article on "Nickel," in *Appleton's American Cyclopedia*.

(56) J. W. S. asks: Can you tell me how I can take a duplicate, in type metal, of bookbinders' hand stamps, also of embossing stamps? A. You can produce copies of the stamps by casting or stereotyping in plaster moulds. It would be better to obtain them by the electrotype process. Various cyclopedias will give you information of the first, and you can obtain books devoted to the second process.

(57) H. J. B. asks: What preparation can I use to reprime rim-fire cartridge shells that have been used once, so they may be loaded again? A. Perhaps the composition used for percussion caps will be best adapted to your purpose, which is fulminate of mercury mixed with half its weight of niter. After the fulminate is inserted in the shell, cover it with a film of thin shellac varnish.

(58) J. B. J. asks if phosphor bronze will bear the explosive force of gunpowder equally as well as decarbonized steel, etc., and is referred to Nos. 45 and 48 of the SCIENTIFIC AMERICAN SUPPLEMENT, where he will obtain the desired information.

(59) J. G. M.—You are probably correct in regard to your idea of the fruit you mention.

(60) W. H. B., London, Canada, is informed that if he will address a letter to the Institute he will receive circulars that will give him all information.

(61) O. H. N. informs A. J. that he has an invention for throwing a paddle wheel off its center.

(62) D. R. is informed that the largest shipments of canary birds are made from Germany. He may correspond with Louis Ruhe, 98 Chatham street, New York city.

(63) A. A. B. is informed that the oriole is a very difficult bird to rear in confinement. Inexperience in management and improper food was the cause of the death of the birds.

(64) C. G. H. asks: What will remove the stain of nitric acid from black wooled goods? A. Wash with a strong, hot solution (in water) of carbonate of alumina. If this does not remove the stain it may be concluded that the acid has destroyed the coloring matter—this is usually the case. If the yellow stain remains, the only remedy will be to re-dye the material.

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

Correspondents sending minerals should number or otherwise designate each specimen, and legibly mark the package containing them with name and address of sender.—W. S.—The hard stone is a red porphyry, the one containing bright specks of pyrites is quartzite. The large one contains silicate of alumina, iron, and lime.—Miss E. M. K.—You failed to number or otherwise designate the minerals. The large one contains orthoclase and biotite, the smallest the same. The others are orthoclase, kyanite, milky quartz, muscovite and some biotite, and tourmaline.—F. K.—It contains alumina, lime, and oxides of iron and chromium.—E. M.—The powders sent were found mixed. The mixture contains sulphate of quinia and chalk, milk sugar, and a phosphate.—The minerals in a tin box marked Eaglewood (no letter) are mostly hornblende. The red substance is a zinc ore. It contains oxides of zinc and manganese. The large crystal is carbonate of lime—calcite.—E. A. S.—We cannot tell anything about your minerals without having seen them.

COMMUNICATIONS RECEIVED.

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

On Ashes. By J. M. B.
On Formulas of Problems. By H. M.
On Curving a Base Ball. By H. C.
On Guns and Armored Vessels. By J. M.
On a Perpetual Motion. By C. M. L.
On Reducing Silver Ore. By I. H. H.
On the American Toad. By C. F. S.
On the Mind. By J. H. R.

Also inquiries and answers from the following:
W. H. R.—A. C. F.—J. E. T.—N. B. H.—P. C.—C. M.—T. A. P.—A. M. S.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who makes the best magnetic motor? Who makes crucible steel? Who makes or sells ice machines? Who sells the best modern books on engineering. Who deals in lithographic printers' materials? Who sells books that treat upon lithography?" 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

June 12, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

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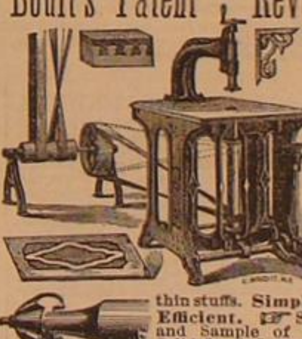

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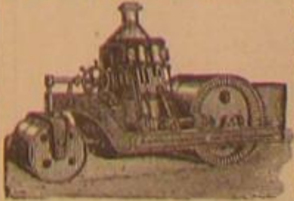

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