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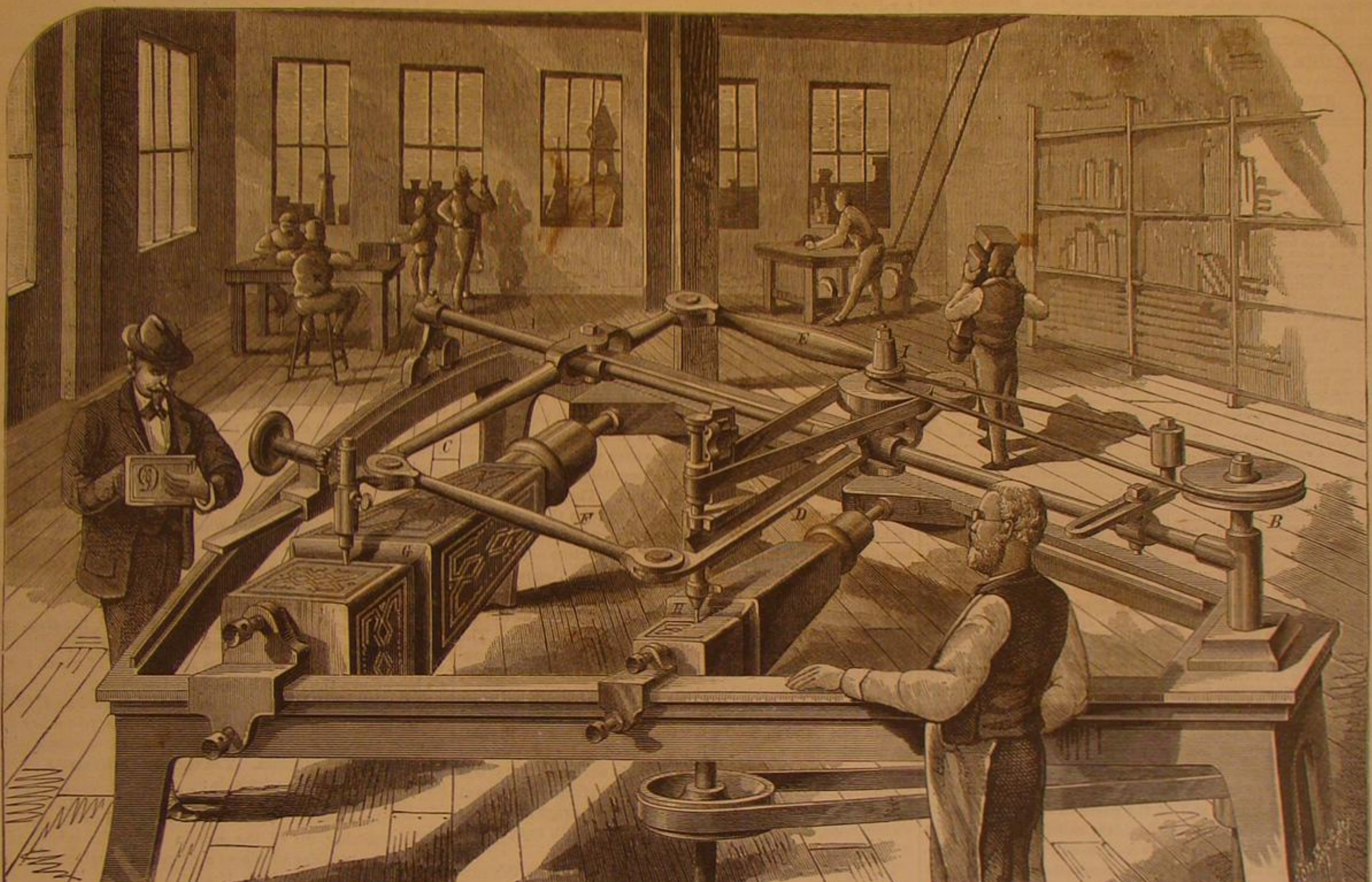
IMPROVED WOOD-CARVING MACHINE.

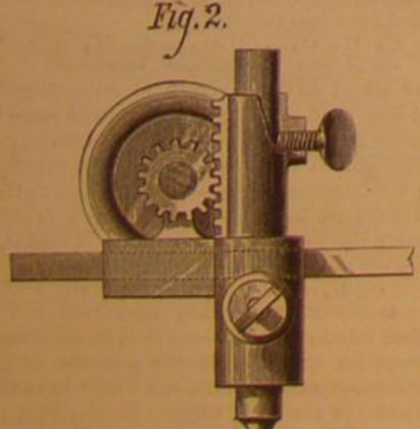
We illustrate herewith a new apparatus designed to perform all kinds of carving, from the coarsest scroll work or similar decoration used upon furniture, down to the pictorial engraving of wood blocks. The principal features of the invention are its simplicity and the ease with which it may the pantagraph frame. Said bars are connected by two other pivoted bars, E and F, which complete the square. The bar, C, carries the pattern tracer, G, and the extremity of said bar serves as a handle for the workman to guide the tracer into the various curves and indentations of the pattern. Adjustably mounted upon bar, D, is a vertical shaft which serves as a counterpoise, and balances the frame on centers on the sleeves on bars, C and D, which surround rod, A. The motion of the frame, therefore, is universal; and at the same time, the parts are perfectly balanced in every position, reducing the manual labor of moving it to a minimum. This is probably the most important improvement in the invention, and gives a large advantage over the ordinary routing machine, the motion of the cutter of which is confined to one horizontal plane.



BLACKMAN'S WOOD-CARVING MACHINE.

be operated, requiring no skilled attention nor especial care other than that involved in the very plain proceeding of following the outlines of a given pattern with a pointer moved by hand. The machine, in construction, is nearly identical with the pantagraph, an instrument used by draftsmen for duplicating drawings on an enlarged or reduced scale, the carving cutters being substituted for the pencil used in that apparatus. A is the principal rod or shaft upon which

Fig. 2.



the working part of the device is supported. Its inner end is attached to a sleeve which surrounds the vertical driving shaft, B, which serves as a center for the circle, an arc of which is described by the outer extremity of the rod which is mounted on slides or rollers which traverse a curved track upon the table. Pivoted, as shown, to collars which slide freely upon the rod, A, and which may be adjusted thereon and clamped in position by set screws, are bars, C and D, o carries the cutting tool, H. Said shaft is driven by a belt from the pulley, I, fixed at the central portion of the bar, D, which, in turn, is actuated by another belt from the pulley located on the summit of the vertical shaft, B. Shaft, B, is belted to the driving pulley shown under the table.

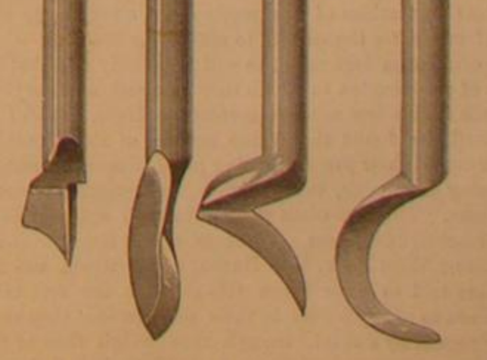
It will be obvious that any motion given to the tracer, G, will be at once followed by the cutting tool, H, so that, for example, if the tracer be moved about the edges of a certain curve, the cutter will follow a like path. The latter, however, will be reduced in size, though in exact proportion, on account of the cutter being located nearer the center of the circle of which the bar, A, is the radius, than the tracer. Since the sleeves to which the bars, C and D, are pivoted are adjustable, it is clear that the nearer the cutter is carried toward the shaft, B, the smaller will be the path it describes, corresponding to that moved over by the tracer; and therefore the object, the outlines of which are followed by the latter, may thus be reduced, to any less scale desired, by suitable movements of the sleeve of the bar, D, in or out on the rod A.

In the engraving, the machine is represented as carving the scroll work upon a pianoforte leg, which is mounted on centers so that the surfaces to be operated upon may be brought uppermost in succession. The work is always reduced in scale from three fourths downward, so as to secure greater ease and accuracy in operation; and therefore the pattern, which is shown secured beneath the tracer, G, is considerably larger than the article itself, which is fastened beneath the cutter.

Thus far we have referred principally to motions of the tracer and cutter in a horizontal plane. In order, however, to cause the tool to form the raised or indented portions of the work, it is necessary that there should be free movement in a vertical plane, so that, by continuous pressure on the tracer, the cutter may cut downward or be raised to leave certain portions in relief. The bar, E, it will be noticed, is very much heavier in construction than bar, F. It thus

Connected with the upper part of the tracer, G, is a small rack, with which engages a pinion operated by a hand wheel. This device is shown more clearly in Fig. 2. Its object is to control the vertical action of the cutter, so that, if desired, it can be prevented from making as deep an indentation as called for by the pattern, or just the reverse. In Fig. 3 several forms of the cutters used are shown.

Fig. 3



The capacity of the machine is large, since the table may be built on a more extended arc, thus admitting of an area to be worked over as great as is afforded beneath the cutter, allowing, of course, room for the pattern. The invention is light in all its portions, and easily constructed. It will prove, we think, a valuable aid to workers in wood of all classes.

Patented July 6, 1875. For further particulars address the inventor, Mr. John F. Blackman, with Vanderbergh, Wells & Co., corner of Fulton and Dutch streets, New York city.

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VOLUME XXXIII., No. 7. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, AUGUST 14, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

THE GREAT ICE SHEET.

In the heat of summer nothing is more refreshing than a generous quantity of ice. And it may be refreshing to the mind, at least, to contemplate, in these sultry summer days, the great sheet of ice that once enveloped all the northern part of our continent, and of the globe as well.

All have seen the immense boulders, called "lost rock" in some sections, scattered over the northern part of the United States, which have little or no resemblance to any mass of rock in place anywhere in their vicinity, and have perhaps asked the question: Where did they come from? also the heaps of sand, gravel, and cobble stones of various sizes, which form many of our ridges, knolls, and hills, and which are totally unlike any fixed rock near them. Some of these have coarse and fine pebbles promiscuously mixed together, and others show beds of stratification in which the coarse and fine seem to be sorted and arranged by themselves. Some, too, have doubtless seen the parallel scratches on the surface of rocks, and noticed, as the Indians did before them, that they all have one direction, and that is usually north and south. Now all these phenomena are attributed to a single cause, and that is the great sheet of ice which Nature stored up ages ago without the necessity of protecting it in an ice-house. The transported boulders, of all sizes down to pebbles and even fine sand, and the scratches upon the rocks, are clear indications of a movement on a very large scale. And if one takes the trouble to search for the place whence these erratic boulders came, he will invariably find that it is north of the position in which they now rest, and varying in distance from a few miles to several hundreds. It will very frequently be found that these masses of stone could not have reached their present resting place without crossing intervening mountains, valleys, lakes, and sometimes parts of the ocean. They are often perched in very singular and almost inaccessible places. There is a very large one on the summit of West Rock, New Haven, under which the regicides are said to have taken refuge after the restoration. Some are so nicely poised in their position that they can be easily rocked by a child, though they weigh tens of tuns. One of the most noted of these erratic blocks is called Pierre à Bot, of fine granite, which now rests on the Jura, 800 feet above Lake Neufchatel, near the early home of Professor Agassiz. This has a solid content of 40,000 cubic feet, and was transported from Mont Blanc across Switzerland, a distance of sixty or seventy miles. Through the influence of their world-renowned fellow townsman, the city authorities of Neufchatel have constructed a promenade to it.

To explain the transportation of these wanderers from their homes, various theories have been advanced, as the effects of floods, or of powerful mud currents, gas explosions of great violence, hurling rocks in all directions, and drifting ice, carrying boulders on its mass and depositing them wherever the ice melted. But these and many others fail to satisfy the observed conditions, and utterly fail to the ground in presence of the facts. To our lamented Agassiz belongs the credit of first attributing the cause of all our drift phenomena to glacial action. But he was not the first to observe that boulders were carried long distances by land ice. More than twenty years before Agassiz announced his conclusions, a chamois hunter of Valais said to M. Charpentier: "Our glaciers had formerly a much longer extent than at present. Our whole valley was occupied by a vast glacier extending as far as Martigny, as is proved by the boulders found in the vicinity of this town, and which are far too large for the water to have carried them thither." Charpentier adds that he afterwards received similar explanations from mountaineers in other parts of Switzerland: once, in 1834, from a woodman, when he had at the very time in his pocket a paper advancing the same theory, which he was then going to Lucerne to submit to a convention of Swiss naturalists.

In 1836, Agassiz became acquainted with Charpentier and was made familiar with his investigations. Soon after, he (Agassiz) carried the theory beyond the limits of the Swiss Alps, and made it embrace a sheet of snow and ice extended enough to cover a continent. Having noticed that the markings in the region of the Alps below the glaciers were the same as those found beneath the ice mass, he compared these with similar appearances in Northern Europe and Asia, which were generally attributed to the great flood, and made the bold generalization that all were due to the very same cause, and that one vast sheet of ice must have covered all the northern regions of the globe. While these theories at first met with great opposition, they are now universally accepted.

According to Agassiz, the sheet of ice extended in this country as far south as South Carolina or Alabama, and was thick enough to cover all the mountains of the eastern part of North America with the exception of Mount Washington. This peak projected, a lone sentinel on that vast waste of ice, two or three hundred feet. In the latitude of northern Massachusetts, he conceives the ice to have been between two and three miles thick; and it held its direct southerly course in spite of the mountains and ridges over which it moved, as is indicated by the direction of the parallel grooves it made, and the trains of boulders which it left. The boulders were all torn off, by the advancing ice sheet, from the projecting rocks over which it moved, and carried or pushed as "bottom drift," scratching and plowing the surface over which they passed, and being scratched and polished themselves in return, till they were finally brought to rest by the melting of the ice. They were not carried as far south as the ice sheet extended, seldom beyond the parallel of 40° N. The native copper of Lake Superior was drifted four or five hundred miles south; and the pudding stones of Roxbury, Mass., were carried as far south as the Island of Penikese.

The tough, elastic, compact clay, called in this country "hard pan" and in Scotland "till," is described as the oldest deposit of ice agency. It was formed under the great ice sheet as it ground along on the earth's surface. This was often plowed and forced forward in a confused mass, was thickest in the valleys and on the lee side of crags and other obstructions, and thins out towards the mountain tops, where it appears only in protected places.

During the existence of this ice sheet over the earth's surface, geologists tell us there was a great depression of the crust, which of course resulted in an equally great encroachment of the sea upon the land. Various reasons have been assigned as the cause of this. Adhémar, and later Croll, attribute it to a displacement of the earth's center of gravity, due to an increased weight of ice at the north pole, while at the same time there is a diminution of ice at the south pole. The latter authority estimates that the melting of two miles of ice from the antartic regions would raise the ocean level one foot; and the simultaneous abstraction of heat from the arctic regions would add a mile to the thickness of the ice at the north pole; and that these results would so change the earth's center of gravity as to cause a submergence of nearly 500 feet in the northern polar regions, and a gradual diminution of this amount towards the equator. But, unfortunately for this theory, the facts show that the amount of submersion does not diminish with uniformity as we recede from the pole, but with much greater rapidity than the theory requires.

Another theory, advanced by Professor Shaler, attributes this depression to the weight of ice accumulated on the continents during the glacial period. This theory assumes that a cap of ice, a mile or more in thickness, would, by its gravity, depress the earth's crust at least 500 feet from the Great Lakes to the Arctic Ocean. That this weight would tend to produce a depression cannot be denied; but it is hardly probable that it would be sufficient to produce so great an effect upon the earth's crust, which is probably not less than 100 miles thick, and so shaped as to offer a resistance to pressure very similar to that of a monstrous arched bridge. It would seem more natural and reasonable to attribute this depression to the commonly accepted cause of all the elevations and depressions on the earth's surface: the contraction of its crust due to constant cooling.

After the disappearance of the ice sheet, there were local glaciers which conformed to the larger valleys, like those now seen in the Alps. They carried down boulders torn from the rocks along their sides and deposited them, with other *débris*, as terminal and lateral moraines, which often dammed up rivers and formed many of the lakes which now beautify our landscapes. Other lakes were formed in the solid rock by the gouging action of the boulders frozen into the ice. At perhaps about the same time there was again an upheaval or elevation of the land, or, more strictly, successions of elevations. These caused a rapid drainage, from the land, of the water previously making up the ice sheet, by which the drift was stratified and its pebbles assorted and rounded; hills and ridges were formed by a deposition of material suspended in the water, just as drifts of various shapes and sizes are formed by the snow suspended in the air; and the beautiful terraces which ornament so richly our river valleys were formed. These elevations were also due to shrinkage of the earth's crust, for a depression in one place must necessarily make an elevation in another.

SALICYLIC ACID.

Disinfectants and antiseptics may be divided into two classes, those which have a destructive action by the dominant power of their chemical affinities, of which chlorine is the type, and those which have a preservative action, causing them to prevent decay and putrefaction, of which class carbolic acid is the type.

The first class destroy the infectious materials. Chlorine does so by its great affinity for hydrogen, which breaks down all hydrogen compounds; while at the same time, if oxygen is set free, the latter will, by the power of its nascent condition, finish the work and utterly destroy the compound. As all organic infectious substances are hydrogen compounds, the special action upon them of chlorine or its equivalent is evident.

Of the second class of disinfectants, preventing the decay of organic compounds, there are several. Carbolic acid and its nearly equivalent creosote, chloride of zinc, arsenic, bichloride of mercury, and others are well known. Notwithstanding that many of them may be used as disinfectants, they are rather preservatives, protecting as they do the organic substance against the destructive agency of zymotic principles, and against the action of fermentation, eremacausis, or other modes of decay.

Till recently, all the known disinfectants and preservatives had the grave defect of possessing a bad odor or flavor, or of being poisonous, and sometimes these disadvantages were combined in one body; and the discovery of a preservative and disinfectant having neither taste nor smell when diluted, and an agreeable odor when concentrated, is of great importance. Such a substance is salicylic acid, and it may be well, therefore, to give an outline of the history of the discovery of this compound, which promises to come widely into use.

The starting point was the study of salicin, a crystalline bitter substance contained in the leaves and young bark of willow, poplar, and some other trees. It is simply obtained by exhausting the bark with boiling water, filtering, concentrating by evaporation, and subsequently crystallizing, when pure white, silky needles are formed, of which analysis has shown the formula to be $C_{13} H_{18} O_7$.

When this substance is boiled with a diluted acid, it will absorb one atom of water and be split up into two other substances, glucose or grape sugar and a new compound which has been called saligenin. The chemical action may be simply represented by the formula:

$$\underset{\text{salicin}}{C_{13} H_{18} O_7} + \underset{\text{water}}{H_2 O} = \underset{\text{glucose}}{C_6 H_{12} O_6} + \underset{\text{saligenin}}{C_7 H_8 O_2}.$$

The splitting up of the salicin atom has caused some chemists to consider salicin as a glucosite of saligenin. The latter has little bitter taste, if any.

When saligenin, $C_7 H_8 O_2$, is submitted to the action of chromate of potash and sulphuric acid (a powerful water-forming mixture), two atoms of hydrogen are oxydized out of it and become water, and $C_7 H_8 O_2$ becomes $C_7 H_6 O_2$, a thin, colorless, and very fragrant oil, heavier than water, but soluble in it. This has been called salicylol. When salicylol is oxydized by chromic acid, it takes up an atom of oxygen, and $C_7 H_6 O_2$ becomes $C_7 H_6 O_3$; this is the salicylic acid, the subject of our remarks. It crystalizes in prismatic form, and is very soluble in hot water and alcohol. When heated, it melts; and by fu:ther heating to distillation, it gives off carbonic acid and becomes carbolic acid, the same as is obtained from coal tar, thus:

$$\underset{\text{salicylic acid}}{C_7 H_6 O_3} - \underset{\text{carbonic acid}}{C O_2} = \underset{\text{carbolic acid}}{C_6 H_6 O}.$$

This gave a hint to the chemists investigating this substance, and they tried to obtain it by a shorter route by combining carbolic acid with carbonic acid, and they succeeded. Carbonic acid gas is simply passed through the liquid carbolic acid; but in order to loosen the elements in its atoms, pieces of sodium are introduced, which, by their affinity for oxygen, loosen the bands between the C, H, and O, and so predispose them to a new combination; so we have

$$\underset{\text{carbolic acid}}{C_6 H_6 O} + \underset{\text{carbonic acid}}{C O_2} = \underset{\text{salicylic acid}}{C_7 H_6 O_3}.$$

And this close relationship between the two substances gave rise to a suspicion that the salicylic acid was, in a certain sense, a deodorized carbolic acid, and would have the antiseptic properties of the latter without possessing its intense tarry flavor and odor, which make it totally unfit for the preservation of food. This was verified, and it was found that, when three grains of this salicylic acid are placed in a pint of fresh milk, it will keep 40 hours longer than without it. Its presence cannot be detected by odor or taste, and it is claimed that it does not impair the wholesomeness. It also prevents fermentation, and arrests it when begun, in cider, beer, wine, sugar solutions, etc.

We repeat that the discovery of a substance of this class, the presence of which is not revealed by taste or smell, is of the utmost practical importance.

TERRESTRIAL MAGNETISM.

If a magnetized steel needle is suspended by its center of gravity, or placed upon a point, it will take a determinate direction towards a point of the horizon which is very nearly north and south. The force which produces this direction is called terrestrial magnetism. It is one of the modes of manifestation of the natural sources of electricity, since magnetism itself is only a particular form of electricity. The magnetic force of our globe is manifested at its surface by three classes of phenomena, namely, the declination of the magnetized needle, its inclination, and the intensity with which the force acts. The declination is the angle that is formed with the direction of the meridian of the place by the direction of the magnetized needle placed upon a vertical pivot. The inclination is the angle that is formed with the horizon in the magnetic meridian by the direction of a magnetized needle sustained by its center of gravity, around which it is able to turn freely in a vertical plane. These three elements, declination, inclination, and intensity, not only vary from one place to another, but in the same place with time. They also manifest irregular and accidental variations, designated under the name of disturbances, the existence of which is connected with the presence of some natural phenomena, such, in particular, as that of the aurora borealis. It is well established that the forces which act upon the magnetized needle emanate directly from the terrestrial globe, and we are naturally led to regard the earth as a great magnet, and as having one pole situated to the north of us, attracting the north pole of a needle in that direction.

If we suspend a magnetic needle by its center of gravity, so that it may move freely either in a vertical or horizontal plane, the extremity which turns towards the north will incline below the horizon, making at New York an angle with the horizon of about 72°. Hence we conclude that, if the earth be a great magnet, giving direction to the needle, its pole must be situated, not on the north horizon, but almost vertically beneath us.

If the earth is really a magnet, the magnetism of soft iron ought to be decomposed by it, in the same manner as is done by a bar magnet, and such is the fact. If a bar of soft iron is held in the direction which a magnetic needle assumes when freely suspended, its lower end immediately becomes a north pole, and its upper end a south pole, as is shown by bringing a small magnetic needle near each end of the bar. On inverting the bar, it will be found that its poles have immediately changed, the lower end being again a north pole, and the upper one a south pole. If the bar is held horizontally, pointing east and west, no such effect takes place.

A similar but slightly diminished effect is produced on a bar of iron suspended in vertical position; and iron rods which have remained long in a vertical position frequently acquire permanent magnetism.

When a bar of iron is rendered magnetic by the influence of terrestrial magnetism, a stroke of a hammer will sometimes fix the magnetism, and the poles will not be reversed when the bar is inverted. But if several blows with the hammer be struck when in the inverted position, its magnetism may be destroyed or its poles be reversed.

The action exerted by the earth upon a magnetic needle is simply to give direction to the needle, for the weight of a needle is not increased by its magnetism. Hence it is concluded that the attraction of the earth for one pole of the needle is exactly equal to its repulsion for the other. If a magnetic needle be placed upon a cork floating on water, it will soon adjust itself to the magnetic meridian; but it has no tendency to travel either toward the north or south.

Although a magnetic needle, when fully suspended, generally points nearly north and south, it is found in almost all parts of the world that the north pole of the needle deviates a few degrees from the astronomical meridian. This deviation is called the magnetic declination. The declination is said to be east or west, according as the north pole of the needle deviates to the east or west of the true meridian. The declination of the needle is very different at different places on the earth's surface. There are places where the declination is 10°, 20°, 30°, and even 90° west; and there are places where the declination is as much to the east. At most places on the earth's surface, the dipping needle will not rest in a horizontal line, one pole pointing downwards and the other upward. This dip varies at different places from 0° to 90°, and observations to determine its amount have been made in almost every part of the world. In order to represent all these observations conveniently upon a chart, a line is drawn connecting all those places where the dip is the same. A line connecting all those places where the needle rests horizontally is called the magnetic equator. This line exhibits numerous sinuosities in its course around the globe, but does not depart much from a great circle. It crosses the terrestrial equator near the western coast of Africa, attains its greatest southern latitude in South America, where it is 15° south of the geographical equator, crosses the equator again near the meridian of New Zealand, and attains a north latitude of 12° near the southern part of Hindostan.

As we travel northward from the magnetic equator, the north end of the needle inclines downward, and the dip continually increases at the rate of about 1° for 1° of latitude, until we reach the north magnetic pole, where the needle stands vertically, in latitude 70° 5' N., longitude 96° 45' W.

As we travel southward from the magnetic equator, the south end of the needle inclines downward, and this dip continually increases until we reach the south magnetic pole.

That terrestrial magnetism is not produced, in any important degree, by magnetic forces external to the earth is probable, because, if there were an external cause for magnetism, it is scarcely conceivable that some large part of it would not act in planes parallel to the geographical equator: and if so, its effects at any one place would undergo very great changes in the earth's diurnal revolution, every part of the earth being presented, in the course of the day, in different aspects toward forces so acting. Now the fact is that the diurnal changes are very small, only about $\frac{1}{50}$ part of the whole horizontal force. It would seem certain therefore that external bodies or spaces do not produce any sensible part of the magnetism in the planes to which the earth's axis is normal.

That terrestrial magnetism does not reside, in any important degree, in the earth's surface, is probable, because of the non-magnetic property of the materials of which the earth's surface is composed, and upon the general absence of any perceptible change in magnetism depending on the change of soil.

Humboldt adopted the idea that the principal phenomena of terrestrial magnetism could be explained by the action of a powerful magnet, of limited dimensions, near the center of the earth; but it was found that the theory upon which this idea depended, though well representing the broad facts of terrestrial magnetism, failed in accuracy when applied to many special cases.

Hansteen suggested the theory of two large magnets within the earth, but this failed to meet the facts of observation.

Gauss attempted to explain the cause of terrestrial magnetism by supposing that magnets are distributed irregularly through the earth, and the results of observations generally accord with the necessities of his theory.

Regarding the earth as a heterogeneous compound of different substances, which may possess in some degree the properties of different metals, and conceiving (as is the opinion of many physicists) that there is in the interior a great store of caloric, which may heat the points of contact, some of them steadily and some by occasional bursts of flame, it seems within the range of possibility that such a combination, of heat with dissimilar substances, may be the cause of terrestrial magnetism. But there is no evidence of this beyond mere conjecture. It is worthy of remark that the isothermal lines on the earth's surface bear a striking resemblance to the lines of equal magnetic intensity. On the whole, we must express the opinion that the general cause of the earth's magnetism still remains one of the mysteries of cosmical physics.

A YEAR'S EXPERIENCE IN BOILER INSPECTION.

Last year there were upwards a hundred boiler explosions in the United States and Canada of a nature sufficiently serious to be reported in the newspapers. By these explosions 183 persons were killed and about 200 wounded.

By many, such unhappy occurrences, or the most of them, are regarded as pure accidents, mysterious, unaccountable, and therefore unavoidable. The managers of the Hartford Boiler Inspection and Insurance Company say: No. While it is not always possible to point out the particular cause of a particular explosion, for lack of knowledge in the premises, boiler explosions as general phenomena are not mysterious, and not unaccountable. It is neither wise nor safe to assume occult causes for such effects when known conditions are at least apparently sufficient. Unforeseen and unforeseeable occurrences will arise, the most careful of engineers is liable to make mistakes and oversights; yet they hold that, with proper construction, intelligent management, and frequent thorough inspection, the frequency of explosions can be immensely diminished, possibly, in time, prevented altogether. At any rate, given these conditions, they are willing to assume the risk of an explosion in any case at a low figure.

Their experience certainly gives the opinion of these gentlemen very great weight. During the past year they have collected through their inspectors the results of upwards of twenty-nine thousand boiler inspections (more than a third of the number being thorough internal and external examinations), under a wide range of conditions of structure, age, use, etc. One result of these inspections was the direct condemnation of one hundred and sixty-three boilers as unfit for use, the majority of them worn out beyond repair. The distribution of the defects is exhibited in the following classification, the second term of each couplet denoting dangerous defects, or those in which the liability to accident was so great that a guaranteed certificate could not be issued until the defect was corrected:

Furnaces out of shape 602—108 dangerous; fractured plates 1,127—564; burned plates 867—302; blistered plates 2,368—374; deposits, incrustation, and scale 4,816—645; external corrosion 937—250; internal corrosion and grooving 642—268; water gages defective 548—100; defective blow-out 267—79; safety valves overloaded and defective 343—140; pressure gages defective 1,809—315; without gages 714—26; deficiency of water 78—26; broken braces and stays, and insufficient bracing 685—289. Thus the company's inspectors discovered upwards of three thousand dangerous defects in the boilers under their care, and about five times as many as that would no doubt have become dangerous if neglected. The saving in life and property effected by the timely discovery and removal of these germs of destruction is simply incalculable.

It might be expected that the experience gained in a private undertaking of this sort would be carefully withheld from the public for personal profit. It is not so in this case. The President's annual report, from which our statistics have been taken, gives some twenty large pages to the discussion of the causes of the different kinds of defects, with suggestions for their prevention and cure. Practical engineers can judge the value of observations based upon such an extensive range of experience.

Particular attention is given to the causes of sedimentary deposits, incrustation, and scale, and means for removing them, and considerable space is devoted to the action of solvents. Potatoes are mentioned as having good results, in some instances, as a preventive. Crude petroleum has been used in many cases with uniformly good results. It is not recommended for general and indiscriminate use, for it may do harm. Catechu, nutgalls, oak, hemlock, and other astringents containing tannic acid have also been found of service in removing scale where carbonates are present. They fail, however, with sulphate of lime, and tannic acid is further objectionable in that it is liable to attack the iron of the boiler, though less so than acetic acid. One of the most successful solvents used is carbonate of soda, incrustations of both sulphate and carbonate of lime yielding to it. It should be used in quantities varying from one to two pounds a day. Mixed with catechu, in about the proportion of one part catechu to two parts of soda, the action of this solvent has been particularly happy. Stress is laid upon the necessity of the frequent thorough cleaning of boilers where solvents are used. "If the condition of the boiler is particularly bad, blow out the boiler once a week and remove all portions of scale which have been detached." Generally, solvents should be used under special advice adapted to the local conditions.

In the discussion of the cause of internal corrosion, we find the suggestion that it may be due to galvanic action excited in the presence of acids in the water by chemical differences in the iron of the different plates. "It is well known that iron ore, even from the same mine, is not always chemically the same; certain impurities will be found in some places which do not exist in others. And in the manufacture of boiler iron, there is no doubt but that the sheets are chemically slightly different: hence when the boiler is constructed, the presence of acids in the water may excite galvanic action. This would account for the different manner in which boilers are affected. Some are attacked at the front end, while others will be attacked at the back end, and in other cases the rivet heads will be attacked.

"If it is found that the feed water is from a source that is contaminated, it should be changed at once. Ponds and streams on which cotton and woolen manufactories are located are apt to be very impure from the quantities of refuse and spent dies emptied into them. These generally are bad sources from which to take the feed water of boilers unless it can be brought in pipes from above the factories."

The comments on the bursting of experimental boilers for the discovery of the causes of boiler explosion are severely skeptical. "I would not disparage experiments intelligently made," the President remarks. "The experiments of the Franklin Institute made years ago are valuable to-day; and those made by the late Sir William Fairbairn have laid steam users under great obligations. Later experiments on the strength of materials have decided important questions about which there was much controversy; but to suppose that the cause of boiler explosions, as they occur in different parts of the country, where the boilers are indifferently cared for—fed with bad water and having few or no reliable attachments—is to be definitely settled by bursting experimental boilers, surrounded with none of the conditions to which boilers are subjected in daily use, is investing such experiments with an importance worthy the unbroken silence pervading the councils of the commission appointed by government to expend $100,000 in gaining information bearing on this subject."

AN ENORMOUS PEACH CROP.

The estimates of the coming peach crop all point to the same being of remarkable magnitude, the aggregate number of baskets being fixed at from eight to ten millions from the Maryland and Delaware peninsula alone. Strenuous efforts are being made to find markets for the yield, and a degree of enterprise is manifesting itself among the fruit growers which can hardly fail to win merited remuneration. A special train will be dispatched daily over the Baltimore and Ohio railroad to carry supplies to the cities of the West; 1,150 cars have been chartered to transport the fruit to New York and other eastern cities, and it is stated that the American Steamship Company of Philadelphia are fitting up huge refrigerators in their vessels, so that from 25,000 to 30,000 baskets may be carried to Liverpool at each trip.

The necessity of transporting so large a quantity of perishable freight in warm weather, quickly, seems to us to offer a good opportunity of practically testing the preservative properties of compressed air. On another page will be found a full description of M. Bert's important discovery. It is a very easy matter to render a portion of a car airtight, and to force in air by a simple hand pump until a pressure of three or four atmospheres is reached. This could without difficulty be maintained over a long trip; and if the effect stated by M. Bert—namely, complete preservation of the material—is obtained, an enormous saving in the cost of ice and in labor may at once be made. We should be glad to learn of the results if any one should adopt these suggestions.

Back Numbers for the Current Year.

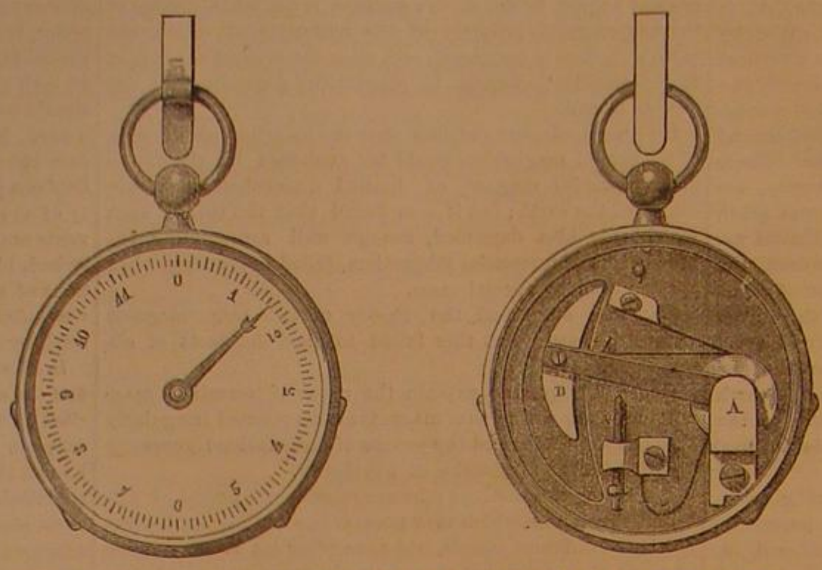
We would state, in answer to numerous inquiries whether all the numbers of the SCIENTIFIC AMERICAN can be had for the year 1875, that they can be furnished from January to the present time, in sheets, or in volumes of 416 pages, bound, up to July 1. The price for the bound volume is $3; in sheets, from January to July, by mail, $1.60. New subscribers can have all the back numbers if they wish. But, unless requested otherwise, all subscriptions will be commenced at time of receiving the order.

THE PODOMETER.

The annexed engravings show a simple little instrument, sold in many of our New York stores, which, now that pedestrianism is so much in vogue, proves the handiest means attainable for measuring distances walked over. The podometer is no bigger than an ordinary watch, is carried in the vest pocket, and is said to indicate distances with as small a margin of error as five per cent.

The shape is apparent from the illustrations. One side serves as a dial having a single hand, the other may be covered with metal, or, if desired, with glass, to allow the inspection of the interior mechanism. The latter consists of a heavy counterweight, B, secured at the extremity of a lever which oscillates about an axis at A. V is a screw which limits the amplitude of the oscillations, while a small spring acting against the counterweight maintains this last in the position represented in the engraving. A simple counting device, not shown, registers the oscillations of the lever and moves the pointer around the dial.

It is clear that, if the instrument be quickly moved from down up, the inertia of the counterweight overcoming the pressure of the spring, the counterweight will remain down, and the screw, V, will strike the lever. When the instrument returns to its former position, the reverse operation will take place, so that the natural movement of the body in walking will, for every step, cause an oscillation of the counterweight, B, and consequently the advance of the pointer on the dial one degree.



THE PODOMETER, OR WALKING DISTANCE INDICATOR.

The operator should make preliminary experiments with the instrument between points, the distance of which apart is accurately known. These will give co-efficients with which to multiply (according to the nature and inclination of the road traveled over) the number of steps, to obtain the distance in yards or feet.

A POWERFUL CRANE.

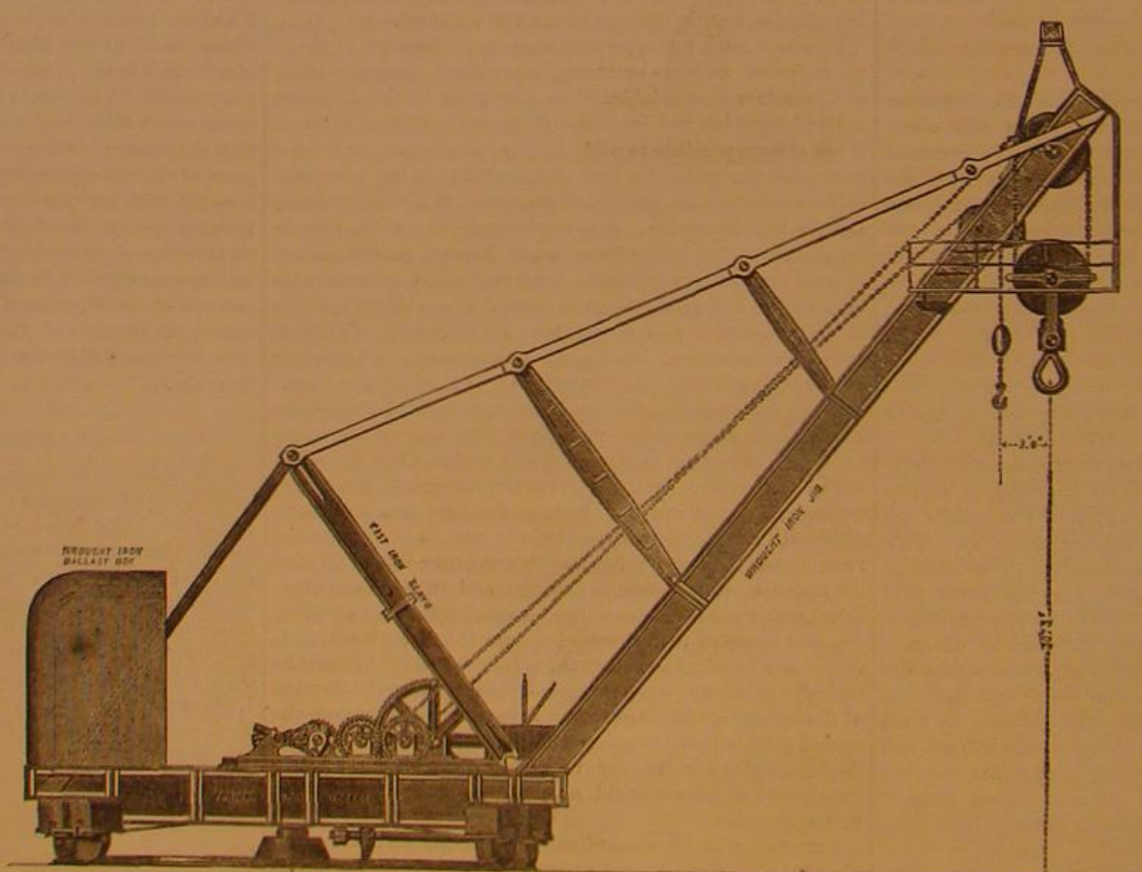
There has recently been erected at Woolwich Arsenal, England, a crane capable of lifting and handling a weight of 85 tuns through a hight of 60 feet. It is intended for lifting the heavy ordnance now constructed at Woolwich, and 80 tuns is considered to be a safe load for it. We publish herewith an engraving of the machine, which has a rake of 47 feet 6 inches from the center of the pivot to the center of the swivel block.

The stipulated speed of lifting the extreme load of 85 tuns is fixed at 4 feet per minute, a second speed being provided of about 7 feet per minute for loads up to but not exceeding 40 tuns, and a third speed of about 40 feet per minute for raising the unloaded swivel block for any necessary purpose. An auxiliary chain is to be provided, having 3 feet less rake than the main block, this being intended for the purpose of lifting loads up to 8 tuns at the rate of about 25 feet per minute. The details of arrangement are shown in the engraving. The speed of turning the crane on its axis is provided to be at the rate of five minutes for the accomplishment of a single complete revolution. These, of course, it is needless to say, are only estimates of the actual working capabilities of the crane now under consideration.

The jib is of wrought iron, 55 feet long, and is attached at the bottom to a platform composed of wrought iron girders mounted upon four pairs of cast iron rollers, which run along the sweep plate or roller path. Two of the pairs have a cogged wheel inside, worked by the hydraulic gear, for revolving the crane within the circle of the roller path; the other rollers are plain. Each pair of rollers is carried in a cast iron roller box, provided with gun metal bearings for the axles to work in. The roller path is of cast iron, and the central pivot or bed, for the crane to work on, of the same material. The latter will be bushed with a gun metal socket for the central pin of the crane, and it will be connected with the cast iron summit length of the 7 feet screw pile by four wrought iron bolts each 3 inches in diameter. The central pin is of wrought iron, and about 13¾ inches in diameter. It connects the crane to the center pivot or bed. The platform girders are to be floored on the top with timber, to which, and direct to the girders themselves, the bed plate of the hydraulic engine for winding the chains and revolving the crane will be bolted. The stays for the jib are of wrought iron, and are supported from the jib by other cross stays, as shown in the engraving. The main stays are of cast iron, and trussed together by diagonal stays of the ordinary character. A wrought iron platform, lightly constructed, is to be suspended at the extremity of the jib, for facilitating the means of access to jib-end sheaves. A wrought iron ballast box, capable of holding about 100 tuns of gravel or slag ballast, is to be attached to the platform girders at the back of the crane, for the purpose of counterweighting the full weight of the load. This counterweight, together with the natural stiffness of the crane, will, it is anticipated, be sufficient to overcome the resistance of a far heavier load than 85 tuns, the greatest test to which it is intended ever to submit it.

The hydraulic engine, for lifting and revolving, will have three cast iron oscillating cylinders, with cast iron plungers, and will be provided with valves, working gear, and reversing apparatus of the ordinary description. All the shafts for the spur and bevel gearing, for communicating the power of the hydraulic engine to the lifting drums, and to the front rollers for turning the crane, will be provided throughout of wrought iron, and will have gun metal bearings to work in. Wrought iron cupped drums of large and small sizes are provided for the large and small lifting chains respectively, and a separate brake and pawl wheel is connected to each several drum.

The multiplying power of the main lifting block is to be four to one, and the lifting chain for this block to be 1½ inches in diameter, or 4½ inches chain. The auxiliary power is to be direct without any multiplying power, and the lifting chain for its block is to be 1 inch in diameter, or 3 inches chain. Both the main and the auxiliary lifting chains are to be tested to an endurance of 10 per cent over and above the ordinary Admiralty proof.



THE EIGHTY-TUN CRANE AT WOOLWICH, ENGLAND.

The Youngest Volcano.

A new volcano was born on the 1st of May, 1871, and at the present time has attained the hight of 1,950 feet. It was recently discovered by the Challenger, in the course of her voyage in the China seas, on the small island of Camiquin, near the coast of Mindanao. For some months previous to the formation, violent earthquakes occurred throughout the islands. These ceased after the first eruption, which gave vent to the imprisoned forces. At the end of four months, the mountain had risen 400 feet and had increased to about a third of a mile in diameter.

The new comer appears to have worked sad desolation. The island had a population of 25,000 people, and was one of the most fertile of the group, producing hemp, sugar, and tobacco of the finest qualities. The base of the mountain has extended so as to cover the entire site of the town of Catarman, which once contained 14,000 inhabitants, but now is a mass of ruins. But a few hundred people remain upon the island, and the fields and groves are choked with new jungle or destroyed by the sulphurous exhalations of the volcano.

Steel Bronze.

No small degree of attention has been attracted throughout military and scientific circles in Europe toward a metal lately used for artillery by General Uchatius, Director General of the Imperial Arsenal at Vienna, and prepared by a process invented by that officer. The name "steel bronze," or "bronze steel," which has been given to the material, is somewhat calculated to mislead, since no steel whatever enters into the composition; and it would appear that the word is used mainly as a synonym for hardness. The metal itself is nothing more than the ordinary bronze, commonly known as gun metal; and to the treatment to which it is subjected it owes its remarkable resisting qualities.

The principal objections to the use of bronze for cannon, as given in standard works on gunnery, are that the work done, in stretching to the elastic limit and to the point of fracture, is less for bronze than for low steel and for wrought iron of maximum ductility; and further, to this defect is added the costliness of bronze, its softness, its injury by heat, and rapid wear and compression. Again, guns cast of bronze, even from the same mass of metal, have exhibited diversities for which no satisfactory cause could be assigned. All of these disadvantages obviously aggravate each other, and, when taken in connection with rifling and excessive pressures, have been deemed conclusive evidence as to the unfitness of the material to meet the conditions of greatest effect.

General Uchatius' plan is based on the well known principle that, after a certain degree of compression, malleable metals assume their closest and most condensed states. This compression he applies to the interior of the bore, since in bronze guns, under the strain of repeated firing, this portion enlarges without any corresponding alteration of the exterior of the piece. The gun is cast in the usual manner, hollow, and with the bore of a somewhat less diameter than it is intended ultimately to be. Thirteen punches, each a bolt of steel, having rounded edges and mounted on the end of a bar of the same metal, are forced through by hydraulic pressure, each punch being slightly larger in diameter than the preceding one. By this means the bore is gradually enlarged, and at the same time the metal subjected to a friction and compression which results in causing it to become extremely hard, and of a nature well suited for the subsequent rifling.

We learn from a well known cannon manufacturer, to whom we are indebted for the foregoing information, that twenty guns thus prepared have been tested in Austria during the past two years. The results obtained have been such that the Austrian Government is now constructing two hundred batteries, or twelve hundred guns, at the rate of six batteries a week. A single gun of steel bronze has withstood 3,000 rounds without any perceptible deterioration, and others, even after being subjected to the severest tests, —shells burst in their bores— appeared to lose nothing in point of accuracy of fire. In estimating the relative cost of steel bronze guns with those of other metals, the value of the bronze for remelting, after the gun has become worn out, must be taken into consideration. This done, the first cost of the steel bronze cannon is placed at less than half that of a Krupp steel piece, and very much below that of a Whitworth compressed steel gun, which, at a rough estimate, is about twenty per cent more expensive than Krupp's.

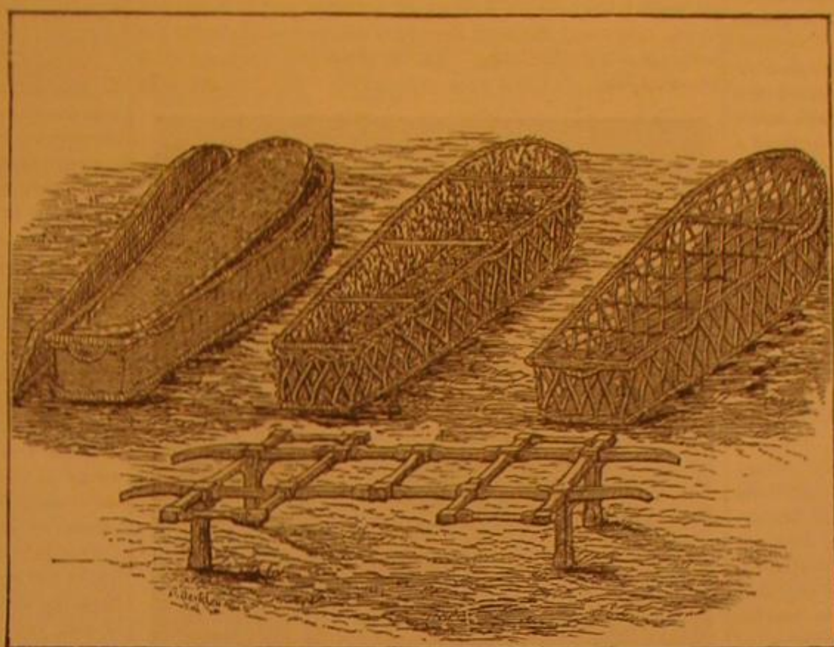
There is another important advantage in bronze guns, especially if they are breech-loaders of complicated construction, as compared with steel weapons of similar character, and that is their non requirement of attention during periods of non-usage. Not being subject to deterioration from rust they need little protection, and thus the cost of such care, necessarily considerable in a large armament, is greatly reduced.

The price of artificial alizarin has fallen about 35 per cent

WICKER COFFINS.

A new use has been developed for the British Duke, a use upon which we are fain to congratulate the British inventor. From his prominent position as an integral portion of the noble and conservative element of the political system of England, the Duke of Sutherland now soars to a loftier hight, and takes rank with the daily journals, and the big hand bills, and the banners carried by small boys as a valuable advertising medium. He recently invited the nobility and gentry of London, to a garden party, not to regale them with the festivities peculiar to such gatherings, but to secure their attention to an improved system of wicker work coffins devised by Mr. Seymour Haden, an illustration of which is given herewith. During two days, everybody accepted His Grace's invitation with alacrity, for everybody does not often get invited to a ducal residence. Everybody read a neatly worded circular, setting forth the varied advantages of the invention, poked in his hand on passing the door, and then everybody, after entering the aristocratic precincts of Stafford House, was permitted to moralize *ad lib.* over a heap of oblong baskets displayed upon the grass.

We do not question for an instant that it is most laudable for the nobility of England to encourage the progress of invention. In so doing they simply follow the example of the rich and enlightened the world over; but it strikes us as extremely ridiculous that a device which in itself possesses but the merest shadow of novelty, and certainly involves no new discovery or principle, should thus be brought into a notoriety through the medium of ducal advertising, which on its merits it could not attain. Even *Punch* makes a little quiet fun out of the affair by putting the question of "Ah—have you seen the coffins yet?" in the mouth of an inane youth who at a party finds himself at a loss for something to say to his fair companion.



THE DUCAL WICKER COFFIN.

So far as basket burials *per se* are concerned, we fail to see any advantage in a basket packed with moss over a deal box with a few holes bored in it, such coffins as thousands of soldiers were buried in during our war or which now are frequently employed to contain the remains of the unfortunates inhumed in the Potter's Field. A simple perforated chest of some thin non-resinous wood, or, better still, of stout pasteboard unsized, would take very little if any longer than a willow basket to decompose, and certainly would be cheaper

CASTING STEEL IN ONE TUN INGOTS.

In an article on the progress of our steel industry, which recently appeared in these columns, we took occasion more especially to allude to the advance made in New York State since the exploitation of the Crown Point mine near Lake Champlain. Large quantities of the ore from this deposit, smelted into pig iron, together with iron from other localities, notably Port Henry, Fort Edward, and from the Lake Superior region, aggregating some 100,000 tuns per year, we stated, were shipped to the immense works of the Albany and Rensselaer Iron and Steel Company, in Troy, N. Y., where, by the Bessemer process, the metal is converted into steel, the major portion of which is rolled into rails. The finished material is sold at a price considerably below that of the steel produced by English makers imported hither, but nevertheless it yields to its manufacturers a fair profit. The process of making this steel, which is cast in ingots weighing over a tun each, is exceedingly interesting, both from the improved and novel mechanism employed, and from the scale of magnitude on which the various operations are conducted. A recent visit to the establishment above named afforded us an opportunity to witness the latter, and to gather the facts upon which the following description is based:

Three great cupola furnaces at the Albany and Rensselaer Works receive the masses of pig. Into each of the three fiery caverns fifteen tuns of material are thrown; and in the course of three quarters of an hour, five and a half tuns from each will be melted. For eighteen hours the furnaces are kept in blast. Near by are two reverberatory furnaces in which the spiegeleisen is prepared, ready to be added at the proper time. Leading from the outlets of these, as well as from those of the cupolas, are gutters which convey the liquid metal to the two converters, which are suspended side by side on the massive framework. One of the great vessels, as we enter the building, is swung over on its side with its bent neck just under the gutter; the other is slightly inclined, and workmen are busily putting in new tweers (cylindrical pieces of fire brick perforated with numerous holes and inserted in the bottom, the orifices serving as air passages), and luting about the bottom plate with a paste made of quartz, sand, and clay.

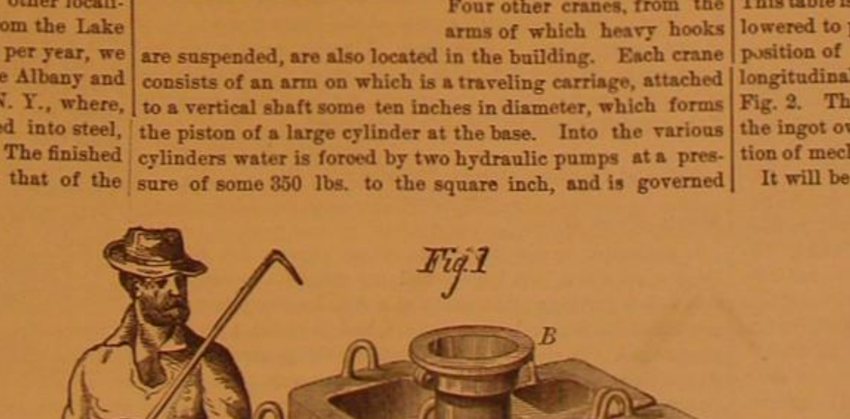
Some one shouts a warning, and we step aside to avoid the heat of a stream of molten metal which comes pouring down the gutter from one of the cupolas. Hissing and shooting forth sheets of flame, it falls into a huge ladle, where it is weighed, and then continues its downward rush between the banks of sand in the gutter, around the bends of the same, and finally tumbles, a miniature cataract, into the mouth of the converter. Over six tuns soon lie bubbling and seething on the deep side of the inclined vessel. Then a sullen roar and a shower of flame and sparks issuing from the open mouth of the latter announces that the blast is turned on, passing, however, only over the surface of the metal. The monster had eaten his fiery meal, but digestion had not yet begun; slowly, however, the huge caldron is turned upright, and then the torrent of flame, augmented, pours into the adjacent chimney. The twenty minutes or thereabouts occupied in the process, we devote to examining the surroundings.

At one end of the immense building is a platform on which is an assemblage of wheels and levers, managed by two or three men, one of whom we are informed is the "blower," the important person upon whom the success of the process depends, for his business it is to watch the flame from the converter and to determine when the blast shall be stopped. Just in front of the two caldrons is a huge crane carrying a ladle. Four other cranes, from the arms of which heavy hooks are suspended, are also located in the building. Each crane consists of an arm on which is a traveling carriage, attached to a vertical shaft some ten inches in diameter, which forms the piston of a large cylinder at the base. Into the various cylinders water is forced by two hydraulic pumps at a pressure of some 350 lbs. to the square inch, and is governed by valves controlled from the platform mentioned at the beginning of this paragraph. The interior of the valve used is so constructed that the water may be sent under the piston and then led from that point to an overflow pipe, so that in one case the piston is raised, and in the other it is allowed to descend. The sensitiveness of the immense crane, with its load, to the merest motion of the valve, and its celerity and certainty of action, are remarkable. From the same platform the converters are manipulated by similar means, water being conducted to sunken cylinders, the pistons of which carry racks, which engage with pinions on the trunnions of the vessels. The blast, which is controlled also from the same point, is supplied at a pressure of 25 pounds to the inch by two horizontal blowing engines, the air cylinders of which are 54 inches in diameter.

Fig. 2

The flame from the converter has been growing in intensity and size, until now dazzling in its brilliancy. The blower is watching it carefully. Suddenly it decreases in length, and becomes reddish, and at that instant the blast is stopped, for the decarbonization is complete. Then the caldron slowly turns on its side, and presently another stream of molten metal comes leaping down the gutter and into the open mouth. This is the spiegeleisen, which has meanwhile been measured and melted. It mixes at once with the liquid mass in the vessel. Now the mouth of the latter is turned still lower until it vomits forth a dazzling, blinding jet of liquid steel, into the enormous ladle which the crane has swung into position.

While the above has been in progress the workmen have been busily preparing the molds. Six one tun ingots are to be cast from the contents of the ladle. Each ingot will make three rails. The molds are of iron of the form, and arranged in a nest, as shown in the engraving, Fig. 1. The lower portion, A, consists of a deep platform lined with fire clay and having channels radiating from the center. B is a tube of iron placed over the central opening. Into this the steel is allowed to flow, so that it enters the grooves in the platform and then, escaping through the apertures, rises in the molds disposed above the latter. The tube, B, retains the cinder, and is therefore made somewhat higher than the molds.



MOLDS FOR CASTING STEEL.—Fig. 1

As soon as sufficient time has elapsed for cooling, the molds are lifted by a crane, leaving the ingots of steel standing upon the platform. These, still red hot, are at once raised, deposited on a car, and transported to the heating furnaces. Each furnace contains four ingots, which are thus brought to a yellow heat.

The rolls are some 34 inches between centers and are driven by the main engine. Each ingot passes through twenty-one times. The table upon which the work is conducted to the rolls consist of a number of cylinders rotated by suitable gearing driven by a separate small engine. A piece laid upon these cylinders is quickly moved forward. This table is adjustable vertically, and may be raised up or lowered to present the ingot according to the adjustment and position of the rolls. Between the cylinders and moving longitudinally are a number of fingers arranged as shown in Fig. 2. These are actuated by water power, and serve to turn the ingot over as it is drawn to and fro. A similar combination of mechanism is located on the opposite side of the rolls.

It will be observed that there is no hammering, to the absence of which the homogeneous nature of the steel, and also its uniform quality, may be ascribed. The ingot on entering is some thirteen inches square; on emerging from the rolls after one minute and thirty seconds drawing, it is reduced to about six inches. This entire work, formerly involving the labor of eighteen men, is now conducted with ease by a man and two boys.

Progress of the Centennial.

The exhibition buildings of the Centennial Exposition are now rapidly progressing; and if the funds requisite for the purpose be forthcoming, they will be completed by the first of next January. The granite work of Machinery Hall is nearly finished, and the roofs are being tinned. The plastering and laying of the floors will shortly be begun. The eastern and western wings of the main edifice are completed, and the entire structure, it is expected, will be up by the 1st of October. The glazing of Horticultural Hall is well under way, and nearly all the flooring is laid. Agricultural Hall will be begun as soon as the machinery building is finished. Laborers are now engaged in grading the grounds and digging out the declivity between the United States building and Machinery Hall in order to form a bed, some four acres in extent, for an artificial lake.

The wrought iron observatory to be erected by a Boston company (it is a pity we could not have had Clarke, Reeves, and Co.'s one thousand foot tower) is slowly rising. This will be 170 feet in hight and is located at Belmont, a point in Fairmount Park some 200 feet above the Schuylkill. The summit of the edifice will be about 100 feet above the highest spire of the Centennial buildings, over which and the city of Phila delphia and surrounding country, it will afford a fine view. The foundation of the tower is Conshohocken stone, laid in cement and dressed with granite. On the bed plate are fastened ten columns, each seven feet high, and supporting a huge iron ring eight feet in diameter inside and weighing a ton and a half. To this ring the main central shaft is riveted. The top of the tower will be reached by an annular car encircling the shaft and moved upward from the base on the outside of the latter. The car will be made of iron and glass, and be hoisted by a 40 horse power engine. Outside the shaft there will be a truss work of wrought iron. The space at the top of the tower will be capable of accommodating 125 persons. About the base of the structure, an ornamental building is to be erected and used for reception rooms, offices, etc.

A separate building is to be erected for the exhibition of the contributions from the Executive Department of the United States government. The main structure will cover 100,000 square feet, in addition to which will be erected a side building containg 20,000 square feet for a field hospital, the whole covering an area of nearly three acres. The different departments will have especial sections allowed to them. The State Department will exhibit old letters and curious documents from its archives. The Interior Department will show the operation of the Patent Office, and the mode of taking the census, and will probably explain how the Indians are (not) taken care of. The War Department will contribute old and new war munitions, etc., also the United States Cadet Corps, who will encamp for a month or two in Fairmount Park. The Quartermaster's Bureau will furnish specimens of army equipments for transportation, hospital service, etc., and the Subsistence Bureau, specimens of rations and modes of cooking. The Navy Department will contribute the Constitution, or rather a reproduction of the once famous old Ironsides, as the now thoroughly rebuilt vessel does not contain a vestige of the original craft except some wood about the keelson and one of the topsail sheet bits: together with models of various other articles incident to marine warfare. A field hospital after the most approved plan of construction will be erected. Probably one of the most interesting collections contributed by the government will be that of the Smithsonian Institute.

Professor Baird, in connection with this department, will give an exhibition of the propagation of fish of many kinds. An arrangement has been made by which a stream of running water will be introduced, and the method will be shown of hatching the fish from the egg, and statistics will be furnished stating the increase of the fish of the United States by this means, and other facts which may be thought of interest in this connection. Proper means will be taken by the Smithsonian Institute to represent the leading features of the Indian races. Their habitations, manners, and customs will be represented by delegations from the different tribes. They will also exhibit a large collection of specimens of prehistoric remains, comprising stone, iron and copper implements and pottery, dug from the mound hills, the relics of the mound builders, who are supposed to have occupied this continent before the Indians. A complete collection of all the minerals of the United States, prepared under the superintendence of Professor Blake, will not be among the least of these valuable collections. In addition to all these and many others, there will be a zoölogical collection, the material for which is now being collected from all sections of the country.

Ground has been broken for laying the foundation of the English buildings. There will be two separate structures, each two stories high. The larger one, 90x60 feet, will be used for offices of the Canadian and other colonial exhibitors. The other, 60x20 feet, will be used as residence sfor attendants required in connection with the British display. The buildings are to be constructed of brick and timber. The architecture will be in the old English style, and the roof will be tiled.

The Japanese commissioners are also preparing to erect buildings after their own style of architecture, and structures will shortly be commenced for Sweden and Morocco.

The questions as regards duty on contributed goods from foreign countries, and also relative to the same being liable to seizure for possible debts of the Centennial commission, have been definitely settled. The Secretary of the Treasury has decided that New York, Boston, Portland, Burlington, Suspension Bridge, Detroit, Port Huron, Chicago, Baltimore, Philadelphia, Norfolk, New Orleans, and San Francisco constitute ports of entry at which goods intended for the exposition will be admitted free of duty. All articles properly marked be will forwarded without examination from the port of arrival to Philadelphia, there to be delivered to the collector of that port. Articles entered at the exhibition may at any time be withdrawn for sale on payment of the duties. The Attorney General of the United States and the Attorney General of Pennsylvania have both given the opinion that goods deposited and placed on exhibition are free from seizure, and are not liable for the debts of the person or corporation thus receiving them.

From the advanced state of the buildings, if from no other indication, the reader may conclude that the time for preparing goods is growing very brief. Several foreign nations have already refused to receive further applications, while the present intention is to close the door to further applications in the American department on September 1 next, since there are already on file requests for considerably more floor room than the area set apart. There is a sifting process to take place, however, by which probably a large number of useless and discreditable entries will be thrown out, so that opportunity may then be given for a few eleventh hour applicants to get their goods in. Those proposing to exhibit should lose no time in filing their applications at once.

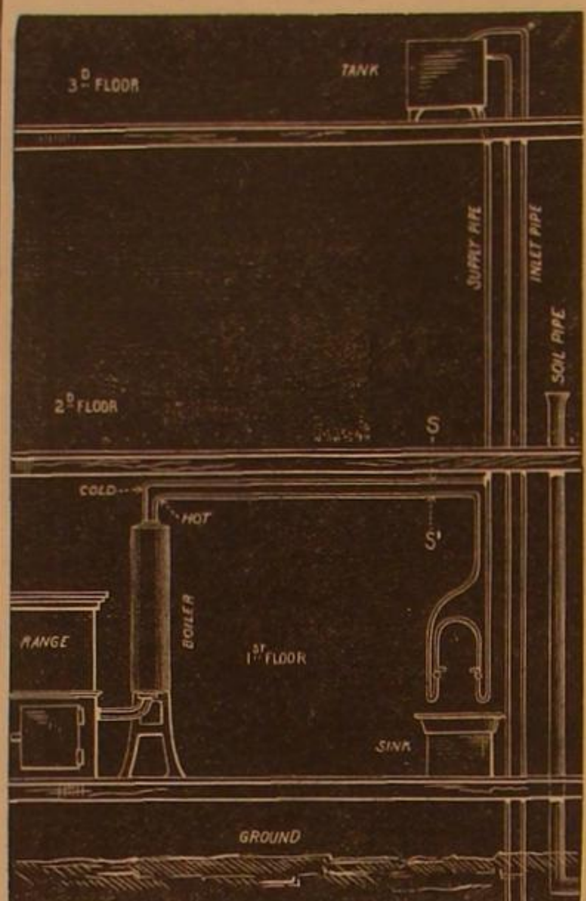
Correspondence.

Remarkable Electric Phenomenon.

To the Editor of the Scientific American:

An electric phenomenon has recently been observed, which I am unable to account for, and I would be grateful if you will help me to an understanding of it.

A house, built of limestone, stands upon a solid bed of the same material. Water is brought to it from a spring on the side of a neighboring hill, across an intervening valley, and poured into a tank on the third floor. An overflow pipe leads from the tank to the barn. The pipe that supplies the kitchen leads from near the bottom of the tank, and is connected to the range and boiler in the usual manner, as shown in the accompanying engraving. All the pipes are in contact with the wall, and are quite near each other. The hot and cold



water pipes are connected at the boiler, and also between the cocks; but of course the pipe is plugged at this point with solder, as usual. During every thunderstorm of any magnitude, frequent and violent electrical discharges are noticed passing from one pipe to the other, at the points marked S S'. The pipes are all iron, except at the connections to boiler and cocks, where lead is used. I would ascribe the ex citement to thermal difference in the pipes, but they are so intimately connected that I cannot see how it is possible. Your opinion would be thankfully received.

THOMAS P. CONARD.

30th and Chestnut streets, Philadelphia, Pa.

Messrs. Munn & Co.:

In reference to the very interesting observation of Mr. Conard, on which you have asked my opinion, I would say that it is a striking illustration of a well known principle of electricity, to which I have before had occasion to refer in your pages. There was at one time a very general impression that, if two routes of different facility were offered to an electric discharge, it would flow entirely by the better one. This, though (I think) still to be found stated in some text books, is entirely untrue. On the contrary, the fact is that, if two or a hundred routes, differing in facility or conducting power, or, to use a technical expression, "of unequal resistances," are offered to the passage of an electric current or discharge, it will divide itself between them all, in direct proportion to their facility or conducting power.

Among other illustrations of this, I find in Ferguson's "Electricity," 1866, page 63, the following: "A Leyden jar being charged, we have a wire bent, as shown in the engraving, and armed with balls at the ends. One end of this being held against the outside of the jar and the other brought within striking distance of the knob, a spark will pass at E, where the two parts of the wire should be, say, one eighth of an inch apart.

"This evidently is because, while the wire is a far better conductor than the air, yet some of the discharge will even pass through the worst conductor; and the wire being long and the air path short, the difference is not so great but that the fraction passing through the air is an appreciable quantity."

The general principle above stated is one which lies at the foundation of the whole subject of electrical measurements, in which such wonderful results have been reached of late years. Those of our readers who may wish for fuller information on this last subject, we would refer to the article by the present writer on "Electricity," in Johnson's "Encyclopedia," or to Sabine's or Culley's works on the electric telegraph.

After what we have said above, it is hardly necessary to make any personal application to the case before us. No doubt Mr. Conard's tank is near his lightning rod, or in some other way is plentifully supplied with electricity during a thunderstorm. This finds its way to the earth by countless routes, by the walls of the house to a very slight degree, by the various pipes in proportion to their conducting power; and, in the particular case noticed, it finds the hot water pipe so far a desirable road to the copper boiler, and thence to the ground, that part of the current which enters the cold water pipe takes that route. I think it likely that there are some joints on the cold water pipe, between the spark plate, S, and the boiler, cemented with red lead, which is an excellent insulator, or other like body. This would not, however, be essential.

Assuming a difference in the tension of the pipes, S and S', through a difference of their ground connections, induction would exaggerate the same, and aid in this production of the spark; but while this and other actions may no doubt conspire to the effect, the first cause which we have described is, we believe, the main one.

HENRY MORTON.

Stevens Institute of Technology, Hoboken, N. J.

Exit from Public Buildings and Railway Cars.

To the Editor of the Scientific American:

As one of our common humanity, I was pleased to see the attention of the public called to the much needed improvement in the means of effecting an escape from churches and public buildings, in case of fire, accident, or sudden emergency, referring as instances to the Holyoke French church disaster, and the accident at a New York church of a few weeks ago; in fact, almost every paper brings an account of some such horrifying occurrence, with the sacrifice of a greater or less number of human lives.

This brings to mind the frequency of accidents and loss of life in railway cars from a similar cause, as instanced in the Roanoke disaster on the Great Western Railway of Canada of last year; in which, during the burning of a car, the passengers, in their frenzy and haste to escape, jammed the door shut, and could not get it reopened, and several were burned to death, some saving themselves by jumping out of the windows.

These accidents will not become less frequent until some important changes are made to prevent them. As your correspondent of July 3 remarks: "Provision can be made, and it should be compelled to be." There has been in force for some years, in the Dominion of Canada, a law compelling the doors of all churches and public buildings to be opened outwards; and so great was the necessity felt for this that the enactment of the statute was accepted as a great boon, and at once universally complied with.

The same feeling is prevalent, requiring statutory enactment compelling the opening outwards of railway car doors, evinced by the fact that, at each of the two last sessions of the Dominion Legislature, a bill was brought forward with this object in view.

As a late resident of the Old Bay State, I am surprised to learn that you are so far behind in such an important matter; and for the welfare of those who are wont to congregate in our churches, and gather in public assemblies, and the ever constant stream of railway travelers, let us hope that those who have assumed the responsibility with the positions they have accepted, as our lawgivers and legislators, will, at the earliest possible moment, do away with these wholesale man traps.

The facts of the case certainly and practically suggest the remedy: Open the doors of all public buildings and railway cars outwards. This is really what must be accomplished, and the wonder will be that it was not done long since.

W. T. SMITHERS, D.D.

Formerly Rector of Christ Church, Boston, Mass.

Lindsay, Ont.

The Iron Horse.

To the Editor of the Scientific American:

Most of your correspondents, when writing on the application of steam to street cars, seem to take it for granted that the power used must be either horse or locomotive, with no alternative. If by locomotive they mean cylinders connected to the car wheels, or to the wheels of a separate vehicle or machine, I must dissent, and agree with you that the horse is to draw these cars awhile longer; for there are some very important things about drawing a street car that locomotives cannot do practically. For instance, a large truck broke down on a track, and the several cars passing each minute were promptly drawn off the track and around the obstruction on the ordinary Belgian pavement, preventing a serious blockade; and this is not uncommon. However effective locomotives may be on a clear track with good rails, they are worth little off it, and on most street railways they would be off too often.

We think the case demands, not a locomotive, but literally an iron horse, that can, like any horse, be readily attached to and detached from the front of any car, with which it can be drawn off from or on to the track at pleasure, and need not be stopped by ice or mud. The first machine would undoubtedly cost the $3,000 estimated by Mr. Woodward (page 52, current volume); but if any of the great lines ordered machinery enough to draw all their cars, they could probably be furnished for $1,500 each. Of course, no company will do this until some one actually brings out the said iron horse, and fully demonstrates his trotting capabilities; for corporations (unlike the Hon. Mortgage Bond) are not so famous for taking "chances," however "big" they may appear.

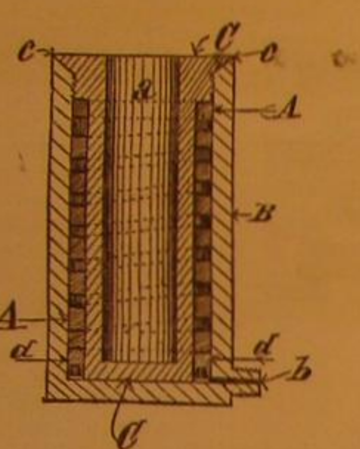
There is a growing demand for a machine of this kind, and many are looking to see whence it will come—a question for our inventors to answer. F. H. Richards.

New Britain, Conn.

Cold Air Motor No. 2.

To the Editor of the Scientific American:

As cold air motor stock is at a high premium, and capital is going for it blind, a good opening is presented for an enterprising man, and I do not propose to allow Mr. Keely to have an undisputed monopoly of the motor business. I would, therefore, exhibit, for the consideration of those interested, a motor that will accomplish all that is claimed for the Keely marvel in a more simple manner, dispensing with the receiver, standpipe, and pipes, cocks, etc., in the interior of the chamber of the generator of the new element of power. The engraving shows a sectional elevation of the device; it



consists of a cylindrical vessel made of brass, having its side and bottom walls made very heavy, for a purpose that will hereafter appear. Said vessel is in reality made up of two cylindrical vessels, A B, A secured within B, concentric to the same, and of such relative diameter as to allow a space of proper width to intervene between them. In said annular cavity, a ring, *d d*, is fitted to move under pressure; it is provided with a leathern cup packing, attached to its lower end. Above this ring, which acts as a piston head, a powerful spiral spring, *a*, is placed; the line of junction between the inner and outer cylinders is made on the edge, *c c*, and if the work is well done it cannot be observed. A strong pipe is connected to the nipple, *b*; said pipe is provided with a suitable stopcock, and to its free end a powerful air pump is attached. The proper amount of air to obtain 2,000 or 3,000 lbs. to the square inch is pumped in; the receiving inlet must necessarily be very small. When the requisite pressure is on the generator, the stopcock is turned, the air pump disconnected, and an indicating gage attached in its place.

This little operation should be conducted privately before you exhibit the generator to the uninitiated. The cap or cover is now secured in place upon the top of the generator; t should have a stopcock to which is attached about a yard of small gum hose. When exhibited, the operator blows into the hose for a few seconds; the hose is then secured to a hydrant nozzle, and a couple of quarts of water introduced into the chamber, *a*. This should be well shaken up to expedite the generation of the cold air vapor. If the stopcock in the pipe that the gage is fastened to be now opened, said gage will instantly show a pressure of 2,000 or 3,000 lbs. per square inch. If this device is made of sufficient dimensions (say, 40 inches high and 20 inches outer diameter), an ample quantity of cold air vapor at said pressure can be produced to run a small engine for several minutes, possibly half an hour, and the pressure would be nearly uniform until the vapor is exhausted. Be sure to quit before that event takes place; then take off the top or cover, and show the experts present that there is no humbug about it.

I must candidly state in advance, for the benefit of capitalists desiring to invest in my motor, that there is a possibility of Mr. Keely's invention being substantially the same in construction, and this would bring on an interference in the Patent Office. Wm. P. Patton.

Harrisburg, Pa.

Fire Escapes Wanted.

To the Editor of the Scientific American:

The communication in your issue of July 3 induces me to propose the following preventive of such horrid human holocausts as the late one at Holyoke. Let all churches and public buildings be made with double door frames, the outer one set fast in the wall and the inner one hinged to it, to open outwards; the doors to be hung in this as usual. When the building is occupied, the inner frame can be slightly fastened, so that the least rush will open it. When the building is unoccupied, it can be made fast. Let every State require, by law, public buildings to be thus made.

Kankakee, Ill. S. N. Manning.

[For the Scientific American.]

Cotton Mathematics.

Deduction of a formula for the production of any number of yarn, per spindle, per hour, in decimals of a pound, at any spindle speed.

Let S R = revolutions of spindles per minute.

N = number of yarn in question.

M = multiplier of square root of number, to determine the twists per inch of yarn; then

$\sqrt{N} \times M$ = number of twists per inch, and

$\frac{S\ R}{\sqrt{N} \times M}$ = number of inches twisted per minute, and

$\frac{60\ S\ R}{\sqrt{N} \times M}$ = number of inches twisted per hour.

The hank measures 30,240 inches.

In a pound of any number of yarn, indicated by N, there are N hanks; hence 30,240 × N = number of inches yarn in question per lb.

$$30240\ N : 1\ \text{lb.} :: \frac{60\ S\ R}{\sqrt{N} \times M} : \frac{60\ S\ R}{30240\ N \times \sqrt{N} \times M} =$$

$\frac{S\ R}{504 N \times \sqrt{N} \times M}$ = decimal of 1 lb. per spindle per hour of N Yarn. In England, the values of M for different descriptions of yarn are as below:

For hosiery yarn, M = 2·5

For doubling, M = 2·75.

For weft, M = 3·25.

For common mule twist, M = 3·75.

For extra mule twist, M = 4.

For super extra mule twist, M = > 4.

Applying the formula, in illustration, to No. 14 yarn, we have as $\sqrt{14}$ = 3·741, with S R = 6,000, and M = 4.

$\frac{6000}{504 \times 14 \times 3{\cdot}741 \times 4}$ = 0·0568 lbs. No. 14 yarn per spindle per hour; and for 10 hours efficient work, 0 568 lbs. With M = 6, instead of 4, the production in 10 hours will be 0·378 lb. per spindle. The difference is 0·568 — 0·378 = 0·19 lb. per spindle, showing a loss daily from 10,000 spindles of 1,900 lbs. yarn No. 14, from excessive twist.

It must be remembered that, in the low numbers, the English spinners use a staple both shorter and weaker than American uplands, requiring more twist than the American. Yet M often in America is made 5, 5½, and sometimes 6.

By comparing, with the practical result in any mill, the theoretical result, ascertained by the infallible formula, the spinner will be at once advised, whether or not his frames are operated to their maximum capacity.

Forwards.

Steam Hay-Making.

It is reasonably certain that only a portion of the annual grass crop becomes converted into hay, and that the aggregate loss due to the spoiling of parts of the harvest by rainfalls amounts to very large sums. There is no process of curing hay so cheap as that of exposure, provided the season continues uniformly dry; but as such is rarely the case, there is clearly an economical advantage to be looked for in efficient machinery which does the work expeditiously and in all times and weathers.

A novel invention for this purpose has recently been exhibited at the Royal Agricultural Society's exposition in England. It is the device of Mr. William A. Gibbs' and its operation, according to the description published in the London *Times*, points to a high degree of efficiency. The apparatus is of the following form:

A portable stove constructed of plate iron is surmounted by a fan, which is driven by a belt from a three-horse power portable steam engine; the fan draws all the heated air and gases from the coke fire, together with a volume of warmed air, which passes through a chamber surrounding the inner chamber of the stove, and blows the hot current, at a temperature of 400° Fah. or more, into the dryer. This resembles in general shape a straw elevator, consisting of a sheet iron trough 6 feet in breadth, 20 feet long if mounted on wheels as a portable carriage, or 40 feet or 50 feet long if a fixture. The trough is raised at one end at a low angle, so that hay fed in at the upper end furthest from the stove shall slowly travel to the lower end of the stove—this being assisted by a slow reciprocating motion given to the bottom of the trough. A ridge of triangular section running along the middle of the trough divides it into two almost semi-circular channels, so that the hay passes down in two streams; the hot air issues through two slit apertures, one on each side of the base of the middle ridge, and for the entire length of the machine; and the hay is kept continually stirred and lightened up over the hot blast by a number of small iron stirrers, cleverly contrived to imitate the action of forks worked by hand.

"We saw," says the *Times*, "partly made but wet hay passed through the machine and converted at once into a thoroughly dry condition for the stack; we saw spoilt and musty hay dried into hay of fair apparent quality and pleasant fragrance; and we saw freshly cut grass, saturated with rain from a very heavy thunder shower which poured down at the time, dried into hay of first class color, and possessing the rich malt odor peculiar to well made hay. With a single twenty-foot machine, the operation is too slow to employ fully one man feeding off a cart and another man removing the product; but with two such machines side by side, or with one fixed machine, of forty or fifty feet length, probably one set of carters and stackers could be kept going. From the experiments made under our supervision, it appears that, while fresh and wet grass loses seventy to seventy-five per cent of its original weight in being made into hay, the quantity of moisture in excess in partially made hay, or hay caught by a heavy rain, may be from ten to twenty per cent. To expel this water from partially made hay requires a consumption of coke in the stove and of coal for the engine not exceeding a cost of 30 cents per tun of hay dried. Preserving freshly cut grass may cost in fuel six or seven times more. With outlay for labor and for wear and tear of apparatus, the total expense, according to Mr. Gibbs' calculations, does not exceed $1.80 or $2.00 per tun, which is, indeed, a very moderate disbursement for saving a loss of perhaps pounds per tun. To make freshly cut grass into the finest hay at one stroke costs about $10 per tun of the dried hay.

Now, it is possible that in a wet season it may pay thus to preserve grass entirely by artificial heat; but Mr. Gibbs recommends the general use of the apparatus for completing the process of hay-making after the grass has been withered by some exposure, and has lost, say, more than half its original moisture. At this stage it will cost little to clear the field and get the hay safely into stack in the best possible condition, instead of leaving it to the chance of being rained on, involving a great additional expense in the ordinary labor of making, with liability to very great loss in "nose" and color. Another feature is that a small proportion of the artificially dried hay, if mixed with damaged stuff, improves the whole bulk in a manner which could hardly be believed without trial; and another is that a farmer having a drying machine at command is not afraid to open out his hay in dubious weather, and thus no fine hours whatever are wasted in waiting."

In some parts of the United States, where sunshine is lacking or wet weather prevails, an apparatus of this kind might be very useful. It could be employed also for fruit-drying and other purposes.

Needed Improvements.

The *Sewing Machine Journal*, published in the interest of the great business indicated by its title, points out the want of the following devices:

1. A ruffler which can be set to gather to a given fulness.
2. A simple embroiderer.
3. An adjustable scroll binder which will not stretch the binding.
4. A practical adjustable hemmer, from the smallest size to an inch wide.
5. A rotary shuttle sewing machine, which will not twist or untwist the thread, and which will sew with great rapidity.
6. A practical tuck folder.
7. A sewing machine which will have, in its working parts, the different attachments which can be thrown in gear with some working part of the machine when the attachment is required.
8. Motive power.
9. A good needle threader.
10. A glass oil bottle which can be sold cheaply, and used to oil the machine instead of the oil can. It must be made so that the oil can be forced out.

Two Inventions Wanted.

We call the attention of inventors and manufacturers to two advertisements in the present issue, in which the advertiser asks for, first, a process by which ten or fifteen copies of freshly written documents can be made rapidly and distinctly on durable paper in ink which will not fade; and second, for a strong, thin, tissue or similar paper which can be used in manifolding with carbon sheets.

It is not difficult to produce several copies of a document by means of devices and materials now in the market; but as a rule, such duplications are blurred and indistinct even when considerable care and skill are employed in producing them. For legal documents, for example, such copies are of little value, and in general, in cases where accuracy and legibility are of importance, press copies are not favored. Again, copying paper in manifold copy books is, as a rule, flimsy and poor stuff, and certainly not the material to which one would wish to commit valuable correspondence were anything better attainable. Messrs. Crane and Co., of Dalton, Mass., make a great variety of special papers for bank notes, bonds, etc., up to a heavy article for machine belting; and we have no doubt that they can make the article required by the advertisements. At all events, the requirements mentioned in the advertisements referred to are well worth the careful consideration of manufacturers generally, as we believe there exists a large demand for the article.

Isaac M. Singer.

Mr. Isaac M. Singer, the well known sewing machine inventor and manufacturer, recently died in England. Mr. Singer was born in Oswego, N. Y, in the year 1811, and in early life worked at the machinist's trade. On the appearance of the sewing machine, he at once turned his attention in that direction, devising an ingenious machine for himself, and subsequently adding improvement after improvement until the now celebrated machine which bears his name was perfected. Mr. Singer obtained a very large number of patents on his various devices, it being his policy to seek such protection as soon as he had demonstrated to himself that any new addition to, or modification of, his machine was essential to its working. His labor and enterprise did not go long unrewarded; and although one of the pioneers in an invention regarding which, as is common with all new ideas, people were at first skeptical, at a comparatively early period in the history of the sewing machine he succeeded in securing the necessary capital wherewith to establish a manufactory.

From that time forward, the fortunate inventor rapidly grew wealthy. The corporation subsequently formed, in which he held a large interest, became one of that powerful combination which practically controlled the entire sewing machine trade of the country, and at the time of his death his private fortune is said to aggregate several millions.

One and two thirds lbs. of coal per horse power, per hour, is the consumption of fuel shown by the steamship Plover, a new boat built at Sunderland, England. She has compound engines indicating 562 horse power.

IMPROVED TOY GUN.

The annexed engraving represents a novel device which may be utilized to "teach the young idea how to shoot," or, in other words, placed in the hands of children as a plaything, or may be employed to kill rats or birds or any other small game. It consists of a gun constructed after the well known pea-shooter plan, that is, the missile is thrown by the contraction of a released elastic band, to moderate distances, with accuracy and considerable force. A general view of the invention is shown in Fig. 1; Fig. 2 shows the trigger mechanism, and Fig. 3, a section the muzzle.

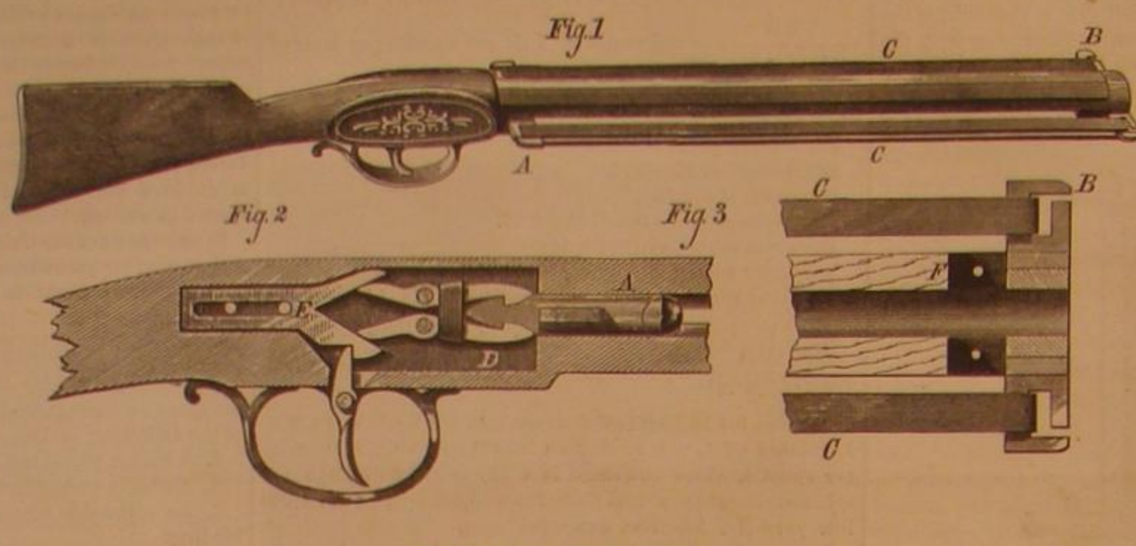
The barrel is slotted longitudinally, the slots forming guides for the sliding piece, A, therein. Extended between stationary hooks, B, at the muzzle, Fig. 3, and the arms of piece, A, which protrude through the slots, are strong rubber springs, C. These are extended when the slide piece is retracted.

The rear portion of the slide piece is provided with a hook or arrow, which catches in the pivoted spring jaws, D, Fig. 2. A slotted piece, E, with V-shaped front end, slides on lateral guide pins and acts on the rear ends of said jaws. The trigger engages in a recess of slide, E, and carries the same forward on being pulled. The rear arms of the spring jaws, otherwise held apart by a rubber spring encircling the front arms, are thereby forced together, and the front part opened. The rear of the slide piece, A, is thus released, and the latter is pulled quickly forward by the contraction of the bands, thus throwing the missile out of the barrel. Elastic cushions, F, Fig. 3, arranged in the ends of the barrel slots, break the force of the shock of the slide as it reaches the muzzle.

On pulling back the slide piece for the next shot, the arrow end spreads the jaws, which carry, by their action on the V-shaped slide, the same and the trigger back, ready for another discharge. Buckshot or bullets may be fired; and to retain the same in place, the forward end of the slide piece, A, is hollowed, and a light spring provided, which grasps the ball and prevents its escaping when the gun is carried muzzle downward.

For dispelling cats in city back yards, we should imagine this invention admirably adapted. It certainly would be a cheap substitute for the air guns now used for target practice. It may also be trusted in the hands of children, to whom it would be dangerous to allow the handling of a weapon charged with powder and ball.

Patented through the Scientific American Patent Agency, May 25, 1875. For further information, relative to sale of patent, address the inventor, Mr. William H. Martin (until 1st of September next), Burnt Ordinary, James City county, Va.; after that date, at Mobile, Ala.



MARTIN'S TOY GUN.

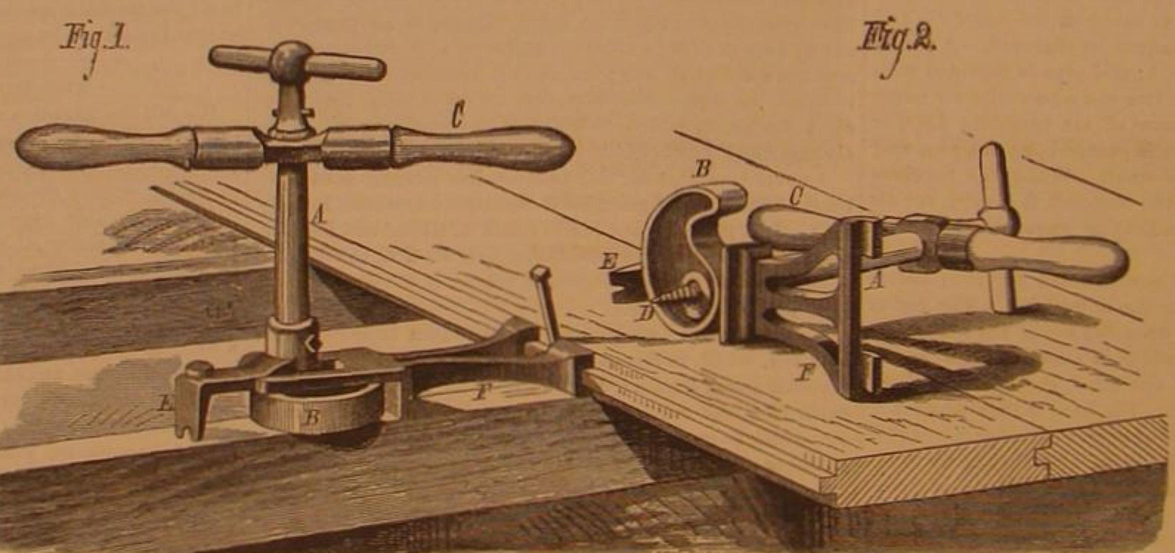
To Distinguish Benzine from Benzol.

Benzol, C_6H_6, was first discovered by Faraday in the cylinders in which coal gas was delivered to consumers in London many years ago. Much more recently, a volatile substance resembling it in several particulars was found among the products of petroleum refineries, and to this too was given the name benzol or benzine. At length the name benzol became confined to the coal tar product, while in this country the name benzine has generally been limited to the petroleum product; but in England and France both are known as benzine. The former is much more valuable than the latter, since it is employed in the manufacture of aniline and the aniline dyes. There is great similarity in color, odor, etc., and the benzine is sometimes sold as benzol, or mixed with it. Dr. Hagar distinguishes the two by means of iodine. A small crystal of iodine, placed in a test tube containing the liquid to be tested and gently agitated, dissolves and imparts to benzol a violet red color; to benzine it imparts a raspberry red color. In a mixture of the two, the color of the solution is also a mixture of violet red and raspberry red, the latter prevailing, so that the addition of the smallest quantity of benzine to benzol can be detected in this way. A few experiments will soon enable a person to judge of the amount of adulteration.

IMPROVED FLOOR CLAMP.

Carpenters, cabinet makers, and others who find it frequently necessary to clamp flooring boards or portions of furniture together are provided, in the device illustrated herewith, with a novel and simple tool especially adapted to such purposes. It consists of a sleeve, A, which at its lower extremity carries a cam, B, Fig. 2, and at its upper end has a handle, C. Passing through the sleeve is a rod having a screw point, D, at its lower end, and turned by the upper handle shown. Attached to a collar on the sleeve, A, is a rearward extending arm, E, the end of which is turned downward and toothed so as to engage with the surface of the joist. F is a slotted and grooved arm which is pressed by the cam against the boards when said cam is suitably revolved by the handle, C. The holding arm, E, prevents any rearward motion of the device, which is still further secured by the screw point, D, entering the wood of the joist.

The invention was patented June 8, 1875, to Mr. W. D. Clark, of Springfield, Ill., to whom inquiries for further particulars may be addressed.



CLARKE'S FLOOR CLAMP.

IMPROVED PRESSURE BLOCKS FOR PLANING MACHINES.

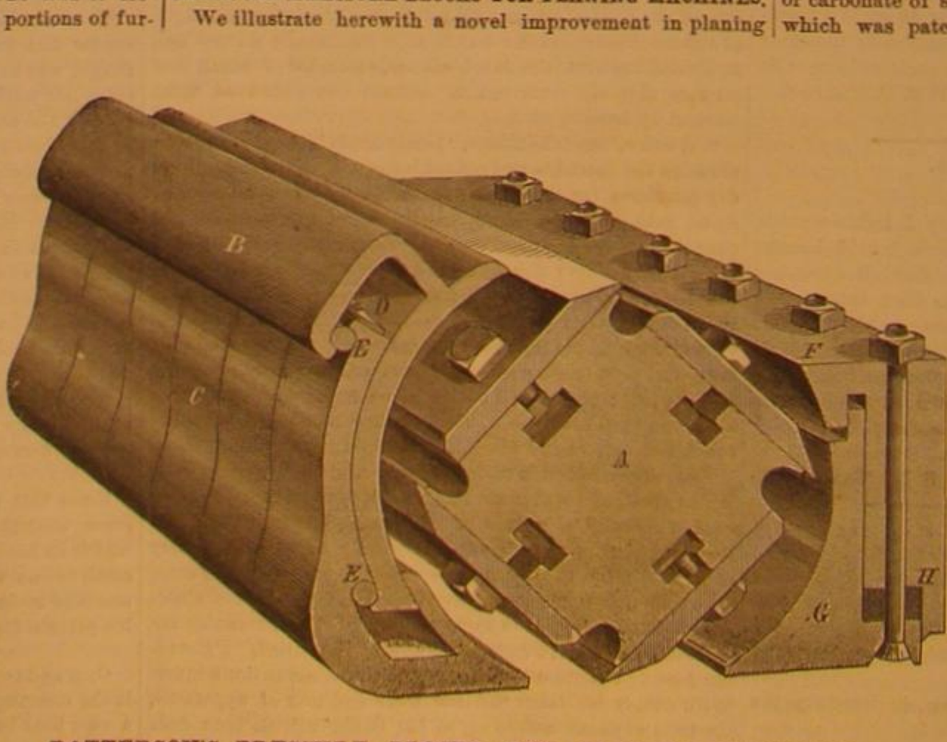
We illustrate herewith a novel improvement in planing machines, which consists in a series of independently operating pressure blocks, arranged on lines parallel with the axis of the rotating cutter. Their object is to hold the lumber while being planed, and in so doing to take the place of the pressure bar or pressure rollers now generally employed. The advantages claimed are that the operator is enabled to feed two boards of different thicknesses at the same time, holding both alike; or he may plane one board on one side of the machine and have it held alike at both edges, thereby securing a uniform thickness and even surface, giving the same amount of wear on the side of the machine as at the middle, and thus keeping the cutters and bed worn alike and even.

At a suitable distance in front of the cutter head, A, is secured a guide, B, the inner side of which is made circular and concentric with the circle described by the cutters in their revolution. On this guide are hung the independent chip breakers or pressure blocks, C. The latter are constructed in the same curve as the guide, and are held down by the spring, D. In the guide are made suitable recesses for the reception of friction rollers, E, for the blocks to work against with an easy movement.

In rear of the cutter head is a crossbar, F, which holds another series of pressure blocks, G, which hold the board after it is planed. These are also curved on their inner sides, and the proper amount of pressure is given to each by means of a rubber spring, H. Each block and its spring is held by means of a bolt, as shown. The tendency of the blocks, G, is to bring down the thinner part of a board not planed alike on both edges, and to keep it from vibrating, thereby securing uniformity of thickness and an even surface.

This invention, which the inventor claims in no wise conflicts with the Woodbury patented pressure bar, offers, as has doubtless already been noticed, a means of overcoming several difficulties peculiar to that appliance.

It was patented in the United States May 25, 1875, and also in Canada, to Mr. Chester R. Patterson, of 438 North Main street, Pittston, Pa., to whom inquiries for further particulars may be addressed.



PATTERSON'S PRESSURE BLOCKS FOR PLANING MACHINES.

Soda Manufacture.

Siebel proposed to make carbonate of soda by fusing together phosphate and nitrate of soda, so as to obtain at the same time nitric acid. Aside from the difficulty that the vessel, in which the fusion was made, would be rapidly destroyed, this process has no practical value, because, in the first place, a number of operations are requisite, and, in the second place, the separation of phosphate from the carbonate of soda is either imperfect, or so expensive on a large scale, that nitric acid, as well as soda, would be much more costly than when prepared in another way. That communication induced the author to publish his process for making nitric acid and caustic or carbonate of soda from Chili saltpeter at one operation, which was patented in Prussia in 1867, in the hope that further experiments or the use of more suitable vessels would render this process a profitable one in industrial chemistry, for obtaining at once, from cheap Chili niter, valuable nitric acid and caustic soda.

In 1805 and 1806 the author had numerous experiments made in his laboratory for the purpose of obtaining nitric acid and caustic soda from Chili saltpeter. It was fused and ignited with various substances like silica, alumina, oxide of zinc, and carbonate of magnesia, but all these required so high a temperature for the decomposition of the nitrate of soda that the greatest part of the liberated nitric acid was completely decomposed, and only a small portion of it was obtained. The least heat was required with carbonate of lime. The author mixed fine chalk with Chili saltpeter in nearly equivalent proportions, with a slight excess of the former. The mixture was heated first in an iron retort, afterwards in large iron pans under a stone vaulted cover, until no more gas was evolved, and the mass be came pasty and thick. The gases were conducted through a system of stone flasks containing water, and in this way at first three fourths, afterwards eleven twelfths, of the nitric acid in the saltpeter was obtained. As the common salt in the saltpeter is not decomposed by carbonate of lime, at least at the temperature employed, the acid obtained was perfectly free from chlorine. The thick sirupy mass was drawn out of the pan while still hot, and the pan charged again. The mass, which contained caustic lime and carbonate of soda, when cold, was boiled with water to obtain caustic soda, the carbonate of lime being precipitated.

Since all the soda in the nitrate of soda is obtained in the form of caustic soda, and as a rule this covers the total cost of the saltpeter and chalk employed, this process would be a profitable one were not the costly vessels rapidly destroyed, as an eight months' experience proved, the operation often being interrupted to renew the pans.—*Carl Lieber.*

To Make Gold and Silver Inks.

Good bright gold, silver, and bronze inks are seldom met in the market; they are almost always of a dull color, do not flow easily from the pen, and the writing remains sticky. Hence architects and artists mostly prefer to use shell gold and shell silver (*Muschel-Silber*), instead of the corresponding ink. The latter, however, is so much easier and safer to use that I will describe its preparation.

For gold ink it is best to employ genuine gold leaf, but owing to the expense this is seldom used; sometimes mosaic gold (sulphide of tin) or iodide of lead is employed, but almost always Dutch leaf.

Owing to the relatively low price of silver, genuine silver foil is used for silver ink, false silver foil is seldom used, and is not so good. For other metallic inks, commercial bronze powders are employed. The genuine and false foils are also sold in a finely pulverized state; they are made from the waste of the gold beaters by rubbing it in metallic sieves to an impalpable powder.

In consequence of the beating between gold beater's skin, it has particles of grease and other impurities attached to it which must be removed before it can be used for ink. For this purpose the whole sheets, or the commercial bronze powder, are triturated with a little honey to a thin magma on a glass or porphyry plate with a pestle, as carefully as possible, as the beauty of the ink depends essentially on this. The finely rubbed paste is rinsed into a thin glass beaker, boiled for a long time with water containing a little alkali, frequently stirred, decanted, well washed with hot water, and dried at a gentle heat. By boiling this powder with water containing sulphuric, nitric, or hydrochloric acid, different shades can be imparted to it.

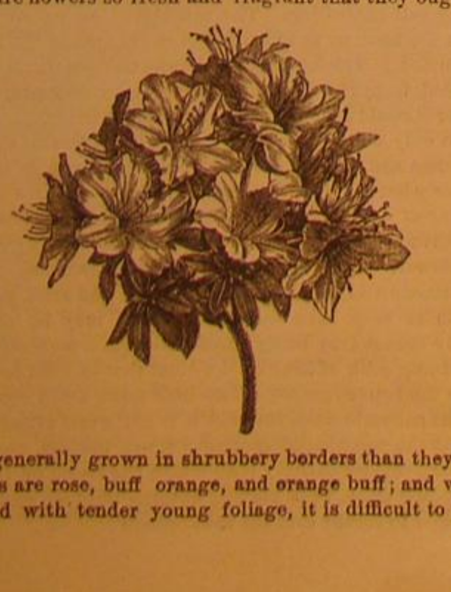
Next, a solution of 1 part of white gum arabic in 4 parts of distilled water is mixed with 1 part of potash water glass, and triturated with the requisite quantity of purified metallic powder. Gold ink will bear more liquid than silver ink, since gold covers much better; on rough paper more metal is necessary than on sized paper; on light paper more than on dark, to make the color of the ink appear equally intense.

In general 1 part of foil is enough for 3 or 4 parts of the above liquid. In preparing large quantities of ink, a low porcelain measure is used for transferring it to the small glass vessels where it is to be kept, and it must be continually and thorougly stirred so that it will always keep well mixed. It requires frequent stirring also when in use. It is best to mix the dry powder with the liquid immediately before using. The ink can be used with a common steel pen, and flows very well when writing slowly, but it is better to use a pencil.

I consider the use of potash water glass of great importance. It greatly increases the metallic luster on paper, prevent its looking dead, protects the writing from being discolored by the action of the atmosphere, and also prevents its penetrating too far into the pores of the paper, without rendering it very viscid. Although the writing of itself possesses a high metallic luster, it may be increased by gently polishing with a polishing steel. Inks made with mosaic gold, mosaic silver, iodide of lead, etc., are not nearly so beautiful.—*C. H. Viedt.*

HARDY AZALEAS.

These are flowers so fresh and fragrant that they ought to be more generally grown in shrubbery borders than they are. The colors are rose, buff orange, and orange buff; and when intermixed with tender young foliage, it is difficult to imagine anything more beautiful. In every variety of this plant, when grown well in any deep rich soil, intermixed with rhododendrons, the different tints of yellow, red, and orange have a pleasing effect among the white, rose, and purple tints of the latter plant. Another attraction possessed by these azaleas is that the foliage becomes bright yellow and crimson in the autumn. Our illustration represents the so-called Ghent azalea, a fine specimen of the hardy class.

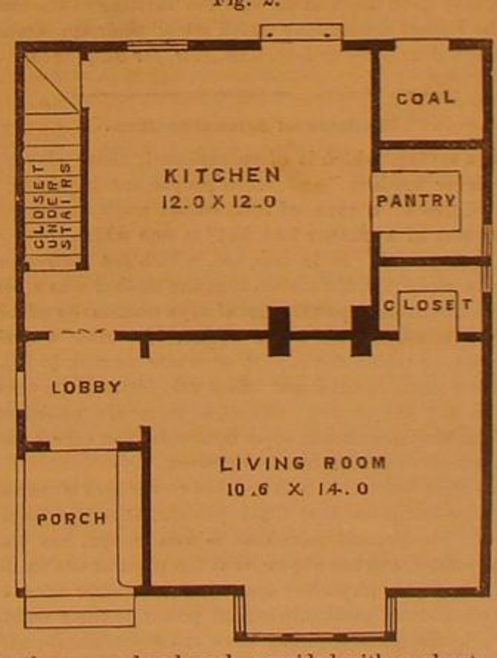


COTTAGE ARCHITECTURE.

The accompanying view and plans (Fig. 2), designed for a gardener's cottage, show a building, small, but very picturesque in appearance. It would be very suitable for a gate lodge or a sea-side or summer cottage, and would look extremely well among the trees of a camp ground. The porch (with its seat) is large and roomy; the living room is of good size, well lighted by a square bay window. The kitchen is well supplied with closets. This first floor could be very much improved by adding a one-story kitchen at the rear, making the living room into a parlor, and the kitchen into a dining and sitting room; the additional cost would be very small. The second floor contains three bed rooms, very conveniently arranged and each provided with a closet. The two downstairs rooms and the large front bed room are supplied with open fireplaces, the value of which for ventilation is so often overlooked in cheap houses; besides this, there should be ventilating tubes or shafts in the chimney sides, with registers opening from each room, thus insuring a good system of ventilation. The roof should be ventilated by openings under the projecting eaves. The estimated cost of this building is from $1,200 to $1,800, according to locality and style of finish.

AN ORNAMENTAL COTTAGE.

Fig. 2.



The view and plans are taken from "Wooden and Brick Buildings," the latest and best work published by Messrs. A. J. Bicknell & Co., of 27 Warren street, New York.

Smith College.

By the endowment of a charitable lady, now deceased, a new and splendid college for the higher education of young women has lately been constructed at Northampton, Mass. The students, instead of congregating in one large boarding house, are divided into small families, residing in separate cottages, scattered about the college grounds.

The general character of the institution has been determined by its founder, whose will provides that the trustees shall furnish young women the "means and facilities for education equal to those which are afforded in our colleges to young men." The fund for the institution was not given to establish an ordinary school, but to found, in the truest sense of that term, a college, which should give young women an education as high and thorough and complete as that which young men receive in Harvard, Yale, Amherst, and other colleges.

The college was dedicated in July last, under the presidency of Professor L. Clark Seelye, formerly of Amherst College, Mass.

On the Paraffins of Pennsylvania Petroleum.

Morgan, under Schorlemmer's direction, has made an examination of the normal hexane and heptane from Pennsylvanian petroleum, to test the question of the presence of isomers. The normal paraffins were chlorinated, and then converted into olefines by treatment with alcoholic potash. These olefines were treated with cold hydrochloric acid, each of them being thereby separated into two fractions, one of which dissolved in the acid, while the other did not. The latter fractions yielded secondary alcohols when suitably treated, that from the hexane being methyl-butyl carbinol and that from the heptane being methyl-pentyl carbinol. It hence appears that the derivative olefines are normal, and have the constitution $CH_2=CH-C_nH_{2n+1}$. The former olefines, or those soluble in hydrochloric acid in the cold, yielded alcohols which appeared to be secondary, but which need further investigation.

In some remarks upon this paper, Schorlemmer says that the above results do not necessarily prove the presence of a third isomeric heptane in petroleum. Heptane when treated with chlorine yields one primary, and may yield three secondary, chlorides. If the heptenes from two of these combine with hydrochloric acid in the cold, the alcohols from them would yield on oxidation ethyl-butyl ketone and dipropyl ketone. These on further oxidation would yield propionic and butyric acids. Since Morgan obtained the latter, and as the acetic acid he obtained came probably from the presence in his heptane of a lower boiling isomer, it is probable that, owing to the method he employed, the propionic acid was overlooked. To decide the question, an absolutely pure paraffin is necessary; and the author proposes to make additional experiments with hexane from mannite.

Snuff for Insects.

The so called tobacco meal, the *Kölnische Zeitung* says, has been successfully used in agriculture for the destruction of noxious insects, but it has not yet been applied largely on account of its high price, which is caused by heavy import duty. The only obstacle lies in the fact that the meal might be used for the manufacture of snuff.

COMBINED PORTABLE AQUARIUM AND WARDIAN CASE.

The accompanying illustration, selected from the English *Garden*, represents a simple and tasteful little parlor aquarium, in which many small exotic aquatics and some of our native water weeds will grow as well as in a contrivance of greater dimensions. It consists simply of a glass vessel, similar in shape to an ordinary bell glass, but furnished with a stand, and covered either with another bell glass or an ordinary glass shade. A handful of sandy soil or gravel and a few shells at the bottom serve to hold the roots of vallisneria, aponogeton, chara, and other water plants. Soft water is best for filling the glass if it can be obtained, and one or two goldfish add brightness and life to such an arrangement, and give motion to the water. Aquatic plants, or such of them as will grow in a vase of small dimensions, very rarely produce flowers; and in order to counteract this want of brilliancy, a vase of cut flowers may be introduced, as shown in our engraving, and they will last fresh and beautiful for a much longer time than when they are fully exposed to the heated atmosphere of the sitting room.

The Meteorite of February 12, 1875.

BY ARTHUR W. WRIGHT.

This meteorite fell in Iowa county, Iowa. It is of the stony kind, not greatly differing in its general appearance from others of the same class. Numerous small grains of metallic iron and of the magnetic sulphide of iron, or troilite, are scattered through the mass, the iron grains ranging in size from the finest particles, like mere powder, to those of the size of a fig seed, with occasionally one as large as a grape seed. The mass of which the meteorite probably once formed a part was of great size.

The recent investigations of Professor Newton, Schiaparelli, Oppolzer, and others, in respect to some of the great meteoric streams, have resulted, on the one hand, in establishing the identity of their orbits with those of certain well known comets, and on the other, in showing that the bodies belonging to these streams are probably of the same nature as the sporadic or occasional meteorites. It seems probably, therefore, that an examination of the gases yielded by a freshly fallen meteorite would be likely to furnish important information respecting the tails of comets, and these anticipations were found to be not unwarranted by the results.

The examination showed that the gaseous contents differed in a marked degree from those obtained from iron meteorites hitherto examined, inasmuch as they contained a very large percentage of carbon di-oxide, with a smaller proportion of carbonic oxide, and a large residue of hydrogen, the two oxides of carbon making about one half of the gaseous mixture.

The whole amount of gas given off was about two and one half times the volume of the solid portion of the meteorite employed, but this was not the whole, for the heat was discontinued before its evolution had entirely ceased. If referred to the iron alone, it would be about twenty times its volume.

The following table gives a comparative view of the relative proportions of the gases obtained at different temperatures, the nitrogen being determined as a residue:

	At 100°.	At 250°.	Below red heat.	At low red heat.	At full red heat.
CO_2	95·46	92·32	42·27	35·82	5·56
CO	0·00	1·82	5·11	0·49	0·00
H	4·54	5·86	48·06	58·51	87·53
N	0·00	0·00	4·56	5·18	6·91
	100·00	100·00	100·00	100·00	100·00

No hydrocarbon compounds of the olefiant series, capable of absorption by fuming sulphuric acid, were found, nor any marsh gas. A very small percentage of the latter would have been readily detected. Tests were applied for sulphurous oxide, hydrogen sulphide, and chlorine, but there was no indication of the presence of these gases. A small amount of water vapor was drawn off by the heat, but not apparently more than the ordinary quantum of hygroscopic moisture which such a substance would absorb from the air.

It will readily be seen, on reviewing the above results, that they showed a marked distinction between the iron and the stony meteorites, as to the gases they contain. For, while hydrogen is the principal gas of the irons, in the Lenarto specimen amounting to 85·68 per cent, in those of the stony kind, if the one examined may represent the class, the characteristic gas is carbon di-oxide; and this, with a small proportion of carbonic oxide, makes up more than nine tenths of the gas given off at the temperature of boiling water, and about half of that evolved at a low red heat.

The spectrum of the gases was observed by means of a vacuum tube, of the kind ordinarily used for spectroscopic work, attached to the apparatus. As was to be expected, it consisted of the hydrogen and carbon spectra together, bearing a general resemblance to those of gases from iron meteorites, but differing from them in the greater relative intensity of the parts due to carbon compounds. At a few millimeters pressure, indeed, the hydrogen spectrum was almost overpowered by them, and was relatively weak. The three middle carbon bands, those in the yellow and green, were very bright, that in the green being most intense of all. In the broad part of the tube these constituted nearly the whole of the spectrum visible, the green hydrogen line being discernible with difficulty, and the others not at all.

These are precisely the three bands observed in the spectra of some of the comets, and they have the same relative order of intensity. This is a very significant fact, for it shows that it is quite unnecessary to assume the existence of volatile hydrocarbons for the explanation of cometary spectra, as is done by some writers, and that the presence of the two oxides of carbon in such quantity is quite sufficient to account for all that has been observed, taking into consideration the circumstance that the tension of the gases in the cometary appendage must be extremely small, and the energy of the electric discharge very feeble.

There is a high degree of probability that, if a large comet should hereafter approach near enough to the sun to have its nucleus intensely heated, the hydrogen lines will be found in its spectrum, in addition to the bands heretofore observed. One cannot help regretting that a comet like Donati's should have departed into space just early enough to escape observation with the spectroscope.

The spectrum of bright lines or bands indicates that the gas gives out some light directly, in addition to that which it reflects. The most obvious, and also the most probable, cause for this luminosity is electricity. Certainly a disturbance of the electrical equilibrium would result from the heating effect of the solar rays, and a change of electrical potential, with consequent discharges, would be produced by the motion of the gaseous molecules from the nucleus and from each other, as also by the change in the distance from the sun, provided either of the bodies possessed an electrical charge as can hardly fail to be the case

There is another supposable cause for the light, which suggests itself, however, in the property of gaseous bodies, that they emit light of the same character as that which they absorb. It is not altogether improbable that the solar radiations absorbed by the gaseous matter, though for the most part converted into heat, would also in part be emitted again as light, and that in the case of volumes of gas filling many cubic miles, the intensity might be sufficient to give a distinct spectrum of bright bands or lines, even though, on the scale of any possible experiment, no trace of such an action can be detected.

These results have thus an important bearing upon the theory of comets and their trains; and if this meteorite may be taken as a representative of its class, they warrant the following conclusions:

1. The stony meteorites are distinguished from the iron ones by having the oxides of carbon, chiefly the di-oxide, as their characteristic *gases, instead of hydrogen.*

2. The proportion of carbon di-oxide given off is much greater at low than at high temperatures, and is sufficient to mask the hydrogen in the spectrum.

3. The amount of the gases contained in a large meteorite, or a cluster of such bodies, serving as a cometary nucleus, is sufficient to form the train as ordinarily observed.

4. The spectrum of the gases is closely identical with that of several of the comets.

We consider a comet, then, as merely a meteorite of considerable magnitude, or a swarm of many of lesser size, containing large quantities of carbon di-oxide, with some carbonic oxide and hydrogen, and giving off these gases under the influence of solar heat. The gaseous substance in streaming away forms the train, which is visible, partly by reflected sunlight, and partly by its own light, due to some molecular or electrical action, which causes it to give the spectrum of the carbon compounds. The form of the train points to a repulsive influence of some kind, as has been shown by Professor Norton, but whether this is due to a specific action of the sun's rays, as is held by Faye, or is electrical in its nature, as maintained by Zöllner, must still be regarded as a subject for investigation.

The loss of the gaseous contents by the action of solar heat readily explains the loss of the tail and diminution of brightness observed in the case of several comets in their successive revolutions; and their final disappearance from sight will follow as an inevitable consequence, the number of revolutions necessary to deprive them of their gaseous contents depending principally upon their size and the nearness of their approach to the sun at their perihelia.

The combustion of the hydrogen and carbonic oxide contained in meteorites, when liberated by the heat caused by their entrance into the atmosphere, must contribute greatly to increase the intensity of the heat, and both in this way, and by the consequent sudden expansion of the imprisoned gases, may have much to do with the bursting of the masses, and the violent detonations which attend their appearance.—*American Journal of Science and Arts, for July,* 1875.

Mothers of Scientific Men.

It is a saying, which is often repeated, that "clever men have clever mothers," and when people are inquiring into the pedigree of a man of intellectual mark, the question "what sort of a mother had he?" is one which may well arise in the mind. It is one, too, which not unfrequently elicits in reply the declaration that the mother was a person of some intellectual power—not always necessarily of a high degree of education, but still a woman who made a mark on the society in which she moved, of whatever rank in life she may have been. Genius and talent are, fortunately, not confined to any one station, although there are undoubtedly some circumstances much more favorable than others to the development of the intellectual powers.

The notion that clever fathers have clever sons is not nearly so popular as the one that brain power is inherited from the mother. Mr. Francis Galton, as is well known, has undertaken to show, and has shown, that the popular notion is, to say the least, an imperfect one, and that clever men have often transmitted great intellectual power to their children, although the manifestations have not been always of the same kind in succeeding generations. In his most recent work on "Scientific Men and their Nature" (D. Appleton & Co.), Mr. Galton takes up a special class of distinguished men, and, by the help of information received from themselves, he gives an account of the influences which have been at work in the determination of their character, and in the direction of their intellectual tastes. He draws a large number of very sound educational deductions, which we would strongly commend to the attention of all those who have anything to do, either as parents or as educators, with the direction of the mental life of children possessed of unusual capacity, or of a decided bent in any special scientific direction.

Among the influences brought to bear upon the nature and nurture of scientific as of other men, undoubtedly that of the mother has much to do Accordingly we find that many of the scientific men record of their mothers that they were possessed of considerable intellectual power; and one or two state that their first impulses toward the pursuit of Science were decidedly derived from their mothers, and distinctly fostered and encouraged by them. On the other hand, however, Mr. Galton remarks that, of all intellectual men, those following Science are least indebted to the maternal influence; in fact it may almost be said that the mother's influence in turning the son's mind in the direction of Science is scarcely felt at all. He declares that this could not be said so far as men distinguished in literature or in certain professions are concerned, and he ascribes the marked absence of the mother's influence over scientific men to the fact that the feminine mind does not care for Science, and that the ways of thinking of scientific persons are not those which commend themselves most to women's habits of thought. *The fact is rendered* all the more noteworthy because, in the great majority of instances, the influence of the father in directing the son's mental tendencies is clearly acknowledged.

It is to be noted that, where feeling, refinement, and even ambition are concerned, mothers have greatly influenced their sons; but where exact thought and patient investigation are involved, their influence seems to have been wanting. Instances being, however, on record that sometimes there has been a mother whose love for natural objects has had an effect on the mind of her son, it may be inferred that, were women generally of more scientific tendencies than they are now, the maternal influence might be as distinctly shown as in the cases of non-scientific men of intellect.

Science certainly has not at present the same attractions as literature for women, except in a few cases here and there. Perhaps that may result from the circumstance that so few possibilities of scientific instruction or work have, as yet, been open to them. But as time passes on, and chances of scientific education develope, women may come to find in the pursuit of Science something which will afford them interest, and will open up to them vast fields of intellectual usefulness, quite within the range of their powers. The day may come when some future Mr. Galton, making statistical inquiries as to the nature and nurture of scientific men of his time, will have to record that the maternal influence in the direction of the minds of scientific men is not, as now, conspicuous by its absence.—*Home Journal.*

Another Flying Machine.

A new air ship has been invented by Mr. W. F. Schroeder, which, so far as we are able to judge of it by the much muddled descriptions of the daily journals, appears to be a combination of all the various principles on which attempts at aerial navigation have heretofore been based. The inventor has been successful in obtaining pecuniary support, and therefore, unlike most schemes of similar nature, this one bids fair to exist elsewhere than on paper. At all events, we are promised a practical trial in the middle of next month, during the course of which Mr. Schroeder proposes to travel between New York, Philadelphia, Baltimore, and Washington, and finally, if successful, to crown his exertions with a transatlantic voyage, without the aid and assistance of that much discussed easterly current.

So far as we can make out the construction of the invention, it includes a boat, made of oiled canvas and wire, 65 feet long. This has two masts of steel, each 28 feet high, between which is extended an egg-shaped balloon, the points of the latter being held in a wire network. Around the middle of the balloon are girdles and nettings, the last of which come down and support the car, which, we suppose, is the boat. At each end of the boat is a propeller, also of wire and canvas. One screw pulls and the other pushes. These are independent, and drive the boat in either direction.

Besides, there are two large rudders, one at each end, and also independent. On each side of the boat is fastened by hinges a wing 35 feet long by 15 feet wide in front, 10 feet wide behind, and concave beneath. These wings are driven at the rate of 170 flaps per minute and the propellers at 1,200 revolutions, by an 8 horse hydraulic engine located in the car. We do not pretend to understand what generates the motive power. An engine run by water is the natural inference from the above; but whence the water p sure is to be obtained, we are unable to conjecture. Is it the Keely motor?

The whole machine is to weigh 1,800 pounds and the balloon to hold 80,000 cubic feet of gas; 12,000 pounds of load are to be transported at the rate of 70 miles an hour in still air, and the ocean is to be crossed in 50 hours. To the foundation for all of which assertions we shall be happy to bear witness after seeing the machine work.

Steam Street Car Construction.

Mr. Henry F. Knapp, in a paper recently submitted to the Rapid Transit Commission now in session in this city, makes some very practical and excellent suggestions relating to the subject of steam-impelled street cars and their machinery. Mr. Knapp is opposed to trains of vehicles, and believes that each car should be built to carry from 50 to 100 passengers, and be self-propelling. The machinery he would place beneath the floor, so as to leave the entire area of the latter unobstructed. The heat radiated from the generator would be shielded from the bottom of the car in summer, while in winter it could be utilized to warm the interior.

The only way of getting rid of exhaust steam, that terror of horses and bugbear of inventors, is to run it into a fan blower where it will be mixed with two or three times its volume of atmospheric air, which subtracts its heat and reduces it to water so quickly that a fine mist is ejected from the blower. The products of combustion (smoke), consisting of carbonic acid, carbonic oxide, steam, and such portions of carbon as may have escaped unburnt, may be most completely reduced by being forced through a reservoir or tank containing milk of lime by the blast that is used for feeding air to the boiler furnace. The lime takes up in combination all the carbonic acid, for which it has great attraction, and retains the particles of escaped carbon, cinders, etc., in suspension, besides entirely condensing the steam of the smoke to a liquid state, thus leaving nothing but free and invisible nitrogen to escape into the atmosphere

The Antiseptic Properties of Compressed Air.

The investigations of M. Paul Bert relative to the properties of compressed air, details of which have already been described in these columns, were the means of discoveries as unexpected as they were important. So far from accelerating respiration and consequently vital activity, as was predicted, the gas caused an enfeeblement of all the natural functions, and, in cases of sufficient compression, death. With pure oxygen, like results were observed, with the difference, however, that the pressure might be five times less than that of compressed air in order to produce a given effect.

Starting from the point thus reached, and adopting the theory according to which fermentations are ascribed to the development of minute elementary organisms, M. Bert has recently undertaken to determine the question of whether air or oxygen in a compressed state does not constitute an antiseptic agent. The experiments made have led him to an affirmative conclusion. Meat submitted for a month to the action of compressed air became yellow and acquired a slightly acid reaction, but all its nutritive properties were found thoroughly preserved. The investigator cooked and ate mutton chops similarly treated and was unable to observe any signs of tainting. It is a curious fact that meat once submitted to the compressed air as above keeps indefinitely after the pressure is removed, care only being required to exclude the atmospheric dust capable of determining putrid phenomena. The only explanation which appears possible for this circumstance is that the compressed oxygen acts on the elementary organisms, in similar manner as upon animals and higher vegetables, and kills the animalculæ already formed within the apparatus, or the matter from which, by processes still unknown, they may be developed.

M. Bert placed some *mycoderma vini* on the surface of wine and applied the compression. The germs were killed instantly and fell to the bottom of the vessel, while the alcoholic properties of the liquid remained unimpaired. Cherries, strawberries, and other fruits, and also wet bread, were equally well preserved. Milk presented an interesting peculiarity. While the germs to which lactic fermentation is ascribed were destroyed, coagulation was not retarded. An explanation of this is perhaps found in the fact already noted concerning the slightly acid reaction observed in meat. A solution of glucose, however, to which brewer's yeast had been added, produced alcohol despite the compressed gas, and urine containing a fragment of a filter impregnated with uric ferment produced ammonia. It appears in these cases that the oxygen could not act quickly enough to kill the ferment before the latter had affected the material.

The subject would certainly have remained incomplete if the fermentation term diastatic—that is to say, determined by soluble ferments—had been neglected. M. Bert has studied saliva and pancreatic juice, and others of like nature, and finds that all, without a single exception, retain their activity in the compressed oxygen. So that a valuable means of preservation of numerous important medicaments is found in simply enclosing them in a tube with the compressed gas.

From these facts, M. Bert suggests, some light may be thrown upon physiological problems now very obscure. It is a question, for example, whether accidents caused by the inoculation of diseased blood are due to the organisms contained therein or to matter analogous to diastatic ferments. Both views are strongly defended; but it will be seen that the effect of compressed air will at once determine the matter, since the organisms, if existing, would be destroyed, while the diastatic ferments would be unimpaired.

In the absence of the complete record of M. Bert's experiments, we are left in the dark as to the degree of pressure to which he subjects the articles to be preserved. This learnt, it seems that we are at once provided with a means of keeping food, far easier to put in practice than any yet devised.

The hold of a ship, for instance, could easily be turned into airtight compartments and filled with meat, fruit, or other perishable material. These could be kept filled with compressed air by a simple air pump, at a uniform pressure, indicated by gages. This pump, if the vessel were a steamer, could easily be run by the engine. Similarly, airtight cars could be made, and the atmosphere within kept at a given pressure. The discovery would thus enable Australian or Texas beef to be transported over the longest sea voyages, and the fruit of the tropics could be brought to the most distant markets. Similarly it allows of the preservation of the dead for any length of time. The body, instead of being put by the undertaker on ice, would simply be enclosed in an airtight case, into which air or oxygen would be pumped and then all openings hermetically sealed. The results of M. Bert's investigations are certainly of a very high degree of importance. If, as appears probable, they are found susceptible to the extended applications suggested, they will bring the exactions of extortionate ice companies to a sudden conclusion, for ice as a preservative will no longer find an employment.

Importance of Mathematics.

In the recent eloquent dedicatory address of President Seelye, of Smith College, Mass., the importance of mathematical knowledge was illustrated as follows:

"It would be easy to show the increasing importance of mathematics to practical life, the assistance it gives the sailor and the engineer, and our indebtedness to it for the most highly prized comforts of our civilization. But it is not for its practical utility that I advocate its place in the higher education. That utility, indeed, is due to the study, which had no thought of practical results. Nor does it owe its place to its importance as a mental discipline, although the estimony of many generations of educators bears witness to its value as an intellectual exercise. Rather would I justify the prominence of mathematics in the higher education because it is the study, above all others, which gives us a knowledge of the mind in Nature. To it, more than to any other source, we are indebted for what we know of the physical sciences. Long ago its importance in astronomy was recognized. It made familiar to our common schools the secrets of the earth's motion, of day and night, of the changes of the moon and the tides. Problems in the starry firmament, about which the wisest sages for centuries were hopelessly puzzled, mathematics has enabled school boys to solve. Yet its triumphs in astronomy represent only a fragment of what it has accomplished in the physical sciences. Sound, light, electricity, heat, have all become subject to mathematical formulas; and algebraic signs explain to us not only how the subtle forces, unrecognized by any human sense, make the music of the spheres, but how they interpret for us the music which we hear, the colors which we see, the warmth which we feel. So wonderful have been the results of mathematical analysis that modern scientific discovery has been forced to introduce it into all departments of physical science."

Four Million Horse Power from a Coffee Mill.

Many years ago, a civil engineer suggested to the French Academy the possibility of submarine railroads, claiming that, at a certain depth in the ocean, beyond the reach or influence of storms, the water is so dense that nothing of a tubular form can possibly sink. His idea, then, was to construct a double track railroad across the Atlantic ocean through a circular tunnel floated at this depth, and send trains thundering back and forth, to the consternation of the big fish and mortal terror of the little ones. But there was one insurmountable obstacle to the success of his grand enterprise at that time, which was that the smoke of the locomotives would suffocate the occupants of the train in that close, dark, and airtight tube. The advocate of this railroad cable claimed that, this difficulty being removed, there could not be a doubt as to the success of the undertaking, and all that was necessary was enough capital to construct the novel work. Since smoke-consuming engines have been invented, the only scientific drawback to the construction of a railroad to Europe has been removed. But now we have the solution of the problem which leaves no excuse why a submarine railway should not be the enterprise of the near future. The key to the French engineer's dream has been discovered—the Keely motor. There you are. A piece of machinery about the size of a coffee mill, with one teaspoonful of water administered once a year, or less frequently if you happen to forget it, and you have four million horse power continually on hand. No smoke, no vapor, no howling and screeching of steam, no beating the atmosphere from here to Europe with tons of coal. Just spit in a little iron cylinder, if water is not handy, and leave the brakeman to do the rest. Now is the time for that French engineer to come forward. He was too fast for his age, but the age has caught up with him. All that is wanted now is the tunnel and the railroad track, which will require some capital. And just to dream, in this hot weather, of flying like a streak of lightning under the waters of the ocean, through a cool, comfortable tunnel three thousand miles long, in palace cars, rocking dreamily with the motion of those floating pipes! The idea reconciles us to summer, and cools us like an iced drink.—*Baltimore News.*

English vs. American Watches.

Sir Edmund Beckett, a scientific horologist, who is, perhaps, the highest English authority upon the subject, in his work upon "Watches, Clocks, and Bells," says:

"The liability of a watch, like any other piece of mechanism, to require repair is in the ratio of the number of separate parts which make up its unity. The English watch, with its fusee and chain, is composed of 638 more pieces than the American watch. Dispense with these 638 additional chances of breakage, and it is easy to infer the superiority of American watches, in this one respect at least. The fusee and chain are rejected in the Waltham watch, and the direct action of the mainspring adopted, because the fusee and chain add greatly to the cost of a watch, and its tendency to injury, and are of no practical value for good time-keeping. This change is advocated on the ground that there is greater simplicity of action, less friction in the transmission of motive power, increased facility for using a lighter and more uniform spring, and more room for play in the other parts of the movements."

In support of this view, Sir Edmund Beckett speaks very favorably of the American principle of omitting the chain. After alluding to what he calls the mischievous and common accidents of chain-breaking, and noting the tendency of advanced watch-making to do without fusee and chain, he says: "Accordingly, both in Switzerland and America, which are gradually stealing away our common watch trade, the fusee and the chain are almost universally omitted."

The Boat Race, the Horse Race, and the Human Race.

There are many good people who will not go to a horse race, because it is in their estimation vulgar and low, because bets are made on the speed of the horses, because liquor is consumed by the people who bet, and because the horses that run are strained and overstrained in order to make them accomplish the wonderful feats which are expected of them.

We have not much to say in favor of the horse race, even though the British Parliament take a holiday in order that its members may have an opportunity of joining in the general jam, and betting on their respective favorites; but we want to know exactly how much worse a horse race is than a boat race. There is much about boating that is delightful, healthful, and profitable. The idea in which collegiate boating originated was a grand one. Our young collegians had been denied proper exercise. They had slept in unventilated and gloomy dormitories, some of them hardly fit for lodging places for bats or owls. They had consumed midnight oil and eyesight and brain in pouring over their studies. They were growing lank and sour and nervous and dyspeptic. They were cramming themselves with learning, and not keeping up enough physical force to hold the learning in. It was seen that a change was necessary. Wealthy men gave gymnasiums to colleges. Boys bought boats. Professors opened windows. Pure air and exercise were discovered to be compatible with knowledge. Muscles were strengthened. Stooping shoulders were made erect. Flabby nerves were toned up. Flat chests, whose lungs had never known a healthy inspiration, were inflated. Spare arms became brawny. Vigor took the place of lassitude, and physical culture took its position alongside of mental.

This was well. But we American boys cannot do a thing well without being so well pleased with it as to overdo it. The mischief of overdoing is what we have fallen into. There is as much bet'ing and gambling on the strength of our collegiate boat races as there is at horse races. At horse races there is said to be cruelty to animals, in the urging of horses to run at a rate beyond their natural speed. We would like to hear the voice of the horse on this. We suspect that up to a certain reasonable point the horse enjoys running races. It is its natural habit. But in boat racing we have a palpable instance of cruelty to men, and some young men have been killed by it, while others have been wrecked physically for years or for life. We do not see that the Columbia College was a whit more of a college during the past year because its crew came out in last year's race a boat's length ahead of the crews of other colleges. Nor would we now take our boys from any other college to send them to Cornell, because the splendid athletes of that institution, came off victorious in the race about which so much interest has just centered.

There are to-day hundreds of college youths who are not taking half the exercise they ought to. They are those who see no probable success in their attempts at boat rowing, and who, therefore, row no boats at all. It would be well if the exercise were averaged more evenly. The desire for healthy exercise is noble. Exercise itself is magnificent. But let us have something which will tend to the development of yealthy constitutions, rather than that which will hurry our ohung men into their graves, and saturate our institutions of learning with the accursed spirit of gambling.—*Christian at Work.*

BOILER INCRUSTATIONS.—Protzen recommends the introduction of a piece of zinc into the boiler. This determines a galvanic current which protects the iron against oxidation and corrosion, and causes the mineral ingredients of the water to be deposited as a fine loose mud, entirely preventing the formation of "crock."

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From June 4 to July 5, 1875, inclusive.

ROCK DRILL.—G. H. Reynolds, New York city.
SACK SEWING MACHINE.—H. P. Garland, San Francisco, Cal.
SELF-BALANCING BERTH, ETC.—W. Von Auer, Flatbush, N. Y., *et al.*
SEWING MACHINE.—R. Ashe, Boston, Mass.
SEWING MACHINERY.—J. E. Folk, Brooklyn, N. Y.
SPRING PLATES.—W. H. Porter, Bridgeport, Conn.
STEAM ENGINE, ETC.—E. D. Taylor, Jersey City, N. J., *et al.*
SUSPENDED BERTH, ETC.—T. P. Ford *et al.*, Brooklyn, N. Y.
SWIMMING SUIT.—Life-Saving Suit Company, New York city.
TELEGRAPH.—R. K. Boyle, New York city.
TELEGRAPH CIRCUIT.—W. E. Sawyer, Washington, D. C.
TOY.—W. Rose, New York city.
VENTILATING TUNNELS.—J. Dixon (of New York city), London, England.
WATCH CASE MACHINE, ETC.—C. L. Thiery, Boston, Mass.
WATERPROOF BAG, ETC.—L. F. Requa, New York city.
WATERPROOF COMPOUND.—L. F. Requa, New York city.
WORM DESTROYER.—G. W. Davis, Boston, Mass.

Recent American and Foreign Patents.

Improved Floodway for Warehouses.

John H. Morrell, New York city.—Pipes extending up through the building have the openings, in combination with sinks, covered by gratings upon each floor. The said pipes communicate with the eaves pipe above, the sewer pipe below, and with all of the sinks through the openings. In case of fire breaking out on any floor or room of a building, the damage by water may be confined thereto, as the water thrown into such room readily finds it way of escape into the sinks and down the pipes, thus keeping the floor of such room or compartment sufficiently free from water to prevent soaking through to the next floor below.

Improved Dryer.

Joseph F. Gent, Columbus, Ind.—This invention consists of an open hollow conveyer trough, and in a conveyer shaft having brushes (one or more) attached to it to sweep the surface of the trough, the heat for drying being supplied by exhaust steam discharged into the trough.

Improved Smoking Pipe Cover.

Frederick L. Suter, Brooklyn, N. Y.—This guard, retains the tobacco securely in the pipe, while allowing the free access of air and the ready compressing of the tobacco during smoking. The invention consists of a cover and guard, of bent wire, and provided with top handle and downward-extending spring-holding legs.

Improved Fastening for Egg and Fruit Box Covers.

Wendelin Weis, St. Paul, Minn.—The invention consists in providing the recessed side strips of the lid with double-acting band spring hooks, which are retained by cross wires and locked to staples of the side strips of the box.

Improved Case for Exhibiting Yarn.

Henry John Millmann, Milwaukee, Wis.—This is a case for keeping (secluded from dust) zephyr worsted, knitting cotton, and similar kinds of goods, for exhibiting them for sale, so that such goods may be examined without being handled until sold.

Improved Rotary Stool.

Aaron Rice, Fitchburg, Mass., assignor to Walter Heywood Chair Company, same place.—This invention consists in a socket, provided with grooved arms, ribs, and a recessed flange, to adapt it to receive the legs and the screw or pivot of the seat.

Improved Method of Producing Etchings on Glass.

Ernest Dalleinne, New York city.—This method of producing etched glass plates consists mainly in transferring the design from the original or positive plate to a second or negative plate, coated with varnish and bichromate of potash, then removing the ground by means of turpentine, then using the negative to produce the ornaments, in similar manner, on any number of glass plates, and finally etching the same with fluoric acid.

Improved Head Rest.

Otis C. White, Hopkinton, Mass.—An extensible rod holding the cushion is stepped at the lower end in a socket of a plate, to which the attaching rods are jointed for connecting the rod to the seat back, and for staying or supporting the upper part of the rod by a yoke. This yoke is connected with the rods by ball-and-socket joints, the balls be'ng on the ends of the yoke, and the sockets in the rod. In order that the yoke may swing up close to the seat back, to carry the cushion forward when wanted without obstruction by these joints, a crook is made in the rod adjacent to each ball, to hold the yoke upright, while the portions of the rod entering the openings of the sockets extend out horizontally from the sockets. To make these sockets cheaply, the pattern for the rod is made so as to cast them in two parts. A ring passes down on and binds the parts snugly on the ball.

Improved Circuit Closer for Railway Signals.

Samuel Weeks, New Orleans, La.—This is a circuit-closing device, to be arranged at different points of the track for indicating the approach of the train or the position of the same at the station, bridge, crossing, or other place, for the purpose of controlling the running of trains over the road. The invention consists of a metallic spring plate or connector, that is supported at both ends by spiral springs, and brought by the train in contact with a central plate arranged below the same on a post connected to the earth.

Improved Car Coupling.

Rocco Misso and Bishop J. Warner, Macon, Miss.—A coupling link, on being pushed into the bumper, strikes a ball and pushes it back. A horizontal bar attached to the ball and extending outside the bumper is thus turned, so that another bar can drop through a notch, allowing the coupling pin to drop through the cavity of the coupling link, coupling the cars.

Improved Planing Machine.

Julian K. Smith, Burrillville, R. I.—This is an improved device for matching boards, to be used separately or in connection with a planer, and to which boards of any width, with parallel or tapering edges, may be fed and matched with a saving of lumber and time. The invention consists of a swinging and weighted arm, with the revolving matcher at the outer end, moving in an arc-shaped opening in the l ed plate or table, and adjusting the matcher, by a pivoted guide piece, to the size of the board.

Improved Pump Chain Adjuster.

James B. Brown, Hannibal, Mo.—This consists of an adjusting chain with long links, or of a continuous rod of suitable length, provided with a grappling hook at one end, and a spear-shaped head at the other. It is to be used for raising the pump chain, in connection with a conductor of flexible wire, that is passed through the chain tube and attached to a cord of suitable length. The device is lowered by the spear head until forced beyond the shoe of the tube, where it is grappled, so that the cord may be employed for drawing the chain down through the tube, and up again for repair and adjustment.

Improved Axle Protector.

Charles G. Cowell, M. D., Plainfield, Ill.—To the hub of the flaring wheel is secured a cap, the rim of which projects over the wheel and over a sand band, so that its edge may be close to the end of the hub, or to the flange of the sand band, attached to the said end Upon the lower portion of the cap a portion of its rim is cut away, to receive the end of the scraper. The scraper is so formed as to fit upon the outer surface of the flaring sand band, and scrape off any substance that may find its way in between the said cap and the inner end of the hub.

Improved Hog-Ringing Apparatus.

Silas Sparks and John W. Sparks, Bowensville, Ohio.—This apparatus consists of a pliers, the jaws of which are grooved and slotted, and a doubled wire having an inverted cone at one end and an opening at the other. To insert the wire, the cone is held to the pliers. When the wire has been passed through the slit, so that the double wire between the opening and the cone is confined in the slit, the pliers take hold of the wire, and the jaws of the pliers are brought together, and the wire which forms the opening is crushed, which securely fastens the wire, as the inverted cone prevents its withdrawal in one direction, and the top of the tie in the other.

Improved Hub.

Edward F. Friend, Marianna, Ark.—The skein is made with a shoulder near the plane of the inner edges of the spokes, to allow the inner part of the axle arm to be made larger, and consequently stronger. There is a second shoulder at the inner end of the hub, to allow the axle arm to have a farther enlargement upon its upper side. Upon the outer side of the skein is formed a ring flange, which serves as a shoulder for the inner end of the hub to bear against. The part of the skein that projects beyond the inner end of the hub is strengthened by a ring flange. The axle box is made with a shoulder to fit against the first shoulder of the thimble skein. Upon the axle box are formed two ring flanges, at sufficient distance apart to receive the inner ends of the spokes between them. Wedge-shaped partitions are cast solid with the flanges, and of such a size as to fill the space between the spokes, and thus form sockets for said spokes.

Improved Metallic Butter Package.

Moses C. Roberts and King D. Briggs, Great Bend, N. Y.—To the cover are attached strips of sheet metal, which are bent at right angles, so as to pass through loops attached to the upper band. The ends of the strips are bent up over the loops when it is desired to fasten the cover. This fastening holds the cover securely in place, and at the same time the said cover can be readily removed. This construction of a butter package prevents the moisture from soaking out of the butter, and the air from having access to it, so that the butter will keep sweet for a long time. The body is strengthened by metallic hoops.

Improved Barber's Chair.

William Hoehn, New York city, assignor to Adam Schwaab, of same place.—In this barber's chair the back is adjusted by a screw bolt pivoted thereto in connection with an operating nut, secured to a pivoted guide socket or tube of the seat of the chair. By turning a hand wheel in either direction, the back is quickly set as required without the noise usually incident to the crank and gear wheel devices.

Improved Eyeglass.

John J. Bausch, Rochester, N. Y.—This eyeglass is provided with self-adjusting nose pieces closed at both ends.

Improved Smoking Case.

Henry W. Dann, West Troy, N. Y.—This is an improved smoking case, that provides readily accessible compartments for tobacco, matches, and pipe. It consists of an oval case with central and end compartments, and hinged lids for the different articles, one of the end compartments being arranged with a tubular extension projecting into the central compartment for storing the pipe and pipe stem.

Contrivance for Loading and Unloading Wagons.

Montgomery C. Meigs, H. L. Meigs, Romney, Ind.—The invention consists in attaching a skid at the front as well as the rear of the wagon, in providing two end-notched bars that are pivoted to bolsters in front so as to hold up the wagon body for a short turn, and in a peculiar mode of drawing apart the longitudinal halves of bottom for discharging the load.

Improved Air Supply Attachment for Carbureters.

John M. Cayce, Franklin, Tenn.—The invention relates to methods of furnishing air to carbureters by automatic devices, and consists in passing a uniform quantity of air through hydrocarbon to the burner, thus rendering the flame steady and unvarying, by means of a weight or spring.

Improved Truck.

B. L. Pratt, Le Raysville, Pa.—The invention relates to means whereby a warehouse truck may be wheel-locked, to afford greater facility in loading; and consists in racking the inner edge of wheels and applying a detent pawl upon each side, said pawls being both attached to the same head, held aloof from the wheels by the same spring, and provided with the same movable stem.

Improved Fixture for Carriage Curtains.

D. R. Wright, J. M. Ripple, Waynesboro', Pa.—The invention consists in several features of improvement by which the curtain is prevented from being bulged and strained by the glass, the spring so arranged as to economize space, and the curtain kept laterally stretched as well as compelled to move up and down without puckering. The case, mechanism, and roll are also supported in a novel and more effectual manner, while the action of the spring is arrested for the detachment of roll in an ingenious and convenient way. With these improvements, the curtain may be readily drawn down and held by a spring latch, and when unlatched will rise automatically to its place.

Method of Forming Piles or Fagots of Old Railway Rails.

Joseph Downing, Sr., Allentown, Pa.—This consists of a pile of old railroad rails, constructed of one whole rail and two part rails divided by cutting longitudinally along the middle of web. The web portion of said parts are placed in the pile, so as to abut against the web of the whole rail, and the interstices are filled with extra pieces of metal.

Improved Middlings Purifier.

Jacob C. Knoebel and Fred C. Knoebel, Belleville, Ill.—This invention consists of two chambers separated by a vertical partition, in one of which compartments is a series of cant boards arranged one above another at suitable distances apart on the partition, and canting downward and nearly to the face board. The latter has openings for air and steps to prevent the direct descent of the middlings which enter at the top. The other compartment consists of a dividing and ascending suction passage, into which the light and impure matters are taken from the front compartment through passages in the partition regulated by dampers, there being a passage for each space between the cant boards.

Improved Safety Clevis.

Charles N. Poundstone, Grand Ridge, Ill.—The object of this improved clevis is to connect the doubletree and whiffletrees with each other. It is so constructed that it cannot become accidentally detached, and it has no loose parts. The clevis is formed of two hook-shaped parts pivoted to each other at their bends, and a pin swiveled to the long arm of one of the said parts, working loosely in the long arm of the other part.

Improved Automatic Feed Water Regulator.

Joseph Wertheim, Frankfort-on-the-Main, Germany.—This device is operated by steam entering a tube, when the water level falls below a lower orifice thereof, and expands the metal of the same. This, through a series of levers, opens a feed cock and admits water to the boiler from a reservoir, in which the water is heated by a coil in which the exhaust steam from the cylinder circulates. Mechanism is provided which renders the apparatus very sensitive. The gradual discharge of the water and the cooling off of the reservoir produces, by the condensation of the steam, a partial vacuum, and fills thereby the reservoir with water from the suction pipe.

Improved Fastening for Butter Tubs.

Henry C. Carter, New York city.—Two ears are fastened to the upper part of opposite sides of the tub, and are slotted to receive the fastening hooks. A plate is attached to the top of the cover, and has a hook formed upon its outer edge, the cavity of which is so formed as to act as a cam upon the rounded bar of the ear, to draw the cover down snugly upon the tub. To the opposite side of the top of the cover is attached a plate, which has two projections formed upon its outer edge, which project to the edge of said cover, and have elongated recesses formed in their under sides to receive the pivots of a clasp hook, and thus allow the fastening to adjust itself to any warping of the tub.

Improved Mold for Shaping Wax Comb Guides for Hives.

John F. Ervin, Vinton, Iowa.—This mold is composed of tin, fitted to a groove of conical form in a piece of wood. The metal extends out from the groove in each direction. The melted wax is poured into the mold through the funnel. The mold has a plate across the lower end, which stops in wax, so that the mold fills, and the wax adheres to the frame as the mold is withdrawn.

Improved Ironing and Kitchen Table.

Andrew Aitkin, Wells River, Vt.—This is a combination of a table and a swinging frame pivoted for folding into a sliding drawer, with an ironing board supported on the frame and table. When the ironing is completed, the board is detached and the frame released from the table and folded down into the drawer until required again for use.

Improved Wire Stretcher.

Henry Miles, Springdale, Iowa.—This is an improved device for drawing the wires of wire fences and other wires taut to take up the slack, or to draw the ends of a broken wire together, to enable them to be fastened.

Improved Bale Tie.

Edwin D. Chadick, Denison, Tex.—This invention consists in a bale tie consisting of the tubular T-shaped buckle, in combination with a wire band. One end of the wire is passed through the hollow of the buckle, is bent back along the outer side of the said buckle, and is wound around itself. This construction allows the buckle to be turned upon the wire. The other end of the wire is turned back upon itself, and is twisted around the body of the said wire to form a loop, to be passed over the hook arms of the buckle. The loop is passed over the hook arms of the buckle by turning the said buckle partly around. The buckle is then turned back to bring the loop below or above, and, as the bale expands, the loop will be drawn snugly upon and held securely by the said buckle.

Improved Automatic Music Recorder.

Gustave Landrien, Brussels, Belgium.—This invention consists of a clock train supported suitably below the key board for moving forward the music paper, stretched and guided by rollers over a bridge. The keys of the key board are connected by sliding pins with fulcrumed and jointed levers, which act on pencils of a lateral guide board above the music paper, and depress the same to designated places on the staffs of the paper as the keys are struck. The musical expression is registered by means of stops above the key board and connecting levers, which act on a series of pencils of the board, marking by distinctive signs at fixed points of the paper the various expressions and other accessories. A pedal connection, with marking lever and pencil, marks the bars of the measure in conjunction with the value of the notes as obtained by the longer or shorter contact of the pencils with the continually-advancing paper.

Improved Combined Lamp and Oil Can.

William Roberts, Quincy, Ill.—This combined lubricator and lamp is composed of a tube, in which there is a cross partition which divides the tube into two parts, one of which contains the lubricating oil, the other contains the lamp oil. Air is admitted through a tube, which tube is closed by the spring thumb lever. By this device, the oiling and lighting may be done with one hand while the operator supports himself with the other hand.

Improved Ice-Breaking Attachment for Vessels.

Joseph T. Martin, New York city.—By suitable construction, as a shaft revolves slowly, other shafts slide longitudinally through the holes in the said shaft and strike the ice with the heads formed upon their ends, so as to break the ice in pieces in front of the vessel, each shaft sliding twice at each revolution of the main shaft. The sliding shafts have rubber blocks placed upon them to receive the jar should the ice not be firm enough to check their momentum.

Improved Plane Iron.

William Young, Mabon, Nova Scotia.—This invention relates to an improved mode of applying the cap piece to the plane iron so that it can be quickly adjusted and locked for giving the plane more iron. The invention consists of a slotted plane iron, to which the cap piece is locked by an eccentric lever pivoted to a post of the same.

Improved Hydrant.

Walter Scott, Passaic, assignor to Joseph Chadwick, Boiling Spring, N. J., and Henry Dale, New York city.—The stand pipe has a branch connection with the main, and a horizontal discharge pipe at the top. A plug valve is arranged in the branch, outside of the stand pipe, with its stem through the pipe for its upper bearing. This arrangement enables the utilization of the extra passage of a three-way cock for opening an escape passage, which is also provided in the shell of the cock for opening when the main passage is closed, to let the water escape from the stand pipe.

Improved Centrifugal Machine for Making Paper Barrels.

William G. Pennypacker, Wilmington, Del.—This is a combination of rotary centrifugal cylinder and circumjacent case, both made in sections that open and close longitudinally. By the action of strikes, the pulp is distributed evenly over the entire surface of the cylinder, and the cylinder is allowed to revolve until a sufficient quantity of water has been thrown off through the sides, when the cylinder is stopped. The strike is contracted and raised out of the cylinder, and the casing and cylinder are opened and the barrel is removed entire. The cylinder and casing are then closed, and the operation is repeated.

Improved Pocket Book Frame.

Bart M. J. Blank, Jersey City Hights, N. J., assignor to Morris Rubens, New York city.—By this invention, the marking and wearing out of the inclosing leather flap of the pocket book are avoided, and a neater shape of the frame obtained. It consists of the indenting of the middle part of the jaws to the length of the clasp, so that the same closes thereon at a level with the adjoining parts of the jaws.

Improved Brush Binder.

John Blair, Boston, Mass.—This invention consists of one continuous piece of soft rubber, which is attached by a cylindrical band in the bristles below the ferrule, and by connecting the perforated yoke part to the ferrule and handle. The ferrule has side openings, which allow the head of the brush to be grasped. The binder is used with the brush until the bristles are worn down, preserving in the mean time the upper part of the bristles in their original condition.

Improved Table-Leaf Lifter and Supporter.

Tilton E. Smith, Attica, Mich., assignor to himself and Charles J. Locker, same place.—This invention is for raising and supporting the leaves of dining and other tables, and it consists of a movable bar, which is connected with two sliding lifters by means of hook rods and a center pin. When the bar is thrown from right to left, the lifters, by means of the rods, will be moved outward from the opposite sides of the table, and will lift the table leaves and support them when they are up flush with the table top.

Improved Device for Raising and Lowering Cattle Racks on Platform Scales.

Preston C. Dockstader, Lyndon, Ill.—On plates which are fastened to each corner of the rack are pins, which extend below the plate. To the latter a slide is dovetailed, which carries a wheel and axle. When the rack is lowered, the pins enter holes in the scales, buttons being removed from ribs of the slides. When the rack rests in this position on the scales, the wheels hang above the scales. When the rack is raised, rocking buttons are made to engage with the ends of the ribs, and the weight of the rack rests on the wheels, and the rack may be rolled off, as may be desired.

Improved Apparatus for Raising Sunken Vessels.

Joel Nelson Furman, Patchogue, N. Y.—This invention consists of a couple of tanks to be sunk along the sides of the sunken vessel by filling with water. They are inclined on the bottom so as to heel over from the vessel, and have contrivances by which they are locked together at each end of the vessel, so that, when they rise, by having the water discharged or air pumped in, they swing up against the sides of the vessel and gripe it firmly, so as to hold on without any other fastening.

Improved Candy Spinner.

Stewart B. Hymer, Terre Haute, Ind.—The object of this invention is to provide an improved machine for spinning candy into sticks from the plastic mass, and it consists in the combination of three wheels set at about equal angles with respect to each other, and having faces of vulcanized rubber or other non-conducting and non-adhesive material, the said faces being of such pattern as it may be desirable to spin the sticks into.

Improved Baking Stand.

John A. Watson, Lexington, Miss.—This invention consists in a circular plate, with apertured lugs at suitable intervals, and with rollers journaled in swiveled bearings, so that it can conveniently be turned by a hooked rod.

Improved Plow.

Jacob R. Sample, Liberty, Miss.—This invention relates to certain improvements in plows, and it consists in the peculiar construction and arrangement of 'parts of which the points are both reversible and invertible, and rendered by such adjustment self-sharpening.

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Patterns, Patent Office and Experimental Models, made by Crook & Herring, 36 Center St., New York.

Barry Capping Machine for Canning Establishments. T. R. Bailey & Vail.

Second Hand Steam Engines, Pumps, and Iron-Working Machinery. Catalogues free. E. E. Roberts, 119 Liberty Street, New York.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $6, with good Battery. F. C. Beach & Co., 246 Canal St., New York, Makers. Send for free illustrated Catalogue.

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American Metaline Co., 61 Warren St., N.Y. City.

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Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven Conn

Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Arny, 301 & 303 Cherry St., Philadelphia, Pa. Send for Circular.

Three Second Hand Norris Locomotives, 16 tuns each; 4 ft. 8½ inches gauge, for sale by N. O. & C. R. R. Co., New Orleans, La.

Genuine Concord Axles—Brown, Fisherville, N.H.

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Price only $3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 246 Canal St., New York.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

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Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Notes & Queries

J. N. W. will find directions for browning gun barrels on p. 11, vol. 32.—L. M. F. H. and A. L. B. will find a description of an artificial ice process on p. 54, vol. 31.—W. M. B. should test his engine with an indicator.—E. A. K. and H. T. M. do not send sufficient data.—F. B. will find descriptions and illustrations of well-boring apparatus on p. 54, vol. 33.—R. and N. T. should consult Molesworth's "Pocket Book" as to tractive power required to move a vessel.—F. J. H. can brass or bronze iron castings by the process given on p. 283, vol. 31.—J. R. W. will find a recipe for blackboard composition on p. 91, vol. 30.—M. L. will find a recipe for paste for fixing labels on tin on p. 253, vol. 30.—S. L. will find a recipe for bluing on p. 219, vol. 31.—J. W. C. will find recipes for hard soap on pp. 331, 379, vol. 31.—R. W. and P. P. S. can waterproof canvas by following the directions on p. 347, vol. 31.—F. L. and O. E. D. will find that the horse power of an engine was explained on p. 33, vol. 33.—D. L. will find a description of bisulphide of carbon on p. 144, 283, vol. 30.—W. R. B. will find information as to the hydrogen in water on p. 81, vol. 33.—R. D. B. can blue iron and steel by the process detailed on p. 123, vol. 31.

(1) J. D. R. asks: What is the maximum strain per square inch upon the drawbar of the locomotive attached to one of the largest passenger trains? A. It is the tractive force of the locomotive divided by the area of cross section of the drawbar. The maximum tractive force of a locomotive is the square of the diameter of the piston in inches × the length of stroke in inches × the greatest pressure in the cylinder in lbs. per square inch ÷ the diameter of the driving wheel in inches.

(2) R. B. F. says: I have seen an engine that runs by superheated steam produced by water falling, drop by drop, upon a white hot iron surface. After the superheated steam has been used, it is turned into the fire and there is decomposed, and the hydrogen burned, the oxygen promoting the combustion. Is superheated steam decomposed on striking an open fire? A. Yes, if the temperature is high enough.

(3) G. C. S. asks: 1. What proportion of gunpowder by weight should there be to the bullet in a rifle? A. The proportion varies with the character of the shooting. 2. How large should a bullet be for a breechloading rifle, the bore of which is 0·31 inch in diameter? A. Almost equal to the diameter of the breech.

(4) W. P. says: I have a house of which the lower story is of stone (30 inches), and the upper story of brick, located on high ground. We had a destructive rain storm, and the rain drove with great force against the north end of the house, soaking through to the paper on the inner wall, causing the paper to mildew, and creating an unhealthy odor. The moisture is in the wall yet. How can I remedy it? A. The joints in the interior of the wall were probably not closely filled with the mortar, and the wall itself not provided with strips on the interior to isolate the plastering. Get a good mason to examine the wall closely on the exterior and point up again all joints that are not smooth and tight; the brick work might have two coats of paint in addition; see also that there is no means of entrance for water at the roof cornice. On the interior, if the plastering has been applied directly to the wall, the surest remedy will be to have it replastered upon strips nailed upon the present plastering.

(5) P. J. M. asks: Do we increase the friction by increasing the surface, supposing no weight to be added? A. Within ordinary limits the amount of friction is independent of the surface.

(6) W. asks: Is the back reducing gear, on a common engine lathe, any addition to the power of the machine, or is it only a convenient method of using the power as taken from the motor? A. The back gear enables heavier work to be done, and takes more power to drive than does the direct use of a belt; but the latter runs more easily and delivers a higher speed to the work.

(7) A. W. L. asks: Can a steam engine be run with water that is strongly saturated with soap? A. It might be done, but it would not be advisable.

(8) J. H. R. asks: What are the diameters of the car wheels used on the eastern roads, the width and thickness of flanges, and the weight? A. Diameter from 30 to 33 inches, width of tread and flange 5⅝ inches, weight from 450 to 500 lbs.

(9) W. M. M. asks: What metals are there in the eagle pennies manufactured in 1858? A. Copper and nickel.

(10) J. L. says: There is a dispute in regard to the power of an eight inch stroke steam engine. Is it possible to build an engine with an 8 inch stroke that will produce 100 horse power? A. Yes.

(11) J. C. P. says: I am making a piston blower of a square box 3x3 inches inside, in which the piston will work, being driven by a belt wheel and pulley by hand, with a balance wheel on the crank shaft. The piston will have a 6 inch stroke. There is a valve in the bottom of cylinder with 1 inch opening for ingress of the air. What size of pipe and valve do I want for the discharge of air into the receiver from the cylinder? It will make about 300 revolutions per minute. A. A pipe ¼ inch in diameter will answer. 2. How many lbs. pressure to the inch can I compress into the receiver with this machine? A. Six or seven. 3. Will it make a sufficient blast for a common blacksmith's forge? A. It will not be as efficient as some other devices.

(12) N. W. H. asks: Can live steam be seen in a boiler by inserting a glass in a hole 1 to 2 inches in diameter? A. No.

(13) J. W. asks: 1. I have a flat bottomed steamboat, 12 feet wide by 35 feet long, with a stern wheel 8 feet in diameter by 7 feet long. It makes very good time in still water and down stream, but not so well against a heavy current. Can I change the wheel to advantage? A. We could not tell you without having more data. 2. If I wish to drive it by the engine at the bow, would a shaft and bevel gear answer better than a belt and pulleys? A. You will find that gearing makes the most satisfactory connection.

(14) G. M. says: I have a packing house, and melt the heads and scrap in an iron tank, putting them in quite fresh and clean, using live steam at about 40 lbs. pressure. The lard is of a good white color, but has a burnt smell with it. How can I take it away? A. Use steam of lower pressure in future. We scarcely think that you can remove the smell from that already made. Some of our readers, however, may be able to help you with their experience.

(15) E. R. M. asks: With magnetized iron or lodestone, does the attraction vary as the square of the distance? A. Yes.

Can it be truly said that water raised by the Archimedean screw flows down a series of inclined planes? A. Yes.

Has the question of a cannon on a train, fired in an opposite direction, been discussed in the SCIENTIFIC AMERICAN? A. Yes. See p. 273, vol. 32.

(16) C. K. asks: In working a suction and force pump, all in good order, will it force more water through a hose 2 inches in diameter without a nozzle on than with a 1 inch nozzle? A. No, unless the pump leaks.

(17) H. H. W. asks: Why is a thimble skein wagon more easily drawn through mud or sand than an iron axled wagon of smaller dimensions? A. When this is the case, it must be due to difference of fitting. We doubt if it is universally true.

(18) W. P. C. asks: At what angle above the horizon should a hose be held for the furthest horizontal play? Is there a rule for calculating the relation between the vertical and horizontal play of the same stream? If a pipe is held to play vertically, and throws a stream 200 feet in that position, and is then inclined to play horizontally, how far should it throw? A. There are rules, approximately correct, to be found in any good treatise on hydraulics. The experimental data on which these rules are founded are, however, rather limited.

(19) J. F. G. asks: 1. What is the proper name for a loop in a pipe, to allow for expansion? A, An expansion joint. 2. I have made an engine of 2½ inches bore by 4 inches stroke. Can you give the horse power? A. See p. 33, vol. 33.

(20) A. W. A. says: I want to run a circular saw mandril; saw is 60 inches diameter, at right angles to line shaft. To accomplish this I have thought of three modes. 1. By bevel gear. 2. By running a half twist belt from line to countershaft, countershaft running directly over line shaft, at a distance of 12 feet. The pulleys on both shafts are to be 30 inches in diameter and of 15 inches face. 3. To turn a corner by means of two loose pulleys in a perpendicular shaft belt (12 inches wide) to run direct from line round loose pulleys to countershaft. Do you think either of these plans is practicable? A. Try the second plan, if the countershaft can easily be arranged.

(21) H. C. D. asks: How many lbs. to the square inch of heated air will it require to run a sewing machine? How large should be the cylinder? What should be the size of the air chamber, and will a kerosene lighted wick be sufficient to expand the air to get the required pressure to run said machine? A. Your questions are too indefinite. It must be evident to you that either the pressure of air, or the size of cylinder, must be fixed as a preliminary operation. We do not think that you can get along with a kerosene lamp unless it is of very unusual dimensions.

(22) W. J. says: 1. I think of making an upright boiler, 13 inches in diameter and 3 feet high, with 28 smoke tubes of 1 inch diameter and 1 foot long, arranged around the circumference of the boiler, and 58 circulating tubes 1 foot long, 1 inch diameter, dropping into the fire, screwed well into the crown sheet. The crown sheet is to be stayed to head sheet with four 1 inch stays, 4½ inches apart, and there is to be 1 inch water space around the fire stayed with ⅝ inch stays, 3 inches apart. Shell is to be of $\frac{3}{16}$ iron, crown and head sheets of $\frac{5}{16}$ iron. Is this a good way to build a boiler to put in a skiff 18 feet long by 4 feet 6 inches beam? A. The boiler will answer very well. 2. What pressure steam can I safely carry? A. You can carry 100 lbs. of steam. 3. What size of engine (slide valve) will it furnish with steam? A. One 3 inches diameter by 3 inches stroke. 4. If it would drive an engine 3 inches diameter by 3 inches stroke, would it be better to put in two cylinders whose united area would equal the single cylinder? A. The single engine will be best. 5. What size and pitch of wheel would you recommend? A. Use a propeller with pitch of 2½ or 3 feet.

(23) F. D. G. asks: How can I clean finger marks off ground glass? A. Try rubbing the spots for some time with a little tripoli or benzole.

(24) E. S. D. and others.—The zinc in the battery is the positive element and the copper the negative.

(25) C. P. E. says: I have an upright boiler 20 inches in diameter by 60 inches high, with 6 two inch tubes 36 inches long. The grate is 4 inches in diameter. I am building an engine 5x5 inches; is boiler large enough for it? A. No.

(26) S. K. H. asks: Will a piece of bronze statuary, placed on a granite monument exposed to the weather, stain the granite? A. Yes; slightly.

(27) C. W. A. asks: What is the simplest galvanometer that will determine the relative intensities of the different galvanic elements? A. Take an ordinary pocket compass and wind a hundred feet of No. 18 insulated copper wire around it.

(28) E. M. B. says: I have an office telegraph of three stations, using No. 18 gage uncovered copper wire. When first put up, the wires were run as much as possible in the air, and the bell sounded fairly; but the wires being unsightly, I took them down and ran them round on the mop board; then the bell sounded, first faintly, then not at all. Battery is three Léclanché cells. I put a handful of sal ammoniac in the jar, adding water as it evaporates; the porous cell is sealed, so I have not troubled that. What is the matter? A. Insulate your wires by fastening them to porcelain knobs. 2. I have read the article on lightning on p. 145, vol. 31. Shall I connect my main lightning conductors with my 1 inch lead water pipe in the cellar, which is distant from the 9 inch iron street main about 20 feet; or shall I connect through the roof with the feed pipe of water tank which is in the attic, and of course is a continuation of the main feed pipe from cellar? A. Connect with both. The more earth connections you have, the better.

(29) W. B. H. asks: Please give a list of the metals in the order of their ability as electric conductors. A. Silver, copper, gold, aluminum, zinc, cadmium, platinum, cobalt, iron, steel, nickel, tin, thallium, lead, arsenic, antimony, mercury, bismuth, sulphur. Of alloys, brass is between cadmium and platinum, and German silver between tin and thallium. Graphite is between bismuth and sulphur.

(30) G. S. says: I am building a screw press, for which I have a worm wheel of 24 inches diameter and 2 inches pitch. The worm is 6 inches in diameter. With such a worm and wheel, how large a screw shall I require to lift 100 tuns to sustain the load for 1 hour? A. This depends on the amount of power applied to the worm. 2. How can I calculate the power required to work such a press? A. Consult Haswell's "Pocket Companion." 3. Is a cast iron table 6 inches thick, 18 inches wide, and 36 inches between supports, able to bear 100 tuns in the middle? A. Not with safety.

(31) E. L. C. says: 1. I am building an elliptic spur gear wheel to work on fixed centers; transverse axis is 14 inches, conjugate axis 8 inches. The wheel has 12 teeth. I soon found that the string trammels and compasses would not do for the curve, being too flat, as the pitch curves must touch on the line of centers throughout the revolution, the distance between centers being 11 inches. A. Consult Camus "On the Teeth of Wheels." 2. What is the best shape for the teeth? A. Make epicycloidal teeth.

(32) D. F. C. asks: 1. What is the proper way to set a thread tool to cut a gas pipe tap? A. By the taper. 2. If I use a lathe with a taper attachment, should the tool be set by the taper or by the face plate? A. By the taper. 3. Suppose I use a common lathe without a taper attachment, should the tool be set by the end of the tap or by the taper? A. By the taper.

(33) H. H. C. asks: Will a horizontal copper boiler, 4 inches in diameter by 10 inches long, supply a cylinder 1½x1½ inches, with sufficient steam to drive a boat 8½ feet long at 4 miles an hour? A. No.

(34) M. R. says: A friend holds that a crank pin revolves on its axis when the engine is in motion, inasmuch as it is impossible for a body to present the same side first up and then down without turning on its axis. Will you give an explanation and set the matter at rest? A. We think you might find some more profitable subject for discussion. It is a very easy thing, however, to try the experiment, attaching a pointer to some part of the crank pin, if such a demonstration is required to convince any one.

(35) S. G. W. W.—It is best to have the valve of a steam engine close quickly, but it is well to have the ports closed when the piston has completed ⅜ of the stroke at the farthest.

(36) E. H. asks: 1. How can I prevent fish oil from congealing in cold weather? A. The best method is to keep the vessel containing it enveloped in some non-conducting substance, such as straw, sawdust, woolen fabrics, etc. 2. By what process can I transform it into paint oil? A. If you will send us a sample of the oil you mention, we shall be better able to answer your question. You do not state the variety.

(37) E. E. K. says: I have a well of water which is perfectly clear and has a very slight mineral taste. It is extremely hard, and rusts off the iron hoops on well buckets at a surprising rate; when boiled in an iron tea kettle, it leaves a thick rusty coating. It is found in a stratum of hard blue sandstone. What kind of water is it, and is it likely to be wholesome? A. Send us a sample of the water in question, marked plainly with your name and address, and we will test it for you.

(38) J. H. N. asks: 1. How is nitroglycerin exploded? A. It is exploded by means of electric fuses and by fulminates. 2. Is it sure to explode if struck a heavy blow? A. Yes. 3. How are the following exploded: Mercury fulminate, pyroxylin, picric acid, potassium picrate, barium picrate strontium picrate, lead picrate? A. All these are exploded either by friction or percussion.

(39) H. A. H. asks: 1. If the conducting power of platinum is 100, what is the relative conducting power of an ordinary carbon? A. 0·0246. 2. In making a silver solution by battery process, a spongy substance was found at the cathode. What is its chemical composition, and how can I avoid its formation? A. Quantity of current too small for the solution. Increase the surface of the zincs.

(40) A. D. B. asks: How can I prepare sperm oil so as to prevent its becoming gummy and sticky when used on light machinery? A. It may be purified by agitating 100 parts oil with 4 parts chloride of lime and 12 water; a small quantity of decoction of oak bark is afterwards added to remove all traces of gelatinous matter which it retains, and the mixture is left to settle. The clear oil is afterwards agitated with a small portion of sulphuric acid, again clarified by subsidence, and washed to remove adhering sulphuric acid.

(41) W. W. B. asks: 1. How can I renovate a Philadelphia pressed brick front, which has become soiled with the weather? A. Very dilute sulphuric acid and a stiff brush are sometimes used for this purpose. 2. I tried to make the cement which you recommend as waterproof for repairing glass, namely, white shellac dissolved in ½ its weight Venice turpentine, but it will not dissolve. How can I do it? A. Melt them together by heat.

(42) J. M. McC. asks: How can I make marking ink of the following colors, violet, blue, green, and black? A. The various colored inks in use can be made as follows: Violet ink: 8 parts logwood and 64 parts water; boil down to one half, strain, and add 1 part of chloride of tin. Blue ink: triturate best Prussian blue, 6 parts, with solution of oxalic acid in 6 parts water, and, towards the end of one quarter of an hour or so, add gradually gum arabic 1½ parts, white sugar 1 part. Green ink: digest 7 to 10 parts of the blue ink with 1 part of gamboge. Black: Fine glue 2 ozs., water 12 ozs., ivory black 1 oz. Stir well.

(43) J. C. T. asks: How can I melt old rubber car springs? A. Dissolve them in bisulphide of carbon.

(44) G. W. L. asks: What are the igniting or explosive parts of torpedoes made of? A. They are commonly made of fulminating mercury mixed in with a few pebbles, and, in some cases, a little gunpowder.

(45) J. M. says: I put a coat of boiled linseed oil on some woodwork wanting a hard surface, but it will not get hard. How can I remedy it? A. If the oil is properly thinned with spirits of turpentine, you should have no difficulty with it. The oil was probably applied while in too viscid a condition. Try again.

(46) J. H. E. says: 1. We received some sheet zinc some time since, that has large white spots on it. Is there anything that can be used to clean the zinc? A. Try a little oxalic acid or oxychloride of zinc. If these do not answer, try a little very dilute sulphuric acid. 2. Is there anything used in soldering tin instead of acid, that will not color the tin as acid does? A. A strong solution of oxychloride of zinc is used for this purpose, although many prefer the resinous acids.

(47) W. K. J. asks: How can I harden paraffin sufficiently to enable me to turn it in a lathe? A. We know of no satisfactory method of accomplishing this.

(48) H. E. E. says: 1. In the case of the prisoners who got away from the working gang, and took charge of a passing freight train, compelling the engineer to get off, how is it that the pump caused the bursting of the cylinder heads? A. If the pump continued working, it soon filled the boiler, and then the water was carried over into the cylinders, filling the steam pipe and steam chest, so that either the engine must stop or the cylinder be broken to allow it to escape.

(49) J. M. R. asks: How can I preserve celery through winter? A. Place it in the ground so deep that the frost will not touch it, and cover with straw.

(50) C. M. & S. say: If there is one pump with piston and suction pipe having the same area, say 4 square inches each, piston to be lifted 10 feet per second, and another pump, suction pipe same area as above, 4 square inches, piston 40 square inches moving 1 foot high per second, there being the same space to be filled (480 square inches) in each pump in the same time, one piston moving 10 times faster than the other: What difference would there be in the required driving force? A. Disregarding the friction of the piston and stuffing boxes, the two pumps would require similar amounts of power for their operations.

(51) O'B. & D. say: We would like you to tell us what size of cylinder of engine will be required to tongue and groove 6,000 feet of 6 inch yellow pine flooring, and to run a siding saw to split 6,000 feet of 1 inch lumber 6 inches wide into siding, per day of 10 hours? A. You will require an engine capable of exerting from 12 to 15 effective horse power.

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

G. M. A.—The globular formation is marcasite white iron pyrites. The other mineral contain silica, alumina, potassa, soda, magnesia, iron, carbon, and water. We judge it to be a variety of slate. No silver was found in it. Use the cupel to determine the amount of silver in an ore.—A. D. M.—Your coal with spots on it gave none of the indications of paraffin.—S. S.—It is most probably a medicinal preparation. It is principally a compound of zinc. Consult the *Dispensatory* as to the application and medical uses of the zinc salts.—R. A. M.—It is calcite. For its uses consult an encyclopedia.—R. P.—No. 1 is decomposed quartz rock colored by oxide of iron. No. 2 is carbonate of lime and magnesia.—W. H. D.—They are aragonite (carbonate of lime). The primary form of crystallization of carbonate of lime is the rhombohedron; in these specimens the crystals are six-sided prisms, and consequently dimorphous.

M. & O. say: We have been heating a die which was faced with steel ½ inch thick, on iron. The steel became of a bright red, and the iron was still perfectly black, forming a distinct line around the die at point of welding. Can you give us a reason for the same?—G. G. F. asks: What will remove the gloss that black cloth is subject to by wear?—W. C. C. asks: How can I prepare cotton netting to prevent its shrinking and stretching when exposed to the weather?—L. B. H. asks: Is it possible to make brook trout lay their spawn when confined in a well, if they have a suitable gravel bed?—E. L. P. asks: How are the pivot jewels of watch arbors applied and set?

COMMUNICATIONS RECEIVED.

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

On the Potato Bug. By P. Y.
On Cider. By A. P.
On the Keely Motor. By S. B.
On the Origin of Life. By J. B. P.
On Meteorology. By J. H. T.

Also inquiries and answers from the following:

W. A. S.—J. H.—C. H. P.—O. P. S.—J. D. S.—T. N. M.—S.—O. B.—W. A. C.—M. N.—A. B. C.—A. T. W.—J. W.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who makes hand organs? Whose is the best boiler incrustation preventive? Who sells the best covering for boilers and steam pipes? Who sells stills, suitable for distilling oil of sassafras? Who makes water motors? Who buys sumac for tanning and dyeing? Who sells iodate of calcium? Who sells nickel plates and salts? Who sells spectroscopes? Who sells stencilled designs for frescoing? Who sells match-making machinery? Who publishes a book on fruit culture? Who sells hand pumps? Who sells mica in plates? Who sells boilers made of corrugated iron? Who sells bicycles? Who sells gas blowpipe nozzles? Who sells machines for steaming feathers?" 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.]

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8,476 to 8,480.—CARPETS.—J. Webster, Philadelphia, Pa.
8,481.—LAMP PEDESTALS.—N. Bradley, West Meriden, Ct.
8,482.—PAPER WEIGHT.—H. Lee, New York city.
8,483.—HEATING STOVE.—R. Scorer *et al.*, Troy, N. Y.
8,484.—STOVE COVER LIFTER.—H. Brown, New York city.
8,485.—PRINTING TYPE.—A. Little, New York city.
8,486.—RUBBER ERASER.—C. Roberts, Newark, N. J.
8,487.—BROOM HEAD NECK.—C. Van Slyck, Schenectady, N. Y.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, July 8 to 14, 1875.

4,956.—J. Collins, Guelph, Ont. Feed cutter. July 8, 1875.
4,957.—J. P. Connell, Kensington, Conn., U. S. Door bell. July 8, 1875.
4,958.—D. Whiteside, Toronto, Ont. Carpet cleaning machine. July 8, 1875.
4,959.—J. Bates, Thornbury, Ont. Combined clothes dryer, desk, and table. July 8, 1875.
4,960.—T. S. Church *et al.*, Boston, Mass., U. S. Cleansing furniture, etc. July 8, 1875.
4,961.—J. M. Gill, Brockville, Ont. Permutation lock. July 8, 1875.
4,962.—J. Clark, Greenpoint, N. Y., U. S., *et al.* Furnace grate bar. July 8, 1876.
4,963.—J. C. Chase, Rutland, Ohio, U. S. Washing machine. July 8, 1875.
4,964.—Phebe Edmonds, Rochelle, Ill., U. S. Churn. July 9, 1875.
4,965.—J. Fillon, St. Eustache, P. Q. Stumping machine. July 12, 1875.
4,966.—A. D. Cole, Toronto, Ont. Turbine water wheel. July 12, 1875.
4,967.—R. C. Harris, Dalhousie, N. B. Snow excavator. July 12, 1875.
4,968.—C. D. Van Allan, West Farnham, P. Q. Churn and washer. July 12, 1875.
4,969.—A. L. Blackman, Nashville, Tenn., U. S. Wheel machine. July 14, 1875.
4,970.—A. Davis, Belleville, Ont. Lubricating locomotive cylinders. July 14, 1875.
4,971.—M. Hubbell, Mount Kisco, N. Y., U. S. Horse collar and hames. July 14, 1875.
4,972.—W. B. Wright, Toronto, Ont. Barber's chair. July 14, 1875.
4,973.—P. Baker, Lockport, N. Y., U. S. Sash supporter and lock. July 14 1875.
4,974.—G. Henry, Lennoxville, P. Q. Regulator for feed apparatus. July 14, 1875.
4,975.—E. Fuller, Caledon, Ont. Bridle. July 1875.
4,976.—M. Fox, New York city, U. S. Reversible cap. July 14, 1875.
4,977.—J. E. Finley, Memphis, Tenn., U. S. Hard corn sheller. July 14, 1875.
4,978.—C. H. Orcutt, Leominster, Mass., U. S. Cutting and skiving leather. July 14, 1875.
4,979.—C. Robinson, Eau Claire, Wis., U. S. Trace fastening. July 14, 1875.
4,980.—J. W. Beatley, Brooklyn, N. Y., U. S. Illuminating gas. July 14, 1875.
4,981.—C. Russ, Beamsville, Ont. Stop motion for harvester. July 14, 1875.

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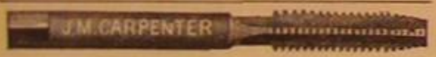

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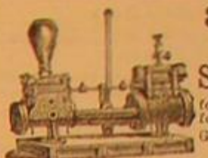

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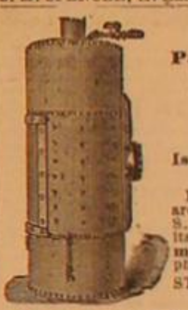

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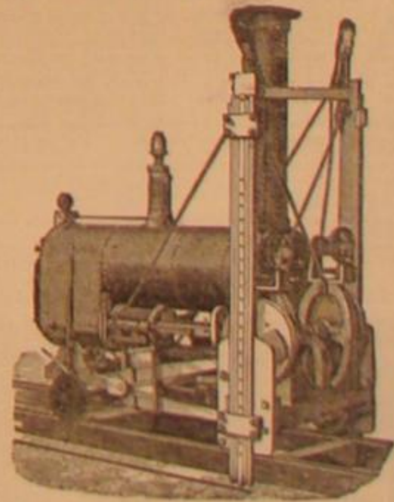

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