SCIENTIFIC AMERICAN

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THE BUILDINGS FOR THE FRENCH EXPOSITION.

The preparatory arrangements for the international exposition, to be held in Paris in 1878, are already in a forward condition. The building will, as in 1867, be erected in the Champ de Mars, and will cover the entire extent of that celebrated parade ground, reaching from the Ecole Militaire to the river Seine, at the bridge of Jena. Leaving the main exposition building, and crossing the bridge, we enter the Trocadero, an ornamental garden of great beauty, which forms one of the greatest attractions of the renowned Bois de Boulogne.

Our illustration gives an admirable view of the Trocadero as it will appear in the summer of 1878, the artist having stood on the bridge of Jena while making his sketch. Several subsidiary buildings and offices will be erected in the gardens; and a grand central hall for fêtes, ceremonial occasions, etc., will stand in the middle of the further end, on the higher ground towards the Bois de Boulogne. The two crescent-shaped side structures, which, as will be seen, are to be of great extent, will be devoted to the historical collections of pictures, contemporary paintings being exhibited elsewhere. The fountain and cascade will be very attractive features, and will show how artistically the French arrange the water displays which ornament so many of their parks, gardens, and other public resorts.

The cascade is 160 feet wide, falling in several descents to a lake, from which the different parks and shrubberies will be watered. The palace of the Trocadero is, from one pavilion to the other, about 1,330 feet in length, the pavilions at the extremities being connected with the great central rotunda, from the foot of which flows the cascade, by galleries forming segments of a semicircle. In the great hall of the rotunda, an immense organ is to be placed, and concerts will be given on the grandest scale. It has a large parterre, two rows of boxes, and above all an amphitheater, and will seat 8,000 people. Round the concert room outside, giving access to the boxes, are double galleries, closed from the weather, and affording to promenaders a splendid view of the city. On either side are peristyles opening on the Place du Trocadero on the side of the Bois du Boulogne. Above them are the offices of the managers and committees; they also serve as vestibules to the two great curved galleries that run from the central rotunda to the pavilions. These galleries are in a succession of halls; before each is a light, covered portico, running the whole length.

From all parts of Paris will be visible the two immense towers, 260 feet in height, flanking the Trocadero. A flight of seventeen broad steps conducts to the palace, before the portico of which a wide terrace stretches from one extremity to the other. The principal entrance is at the middle, and at each end are two immense domes in iron and glass, surmounted by lanterns and flagstaffs. The gardens stretch on either side of the façade between the palace and the avenues, and contain a number of small buildings, kiosks, model farms, cottages, *cafés*, greenhouses, and the like. The center is left unoccupied for the better convenience of spectators.

The architects in charge of this important feature of the exposition are MM. Davioud and Bourdais.

This is the first illustration of a series which we intend to publish, showing all the features of this great exposition, which will be the largest that the world has ever seen. Although the opening will not take place for the next sixteen months, the demands for space are already pouring in, and intending exhibitors should at once begin making their arrangements. The rapidly increasing export of American machinery to Europe, notably stationary steam engines, in which manufacture the United States has no competitor, gives additional importance to the Paris Exposition; and we hope that our manufacturers and inventors will sustain the national credit for ingenuity and practical skill. The regulations as to forwarding exhibits were published on page 361 of our volume XXXV.

A Gigantic Time Piece.

The monster clock by Messrs. E. Dent & Co., London, for the Crystal Palace, which has been in course of erection during the past six months at the south end of the building, is now completed and in working order. This clock is almost a counterpart of the great Westminster clock (which was built by the same firm), with the exception of the striking and chiming apparatus, and the dial is the largest ever yet constructed, being 40 feet in diameter, or nearly 1,300 square feet in area. The diameter of the Westminster clock is but 23 feet. The hands, with their counterpoises, weigh nearly a quarter of a ton; the minute hand measures 19 feet in length, and moves ½ inch at every beat of the pendulum. The distance travelled by the point of the minute hand is nearly four miles a week. During seventeen days of observation the variation was eight seconds only.

To Obtain the True Meridian.

In all of the recent works on surveying, it will be found that Alioth, the first star in the handle of the Dipper, is designated as being directly opposite the pole from Polaris, the north star. There was a time when such was the case, but now it is far from being correct.

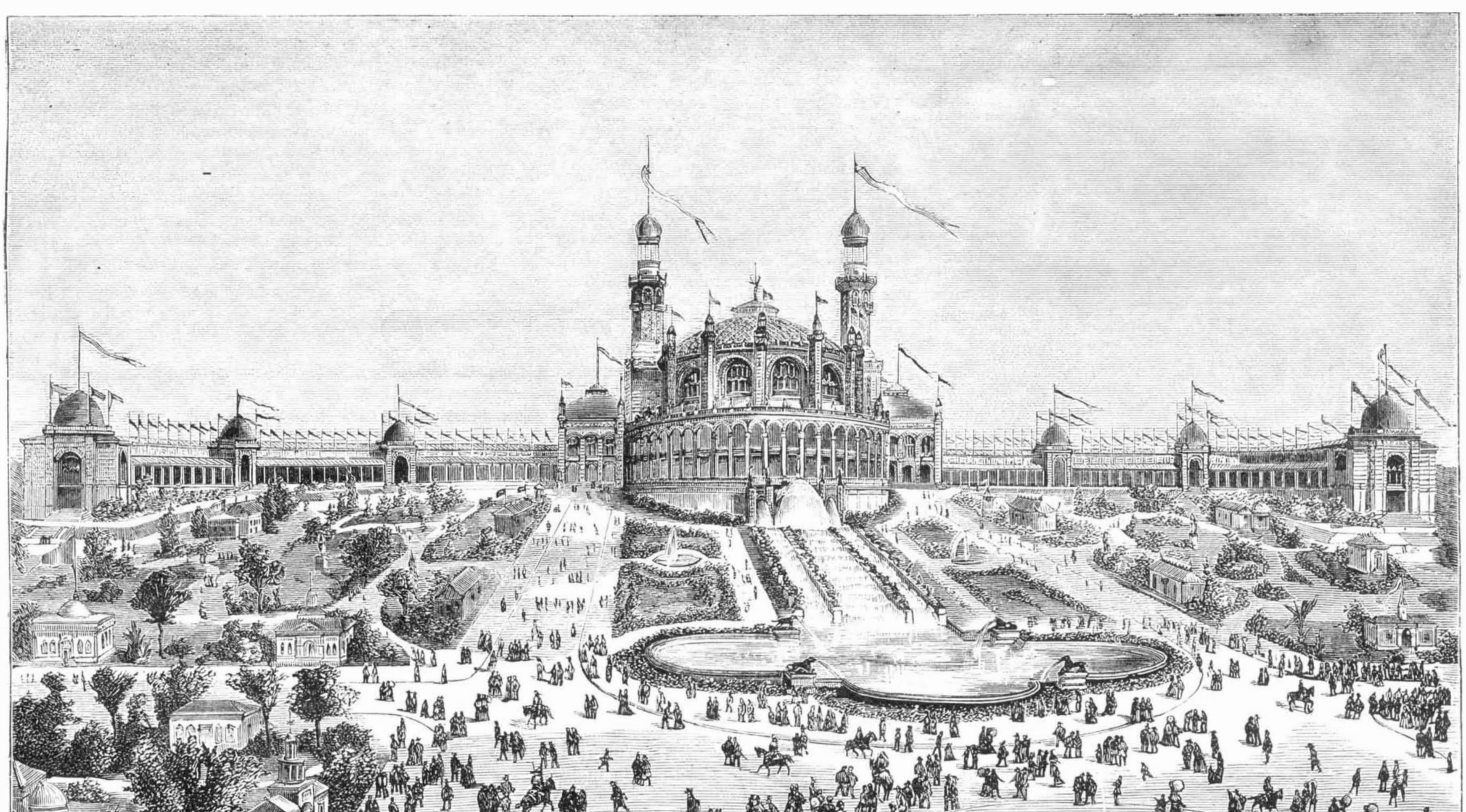
The first published account of this method which we have been able to find is in a revised edition of Abel Flint's work on surveying, published in 1833, which states that this method was communicated to the compiler, with permission to publish, by Moses Warren, of Lyme, Conn. It appears that this mode of reckoning had been in use among surveyors for some time previously; but we have not been able to find by whom or when it originated.

In 1800, Alioth was opposite Polaris; but a retrograde movement of the latter, of about twenty seconds a year, has caused Alioth to be, at the present time, twenty-five minutes ahead, and brings Mizar, the second star in the handle, within five minutes of being opposite; so that, in fifteen years more, Mizar will be exactly opposite. Polaris is on the meridian twenty-five minutes after Alioth has passed the perpendicular, and five minutes before Mizar reaches it. C.

[We republish this article, in consequence of some errors in the previous insertion of it.—EDS.]

Steam Street Sweeper.

The Third Avenue Railway Company, New York city, has lately put into use a steam sweeping machine which performs the work of removing the snow from the street tracks with much success. The machine resembles in appearance an ordinary box freight car. Under each end of the car is a revolving brush, which extends obliquely across the track, and capable of being raised or lowered as required, by an attendant within. The car is drawn by horses, but the brushes are worked by steam power. As the machine moves along, the horses on a walk, the snow is lifted into the air in large quantities, by the powerful brushes, and falls in graceful cascades upon one side of the track, forming a continuous windrow.



THE FRENCH EXPOSITION OF 1878.—THE TROCADERO.

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THE PREVENTION OF CRIMINAL PROPAGATION.

In discussing the scientific treatment of criminals and kindred topics, the SCIENTIFIC AMERICAN has long insisted that the safety of the social order demands a different treatment of the criminal classes than has hitherto prevailed. The vindictive method, the first resort in all rude communities, has everywhere resulted in failure. The severest punishments, the most threatening of decrees against wrong-doing, have never yet been able to diminish, much less suppress, crime. Indeed, violence has usually been met with violence; so that the prevalence of crime has, as a rule, been in direct ratio to the severity of the law. As a reaction against legal harshness, the sentimental treatment of criminals arose. The reformation of the criminal, not the vindictive punishment of him, became the watchword. Crime was regarded as a purely moral disease, to be cured by moral agencies, with only so much severity and restraint as might be necessary to prepare the subject for the medicine, and secure his continued treatment. This method has succeeded better than the first, wherever it has been thoroughly and consistently carried out; still it has failed utterly wherever the time of treatment has been arbitrarily limited, as it generally is, and in all cases where the criminal tendency is the result of low organization or hereditary taint. And it is open to the very serious objection that it makes the criminal class, as a whole, an unnecessarily heavy burden upon the honest and law-abiding. It puts the State in the attitude of an affectionate but unjust mother, who sacrifices the rights of her well behaved children upon the altar of her morbid affection for the "black sheep" of her little flock. As a possible and more promising third course, our proposition was to sink the idea of vengeance in the treatment of criminals, and all the suggestions of sentimentality as well. The criminal is not a devil-possessed monster to be destroyed, or in any way made the subject of vindictive or warning penalties; no more is he a saint under a cloud, to be coddled and cherished and helped on to heaven. He is simply an ill born or ill bred organization, more or less unfit to enjoy the privileges of civilized society. Society may be really more to blame than the criminal for his criminal condition; nevertheless, the safety of the whole makes it necessary that he should be restrained from the exercise of his evil propensities, and still more that he should not be suffered to transmit his vicious organization to other generations. And in justice to the law-abiding, the means adopted for the securing of these ends should be so simple and direct that the inevitable burden of crime should not be needlessly exaggerated.

How the latter result can best be secured, it is not our purpose to consider here, our attention being just now drawn to the more important element of the problem, the prevention of criminal propagation. We are glad to see that the novel and sufficiently radical position taken by the SCIENTIFIC AMERICAN, in the article entitled "The Generation of the Wicked," is having its effect in the right quarter, that is, among scientific men who will ultimately have this great reform to carry out. The moment the public comes to understand the enormous importance of heredity in this and in other directions, there will be a stop, we fancy, to the suicidal care that is now taken in so many quarters to insure the perpetuation and survival of the worst.

In the closing pages of his instructive survey of what American zoologists have done toward the development of the doctrine of evolution, read before the American Association for the Advancement of Science at Buffalo, and published in the *Popular Science Monthly*, Professor Morse reviews the evidences of man's primitive character—"an array of facts which irresistibly point to man's common origin with animals directly below us"—and remarks that only the densest blindness can fail to recognize the bearing of such grave and suggestive facts. "The dreadful outrages which shock us from time to time in the public prints," he continues, "are not instigated by an evil spirit, but are outbursts of the same savage nature which found more frequent expression years ago, and which are still present in the lower races to-day. When the study of heredity reveals the fact that even the nature of vagabondage is perpetuated, when the surprising revelations of Margaret, mother of criminals, from whose loins nearly a thousand criminals have thus far been traced, are considered, common sense will ultimately recognize that the imprisonment of a criminal for ten or twenty years is not simply to punish him, or relieve the public of his lawless acts, but to restrain him from perpetuating his kind. No sudden revulsion of feelings and amended ways is to purify the taint; but he is to be quarantined in just the same way that a case of plague might be, that his kind may not increase. With these plain facts thoroughly understood, men high in authority must find some other excuse for the exercise of their pardoning power, and other reasons be given for allowing so large a proportion of criminals to go free."

We have discussed this whole matter at length already, and our readers know how little we are disposed to trust to the saving influence of perpetual imprisonment for the prevention of criminal propagation. The stream of tendency that works for unrighteousness—the dark side of Matthew Arnold's divinity—must be stopped at its source, so far as it lies in the power of man to do it. The pestilent flood of criminal entailment must be dried up absolutely: not temporarily suppressed, and left at the mercy of any magistrate to let loose again at any moment. In other words, the surgeon, not the parson or the turnkey, is the proper man to deal with the matter.

If the criminal is in debt to society, let him be confined till the wrong done has been repaired, and the debt paid by hard labor. Then if he be so far reformed in character that the public safety is not endangered by his being at liberty, let him go free—on this sole condition, however, that he has been physically debarred from tainting generations yet to be. This act of justice to the future should be, indeed, the first step taken in the treatment of all criminals, more especially those in which the crime is a symptom of tainted blood. After that, let strict justice to the present unite with sentiment and religion to make the most and best of the perverted organization in hand.

THE GEOGRAPHICAL DISTRIBUTION OF ANIMALS.

Mr. Alfred Russell Wallace shares with Mr. Darwin the honor of developing the natural selection theory in its present form. He conceived his theory of the origin of species, as he himself says, "before I had the least notion of the scope and nature of Mr. Darwin's labors," and he reached his conclusions simultaneously. He differs, however, from Mr. Darwin in the very important item of the derivation of man, holding that the doctrine of natural selection is not sufficient to explain the transition from the anthropoid ape to man, and that it requires the co-operating agency of some higher cause.

The field of labor of Mr. Wallace, while differing from that of Mr. Darwin, is scarcely of less importance. While the latter naturalist has spent his life studying the hidden characteristics of animal life, and so evolving a history of all living beings *ab initio*, Mr. Wallace has chiefly devoted himself to the investigation of the external part of animal existence; and by dint of personal labor of great magnitude, he has rendered to Science services of inestimable value. It is not our purpose here to enter into Mr. Wallace's biography as a scientist, any further than is necessary to estimate the foundation upon which his latest and greatest work has been reared. From an early period of his life he has been an indefatigable explorer. In the primeval forests of the Amazon and the islands of the Malayan Archipelago, he has spent years; his collections of specimens of birds and insects are remarkably large, and thus his knowledge is not that of the closet naturalist, but has been gained directly from the study of Nature herself. The geographical distribution of animals has been the subject of his researches for several years past, and the results thereof are embodied in the voluminous work which he has lately published. To understand the basis of the investigation, we may briefly follow the author through his introductory summary of his subject: "It is a fact," he says, "within the experience of most persons, that the various species of most animals are not uniformly dispossed over the surface of the country." If we wish to find certain birds, or insects even, in our own vicinity, we search for them in particular places; then, as we travel, we constantly meet new species, and lose sight of old ones; and if we progress far enough, we shall find the creatures peculiar to our own district replaced by an entirely new set. We have thus witnessed a double change. First, in our own neighborhood, animals appeared or disappeared according as the soil, vegetation, etc., suited them, or the reverse. But as we got further away, we began to find (second) that localities, very similar to those we had left, were inhabited by a somewhat different set of species, and this difference increased with distance, notwithstanding that almost identical external conditions might be often met with. The first class of changes is that of stations; the second that of habitats. One is a local, the other a geographical phenomenon. The whole area over which a particular animal is found may consist of any number of stations, but rarely of more than one habitat. Again, of the new animals we meet in our travels, some are very much like those we leave at home, others are totally dissimilar. The first series are examples of what are termed representative species, the second of distinct groups or types of animals. The one represents a recent comparative modification and an origin in or near the locality where it occurs; the other is the result of very ancient changes, both organic and inorganic.

It has commonly been believed that the manner in which the various kinds of animals are dispersed over the globe is almost wholly due to diversities of climate and of vegetation. Thus the arctic regions are characterized by white bears, reindeer, walruses, etc., and the tropics by elephants, peacocks, etc.; but it has been found that this explanation is altogether insufficient, and it is now known that countries exceedingly similar in climate and all physical features may yet have very distinct animal populations. Thus the equatorial parts of Africa and South America are similar in climate, and both are covered by luxuriant forests; yet the apes, leopards, and elephants of the one are replaced by prehensile-tailed monkeys, jaguars, and tapirs in the other. Again, if we examine closely the distribution of animals in any extensive region, we find that different, though closely allied, species are often found on opposite sides of any considerable barrier to their migration. Mountain ranges, rivers, arms of the sea, and changes of climate and of vegetation form effective barriers, and the limits of the great forests strictly determine in most parts of the world the range of many species.

Naturalists now believe that, by some slow process of development or transmutation, all animals have been produced from those which preceded them. This modification takes place very slowly, and the changes appear to have accompanied, and perhaps appear to have depended on, changes of climate, vegetation, etc. "If we keep in view these facts," says our author, "that the minor features of the earth are everywhere slowly changing, that the forms and structure and habits of all living things are also slowly changing: while the great features of the earth, the continents and oceans and loftiest mountain ranges, only change after very long intervals and with extreme slowness: we must see that the present distribution of animals upon the several parts of the earth's surface is the final product of all these wonderful revolutions in organic and inorganic nature." Hence the study of animals may reveal to us which are the oldest and most permanent features of the earth's surface, and which the newest; and may show us the existence of continents, now sunk beneath the ocean, which have left no record save the animal and vegetable productions, which have migrated to distant lands.

Mr. Wallace's work is too extended to admit of its complete review within the limits here at our disposal; but the foregoing will convey a general idea of his theory, and prepare the reader for other articles, wherein we shall consider the salient features of the facts and arguments presented.

MODERN HALLS AND THEATERS.

Sooner or later every theater burns. From the conditions of the case, the chances are that the fire will occur while the building is occupied. Owing to the combustible nature of the stage and its appliances, the fire is certain to be sudden and fierce, and the smoke exceedingly pungent and suffocating. The sharp awakening of the spectators from the unreal life of the play to the real terrors of death by fire takes them at a serious disadvantage. The imagination, excited by the play, leaps at once to the extremity of fear, and the condition of panic is almost inevitable. Nothing short of the conviction that escape is easy and sure, and not always that, will prevent a headlong rush for the door. In such a rush some are sure to fall, thus adding to the unavoidable confusion and delay. Converging streams of excited people, narrow stairways, and sudden turns invariably result in increasing the falls, crushes, and fatal hindrances, whenever haste is important or danger imminent; so that passage ways which would be ample under ordinary circumstances are altogether inadequate in case of panic.

These conditions are as apparent before a disaster comes as after. They are elements of danger in public assembly rooms, which the builder should take into account and provide against as carefully as against unstable walls or insufficient supports. Not to do so is simply criminal. Yet how few are the public halls in New York in which they have been guarded against! How many theaters and concert halls have we in which a disaster, as terrible as the one in Brooklyn, is quite impossible?

Now that public feeling is aroused on this point, it is to be hoped that the discussion will not end until practical measures of precaution have been secured, by legislative action or otherwise.

It is but a few years since a cathedral in South America was a scene of horror as fearful as that in the Brooklyn Theater. In how many of our costly churches would any panic stricken congregation fare any better under like conditions? In how many could the audience escape, in case an explosion of gas or other cause should give rise to a sudden fire in the lobby? Very often there is but one means of exit from the body of the church, and very rarely is there more than one from the galleries. Our theaters and concert halls are, as a rule, still worse in their construction. The new hall on Fifth avenue is perhaps a fair type of such mantraps. From the capacious gallery there is absolutely no outlet except to the front, where two narrow stairways converge in a narrow hall into which the outlets of the main hall open. Thus half a dozen streams of people pour in cross currents into a space which would be packed in case of a rush so that escape from it would be all but impossible, and out of which there is no passage except down other stairways, badly placed and insufficient for easy exit even when there is no pressure from behind. Should a fire break out on that side of the house, the trap would be especially deadly. Those in the galleries would have absolutely no way of escape, while for those in the body of the hall the chances would be anything but cheering. The hall of the Young Men's Christian Association Building and others that might be named are little, if any, better provided with easy outlets.

The ancients did better. They made their theaters of solid earth and masonry, practically fireproof. In course of time we moderns may learn to do likewise, but we fear that such wise and costly precautions for public safety are not to be looked for yet awhile. The most that we can expect is the adoption of simple means already at hand for lessening the danger of fire and for facilitating the escape of audiences when the inevitable time of danger arrives. Among them not the least important are these, and the public should rest with nothing less, namely: That there be provided a sufficient supply of fire extinguishers in all places of popular resort. That the passage ways from every assembly room should be numerous and ample, so that escape may be easy, even should one or more of the ways be blocked by fire or otherwise.

That the outlets of the passage ways be easily opened from within, and so placed as to be readily accessible from every part of the hall.

That each general division of the audience have its independent means of exit.

That an incombustible curtain be hung so that it will drop between the audience and the stage, in any case of fire in that part of the building.

That all stairways leading from galleries or other parts of the auditorium be broad and free from sudden turns.

Perhaps the risk of jams and falls, with their attendant dangers, might be further lessened by dividing the stairways into lanes by means of stout hand rails, which would keep the living currents from side thrusts and general obstruction.

Had these safeguards or anything like them existed in the Brooklyn theater, the disaster there could never have occurred. Its repetition elsewhere should at once be made impossible by their adoption everywhere, so far as may be demanded in each particular case.

A MUTUAL DISSECTION AND DECAPITATION SOCIETY.

Some time ago, we noted the strange mutual compact, made by a few eccentric physicians of Paris, to the effect that each would provide that his body should be delivered, after death, to his fellow members for purposes of dissection. It now appears that many well known French medical men and scientists have joined in a similar agreement, and a society has been organized, and a constitution has been adopted which is quite a curiosity in its way. The document recites that "the subscribers, convinced that the intellectual future of humanity depends entirely upon the more or less exact notions which are possessed concerning the cerebral functions and the localization of the different faculties," agree upon the following propositions:

The physiological study of psychology, that is to say, the determination of the relation existing between a special function and some corresponding clearly circumscribed portion of the brain, is still very incomplete. Observation, to be fruitful, should be made upon the *encephala* of individuals belonging to the cultivated classes: in other words, of persons who have become well known as savants, literary men, politicians, etc. In such cases, where the life of the person has in part been before the public, it is believed that the comparative study of the healthy convolutions and the faculties in action, will lead to valuable positive knowledge. In the interest of public health and of the longevity of posterity, the society thinks that it is greatly to be desired that the practice of making *post mortem* examinations be rendered more general, and that families should keep records of the results of autopsies of their deceased members, in order to guide their medical advisers in treating the living.

The formal part of the constitution is as follows: "The subscribers, considering that the best way of conquering prejudice is to set the example, organize themselves into a society on the following basis: Article 1. Each member, resolved to contribute to the double object, scientific and humanitarian, above detailed, agrees that his autopsy shall take place. Article 2. In order to remove any obstacle to the execution of his desire, which may be brought forward after death, he will leave (written by himself in duplicate, and confided to responsible persons who 'shall accept the pious duty of respecting it') the following testament: 'I, the undersigned, desire and wish that, after my death, my autopsy may take place, in order that the discovery of vices of conformation, or the hereditary maladies to which they may give rise, may serve as a guide to the proper means for opposing their development in my descendants. I desire especially that my body be utilized to the profit of the scientific idea that I have pursued during my life. To this end I bequeath my corpse, notably my brain and skull, to the laboratory of anthropology, where it will be utilized in any suitable way not opposed to the provisions herein stated. The parts of my body remaining unutilized will be buried or disposed of in the following manner:'" Here a blank occurs for the testator to specify his predilections as regards cremation, burial, etc. Then comes a long list of physicians, and the information that people wishing to join may address Dr. Condercan, 5 rue Marsollier, Paris.

The institution seems to be a new kind of mutual admiration society, or rather an association for the cheap supply of posthumous fame. A person has only to become a member to be assured that after death some inquisitive scientist, mousing around his brain, will probably discover that he might have been a great author or a great general, if his genius had had but the opportunity. Inventors of perpetual motions and Keely motors, scouted during life by an unappreciative world, will, through their *encephala* under the hands of the anatomist, demonstrate that the mental possibilities of vast discovery were in them, even if the sordid and material practical portion of the same were absent. Finely developed convolutions, unimpaired gray matter, and absence of adipose deposit will be all that is necessary to place the Slades and the Homes, and the myriad other victims of the "scoffers and unbelievers," in a high seat in this necrological legion of honor.

COLORED PHOTO-LITHOGRAPHS BY COLOR-BLIND CAMERAS.

In our recent article on color blindness, we explained the simple expedient of spectacles of colored glass, whereby persons afflicted with the above defect in vision might counteract its deceptive influence. The glass, according to its color, cuts off from the retina certain rays. Thus red glass stops out all but the red and orange rays; yellow glass extinguishes the purple rays, and so on, through the different hues of the medium, the latter in every case being thus opaque to some part of the spectrum. It follows, conversely, that, by the aid of colored glass, our eyes being perfect, we can put ourselves in the same condition as a color-blind person; and in the article referred to, we noted various cases where such temporary color blindness might be beneficially resorted to.

The reader has only to bear in mind the analogy between the photographic camera and the human eye to understand the ingenious application of the foregoing to the practice of colored photo-lithography, as invented by MM. Cros, Du Hauron, and others, and which has of late been successfully experimented upon in Paris. Of the various colors of the spectrum, red, yellow, and blue have been regarded as fundamental, because from them, by mechanical mixtures of pigments, the other colors can all be compounded. The premises are correct, but the conclusion is wrong, as the latest experiments prove that red, green, and violet-blue are the color sensations of the simplest nature. For the purposes of the present explanation, however, it will suffice to regard the colors first mentioned as the bases of all natural hues, and, therefore, by suitable superpositions of tints and shades of red, yellow, and blue, we may reproduce the natural colors of any image, just as they appear on the ground glass screen in the camera. We need only, in fact, supply our camera with colored spectacles to effect this result.

Suppose that, first, a green glass is placed between the lens and object to be photographed. Glass of this color, while allowing blue and yellow rays to pass, stops all the red rays. Hence the image on the ground glass screen in the instrument will be destitute of red, and for the same reason a sensitive plate interposed will be unaffected at wherever the red rays would strike, were the green glass absent; and at such points, therefore, the negative will be transparent. A positive, taken in the ordinary way from this negative, would therefore exhibit in black only the red portions of the object, and it would resemble the proof from a chromo-lithographer's stone used for printing a part of a picture in a certain color.

Similarly, an orange glass would cut off all the blue rays, and a violet glass would annul the yellow rays, and with each of the glasses, the above process being repeated, would yield positives showing respectively only the parts in blue and in yellow on the original. At first sight it is not clear how the actual whites and blacks would, in the above way, be provided for, and made to appear in their relative proportions and values on the final proof. The rays of white light emanating from the white parts of the model traverse, of course, the three colored glasses, each in turn becoming tinted more or less with the hues of the glasses, but keeping, nevertheless, a photogenic action. This action will be indicated on each negative by opacities, which, on the monochromic positive proofs, will be represented by transparent portions. Therefore, when the three monochromic proofs are superposed, as below described, on a sheet of white paper, the latter will show through wherever there is transparence. The blacks, on the other hand, will be indicated on the negatives by transparent places, and hence at such points the color of each positive will appear at maximum intensity. But the superposition of the three colors (those below being seen through those above) will, by their combination form black.

The actual operation of superposing the three positives, as described by M. E. Dumoulin, in *La Nature*, is quite simple. Photo-lithograph may be resorted to to prepare stones for printing from in the usual way on the white sheet. The chief difficulty with which the above described process had to contend was that of shortening the posing period. When the orange glass was before the lens, this period was extremely long, despite the fact that the collodion was strongly bromidized. It has since been found that coralline, mixed with the collodion, greatly diminishes the necessary time of exposure, as this substance possesses the property of communicating to the collodion an especial sensitiveness to red and green rays. Chlorophyll has, however, lately been substituted for coralline, and the alkaline development for the ordinary process, by which means the period of exposure under the orange glass has been shortened from several hours to a few minutes.

Spirit Lace.

We are greatly indebted to a correspondent for a specimen of lace which, he informs us, was "materialized" at a recent spiritualistic *séance*. We have long desired to examine some of these marvellous productions of the elect, hoping thereby to acquire a knowledge of some of the phenomena not "known to our philosophy." It is with the greater regret, therefore, that we perceive that the spirits have not improved upon the goods manufactured by base mortals, and that the filmy cloud wreaths, out of which this veil was undoubtedly formed, are capable of no better materialization than as a cheap quality of tulle, stiffened with unspiritual British gum. The only thing about the fabric which savors of the spiritualistic is that it is of the variety of lace commonly known as "illusion."

Alcohol and Cold.

At a meeting given to the Good Templars of the English arctic expedition, Mr. William Malley, of the Alert, in relating his experiences, said that, among the few men who escaped scurvy, and did any sledging worthy of notice, were four teetotallers, who enjoyed perfect immunity from all sickness, establishing beyond the shadow of doubt that the intense cold of the polar regions could be well endured without stimulants.

Intense Light for Taking Photographs.

A very brilliant, perfectly white, and very actinic light, which may be used for taking photographs, is produced as follows: Place some perfectly dry, powdered nitre in a suitable clay vessel, and in a cavity made in the middle of the powder place a piece of phosphorus and ignite it. While it burns, the nitre melts and a quantity of oxygen gas is given off, producing an intense light.

THE RECENT ARCTIC EXPEDITION.

We so recently published a description of the achievements of the British Arctic Expedition, under Captain Nares, that any repetition of the account is unnecessary. We are now, however, in possession of the Captain's journal of the voyage, and the following extracts from it will serve to explain why the two ships, provided with every necessary equipment and fully manned, were unable to proceed further toward the pole, and will also show the futility of the open polar sea theory. After fully describing the route taken by the ships, and the geography of the explored region, Captain Nares states that it was found that, "owing to the absence of land trending to the northward, the polar pack not being navigable, no ship could be carried north on either side of Smith's Sound beyond the position we had already attained; and also that from any attainable position in Smith's Sound, it was impossible to advance nearer the pole by sledges. The only object, therefore, to be gained by the expedition remaining in the vicinity for another season would be to extend the exploration of the shores of Grant Land to the southwestward, and Greenland to the northeastward and eastward; but as with the resources of the expedition I could not hope to advance more than about fifty miles beyond the positions already attained on those coasts, and, moreover, although the crew were rapidly recovering from the disease which had attacked them, they would certainly be unfit for employment on extended sledge parties next year, I decided that the expedition should return to England as soon as the ice broke up and released the ships. On July 31, after considerable labor to clear away a passage through the barrier of floe bergs, which had so well protected us during the winter, we succeeded during a strong southwest wind in rounding Cape Rawson and entering Robeson Channel on our return voyage."

Another member of the expedition says: "If we have not yet learned the way to the North Pole, we have at any rate found out for certain what is *not* the way. We have demonstrated the open polar sea to be a myth; we have shown that the Smith Sound route, affording no continuous land to the northward, is not the route by which the highest latitudes will ultimately be gained; and we have traced the real difficulty of arctic exploration to its true and final source, and proved that, until some way can be discovered which opens out a totally different description of ice from that encountered by our present expedition north of latitude 83°, no amount of strength, or skill, or daring will suffice to overpass the barriers which Nature has set up around the pole."

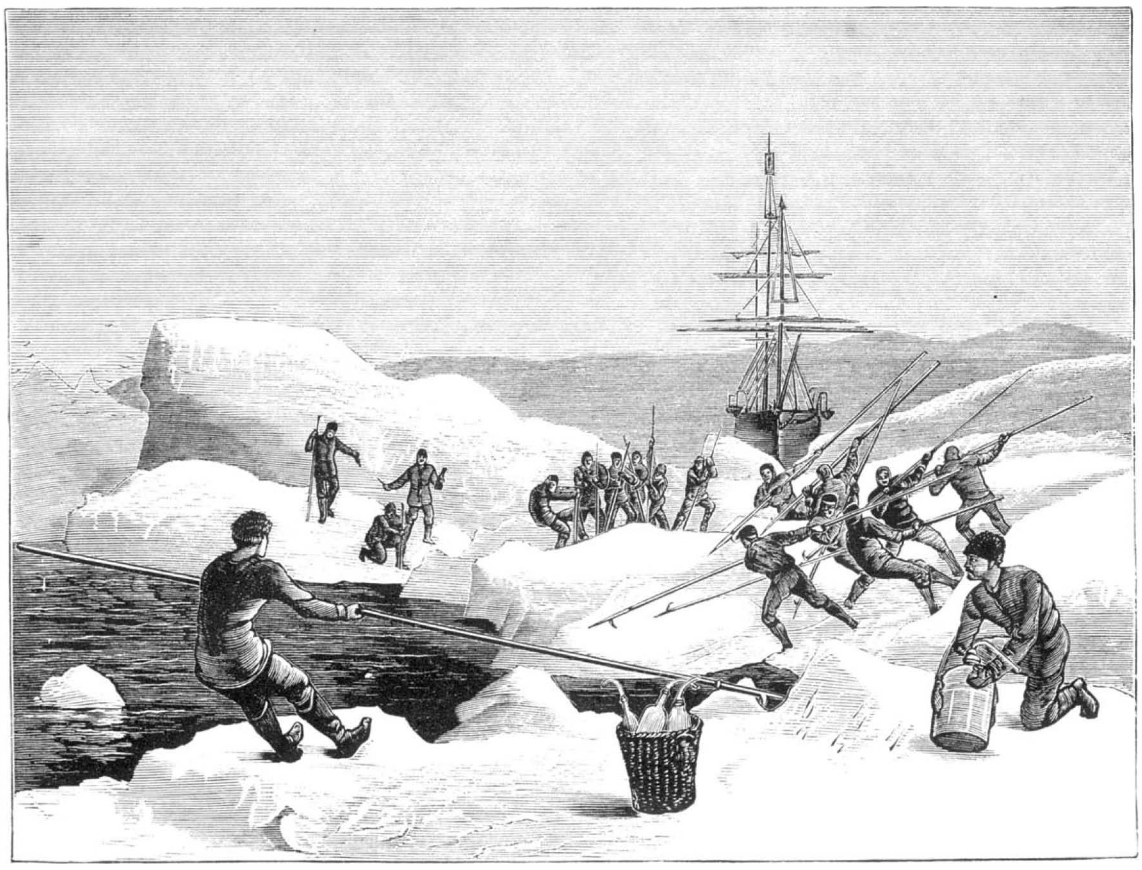
A good idea of the magnitude of the labor and the severity of the climate which lay before the expedition may be formed from the following extract from Captain Nares' journal:

"The long arctic winter, with its unparalleled intensity and duration of darkness, produced by an absence of sunlight for 142 days, was passed on board with much cheerfulness and contentment; the time, in reality, passed with great rapidity; and in January, when the first glimmering increase in the midday twilight began to lengthen sensibly day by day, the want of light was scarcely noticeable by any one; and not until the sun actually returned on the 1st of March, did we in any way realize the intense darkness we must have experienced for so long a period. On five evenings in the week a school, formed on the lower deck, under Commander Markham and several of the officers, was well attended, each Thursday being devoted to lectures, songs in character, and readings, with occasional theatrical representations: the whole so admirably arranged and conducted by Commander Markham as to keep up the pleased interest of all for the whole period. The health of the officers and crew, with only one exception, was most excellent; and the habitable deck as dry as is possible in these regions, in a ship, without an extraordinary expenditure of coal.

"Although we had frequent evidence of strong winds prevailing in Robeson Channel, the weather at our winter quarters was remarkably calm; indeed, we may be said to have wintered on the border of a Pacific Sea. The prevailing wind was from the westward; we never experienced any easterly winds: it always blew off the land. Had it not been for the intervening calms, the persistent westerly winds might have been well called a trade wind. On only two days were we prevented by the wind and accompanying snowdrift from taking exercise outside of the ship. This quiet state of the atmosphere was productive of the severest cold ever experienced in the arctic regions. During February mercury remained frozen for fifteen consecutive days; a southwesterly gale, lasting four days, then brought warmer weather; immediately the wind fell, cold weather returned, and the mercury remained frozen for a further period of fifteen days."

In spite of this most discouraging report, further expeditions are already being talked of; but we think that they will serve more to demonstrate man's endurance and perseverance than to achieve the wished-for result. But that the open polar sea should vanish from our books on geography without any explanation seems incredible; and it is to be hoped that some physicist will show us how a point on the earth's surface, twenty-six miles nearer the center than the equator, can so far escape the effect of the central heat as to be covered with perpetual ice.

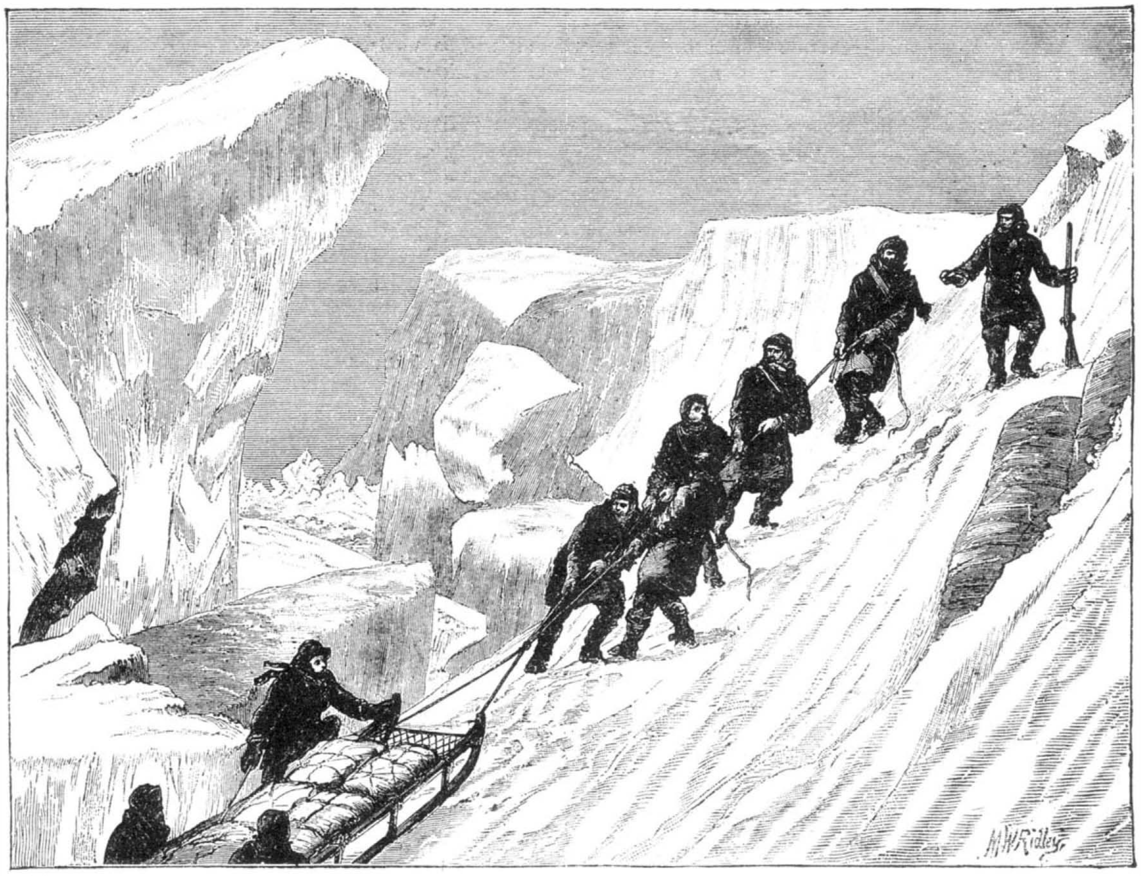
We publish three excellent engravings, selected from the London *Graphic*, the first showing the method employed in cutting a way through the ice. In many places, the ice was blasted with gunpowder, and the pieces removed from the ship's course by manual labor, as shown in our engraving. Captain Nares shows that this was a work of some magnitude.



CUTTING A WAY THROUGH THE ICE.

"In Robeson Channel proper, except where the cliffs rise precipitously from the sea, the shore line is fronted at a few paces distance by a nearly continuous ragged-topped ice wall from fifteen to thirty-five feet high. But on leaving Robeson Channel the coast line loses its steep character, and the heavy ice is stranded at a distance of 100 to 200 yards from the shore, forming a fringe of detached masses of ice from twenty feet to upwards of sixty feet in height above water. The average measurement of the ice in thickness as it floated is eighty feet."

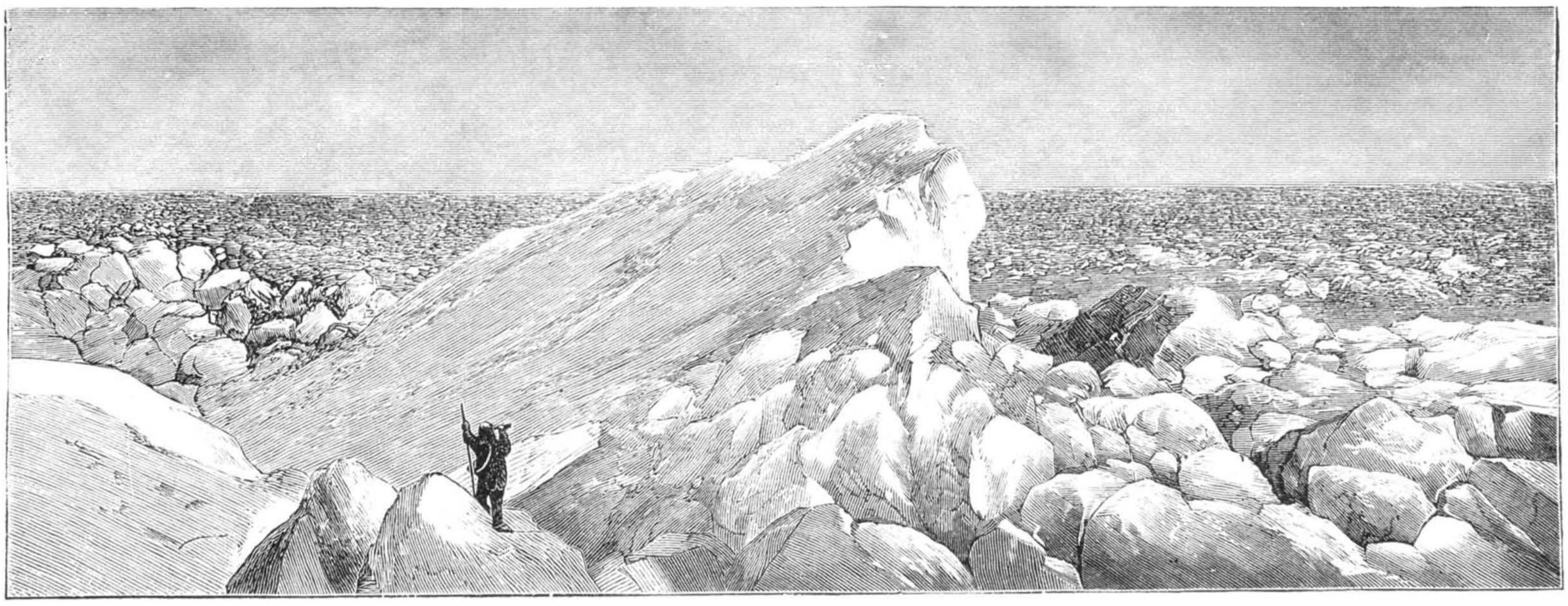
Our second engraving shows an incident in the sledge travelling which did such good work in achieving the highest known latitudes. "Commander A. H. Markham, with Lieutenants A.A. C. Parr and W. H. May under his orders, started on September 25, 1875, with three sledges, to establish a depot of provisions as far in advance to the northwestward as possible. Lieutenant P. Aldrich left four days previously with two lightly equipped dog sledges to pioneer the road round Cape Joseph Henry for the larger party. He returned on board on October 5, after an absence of thirteen days, having, accompanied by Adam Ayles, on September 27 (from the summit of a mountain 2,000 feet high, situated in latitude 82° 48′ north, somewhat further north than the most northern latitude attained by our most gallant predecessor, Sir Edward Parry, in his celebrated boat journey towards the north pole), discovered land extending to the northwestward for a distance of sixty miles, to latitude 83° 7′, with lofty mountains in the interior to the southward. No land was sighted to the northward. On October 14, two days after the sun had left us for its long winter's absence, Commander Markham's party returned after a journey of nineteen days, having, with very severe labor, succeeded in placing a depot of provisions in latitude 82° 44′ north, and of tracing the coast line nearly two miles further north, thus reaching the exact latitude attained by Sir Edward Parry. I despatched Lieutenant Rawson to again attempt to open communication between the two vessels. He was absent from the 2d to the 12th of October, returning unsuccessful on the latter day, having found his road again stopped by unsafe ice within a distance of nine miles of the ship. During these autumn sledging journeys, with the temperature ranging between 15° above and 22° below zero, the heavy labor, hardships, and discomforts inseparable from arctic travelling were much greater than those usually experienced. Out of the northern party of twenty-one men and three officers, seven men and one officer returned to the ship badly frostbitten, three of these so severely as to render amputation necessary, the patients being confined to their beds for the greater part of the winter."



HAULING A SLEDGE OVER THE ICE.

The engraving gives a view of part of the road southwards towards where the Discovery was lying. The only place where sledges could get along was between the steep, snow-covered cliffs eaten out by sea ice, and the hummocks forced up on the shore. Abrupt declivities of from 20 to 30 feet were common. The sledge shown in the engraving is loaded with pemmican for a depot close to the ship. For a regular sledge party, it would, of course, be laden with tent, bags, cooking gear, etc.

Our third engraving is the most interesting ever published in illustration of the long investigated question of polar geography. It shows the sea of ancient ice lying between the highest attained point and the pole itself, and any investigator who reaches the pole must traverse it. For want of a better name, Captain Nares called this frozen desert the "palæocrystic sea," or sea of old ice, to distinguish it from the sea whose surface is undergoing perpetual change from the breaking up and shifting of the floes in spring, the consequent formation of new "one season's" ice, and the incursions of icebergs broken off from the glaciers. The reader



THE PALÆOCRYSTIC SEA.

may judge from the engraving how far the existence of an open polar sea may be calculated upon for purposes of navigation. The big block of ice in front is perhaps fifty or sixty feet high; while the frozen mass beyond is by no means as smooth as it looks in the engraving, and may be shortly described as a wilderness of ice rocks, of every variety in form and size, matted together by patches of drifted snow. At a point about two miles south of the Alert's winter quarters, where Robeson Channel begins to widen out and its shores to retreat westward and eastward, the ice was found to assume quite a different character from that which had been observed in lower latitudes. Its massive hummocks and extended floes were clearly the product of a distinct region, and had been formed, not in narrow channels and under comparatively sheltered headlands, but in the broad expanse of the polar ocean.

A NEW HYGROMETER.

BY G. P. HACHENBERG, M. D.

A change in the weather is almost always preceded by a change in the humidity of the air, and frequently these changes may occur without materially affecting atmospheric pressure. Consequently, a sensitive hygrometer is more reliable to prognosticate changes in the weather than a barometer. The psychrometer, commonly known as the "dry and wet bulb thermometer," an instrument in use by the Signal Corps, U. S. A., is readily influenced by any changes in the humidity in the air; but practically it is of little use in predicting changes in the weather. From an experiment made on board a Spanish ship of war, many years ago, where a single stem of pine wood, glued to another piece of firm wood, was used in testing the humidity of the air, I was led to invent a hygrometer, which appears to meet all the requirements of an instrument of that kind; for not only by its indications is the degree of humidity in the air accurately given, but we are often able to prognosticate changes in the weather.

The instrument is represented by Fig. 1. *a a a* are three upright strips of wood, $\frac{1}{10}$ by 1 inch, and 2½ feet long. The narrow left hand side of each piece is faced with a thin strip of cedar, ⅛ of an inch thick, with the grain running lengthwise. Each piece consists of this strip of cedar, glued to thoroughly seasoned white pine, with the grain running transversely to that of the cedar. The middle piece is a few inches longer than the other two, in order to receive the lever, *b*, which is attached to index hand, *c*. *d d* represent the degrees of the instrument, 1 inch to each degree. Zero (0) stands in the middle of the scale, and is the dividing line between wet and dry. Each side is divided into 20 degrees, showing the degree of aridity on the one side and of humidity on the other. The three pieces, *a a a*, are united above with round nails by a brace, *e e*. The nails of the two outer pieces work in slots cut perpendicularly. The pieces, *a a a*, are accurately fitted at the bottom into a piece of plank, with screw holes at the end, *f f*, in order to fasten it against the wall. At *g*, the index hand, *c*, is likewise fastened to the wall in a manner to give free action, both to the hand itself and to the lever, *b*. There is a free joint between the index hand and the lever. J is an apparatus attached to the index hand to register the action of the instrument. K is a blank card fastened against the wall.

L is a part of an ordinary lead pencil, held by an oblong slot attached to the index hand; and a ring to receive the pencil is attached over the opening of the slot. Near the point of the pencil is a notch to receive a small metallic ball, M, suspended by a thread. The end of the pencil is perforated to receive a thread, to which is attached ball N, and it is fastened at *g*. This ball keeps the pencil in contact with the card.

It will be perceived that, by the least motion of the index hand, either way, the pencil will make its mark on the card; and as the pressure on the pencil by the ball, M, is downward, it will not take the same line twice. This part of the register is adjusted, from time to time, as it may be necessary; it may be once a day, or once a week, according to the changes in the weather.

In preparing the wood for the construction of this instrument, both the pine and the cedar must be carefully dried. The pine should be placed in a warm oven, and care taken not to impair the texture of the wood by too great heat. When thus dried, it is dressed and cut crosswise, and the pieces accurately glued to the cedar. The pine will absorb sufficient water out of the glue to warp it considerably. This warp is taken out by another drying process. When the pieces are perfectly straight, they are fastened to a strip of plank, as stated above. The instrument should be fastened against a firm wall in a dry, shady place out of doors, and in the following manner: Draw two perpendicular

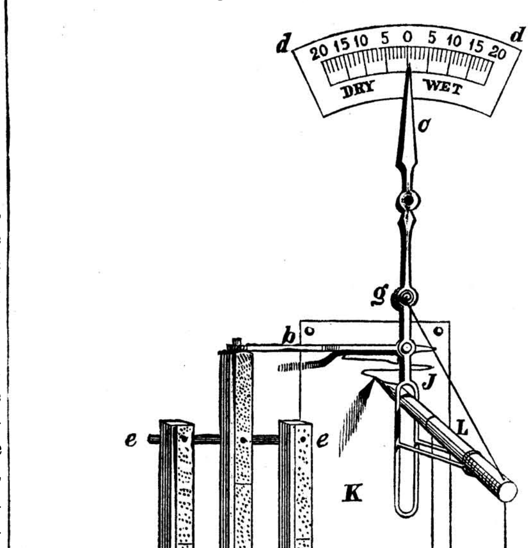


Fig. 1

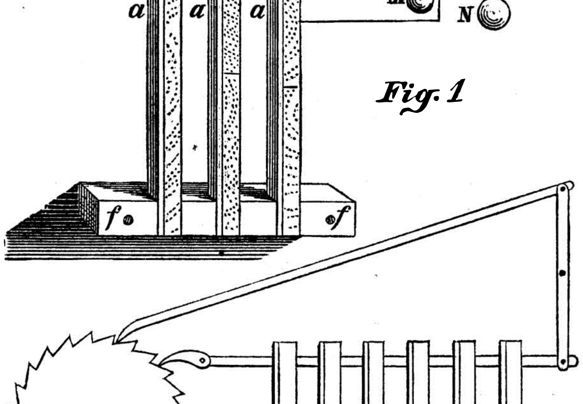


Fig. 2

lines on the wall, one to correspond to the middle line of the middle piece, *a*, and the other to the zero line on the scale. The instrument is fastened to the wall to correspond with these lines. However, if there is any curvature left in the pieces, *a a a*, an allowance on the scale must be made for it. (The representation of the registering part is entirely out of proportion with the rest of the instrument).

The immediate operation of this instrument is neither accurate nor satisfactory, owing, in part, to the moisture which the wood absorbs from the glue, and to its not yet having received the hygrometrical temperature, so to speak, of the air. But after it has assumed its normal action, it becomes exceedingly sensitive to any change in the air. Its *modus operandi* is: As the humidity of the air increases, the pine absorbs moisture, which swells it, and causes a curvature of the three pieces; the degree of the curvature gives us, on the scales, the degree of the humidity in the air. When the air becomes arid, the pine expels its moisture and shrinks, throwing its curvature in the opposite direction, in proportion to the degree of the aridity. The reading of the probabilities of the weather by the use of this instrument depends not always upon the degree of the dry and wet on the scales, but on the manner in which the index hand moves, through the period of a day or so. Sometimes there is a tidal wave, either of aridity or humidity, that may influence the instrument for a brief time to several degrees, after which it will take its former position; but if from this, or any other position, it should persistently move either way, to wet or dry, we may conclude as to the probable state of the weather for the coming night or the next day with certainty. This is so invariably the case that it may rain, or be cloudy, and the weather may appear altogether unsettled, and the index hand may point to 15° wet; but should the hand slowly work its way to zero, notwithstanding all the signs unfavorable for clear weather, even those of the barometer itself, we can safely calculate on immediate fair weather.

This instrument might be made much smaller and portable, and utilized for various purposes, such as testing the dampness of rooms, cellars, and public buildings.

In developing my hygrometer, I constructed an instrument partly represented by Fig. 2, where I took advantage of the atomic changes in the wood, and effected an adynamic rotary motion. The force was easily made accumulative to an extent to produce a ceaseless motion. Had I not pointed out the secret of this perpetual motion, and had I befogged the apparatus with a mechanical complication, I might have been amused, for a brief time, with the reception that the solution of this "mechanical impossibility" would have received, for but few would have taken that row of sticks for my source of power. The power created by this instrument is not that of a ceaseless strain, but, as the force is from two opposite directions applied to the wheel, it is interrupted in its nature.

Round Mountain, Texas.

Sulphur for Scarlet Fever.

Dr. Henry Pigeon writes to the London *Lancet* as follows: "The marvellous success which has attended my treatment of scarlet fever by sulphur induces me to let my medical brethren know of my plan, so that they may be able to apply the same remedy without delay. All the cases in which I used it were very well marked, and the epidermis on the arms in each case came away like the skin of a snake. The following was the exact treatment followed in each case: Thoroughly anoint the patient twice daily with sulphur ointment; give five to ten grains of sulphur in a little jam three times a day. Sufficient sulphur was burned, twice daily (on coals on a shovel), to fill the room with the fumes, and, of course, was thoroughly inhaled by the patient. Under this mode of treatment each case improved immediately, and none were over eight days in making a complete recovery, and I firmly believe in each it was prevented from spreading by the treatment adopted. One case was in a large school. Having had a large experience in scarlet fever last year and this, I feel some confidence in my own judgment, and I am of opinion that the very mildest cases I ever saw do not do half so well as bad cases do by the sulphur treatment and as far as I can judge, sulphur is as near a specific for scarlet fever as possible."

MARSTON'S PORTABLE GANG SAW MILL.—In our illustrated article on the above machine, in No. 1, current volume, an error occurred in the accidental omission of a 0 in the number of feet sawn per day of 10 hours. The figure should be 20,000, and obviously not 2,000, as stated, which would be rather slow sawing.

Communications.

Patent Office Requirements in Reissue Cases.

To the Editor of the Scientific American:

In last week's *Official Gazette* you will notice a ruling on a motion to rescind that part of rule 63 which requires an applicant for reissue to place on the file, at his own expense, a certified abstract of title. If the Commissioner would append to his decisions even an abstract, showing the points or line of argument pursued by counsel, the decisions themselves would be more intelligible. In this case but little can be gathered from the decision, except the Commissioner's opinion upon the question, the arguments in favor of which are entirely unknown. This imposition of an extra tax in reissue cases is one of those arbitrary exactions which now and then crop out in the administration of the Patent Office, having their origin apparently in a desire to introduce something new, without special regard to its utility or lawfulness. The statute provides that, for certain specified reasons, a patentee may reissue his patent. "The Commissioners *shall*, on the surrender of such patent, and the payment of the duty required by law, cause a new patent * * to be issued," etc., (sec. 4916). The duty required by law is $30, but the Commissioner refuses even to send an application to the Examiner until he has paid into the Patent Office another duty, to wit, the price of a certified abstract of title. This is a subject of importance to patentees, not only because it involves an additional and uncertain expense, but because the same principle will justify possibly greater impositions. I hope this letter may awaken attention to the question.

The points of my argument are as follows:

1. The Examiners are bound to take notice of all the records of the Patent Office, and the record of assignments forms a part of these. There is no more reason why the applicant should furnish the Examiner with copies of these records than of any others: patents, for instance, upon which his claim may be rejected.

2. There is no authority in the Commissioner to make such a rule. He is only permitted to make rules and regulations "not inconsistent with law" (statute, S. 483, title XI).

3. There is no value in the abstract after it is obtained, because it shows nothing as to unrecorded transfers.

4. The applicant is obliged to make oath as to the residence of the title. That is the latest and best evidence of the facts sufficient for every purpose, in a reissue as much as in an original application. As the Commissioner says, if this statement should prove to be untrue, the patent issued under it would be defective. Well, does the Patent Office ever guarantee the validity of the patents issued? The Commissioner further says that certain evidence of title is necessary to show to whom the reissue should go, and that the fee paid for the abstract is the price of this evidence; yet he admits that he cannot be impeached for issuing a patent to an improper party. Now, the rule amounts to just this: The Commissioner rules out the oath of the only competent witness, and requires at his expense a piece of testimony which is of no value as proof, and refuses to forward the application until the coffers of the Patent Office are enriched to an extent beyond the fee prescribed by law. It is easy to see that the patentee knows whether he has made assignments or not. Supposing he swears that he has not, why should not the officers test that statement by the record of the Office as much as his other statement (both under oath), that he was the first to invent the combination, etc.? But suppose the application is made in fraud. He assigns to-day and asks a reissue to-morrow, swearing that he has not assigned. Would a certified abstract help the Office to any information as to that?

This tax is an imposition, pure and simple. It has no purpose, nor any use except to swell the receipts of the Patent Office, which are too large without it; and it ought summarily to be abolished. S.

Carbolic Acid for Whooping Cough.

To the Editor of the Scientific American:

An item in your issue of December 23, 1876, relating to the application of the vapor of carbolic acid, by Dr. Lee, of London, for whooping cough, recalls a similar application made for my children in the winter and spring of 1873. Two little girls returned from school with hard coughs. During the night following they received small doses of various cough medicines, but without apparent effect; they coughed incessantly. The next day we learned that they had been exposed to whooping cough at school, and that they probably had it. That night, as our usual remedies had failed, it occurred to me that possibly some relief might be obtained by their inhaling the vapor of carbolic acid. So, when the children were in bed, we evaporated, over the gas in their bedroom, a very weak solution of the acid for about fifteen or twenty minutes. The effect was magical. The character of the cough was from that time changed. There was no hard coughing that night. The children had a light cough, which continued during the usual term of whooping cough, but it was without the "whoop," save in one or two instances, and without any special distress, sickness, or discomfort. Three other children took the cough at this time, and were treated in the same way, with the same result.

In these instances a teaspoonful of a strong solution of carbolic acid crytals and glycerin was well mixed in a quart of water. From one to two gills of this weak solution was evaporated slowly over the gas (in the room where the children were asleep or at play), with doors and windows closed, twice daily. R.

New York city.

An Instrument for the Mechanical Trisection of an Angle.

To the Editor of the Scientific American:

This device consists of a pair of compound compasses of four legs, so connected by levers that in every position of the compasses the second leg will bisect the angle formed by the first and third legs, while at the same time the third leg will bisect the angle formed by the second and fourth; thus the angle formed by the first and fourth legs will be trisected.

In Fig. 1, O G, O H, O I, and O K are the legs of the compasses. A E, C E, B F, and D F are connecting rods or levers, pivoted at A, B, C, and D, united by pivots at E and F, and moving in slots upon the legs O H and O I. In the triangles O A E and O C E, O A = O C, A E = C E, and O E is common. Hence the angle G O H = the angle H O I. In like manner, the angle H O I = the angle I O K. Thus the three angles are equal.

Make the sides, O G and O K, coincide with the given angle. Mark the points, H and I, and H O and I O.

This construction suggests a method of trisecting the angle by means of two pairs of parallel rulers (Fig. 2). Lay off

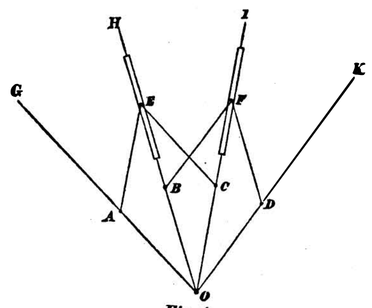


Fig. 1

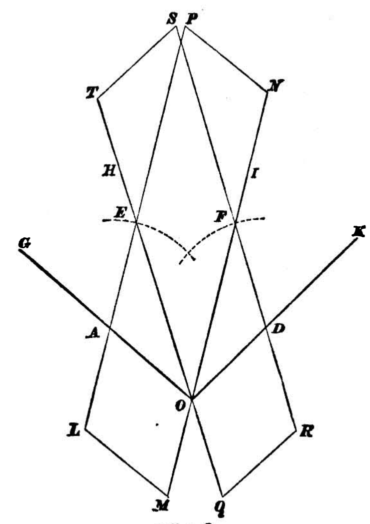


Fig. 2

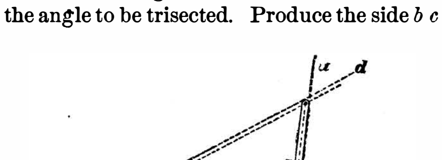
O A = O D; and with the same radius and A and D as centers, draw two arcs. The point E, of the line O H, will be found on one arc, and point F, of the line O I, on the other arc. Drive pins at O, A, and D. Bring the inner edges of the parallel rulers L M N P against the pins at A and O. In like manner, bring the inner edges of the parallel rulers Q R, S T, against the pins at O and D. Then keeping the rulers against the pins, move them around until L P intersects Q T on one of the arcs, and M N intersects R S on the other arc. Then draw lines along Q T and M N, and the angle will be trisected. It will be seen that L P and R S also intersect each other on the line besecting the given angle —a fact which will serve as an additional guide in bringing the rulers into position. Completing the parallelograms O A E C and O D F B, as seen in the first figure, the proof is the same. WARREN HOLDEN.

An Instrument for Trisecting an Angle.

To the Editor of the Scientific American:

I have constructed an instrument for trisecting angles. You will understand it at first sight. In the annexed figure, the triangles 1 2 3 and 2 3 4 being isosceles, the angle 2 1 3, or its equal, *d o c*, = ⅓ *a b c*.

The manner of using the instrument is as follows:—Let *a b c* be the angle to be trisected. Produce the side *b c* towards



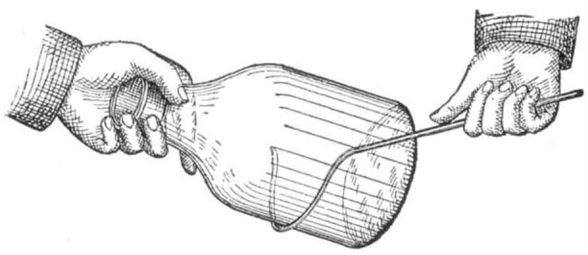
o. Apply the side marked C of the instrument to *a b*, as in the figure; hold it tight with one hand, and, with the other, bring the end of the side A to touch *b c* produced. Place a rule against the side A, and, the instrument being withdrawn, *d o* may be drawn.

A slight addition to the instrument would transform it into one for finding either the square or the square root of a number. D. MATTE.

Cutting Glass Bottles.

To the Editor of the Scientific American:

It is often desirable for experimental purposes to cut glass bottles to form jars, or to cut large glass tubes into sections, when diamonds cannot be obtained or are unavailable. To do it readily and neatly, it is only necessary to provide a wire of from ⅛ to $\frac{3}{16}$ inch diameter, and bend it to conform to the curvature of the bottle or tube to be cut, so that it extends over about half the circumference. The bottle or tube is scratched with a file, or otherwise marked; and the wire is heated to a low red or black heat, and placed under it, as shown in the engraving, and the bottle is slowly rotated through a partial revolution alternately toward the right and



left, until the glass cracks along the line of the wire, when the rotary motion is continued, but more in one direction than the other, until the crack makes a complete circuit.

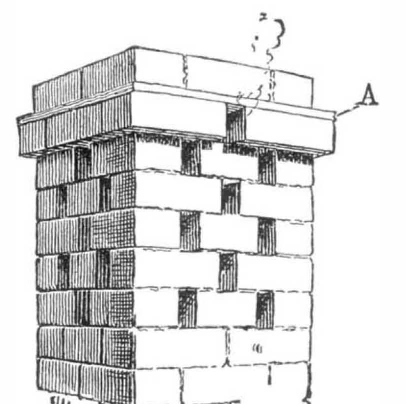
A convenient way of cutting or breaking glass tubes of small diameter, having thick sides, is to make a nick in one side with a file, and place the thumbs close together on the tube opposite the nick, with the nails in contact with each other. Pressure is then exerted on the tube with the thumbs, and at the same time the tube is pulled lengthwise, when it will break with a smooth, square fracture. A single nick is better than a mark around the tube. D. M. H.

Brooklyn, N. Y.

Smoky Chimneys.

To the Editor of the Scientific American:

Of the various remedies for smoky chimneys, I have never seen a more satisfactory one than that represented by the engraving. The chimney from which the sketch was taken was an eight inch square flue, straight and vertical from cellar to top, some thirty-two feet in height. The draught had always been sluggish except in brisk weather, and various sheet iron concerns had been tried with indifferent success. The other day a few of the top courses of bricks were removed and relaid as shown in diagram. Instead of the eight



inch square flue out of the top, seven or eight 2x2 inch openings were left in each of the four sides, making an aggregate area of opening laterally of about 120 square inches instead of sixty-four out of the top. A plate of slate, A, with a three inch opening in its center, covers the top, having a course or two of brick above it to keep it down. A single soapstone or cast iron cap with a small opening in the center would probably be preferable to the slate and brick. The draught is now all right.

Worcester, Mass. F. G. WOODWARD.

THE DEATH OF COMMODORE VANDERBILT.

After a tedious illness of several months, during the greater part of which time his demise was daily, if not hourly, expected, Commodore Vanderbilt died on January 4. He had reached the advanced age of 83 years, retaining a wonderful physical power, the strength of which was clearly shown in his long resistence to the ravages of a wasting and painful disease.

Cornelius H. Vanderbilt was born on Staten Island, N. Y., in 1794. His father was a small farmer, in fair cicumstances; but the family was large, and Cornelius, being the eldest son, found himself compelled to rely upon his own efforts for support before he was fairly seventeen years of age. The elder Vanderbilt, in order to transport his produce to New York, had established a ferry between the city and Staten Island. After his death, Cornelius, having earned sufficient money to buy a boat, became a boatman, and carried passengers over the same route for eighteen cents a trip. By dint of close economy, he saved enough to buy a larger vessel, and finally he possessed the best boat in the harbor. Thus began Vanderbilt's connection with public transportation; and from the owner of the single little craft, he rose to be the controlling power of fleets of magnificent vessels and some of the wealthiest railroads in the country. To one boat, others were soon added; then he bought a schooner, and went into the coasting trade; and finally, in his twenty-third year, he owned several fine sailing craft and some $9,000 in money. In 1818 Thomas Gibbons, a New Jersey capitalist, offered him the command of a small steamboat, at a salary much less than his income at the time. Vanderbilt, however, accepted the offer because, with his natural acumen, he foresaw that steam was destined to supplant sails, and a knowledge of steam navigation was necessary to him. For twelve years he remained in Mr. Gibbons' employ, during which time the litigation between rival steamship companies was bitter and continuous, and he was compelled to resort to expedients of every kind to protect his employer's interests. Finally, in 1829, he deemed his education finished; and refusing command of the whole line of boats owned by Gibbons, on his own terms, he started building vessels of his own. The first one he constructed was the famous Caroline, used by Canadian rioters in 1837, in a disturbance which involved an invasion of American territory, and occasioned a vexatious international dispute between England and this country. During the next twenty years of his life his energy was remarkable.

He built steamboat after steamboat, and established opposition lines on the Hudson and on Long Island Sound. He built handsomer and faster boats than those on the regular lines, and cut down the fares. He took great pains in selecting competent men to work for him, paid them well, and kept them in their places. His vessels were constructed under his immediate supervision and from his own plans. He patronized foundries where machinery could be made in accordance with his own ideas. He never insured a vessel; but used to say: "Good vessels and good commanders are the best kind of insurance; if corporations can make money in the insurance business, I can." During his long experience he never lost a vessel by fire or wreck.

Within a few years after the launch of the Caroline, he built 38 steamboats. Then he organized an opposition line of steamers to California, and another between New Orleans and Galveston. In 1853, he had already become one of the richest men in the country, and in that year he made his famous trip to Europe with his family in his own steamer, the North Star. On his return, he organized a line of steamers between New York and Havre, France, and built the magnificent steamer Vanderbilt, at a cost of $800,000. This vessel he presented to the Government during the war. From first to last, he owned, wholly or in part, 100 steam vessels; and in 1857 he began to sell them and invest in railroad stocks.

Through Commodore Vanderbilt's Wall street operations we cannot follow him. He possessed a genius for combination and organization a tenacity of purpose, which enabled him to hold on to advantage once gained, rather than risk anything for the sake of a possible betterment; and he is said to have understood the art of "watering" stock scientifically better than any man that ever lived. As soon, however, as he became practically master of the New York Central, Hudson River, and Lake Shore and Michigan Southern railroads, he introduced systems of close economy. Trains were added, depots were built, tracks were doubled, and the business of the different roads was developed wherever there was an opportunity. At the same time, judicious retrenchment was everywhere carried on. He erected the great freight depot and the Grand Central depot in this city, built the underground railway on Fourth avenue, and constructed the four-track system on the Hudson River and New York Central railroads. The actual value of the estate which he leaves is variously estimated, but it probably aggregates nearly $60,000,000, the greater proportion of which is invested in railroads.

As a man, Commodore Vanderbilt was remarkable for no characteristics outside those already detailed, or apart from his business life. He was almost destitute of education and of cultivated tastes. His vast wealth, with the single exception of the endowment of the Vanderbilt University, in Nashville, Tenn., was not in any wise devoted to philanthropic projects. It was gained, not like the millions of Stewart, through the successful exercise of mercantile ability, or like that of Astor, through the inevitable accretion of capital produced by time and enhancement of values, but rather through gigantic enterprises involving sharp conflicts with men of scarcely less energy, through audacity, through indomitable perseverance, and through thrift. That the use to which his fortune has been placed has benefited the community, there can be no doubt. Such, however, is but the natural result of the enterprises necessary to the accumulation of a great fortune. Mr. Vanderbilt was frugal in his living, systematic in his business and recreations, and industrious at all times.

[For the Scientific American.]

CHEMICAL PROGRESS IN 1876.

The old proverb, that there is nothing new under the sun, seems quite out of date when we look at the scientific records of a year, and especially as we glance over the chemical discoveries that have been made or published in that brief space of time. Rudolph Wagner, one of the German members of the Centennial jury on chemistry, aided by a dozen or more able assistants, publishes annually a brief but careful abstract of all that has been accomplished in chemical technology for the year. These brief notices fill a volume of over eleven hundred pages. The amount of chemical work performed in each year which does not fall under this title would fill another volume of equal size. It is not our intention to undertake the compression into a brief editorial of all the contributions that have been made to chemistry within the year just closed, but only to point out a few interesting facts, omitting in some cases, perhaps, others quite as important for want of time and space. Nor shall we undertake to arrange them in the order of their importance, for it is strangely true that discoveries which seem trifling often prove of immense value, while those which attract most attention at first are soonest forgotten.

INORGANIC CHEMISTRY.

The discovery of the new metal gallium marks an important epoch in chemical chronology, not alone on account of its peculiar properties, its low melting point, etc., but more as being the first element whose discovery had been predicted, and thus bringing into prominence the almost forgotten laws laid down by Mendelejeff several years previously. This metal, its discovery, its spectrum, and other properties have been fully described in our columns.

Although gallium is the last brilliant triumph of the spectroscope, many of its other achievements have been of great practical value. We described, in our issue of July 17, 1876, the use of the spectroscope on the witness stand, in a case of supposed forgery. Professor H. Vogel, of Berlin, has done a vast amount of valuable work in devising methods of detecting adulteration, especially in wine, by means of the absorption spectra. (See SCIENTIFIC AMERICAN, May 20, 1876.) He even adapted it to the detection of some metals of the iron group, and more recently to the salts of aluminum and magnesium, when in very dilute solutions, bringing to his aid an organic coloring matter, purpurine, the absorption spectrum of which is variously modified by these metals. The subject of the detection of blood, even when old and dry, by means of the spectroscope, has also been studied by Vogel, who points out a certain method of distinguishing it from indigo, with which some have claimed that it may be confounded. It may be here remarked that Struve has obtained from some kinds of meat a substance which also yields the same absorption spectrum as blood, from which, however, it can be distinguished by other reactions. Following the path of Professor Vogel, another German, named Wunder, has studied the absorption spectra of different kinds of ultramarine, including the green and violet, as well as the blue. Reimann states that the spectroscope is a good instrument for the detection of mixtures of coaltar colors. He has published, in his *Färber Zeitung*, the position of the absorption bands of several of the best known colors. Thus the spectroscope seems likely to prove exceedingly useful in organic chemistry, especially for distinguishing dyestuffs and detecting adulterations.

Many of the rare metals have been carefully studied during the year, and new properties discovered and new uses devised for them; and as each in turn becomes more valuable in the arts, new sources of it are being discovered. This is strikingly true of vanadium—a metal known since 1830, and yet so rare as to sell for $300 per ounce—which has found a use in the manufacture of aniline black. It is now the subject of much study at home and abroad. Gerland has studied its sulphates; Crow, its tetroxide; Guyard, Rosenstiehl, and others, its action in producing aniline black; while Dr. I. Walz, of this city, has rendered valuable service by pointing out a new source of this metal in our own immediate vicinity—namely, in American magnetites, where the quantity is often quite considerable, sometimes 0.3 per cent. Mr. C. M. Stillwell, continuing the search, found vanadium, but in smaller quantities, in hematites and other secondary iron ores.

Platinum and the metals associated with it have been the subject of study in France. Boussingault has made it combine with silicon, as has also Guyard; while Meyer has investigated its catalytic action, and Zdrawkowitch has devised a new method of making platinum black. It consists in mixing together 15 parts of glycerine and 10 parts caustic potash of specific gravity 1·08, heating to boiling, and adding 5 parts dilute perchloride of platinum. Among the new alloys proposed is one by Schmitte, which contains platinum, copper, and tungsten, and resembles 18 carat gold. Daubrée has produced an alloy possessing the most intense magnetic polarity by adding to fused platinum one fourth its weight of iron. Osmium, long known as the most poisonous metal, has been found by Déville and Débray to be the heaviest metal, its density being 22·577 times that of water. Cæsium and rubidium, the two eldest children of spectroscopic research, and rarest of the rare, have been the subject of careful study by F. Godeffroy, who has determined their atomic weights, besides making a silico-tungstate of each. Thallium, also born of the spectroscope, but most abundant of this class of bodies, has received the attention of Nietzki, Krausi, and Muir. The two former were chiefly interested in the preparation of the metal, the latter of the chlorate. Krausi speaks of having made 23 lbs. of thallium from soot by simply leaching out, precipitating as chloride, and reducing with zinc. Indium, the next born, and, excepting gallium, the last, has received but little attention, except from Professor Cornwall, who has chased it through all the new blendes he could lay hands upon, and with some success.

The rare metals of the earth, cerium, lanthanum, and didymium, have been prepared and studied by Hillebrand and Norton, while Rammelsberg has determined anew the atomic weights of cerium and yttrium. Columbium and tantalum, fast friends and companions, have been examined by Jolly and Santesson, and some new compounds have been prepared. Zirconium, titanium, glucinum, and uranium have likewise received attention. Selenium has recently acquired a new importance from its sensitiveness to light, and Dr. Siemens has devised an electrical eye that will wink in the bright sunlight and open in the dark. This peculiar property of selenium promises to be of use in the manufacture of photometers. It is the crystalline form only in which the electric conductivity varies with the illumination. As selenium is found abundantly in the soot of certain sulphuric acid works, and is not difficult of preparation, its price will no doubt fall as soon as it is introduced into some practical use. It now sells for $4 per oz. The researches of Pieverling on the organic compounds containing selenium prove it to be, like sulphur and tellurium, sometimes a diad, and often a tetrad. Tellurium has been brought somewhat into prominence recently by the discovery of large quantities of it in combination, as usual, with precious metals, both in the West and Chili. No use has yet been devised for it, and the terrible odor that its compounds impart to those experimenting with them have, perhaps, frightened chemists who delight in social enjoyment. Kastner advises the use of grape sugar in the quantitative analysis of telluric compounds. Becker has prepared pure tellurium, and studied and described some tellurium compounds, such as the tartrate and tri-ethyl-iodide, as a platium compound.

Dr. Vogel has continued his experiments in regard to the action of light of different colors upon the bromide of silver. Among his many remarkable discoveries, we may here only mention one. A plate coated with bromide of silver and a thin film of naphthaline red was very sensitive to yellow, that very non-actinic light, provided an excess of nitrate of silver were employed; if an excess of bromide of potassium were used, it was sensitive to blue and violet only. These interesting experiments were interrupted by his appointment as one of the German jury at the Centennial.

The action of water and saline solutions upon copper, a subject on which very little was previously known, has been carefully investigated by T. Carnelley. Dr. A. Wagner has also examined the action of saline solutions, both hot and cold, upon tin, copper, zinc, and other metals (See SCIENTIFIC AMERICAN, p. 295, vol. XXXV.) Kaiser, who has investigated the action of sea water on lead, reports that the lead soon became coated, and was then protected. Balard is of the opinion that it is the exygen of the air dissolved in water which causes it to attack lead, even when salts are present in small quantities.

Hardened glass continues to attract attention, but little new can be said of it. The generally received impression is that it is the familiar phenomenon of the Prince Rupert drops on a large scale; the glass, being under tension, sometimes explodes violently.

In manufacturing chemistry and technology, there is not much which is radically new to record. Improvements rather than revolutions have been the order of the day in inorganic chemistry. The ammonia soda process is slowly gaining headway; the De Hemptinné sulphuric acid process is not yet in practical operation; many things are kept as trade secrets, and hence the world knows nothing of them for years. S. Lupton proposes a new method of making nitrogen, namely, by allowing air to bubble through strong aqua ammonia and then passing it over heated copper. The action is continuous and the nitrogen pure, an important point if it is to be employed for medical purposes. Dr. Steinbrueck states that tuberculosis, in the first and second stages, may be cured by the inhalation of nitrogen.

Organic chemistry has so many triumphs to record that we must delay a review of them until our next issue. H.

Novel Method of Ornamenting Furs.

Messrs. Jules and Georges Mathias, of Paris, France, have patented through the Scientific American Patent Agency, November 21, 1876, the application of gold, silver, and other metallic powders to all kinds of furs, the powders being applied to the points or ends only of the hairs by means of a brush or otherwise. The preparation employed for the purpose is composed of varnish and gold, silver, or other metallic powders, which are well known.

Black furs and others of a dark color may, in this manner, say the inventors, have a fawn colored and brownish tinge or luster imparted, which will much improve their appearance and value. These metallic powders, when mixed with suitably colored varnishes, may be applied to white and other light-colored furs, for producing fancy furs or imitating costly varieties of furs.

If it is desired that the ends of the fur fibers shall present the color of the metal, the impalpable powder is mixed with white varnish; but if it is desired to secure a shade or tint that differs from the metal, the powder is mixed with a varnish of suitable color.

The fur is first slightly glazed with a flat hair pencil or brush, so as to impart the desired color to the fiber ends, and after drying is combed lightly to separate the individual hairs which have been united by the varnish.

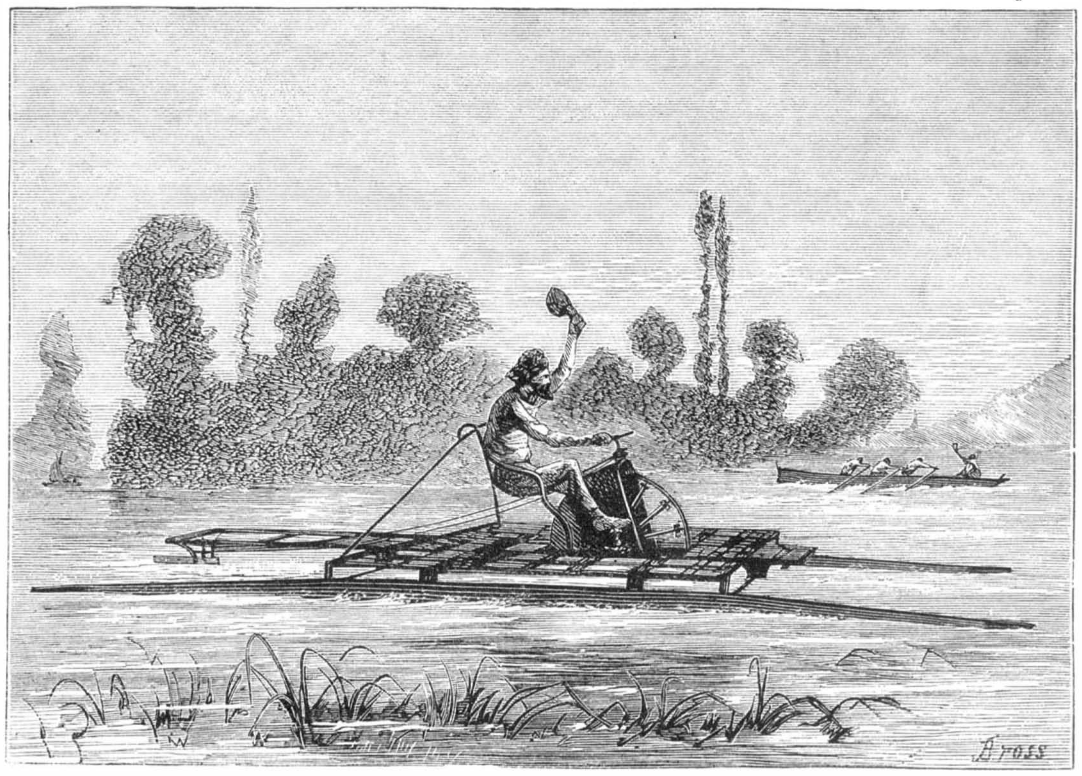
Medical Specimens.

For rapidly preparing bones and ligaments for museum purposes, Dr. L. Frederick recommends that, after the soft parts have been taken away, except the ligaments, the preparation should be washed in water, dehydrated by alcohol, and then plunged into essence of turpentine. After two or three days' maceration in this fluid, the skeleton is placed in the position in which it is designed to keep it, and dried in the air. In drying, the bones and ligaments become beautifully white, and the whiteness increases as time passes. The same process gives less satisfactory results for muscles. For a parenchymatous organ, on removing it from the turpentine bath Dr. Frederick plunges it into melted wax or paraffin during half an hour or two hours, till the bubbles of turpentine have ceased to pass off. When withdrawn and cooled, the piece resembles a wax model, but it is far superior in its minor details; the color of the organ persists.

WATER VELOCIPEDES.

A recent attempt at applying foot power to the propulsion of a boat was made by the late Crocé-Spinelli, whose experiments were interrupted by the Franco-German war; and the inventor's talents were then devoted to the science of aerostation, in experimenting in which he lost his life. M. Jobert has recently revived the subject, and he exhibited a new river velocipede at the Maritime Exposition held last year in the Palais de l' Industrie, Paris. It was composed of two cigar-shaped floats made of tinned plate, united by a platform of very light wood, which carried the seat of the operator. To the platform the mechanism was also attached; and it consisted of a paddle-wheel, with two cranks on the axles, with straps for the feet. The action is exactly that of a terrestrial velocipede, and therefore requires no further explanation.

To steer the velocipede, a light rudder is placed in the rear of the apparatus, and it is handled by the cords shown passing round a pulley turned by the handle in the hand of the operator. It will be seen that the operation of the machine is simple and easy, and M. Jobert claims that a very high speed can be obtained.



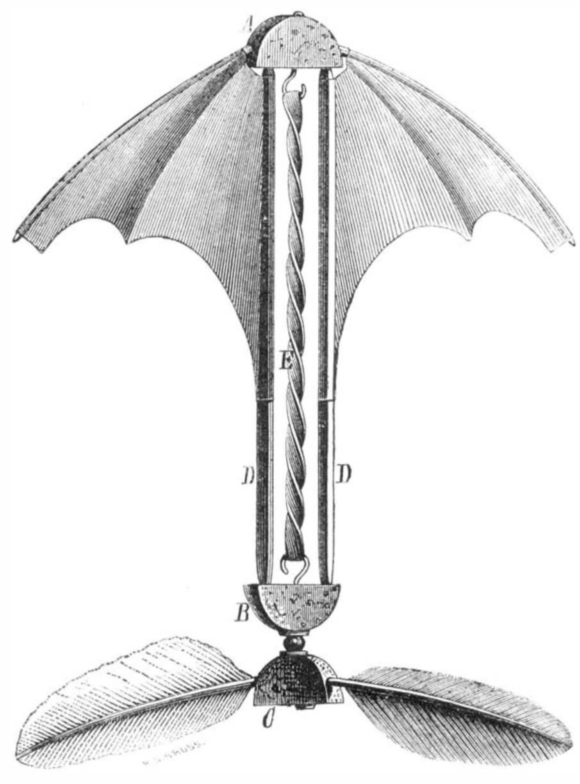
NEW WATER VELOCIPEDE.

New French Ironclad.

The new ironclad Trident was lately launched at Toulon, and will be one of the most powerful vessels in the French navy. The Trident, which was commenced in 1870, after the designs of M. Sabatier, the eminent naval engineer, is 320 feet long by 57 feet wide. It is entirely constructed of wood, and its sides, which are about 3 feet thick, carry 9 inch iron plates, each plate weighing about 20 tuns. The battery will also be protected with 6 inch iron plates, and the bow is armed with an iron ram 12 feet long, and weighing 30 tuns. The total weight of the hull and the iron plates is about 5,500 tuns. The armament of the Trident is to consist of nine guns of heavy calibre, and six of medium calibre. The engines, of 4,800 horse power, with a screw 20 feet in diameter, will enable the Trident to steam at a minimum speed of fourteen knots an hour. There are separate engines for the helm, the capstan, and the pumps of the Trident; and she will carry 700 tuns of coal and a crew of 689 men.

A TOY FLYING MACHINE.

A very ingenious toy, of French invention, which is a really successful flying machine, is now sold in the toy shops of this city. It is termed the "mechanical bat;" and it imitates the erratic flight of that creature in a very curious and amusing manner. The construction is shown in the annexed engraving. A, B, and C are semicircular pieces of cork. Between A and B are secured two thin wooden rods, D, made of orange or some other light strong wood. From A, extend arms, between which and the adjacent rods, D, are pasted tissue paper wings. In A is rigidly secured a hook. The similar hook in B turns freely therein, but is fastened in another piece of cork, C. Between the rods and from hook to hook is stretched a rubber band, E; and in the cork, C, are inserted two feathers, like the fans of a propeller.



The apparatus is wound up by turning the cork, C, until a strong twist is thrown in the rubber, E. Then the machine is released, when it will fly for a considerable distance either vertically upward or horizontally, return, and circle about, until the revolution of its propeller ceases, when it sinks to the ground.

The principle of the device embodies both the plans which, it is now generally admitted, must underlie the construction of any successful flying machine—namely, the kite and the screw. The screw drives the machine ahead, and at the same time causes the resistance of the air to furnish the component of force vertically applied, which, acting on the wings, sustains the apparatus against the action of gravity.

The device is one of the most amusing philosophical toys that have come under our notice. It may besides serve a very useful purpose in illustrating some important, though not very clearly understood, mechanical truths. The toy is 8½ inches in length, and 8 inches in breadth from tip to tip of the wings.

An Arizona Bonanza.

The Silver King Mine, located on the western slope of the Pinal ranges, about 30 miles from Florence, is a private mine, and is, therefore, little known to the public, though it is probably one of the richest mines ever discovered on this coast. The proprietors have been steadily working it for the past twelve months, and have shipped, in every month of the present year, one or more parcels of selected ore of the value of $1,000 to $2,000 per tun, to the works in Mission street, near Fremont, where it has been ground and subsequently sold by private tender, the owners of the Selby Smelting Works having been considerable purchasers. There is now on the way from the mine to San Francisco 40 tuns of ore, which assays from $1,250 to $2,500 per tun, and 1 tun of nuggets, which it is estimated will return $14,000; 27 tuns of this ore is on the steamer *en route* from Fort Yuma to San Francisco. There is on the dumps at the mine about 3,000 tuns of third class ore, estimated to be worth $350 per tun. The ore hitherto extracted has been chiefly taken from between the 43 feet level and surface, and in both stopes and drifts the showing of ore is magnificent. Work is now being pushed on in the 100 feet level, where the showing is equal to the best parts of the upper levels. There are about 40 men employed on the mine. The fortunate owners of this splendid property are Messrs. Reay and Mason. The superintendent is Mr. Mason, brother of the owner of that name. The ledge is located for several miles north and south of the Silver King. Within the past month the Silver King South Mining Company, which has about 4,000 feet on the southern extension, have started up work under the superintendence of Mr. M. L. Power; their shaft is now down about 45 feet, and they are in hourly anticipation of cutting the ledge. A new discovery has just been reported from about four miles south of the Silver King, where $1,000 ore is being extracted from what is believed to be the continuation of the Silver King ledge.

The Duration of Life.

Dr. William Farr, F. R. S., in his letter to the Registrar-General on the mortality in England and Wales during the ten years 1861–70, states that the annual mortality in the city of London was at the rate of 80 per 1,000 in the latter half of the seventeenth century, and 50 in the eighteenth century, against 24 in the present day. This implies that the mean duration of life in London was little more than twelve years in the seventeenth century, was about twenty years in the eighteenth century, whereas it is now about forty years. The mean duration of life depends upon the death rate at various ages, which show the widest range in different parts of the country, dependent upon their sanitary condition.

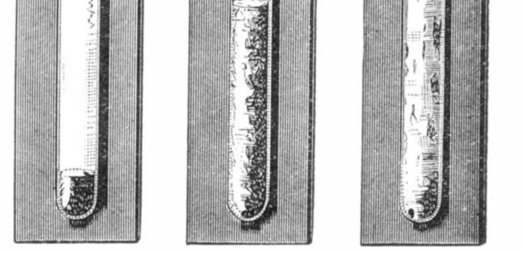
STORM GLASSES AND THEIR INDICATIONS.

Our readers have doubtless noticed in the stores of opticians a weather indicator, now widely offered for sale at a low price. It consists of a glass test tube, hermetically sealed and fastened to a piece of wood, so that it may be hung up against the wall. A thermometer is often likewise attached to the wood. The tube contains a transparent liquid in which are needle-like, pearly crystals, which vary greatly in appearance, forming sometimes at the bottom, sometimes at the middle, and sometimes at the surface of the fluid, as shown in the annexed engraving. It is said that the alterations of form of the crystals presage atmospheric changes, and announce variations of temperature, tempests, storms, etc.

This instrument was invented nearly a century ago; but whether the inventor was an Italian named Malacredi, who lived in England, or a French lawyer named Le Gaux, is exceedingly doubtful. One or the other of the two is entitled to the credit of the discovery; but neither succeeded in rendering the invention of any practical utility. In 1864 it was revived by Messrs. Negretti and Zambra, and its value was soon after vouched for by Admiral Fitz Roy, R. N. The crystals consist of camphor 2 parts, nitrate of potash (saltpeter) 1 part, and sal ammoniac 1 part, dissolved in pure alcohol and partially precipitated with distilled water.

The instrument must be fixed in the open air, out of the sun, but exposed to diffused light. The mixture then shows changes according to the direction, but not according to the force, of the wind, which changes Admiral Fitz Roy considered to depend on the electric tension of the atmosphere. If the wind comes from the northward, by examining the mixture with a lens the crystals will be seen to agglomerate and group themselves into leaf-like forms. On the other hand, if the wind is southerly, the crystals vanish; and if the wind is constant for some time, the mixture looks like sugar in solution.

An east wind produces stars more or less numerous; the liquid is somewhat turbid. With a west wind, the liquid is clear, and the crystals well defined. When the solid portions appear at the bottom or top of the liquid, positive electricity in the atmosphere is indicated. A confused mixture shows the coexistence of a north current with a south current in the same locality. Dirty, flocculent masses in a confused mixture, or stars in motion, indicate a strong south wind or gale. When in the tube a soft material, like honey or sugar, seems to be present, a weak south current of air, with negative



electricity, is predicted. These facts were determined by Admiral Fitz Roy by repeated experiment with a delicate galvanometer in measuring the electric tension of the air.

We have had one of the tubes exposed to the air, but concealed from the storms, for several years. It is curious to observe the changes of the crystals; but we have never had much faith in its prognostications of changes in the weather.

Relics of the Spanish Armada.

Two treasure galleons of the celebrated Spanish Armada were, it seems, wrecked on Chesil Beach, Dorsetshire, England, where, after every heavy storm, the Portlanders keep a sharp lookout on the blue clay in West Bay. The recent heavy gales having scoured away the shingle, among other waifs, the London *Times* says, a bar of pure silver, 3 lbs. 2 ozs. in weight, was lately found, which, having been tested, has been valued at $60.

DAIRY CATTLE.

We recently illustrated the cheese and butter making processes as exhibited at a cattle and dairy show recently held in the Agricultural Hall, London. Many valuable prizes were offered for the best milch cows, the awards being divided mainly into two classes, those for Channel Islands cattle, and those for all other breeds. The principal prize was in the latter class, and consisted of a gold vase—value $525; it was gained by Mr. W. T. Carrington. In the former class, Mr. W. R. Leigh took the first prize. The two winning animals are shown in the upper part of our illustration, the bright little intelligent-looking Jersey cow of Mr. Leigh being in the foreground. In the lower part of the engraving are also shown Mr. J. A. Mumford's short-horn, which gained a $105 prize, and a Channel Islands cow belonging to Mr. G. Simpson, which was awarded the second prize in her class —value $262.50.

In all, 140 cows were exhibited, the entries being made by the chief cattle breeders in England. The show was largely attended, and it is intended to hold a similar exhibition annually.

American Progress.

In these times, it has become fashionable to talk of modern degeneracy and to regretfully look back to the "good old times." It is therefore pleasant, for a change, to hear such sentiments as are embodied in the following extract from the annual message of Governor Hartranft, of Pennsylvania. The Governor speaks of his own State, but his views apply equally well to the whole country.

"A hundred years have wrought a wonderful change. The population has increased tenfold, the area under cultivation a hundredfold, and wealth almost beyond comparison. Thousands of miles of canals and railroads intersect the Commonwealth. Immense mining, manufacturing, agricultural, and carrying enterprizes give employment to the toiling millions of the State. All the products of the earth are within our reach; fuel and provisions are brought to our doors; gas and water are in our houses, and the news of the world of yesterday is laid on our breakfast tables in the morning. Thousands of schools and colleges are scattered over the State, and the post is burdened daily with millions of letters, attesting the general diffusion of knowledge. The people are more intelligent, freer, and happier; more cheerful, tolerant, and liberal. The charges of modern degeneracy are refuted by the clear testimony of a hundred years. The cant of politics is a wilful perversion of the truth of history. Comparing 1876 with 1776, it is apparent that we have advanced not only in population and wealth, but in freedom, in intelligence, in morals, and in general welfare."

A Warning to Bad Plumbers.

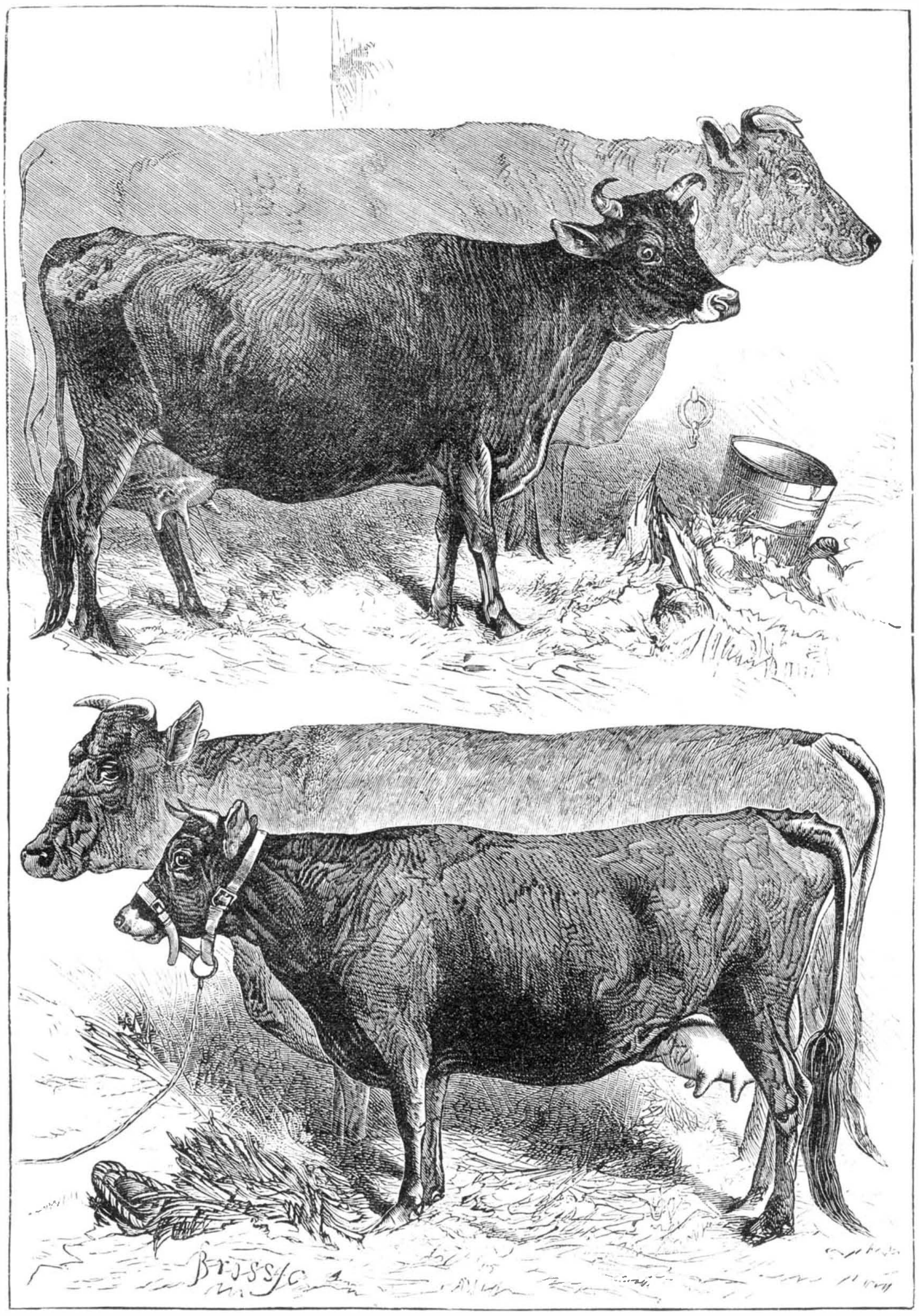
The crushed worm will (metaphorically speaking) sometimes turn, and bite the foot which treads upon it; so also will the luckless householder, goaded into desperation, rebel once in a great while against the remorseless plumber. History will bestow undying laurels upon the bold citizen of Cincinnati, who recently, when a plumber sent him an exorbitant bill for $300, in his turn sued that plumber and recovered to the extent of $2,000, for damages, etc., on account of the abominable manner in which the work was performed.

Stenochromy---A New Art.

A recent number of the *Journal of the Society of Arts* contains a lecture read before the Society by Mr. Meyerstein, in which he describes the new art of color printing, termed "stenochromy." This consists in producing pictures composed of many different colors, by one impression, on paper. The making of pictures by setting together a great variety of differently shaded bits of stone, known as mosaic work, has been practised for several hundreds of years, and many most valuable and remarkable specimens of this style of ornamentation exist. Some of the most precious works of this kind, from Italy, were shown at the Centennial, one of which, a mosaic table top, was valued at fifty thousand dollars. If now a print on paper from such a mosaic could be taken, showing all its multitudinous colors, that substantially would be "stenochromy," the new art we are speaking of. Instead of stones, cakes of colors are substituted, the colors being so compounded that, when moist paper is pressed upon them, they yield a print in kind.

The colors are originally prepared and used in a liquid state, but are of such a character that they rapidly solidify. A little of the color is poured on a flat slab into a sort of little cell or compartment formed by slips of metal standing edgewise on the slab. As soon as this has become solid, the slips are removed, and the little mass of color pared away to the outline required, say the form of a green leaf. The next color is similarly applied, and cut, say to the form of a rose leaf, then the next to that, and so on, until the picture is thus built up piece by piece, in different colors. The paring away is done by a vertical knife fixed in a frame, so that it can be moved sideways in any direction, but all its cuts are perfectly vertical. From the compound block thus produced the picture is printed in a press like that used for lithography.

The specimen now before us, a floral picture, is marvellous for the purity, brilliancy, depth, and freshness of the colors. Some of the pictures exhibited by the lecturer contained no less than seventy-two different shades of colors, and were quite artistic in their general effects. The new art promises well in respect to future development. The field for its employment commercially is very large. To say nothing of pictorial and book illustrations, it would seem that the publication of daily newspapers, illustrated by artistic pictures in colors, is among the possibilities of the near future. But if the new process had but one capability—namely, that of a color exhibitor—it would, in an educative sense, be a boon to the public. By its use the beautiful hues of the spectrum may be economically represented with such approximate correctness as to satisfy the eye.



PRIZE ENGLISH DAIRY CATTLE.

Hydraulic Propulsion of Cars.

About midway on a line or network of tramways, or at any other point of the same line, a motive power engine is, according to the invention of Mr. L. Rosseau, C. E., of Brussels, mounted and arranged in combination with pumps and apparatus in a similar manner to those employed in ports, docks, or warehouses, where the lifting apparatus is actuated by hydraulic pressure. For this purpose a pipe or tube for conducting water under pressure is laid down along the whole of the line of tramway or its branches, and in communication with a reservoir or receiver. At suitable distances apart valves or taps are placed in the said pipe or tube in order to supply water under pressure to the carriages of the train, which are placed at certain stations in communication with the reservoir or receiver above mentioned. At these different points or stations each carriage completes or renews and stores away the necessary quantity of water under pressure which is required to enable it to act automatically in the distance comprised between two hydrants for taking in the water. In order to maintain the water under pressure stored in each carriage, a receiver is fixed either horizontally or vertically under the floor of the carriage. This receiver is composed of one or more cylindrical metallic vessels containing compressed air at high pressure (from 20 to 30 atmospheres) according to the power required. The compressed air contained in each receiver acts by its elasticity similar to a spring, either direct or by means of a piston, on the water supply, contained also in one or more cylindrical vessels. The water under pressure in the reservoirs or receivers puts in motion the mechanism, and thereby gives rotary movement to the wheels of the carriage. In order to put the mechanism in motion, an ordinary hydraulic capstan is employed, or the well known multiple cylinder apparatus of Brotherhood or West, or the well known cyclo-dynamic machines of Mathon, or any other suitable mechanism, in order to obtain the same result.

Two Harmless Doses That Make One Poison.

Chlorate of potassium and iodide of potassium are both entirely harmless in suitable doses. Furthermore, these two salts do not react upon each other in solution, even at a boiling heat. Yet it has been proved that, when they are administered together, they do combine in the stomach, producing iodate of potassium, which is poisonous. M. Melsens found that dogs could take the chlorate or iodide in doses from five to seven grammes with impunity, but that a mixture of the two killed them in a few days, with the symptoms of poisoning by iodate of potassium. This combination must therefore be avoided. Indeed, as a general rule, the chlorate is so unstable, and so ready to give up its oxygen, that it cannot safely be combined with any substance capable of oxidation.—*American Journal of Pharmacy.*

Effect of Cold Iron on the Mucous Membrane.

People who clip horses and leave them out of doors without blankets are just now the objects of the attention of societies for the prevention of cruelty to animals. There is another cruelty often thoughtlessly practised, which, unfortunately, the above associations cannot prevent, and that is the putting of intensely cold iron bits into the mouths of the animals. Cold iron acts on the delicate lining membrane of the mouth, very much as if the metal were red hot, and excoriates and blisters the tender parts in its vicinity. There was a great excitement one cold day, not many winters ago, in the usual crowd which throngs Broadway near this office, brought about by a newsboy who was foolish enough to test this property of cold iron. He touched an iron railing with his tongue, and, to his astonishment, found that useful member frozen fast. Of course, he yelled lustily, and the sympathizing crowd, equally astonished, were at loss for a remedy. Finally, the boy was taken away from the iron railing, but he found himself *minus* the skin of his tongue.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

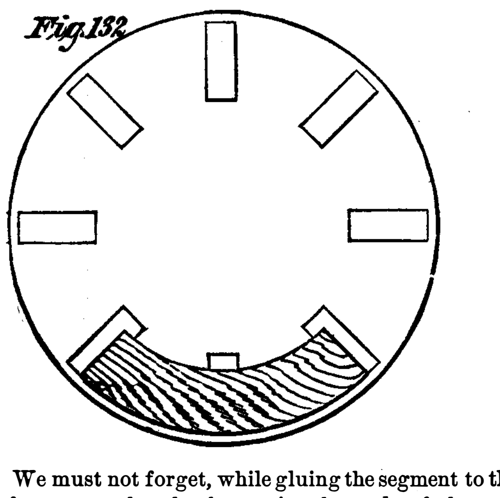
SECOND SERIES.—Number XVIII.

PATTERN MAKING.

Our templates being made, we plane up some pieces of board a trifle thicker than the courses are intended to be. It is easier to plane up the pieces of board while yet square than to plane up the segments separately. From the template, with a black lead pencil, we mark off on the planed pieces of board the requisite number of segments, and cut them out with a band or jig saw. We now proceed to building up, for which purpose we employ a chuck as a base whereon to build. It will save time, however, to have two chucks, building one half of the pattern on each and both halves simultaneously, which will give sufficient time for each course to dry, without requiring nails or pegs to assist the glue in holding them together. The two chucks having been prepared, we glue to them strips of paper at intervals where the points of the segments will come, as shown in Fig. 132; and if the segments are very long, we glue another strip between each of these strips, so that the segment may lie level on the chuck. As the building proceeds, the end of each segment must be planed; and for this purpose, we require what is called a shooting board, which is a simple contrivance made in the following manner: We take a piece of board about 2 feet long, 8 or 9 inches wide, and nearly 1 inch thick, and also a piece of the same length, but 6 inches wide, and ⅝ inch thick; and after planing them up straight, we screw one to the other, as shown in Fig. 133, at A B. S is a raised piece called a stop, and it should be recessed about ⅜ inch into B, and dovetailed. It should not be glued, as the shooting board is useful for other purposes besides dressing segments; and it may be necessary to change the stop for one of a different height. In Fig. 133, the segment is shown in position for being dressed; while in Fig. 132 *a*, the truing plane is shown lying upon its side, in which position it works along the board, guided by the piece, B.

The shooting board, made as above, when in use lies upon the bench, butting against the bench stop, B G. In cases, however, where the space is confined, the work bench being small, the shooting board may be worked lying across the bench, providing the stop, C, be affixed to it. The use of the shooting board, then, is to plane the end of each segment to its necessary length and angle; and having so dressed one segment, we glue it to the pieces of paper on the chuck upon which a circle of the necessary diameter has been marked, as a guide whereby to set the first course of segments.

Fig. 132



We must not forget, while gluing the segment to the pieces of paper on the chuck, to give the ends of the segment a coat of glue for sizing, as explained in a previous example. Our next segment we treat in a precisely similar manner, save that, while gluing it to the chuck, we also glue it on the ends, so that it shall be sized at one end, and glued at the other to the segment already glued to the chuck, the object of the end gluing being to strengthen the building and at the same time to prevent the corners of the segments from breaking out during the process of turning them in the lathe. As each segment is glued to its place, it should be clamped or weighted down, so as to expel the excess of glue and also to prevent it from shifting while its neighbor is being butted against it. Having completed one course (which will, of course, be one of those intended for the flange), and allowed sufficient time for the glue to dry, we put the chuck in the lathe, and true up by facing off this layer of segments to its proper thickness, making the face straight and testing the same by using a chalked straight edge to make the high places more plainly visible. We then true the diameter of the course.

Our work is at present fastened to the chuck by glue only; and for small work, only two or three courses high, this will suffice. But if the work is large, one screw should be inserted through the chuck into each segment, about half way between the points; and even then, if we build far out from the chuck, it will be necessary, after a few more courses have been added, to replace these screws by longer ones, which may be done (without disturbing the work) by replacing them one by one. If screws are inadmissible by reason of the danger of splitting the segments (as is sometimes the case), we must adopt another method; and that is to discard the paper, and glue an extra course of segments firmly to the chuck, this extra course being afterwards turned away until cut through.

The second and consecutive courses of segments are built up in the same manner as the first, the planed faces of the segments being glued to the respective faced courses on the chuck, until we arrive at the last course in the half pattern; and into this the half spokes or disc, whichever it may be, must be recessed, as shown in Fig. 131. The hubs are to be

Fig. 133.

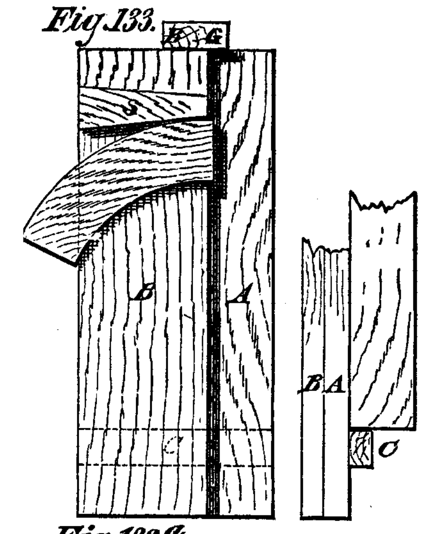
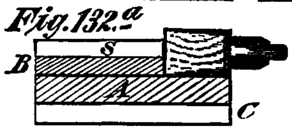


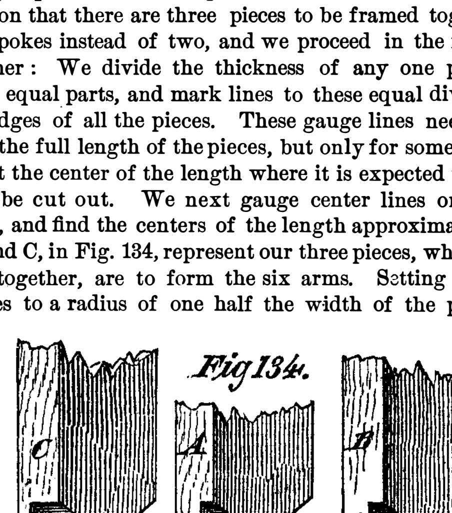
Fig. 132a



turned in the lathe separately, with a short plug on the under side to fit a slight recess turned in the disc. If it is preferred, the disc or spokes may be made solid and fixed to one half of the pattern, the other half and its half hub being left loose.

As we have stated that this may be a spoke wheel, it will be as well to explain the operation of making and fitting the spokes or arms. If the spokes are four in number, the process is very simple. We take two pieces of timber long enough to reach across the wheel, and plane them to the required thickness of arm, and have them sufficiently wide to shape the hollows about the hub and towards the rim. Then we make a mark with a pencil on one side of each, which we call the face. We then set a gauge to half the thickness of the spoke, and with it mark lines on both edges of each piece, always gauging from the face side. We meet at the center of the length, cut a recess out of each, sufficiently wide and deep to admit the other, so that the pieces, when put together, form a cross, which we let into the wheel and fix temporarily with brads. We now place the work in the lathe, and start the lathe so as to find the center of the wheel, from which center we draw out the arms, and then turn out the recess to receive the hub. We mark the arms to their respective places in the rim, so as to be able to correctly replace them, and then we take them out of the rim and shape them to their proper conformation. This being done, we glue them to their places in the rim. In the case of six arms being required, all these operations are similar, with the exception that there are three pieces to be framed together for the spokes instead of two, and we proceed in the following manner: We divide the thickness of any one piece into three equal parts, and mark lines to these equal divisions on the edges of all the pieces. These gauge lines need not extend the full length of the pieces, but only for some distance, about the center of the length where it is expected the recess will be cut out. We next gauge center lines on the flat sides, and find the centers of the length approximately. A, B, and C, in Fig. 134, represent our three pieces, which, when put together, are to form the six arms. Setting the compasses to a radius of one half the width of the pieces, we

Fig. 134.

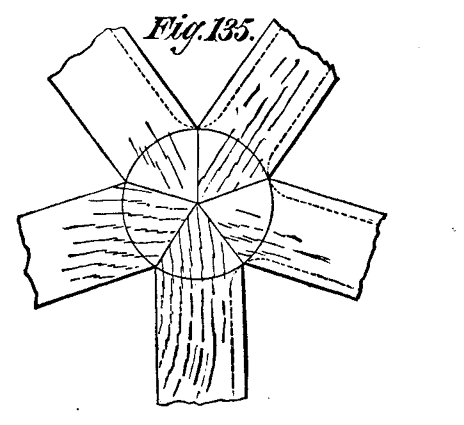


mark (from the centers already found) circles on one side of the pieces, A and C, and also on both sides of B. We next set a bevel square to an angle of 60°; and with this set to touch the edge of the circle, we draw, on A and C, tangents crossing each other; and on the piece, B, four such tangents, two on each side, must be marked. The piece, A, must now be recessed between one pair of tangents to a depth of two thirds of its thickness, and between the other pair to a depth of one third. B must be recessed on each side to a depth of one third its thickness; while on the piece, C, the whole of the space included between the tangents must be cut away to the depth of two thirds. The recesses must be cut true to the lines, and level, a rabbet plane being useful for the purpose, unless the work is small; and if the job has been carefully executed, the pieces will fit right together, and may be glued without further labor. For an odd number of arms, such as 3, 5, or 7, the method of putting together is different, and is not so strong as the foregoing. It is as follows: Upon a flat piece of board, fasten a piece of paper, and describe upon the latter a circle; then divide the circumference of the latter into as many equal parts as it is required to have arms, and draw lines from this center of the circle to the circumferential points of division, as shown in Fig. 135. Then bevel the ends of the pieces equally on each side, so that each shall exactly cover its own division of the circle; and as each is fitted, fasten it temporarily down, and when all are fitted, verify the work as follows: Observe if the pieces are equidistant from one another, at an equal distance from the center of the circle, and at or near the extremities, when any error will be easily detected and rectified. Then glue the pointed ends all together, fastening each piece temporarily to the board as before, and set the whole away until it is quite dry, when the piece may be taken from the board, and the required form given to the arms, ready for finally fixing to the rim of the pattern.

In almost all cases, it is necessary that wheels of this kind be provided with hubs; and by the attachment of the latter, the joints of the spokes at the center, when made as shown in Fig. 135, are very much strengthened. But in the rare event of having to put together such a combination of arms without hubs, it will be advisable to turn out a recess at the center, making it as large as practicable, and fitting into it a disc of hard wood. Before cutting out the spaces in the rim to receive the extremities of the arms, it is necessary to turn out that part of the rim to the finished size, as it will be inaccessible to the turning tool when the arms are glued in. The arms being fitted to their places and made fast to the rim, we proceed to turn all that can be got at—that is to say, the exterior diameter of the body of the half of the half-pattern, and also the flange. It is needless to add that each half of the pattern must be similarly treated.

The work is now to be reversed on the chuck, and the inside turned out, together with a recess at the center to receive the hub. To maintain the two halves of the pattern in coincidence, two, and sometimes three or more, pegs are inserted in the arms of one half, which pegs fit into holes bored to correspond in the arms of the other half of the pattern. In

Fig. 135.



some cases, the flanges of the pattern are required to be so thin as not to admit of two layers or courses of segments in their composition, in which event, especially if the flanges extend far from the body of the pattern, it is well to strengthen the joints of the segments. Perhaps the neatest way of accomplishing this is to make a saw cut in the ends of each segment, and, at the time of gluing, to insert a tongue or thin strip of wood, nicely filling the saw cut, the grain of the tongue being at right angles to the line of the joint of the segments. Care should, however, be taken to have the saw cut in each at a similar distance from the face of the segment. It will be perceived that the flanges might be omitted without making any difference in the method of construction; nor does the method to be pursued vary to any great extent for all kinds of rope or chain pulleys.

Novelty in Flooring Tiles.

The London *Building News* states that at the Bavarian Industrial Museum may be seen a collection of square tiles of asphalt prepared by a new process, and intended for floorings. The tiles are ornamented with mosaic, in white china or colored glass, which may be arranged according to any design. The drawing to be reproduced is traced on a sheet of thick paper, which is afterwards covered with the various fragments of china or glass, which will form the mosaic; a border is made to the sheet, and boiling asphalt poured upon it. After the whole is cooled, the paper is taken away with cold water, and the tile is finished. A flooring covered with such tiles bound together by a string of asphalt appears to have been made by a single melting, and has a good appearance. It indefinitely resists damp, and is consequently useful in bath rooms, halls of houses, and balconies.

Bell Metal.

An improved alloy for bell metal is proposed, which, it is said, does not tarnish, is less likely to crack, gives a better sound, and is much lighter in weight than the alloy usually employed for the purpose. It is prepared as follows: Nickel, 1 lb., and copper, 6 lbs., are melted and cooled. Add zinc, 1 lb.; aluminium, ½ oz. Melt and cool. Melt again, and finally add ½ oz. quicksilver and 6 lbs. melted copper.

Indian Corn Culture.

In the "Transactions" of the Department of Agriculture, of the State of Illinois, for the year 1875, a volume just published, there is a valuable prize essay by Mr. B. F. Johnson, of Champaign, Ill., on the culture of Indian corn and the ways in which it may profitably be utilized. The author thinks that the best variety for a profitable present crop is probably that which fifty years of cultivation has developed in a given county or neighborhood; but in selecting, preference should always be given to seed having a more southern rather than a more northern origin, since we go south to find the corn crop in its highest perfection, which is at latitude 37°; and further because presumably southern grown corn contains more, of the elements which make Indian corn a perfect food, than grain of northern growth. The best variety for general cultivation is, however, yet to be produced; but it is believed that the same will come from the careful selection of parent stock, special manuring for the purpose of producing the largest amount of desirable elements, and careful and intelligent cultivation.

Mr. Johnson's essay abounds in excellent practical hints, among which we find the following: In the preparation for crops of Indian corn, fall plowing on central Illinois prairie soils is preferable to spring plowing, and deep plowing to shallow; but deep plowing should be confined to rich lands plowed in the fall, and shallow to thin ones plowed in the spring, leaving the middle course for the medium soils. Manure when used should, if possible, be spread and plowed in during the fall; but if spread on the surface as fast as made, during the winter season, it suffers less waste and depreciation than when heating in the barn yard. Barn yard manure stimulates stalk and leaf growth at the expense of the ear; but manufactured fertilizers exercise a contrary effect. In fact, to grow the largest crop of corn, grain being considered, recourse must be had to plant or animal ashes.

In fall-plowed land, the best preparation for the seed bed is to throw up, by means of a shovel plow, a slight ridge where the rows are to stand and where the planter is to follow; then after planting, pack the loose soil, to insure germination, by using the plank drag. Finally, since the atmosphere furnishes from 96 to 98 per cent. of plant food, there can be no such thing, says our author, as too much cultivation, unless it is carried so far as to retard growth by wounding plant roots or firing the crops in dry weather.

The most profitable use of Indian corn—that is in returns of dollars and cents—is to convert it into whiskey, because this affords a large revenue to the Government, ensures a home market to the farmer, and makes money for the distiller. In an agricultural sense, the most profitable use is found in the old custom of out-of-door feeding of cattle. To our Eastern agriculturists this will seem a wasteful method of disposing of a grown crop; but, to again quote our author, "when the price of corn ranges from 25 to 50 cents per bushel, and the price of hogs and cattle from $3 to $6 (live weight), per 100 lbs., when indifferent farm labor costs $26 a month for eight months of the year, and skilled labor is not to be had at any reasonable price; when the farmer has poor barns, and runs in debt for a cooking apparatus, the cooking and grinding of corn as food is pretty sure to result in a decided failure." It is cheaper, in brief, to fence off enough corn to last a number of hogs for a month at a time, and let them eat it as they like, than to gather, grind, and cook the crop, and feed the hogs or cattle with it.

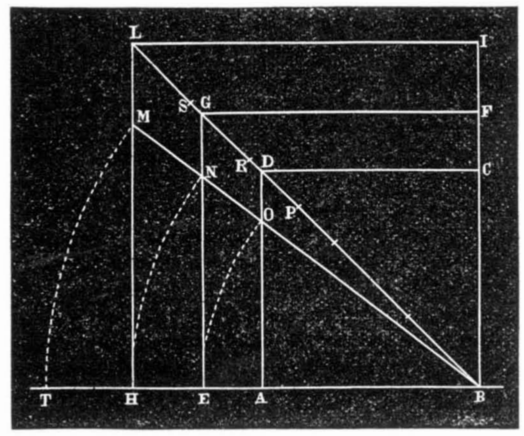
Among the minor profitable uses of Indian corn are soiling milch cows in summer, and preparing whole green corn for winter food for these and the younger stock. There is no better food for the production of a full flow of rich milk from cows than green sweet corn, fed ears, stalks, and all.

The new process, termed "ensilage of maize," now moreover enables the farmer to preserve his corn in a partially green state, and hence in valuable condition for fodder. To "ensilage" is to bury in *silos* or pits; and the ensilage of maize consists in cutting up the green Indian corn plant, which has made a full growth, into small pieces, and burying them in pits or trenches. The pieces are of such a size that there shall be no cross section of stalk or ear of more than a third of an inch in thickness. The pit is made in well drained land, about 2 or 2½ feet deep, from 3 to 6 feet wide, and in length sufficient to hold the material to be stored. The inside is lined with straw, and then the chopped mass is packed in hard. More straw is placed above, and then the earth is piled on to a thickness of 3 or 4 feet. Indian corn and other forage plants undergo a fermentation when so treated, not unlike that of cabbage when made into *sauer kraut*, and is greedily sought for by all kinds of domestic animals, being particularly relished by cows giving milk. It is important that the corn be cut very fine, that the packing be thorough, and that the weight of superincumbent earth keep all in place, and prevent either the escape or entrance of moisture.

THE DUPLICATION OF THE CUBE.

We find the following new and ingenious demonstration of this problem in *Les Mondes;* it is credited to Dr. Gaetano Buonafalca. The author's proposition is: If on one side of a square, the sixth part of its diagonal be laid off, the right line joining the point of division and the apex of the opposite angle will represent the side of a cube of double the cubic contents of a cube constructed on the same square. Let A B, in the annexed figure, be the side of the given cube, and A B C D its square. Divide the diagonal, D B, into six equal parts, of which let D P be one. Lay off D P to D O, and draw O B. Then O B will be the length of the side of the double cube sought.

Let the hypothesis be that this line, O B, really expresses the side of the double cube. Carry O B on the side, B A, indefinitely prolonged, and mark the point E. Now construct the square, E B F G, and divide the diagonal, G B, into six equal parts, as previously done. Carry one of these parts, G R, to G N, and draw N B. Then the line, N B, will express the length of the side of the cube quadruple the first. Take now the same line, N B, carry it on the side, B A, prolonged, and mark the point, H, where it terminates. Then complete the square, H B I L, divide the diagonal, L B, into six equal parts, as before, take one part, L S, carry it to L M, and draw M B. This line, M B, from the hypothesis with which we started, will express the side of a cube octuple that of the given cube.



Now knowing that the octuple cube of any given cube should have its side double the side of the latter, it follows that, if the line, M B, represents the true side of the octuple cube, it should be double the side, A B. If T B be made equal to 2 A B, the line M B will be found to be equal to T B. Hence, as we are sure that the line, M B, expresses the side of the octuple cube, it follows that the line, N B, obtained by identical and analogous means, represents the side of the quadruple cube, and finally the line, O B, for the same reasons, represents, as we supposed in the beginning, the side of the double cube, and hence is the cube root thereof.

The analytical demonstration of the above, which we append, was prepared by Father Secchi:

$$O B = \sqrt{O A^2 + A B^2} = \sqrt{(A D - O D)^2 + A B^2} = \sqrt{(A B - \tfrac{1}{6} B D)^2 + A B^2}$$ and as B D is the diagonal of the square, we have $BD = A B \sqrt{2}$: whence

$$O B = \sqrt{(A B - \tfrac{1}{6} A B \sqrt{2})^2 + A B^2} = A B \sqrt{(1 - \tfrac{1}{6}\sqrt{2})^2 + 1} = A B \sqrt{2 + \frac{2}{6^2} - \tfrac{2}{6}\sqrt{2}} = A B \times 1.2606.$$

The side of the double cube should be $x = A B \times 1.2606$, which gives the value to within $\frac{1}{2000}$, about, which is near enough for all purposes of graphic construction.

Removal of Hyposulphite of Soda.

In writing upon that ever recurring subject, the elimination of hyposulphite of soda from silver prints, Herr Rotter, of Dresden, stated that every photographer knew that the indispensable hyposulphite of soda was the photographer's greatest enemy, and that the most varied contrivances had been invented in order to eliminate it completely by washing from the fixed picture; but a little reflection showed that in this way all that was obtained was a greater or less dilution of the soda, part of which was sucked up and retained by the spongy fibres of the paper, so that even after long continued washing some traces of the fatal stuff still remained. It was, therefore, natural that one should endeavor to remove the hyposulphite by chemical means—namely, powerful oxidizers, which change the dangerous hyposulphurous acid into harmless sulphuric acid.

Hydric peroxide, which was first suggested for this purpose, could not be used on account of its instability and its doubtful effect upon the organic matter present. Just as little could a solution of iodine be recommended, as, in addition to its poisonous properties, it was apt to form iodide of silver so as to discolor the whites of the picture. On the contrary, all requirements were fulfilled by the *eau Javelle*—that is, the spotting water of washerwomen, which costs about 6 cents per quart—of Herr Günther, of Berlin, and which is really a solution of hypochlorite of soda. This gave off the oxygen of the hypochlorous acid to the hyposulphurous acid; the chlorine thus set free combined with the hydrogen of the water to form hydrochloric acid, and the oxygen set free from the water went to the hyposulphurous acid, which was thus changed in a few minutes to sulphuric acid. The operation was exactly the same as when hyposulphite was used as a bleaching agent, only that in our case, when the durability of the fibers of the paper was not in question, an excess of hypochlorite of soda must be present. One proceeds as follows: Immediately on removing the pictures from the soda, lay them in water containing about one tablespoonful of *eau Javelle* to 5 pints of water, and when removed from this water place them in another bath of the same composition. At the third removal they may be placed in pure water, and are then ready to be taken out and dried. They do not fade at all in these baths, and come out of them brilliant in the whites. On account of the shortness of the time the pictures are in the water they are uncommonly brilliant, and the blisters, often so troublesome, are perfectly harmless. In a word, says the *British Journal of Photography,* we are informed that whoever has tried this simple, thorough, and cheap process will never use another. It is especially cheap for those photographers whose supply of water is limited and dear.

GYNOMANIA AND OTHER MANIAS.

It is not strange that we sometimes hear it asked: Is any body sane? A large proportion of men are harmless monomaniacs on some question or other. Some have an insane passion for old postage stamps and other worthless relics; and perhaps they cherish bits of a house where Washington lived, or where Ellsworth was killed. These insane relict hunters are frequently scourges of civilization, and direct enemies of art. They have broken up and carried off piecemeal many of the finest monuments and ruins of antiquity; and but for the vigilant police, they would have destroyed many of the most beautiful exhibits at our Centennial.

There is a more dangerous class of semi-lunatics, persons whose deeds are more or less criminal. This class includes the victims of dipsomania, kleptomania, and many another mania yet unnamed and undescribed. Dipsomania is now treated as a disease; the poor drunkard, whose feeble will is unable to resist his powerful desire for intoxicating drinks, is now confined in an asylum, and treated with drugs instead of moral lectures. Punishment is in part replaced by medical advice and remedies. The kleptomaniac is more rare, and perhaps more harmless. What treatment he should receive is still an open question. We sometimes hear of ladies of wealth and high social standing who are subject to attacks of kleptomania, and bring home loads of stolen goods, for which their husbands willingly pay to avoid the disgrace of permitting their arrest on a charge of stealing. Unfortunately, if the victim of this passion is poor and without influence, it is looked upon as a crime and punished as such. There are many, in fact, who think that, because they have no desire to drink or steal, others who have such desires can overcome them if they will, and that it is only by yielding to their passions and desires that the latter have obtained the victory over common sense and virtuous intentions. Others look upon these persons as suffering physically as well as mentally, and consider them proper subjects for medical treatment. Kleptomania is far more rare than dipsomania; but there is another mania rarer even than the latter, and to many, probably, its existence is unknown and unheard of. As yet it has not even a name; hence we shall call it, for want of a better title, *gynomania,* and apply to its victims the familiar botanical term, *gynandria.* We refer to the passion that some young people have for the dress and manner of the opposite sex. At no time in history have the coats, hats, and boots worn by ladies so closely resembled the corresponding articles of male attire. It is true that in most cases it is possible to distinguish the two by the superior elegance and finish of those intended for the gentler sex. Then, too, a miss who would follow too closely the dress of her brother is designated "fast;" and hence, modest and virtuous girls relinquish the extreme styles to their sisters of a bolder class. Young men have reached the limit of effeminancy when they have curled their hair, and parted it the middle. There is no other safety valve for the escape of their pent-up womanhood; and he that would go further must adopt the entire dress and appearance of a woman. Startling as it may seem, there are men, some of them no longer young, who can no more refrain from skirts and bustles than the toper from his glass. Some time since a young man was arrested in the streets of a neighboring city, dressed like a fashionable lady. His slender form was rendered more so by the tightest of stays; his legs were bound together by a pulled-back skirt and bustle; his narrow feet were encased in high-heeled boots; his hair was crimped and frizzed; he was adorned with ear rings, breast pin, ruffles, and laces; he was accustomed to walk the streets at midday, unsuspected by either sex. Although heavily punished by fines and imprisonment, he always returns at the earliest possible moment to his peculiar practices, unable to break away from this strange infatuation. He states that he can assign no reason for his odd conduct.

This gynandrion, or female man, was a gentleman of respectability, wealth, and influence, and had worn this dress long enough for the novelty of the thing to wear off; but he took the risk of exposure, shame, imprisonment, and social ostracism, merely because "he can't help it." As with the drunkard and kleptomaniac, he acknowledges his sin, makes repeated efforts to reform, but all to no purpose. Is it a mental disease or a physical one? What treatment does it require? May it not be a *lusus naturæ,* a mistake or freak of Nature? This man seems to be, in all his tastes and desires, a woman; with the feet, hands, waist, and hair of a woman; skillful in all the pursuits of women; lacking in strength, courage, and manly qualities. "Who hath sinned, this man or his parents," that he is thus constituted?

The case of gynomania above cited has never before been published, but we can vouch for its truth; and we fear that it is not an isolated case. Its features are so remarkable that we call the attention of medical men, philanthropists, and more especially biologists to it, hoping that a careful study of the disease may result in the discovery of an antidote, more effectual and more humane than that of fine and imprisonment. *

SIR TITUS SALT, to whose ingenuity the useful fabric known as alpaca is due, is dead. He was the head of the firm of Titus Salt & Sons, to whom the immense factories and the town adjoining them, known as Saltaire, in Yorkshire, England, belong. This is one of the largest establishments ever created by the labor of one man.

TIME LOCKS.

So many times have bank officers and others been seized in the dead of night, and compelled to open their safes and vaults, that although it may be very interesting and exciting to the parties immediately concerned, the thing is becoming monotonous to the public in general, who would much rather see the newspapers filled with matter having more novelty or utility in it. We may, therefore, be pardoned for suggesting that a few patents have been granted for locks that cannot be opened by any one until the proper business hour arrives. The attachment of any of these locks would effectuallyprevent any success attending these raids; and it is, therefore, the duty of every banker or banking company to see that such safeguards are provided for the property in their charge.

It is commonly supposed that the time lock is a newly patented invention, and that its manufacture is therefore a monopoly; but it is not so, for we find no less than seven expired American patents, to say nothing of foreign ones which have no force here, and hence the manufacture of time locks can be monopolized by none. So far as we at present know, the time lock originated in England, as the first known patent for such a device was granted there to W. Rutherford, Jr., April 14, 1831, (No. 6,105, old law). This patent describes three styles of time locks, or rather two styles and a modification of the second one. The first style mentioned describes the uses of a spring clock work (which may consist of two independent movements, to avoid the inconvenience which might result from the stoppage of a single one), giving motion to a shaft carrying a circular guard plate, having a notch cut in it of the size of the bolt. When the door is locked, the outer edge of the periphery of the guard plate is against the back end of the bolt, and prevents its retraction until the clock movement has carried the notch in the guard plate around opposite the bolt, when the latter can be withdrawn. The second style shows a bolt which is held locked by one end of a horizontal lever resting in a notch in the bolt, until a weight belonging to and driving a clock movement, descends upon and depresses the other end of said lever, which raises the first mentioned end out of the notch in the bolt. Another figure in the drawing shows a modification of, or an addition to, this last style, in which the horizontal lever is held by a vertical catch, having an inclined projection on its side that is struck by the weight as it descends, and is pushed aside, thus liberating the end of the horizontal lever, and allowing it to fall when the weight presses on it. The specification mentions the use of falling sand in an instrument on the same principle as the clephydra instead of clock work for operating the lever by the weight of the sand or liquid; and it also proposes to use oil or other combustible material, to be used as a counterpoise on the lever that will allow it to rise when sufficient weight has been removed by burning.

The first American patent, appears to be that granted to J. Y. Savage, October 9, 1847, which shows a bolt shot by a spring so as to be self-locking, which bolt is held locked by a drop hook. A notch on a wheel moved by clock work at the proper time for opening the safe operates a lever that releases a weight, which moves a slide that just raises the drop hook, and then pushes back the bolt, thus unlocking the door.

The next patent (W. L. Bass, December 23, 1851) provides a device for unlocking the door, should the clock happen to stop; but it cannot be used when the latter is in motion.

As an improvement on the last two devices, Holbrook and Fish obtained a patent dated April 28, 1857, for an invention which consisted in arranging the clock work in the same case with the lock, and using two independent clock movements, each of which controls a pawl that, at the proper time, will fall into a notch in a revolving guard, and allow of the retrograde motion of the bolt necessary to unlock the door of the safe.

On May 5 of the same year, Williams and Cummings procured a patent for a time lock having a system of toggle levers held in such a position by a cam wheel, revolved by a clock movement, that the bolt cannot be drawn back until at the appropriate time for opening, this cam wheel bends the toggle joint, and allows a spring to withdraw the bolt, when the door can be opened.

The next patent in this line was granted to A. Holbrook, April 12, 1858, for an arrangement designed to compact the mechanism and lessen the cost of this class of locks, to relieve the time work of the pressure of the springs that open the bolt, and to increase the difficulty of cutting or drilling the latter by making it round, so that it will revolve in its bearings.

The next patent to Holbrook's was issued November 2, 1858, to Lyman Derby, who shows a four-armed or cross-shaped bolt turning on a center, and a Λ-shaped lever, pivoted at the apex of the Λ, one leg of which rests on one of the arms of the bolt, so as to keep the door locked until a roller, on a wheel driven by clock work, strikes the other leg of the lever, moves the first mentioned legs off the four armed bolt, and allows the latter to move by its own gravity out of the keepers, so that the door may be opened.

On the 16th of the same month a patent was issued to Obadiah Bayley for another time lock, the main features of novelty consisting in the use of an ajustable pinion sliding on its shaft to change the time of opening, and an arrangement of levers to stop the clock movements when the bolt is drawn back.

All of these patents have now expired, and the inventions therein shown are common property, so that any manufacturer may make as many of these locks as he chooses. In addition to the above patents, there are the rejected cases of L. Yale, September 24, 1847, Jedediah Weiss, April 14, 1856, and R. S. Harris, January 12, 1867.

The existing patents for improvements of one sort or another, on the foregoing, number nearly forty.

ROPE GEARING.

The substitution of rope gearing for toothed wheels, belting, and other modes of transmitting large power in factories, is at present exciting considerable discussion, generally favorable to the system, among European engineers. In this method of driving, the fly wheel of the engine is made broader than usual; and upon its periphery a number of parallel grooves are turned out for the ropes, the number and size of which are regulated by the power to be transmitted. We have before us two excellent papers on this subject, one by Mr. James Durie, recently read before the Institution of Mechanical Engineers, at Manchester, England, the other by Mr. K. Keller, published in the *Zeitschrift des Vereines der Deutscher Ingenieure*. The conclusions to which are drawn from practical experience in the system, as used in Scotch, German, and East Indian factories.

It is of course important at the outset to examine wherein the advantages offered by rope exceed those of toothed gearing and leather belting. Regarding the first, Mr. Durie notes the difficulty of accurately constructing the gears, as evidenced by the rumbling noise heard in the streets of any manufacturing town, "showing that all is not as it should be for the safe and economical transmission" of steam power; and a necessity consequently exists, where power is taken off by bevel wheels and shafting, of rendering the factory a rigid and immovable structure. This objection to cogged gearing loses much of its force to any one who has examined the admirable working of the massive gear attached to the Corliss engine, at the Centennial, and who is familiar with the accuracy whereby the largest wheels may be cut with the new Corliss gear cutter. In the case of rope gearing, however, the ropes by which the power is transmitted, consist of an elastic substance, namely, carefully selected long-fibered hemp; and their lightness, elasticity, and comparative slackness between the pulleys, which may be from 20 to 60 feet apart, are highly conducive to their taking up any irregularity which may occur in the motive power. Hence all attachments and bearings may be light, and there is considerable saving in the foundations of the engine, and in the wall boxes and the strength of walls, which need not be so ponderous as required for upright shafts. For high speeds, the friction of rope gearing is found to be considerbly less than that of toothed gearing. No data from special tests is given on this point: but note is made of increased steadiness of driving after the alteration from cogged gearing to rope, and a greater weight of yams was turned off from the machinery in spinning mills in the same time.

Comparing ropes with belting, the question of cost may be considered. One of the largest leather houses in this city quotes leather belting at from 80 cts. to $1.00 per lb. Rubber belting (heavy) is worth 35 cts. per lb.: and we have an estimate from a manufacturer of ropes, wherein the best hemp article in large quantities, say a thousand or more fathoms, and varying in circumference from 4 to 6 inches, is offered at about 21 cts. per lb. Grooved pulleys for ropes cost more than plain pulleys; but making allowance for this, it is probably safe to say that the total cost of ropes and grooved pulleys for transmitting a given power, will not exceed one-half or two-thirds the cost of leather belting, and flat pulleys. The cost of fitting up a mill with rope gearing, Mr. Durie states, is considerably less than with tooth gearing, when the shafts to be driven revolve at high speed; otherwise the expense is about the same. As regards the comparative friction of ropes and belts, the experiments quoted exhibit wide differences, so that it is impossible to reach any definite proportion; but they show that ropes have a considerably greater hold on the V-shaped grooves per square inch of bearing surface than flat belts have on pulleys. The lifetime of a rope is found to be from three to five years, as a general rule; and the cost of maintenance in Scotland is about $25 per 100 indicated horse power transmitted per annum. The main advantage of ropes over belting, however, lies in the power being divided up into a number of ropes, so that in the case of any one of the ropes showing symptoms of weakness—and this is always the case long before the rope breaks—that rope may be removed by stopping the engine for a few minutes, the remaining ropes continuing to do the work until the stoppage occurs. In the case of belting, as only one belt is employed to drive one flat of a mill, if anything were to happen to the belt, all the machinery in the flat would of course have to stop until repairs could be effected.

The ropes used are three-stranded cables, made of the best hemp. Cotton ropes have been unsuccessfully tried, and leather ropes are too costly. The sizes employed are from 3½ to 6½ inches, although there are do definitely ascertained limits in this respect. The weight corresponding to any circumference per foot in lbs., is easily found by multiplying the square of the circumference by 0.031. Grooves in the pulleys usually have their sides at an angle of 40°, which is found to be the best V—that in which the ropes have least tendency either to slip or bind. The ends of the lables are united by what sailors call a "long splice," which is not of greater diameter than the rest of the rope, and is about 9 or 10 feet long.

We have now to consider the practical questions of the number and diameter of cables to be employed under various circumstances. The stress upon a rope is twofold, and is due first to longitudinal tension, and secondly to curvature. When the diameter of the first pulley is not less than 45 or 50 times that of the cable, the tension resulting from curvature may be neglected. The flywheel or first driving pulley should, therefore, have a diameter equal to double the above or not less than ninety times that of the rope, which works on it. This is essential, as, if the diameter of the pulley is too small, the rope in bending over is subjected to strains which greatly impair its durability. According to Keller, experiment shows that the longitudinal tension may be estimated at from 107 to 114 lbs., per square inch of section of area of the rope. Taking the larger estimate, the total tension on a 5¼ inch rope for example will be about 275 lbs. If it be admitted that, of the two tensions produced in the cable, the larger, that of the motive portion, equals twice that of the smaller, the power to transport at the circumference of the pulley will be equal to one half the above total tension, or 138 lbs. Suppose the velocity to be as low as 32 feet per second, or 1,920 feet per minute: the work done will then be 264,960 foot lbs., per minute, or something over 8 horse power. This, with other velocities, will of course be greater. From the foregoing, however, we may easily calculate the number of cables necessary in any case, if their diameter, the power to be transmitted, and the velocity be known. Takingthe cable again as 5¼ inches in circumference, and supposing the velocity to be 48 feet per second, and power 90 horse, we shall have the number of cables necessary under such conditions $= \frac{90}{8} \times \frac{32}{48} =$ between seven and eight. But it would be better to use nine, the extra one being advantageous in order that, when repairs are needed to any single rope (and it is hence thrown out of operation) a greater stress than the 114 lbs., per square inch may not come on the series.

To determine the diameter of cable needed Mr. Keller gives the following formulæ: Diameter $= 0{\cdot}58\sqrt{\frac{P}{a}} \times 0{\cdot}58\sqrt{p}$ in which P is the total power to be transmitted, p the tangential force to be transmitted by one cable, and a the number of cables. Or letting R represent the radius of the pulley, N the horse power and n the number of turns: Diameter $=155\sqrt{\frac{N}{a\,n} \times \frac{1}{R}}$. These give the diameter in centimeters; to reduce to inches, multiply by 0·293.

It will be interesting, in conclusion, to note some of the practical conditions quoted by the authors. The engine fly wheel of a jute weaving and spinning factory, in Dundee, Scotland, is 22 feet in diameter, and has 18 grooves cut in its circumference: its width is 4 feet 10 inches over all. The engine makes 43 revolutions per minute, and the velocity of the fly wheel run is 2,967 feet per minute. The power of the engine varies from 400 to 425 indicated horse power, so that each of the ropes, which are 6½ inches in circumference transmits about 23 horse power, 115 horse power is transmitted to the ground floor by 5 ropes on to a pulley 7 feet 6 inches in diameter; 92 indicated horse power to the first floor by 4 ropes to a 5 feet 6 inches pulley; 138 indicated horse power to the attic by 6 ropes to a pulley of the same size as the preceeding, and 69 indicated horse power to a weaving shed on the other side of the engine by 3 ropes to a pulley 7 feet 6 inches in diameter. The tension on each rope is $\frac{53000\times23}{2967} = 256$ lbs.

In a jute factory in Calcutta, the engines are 1,000 horse power and make 43 revolutions, the fly wheel is 28 feet diameter and 6 feet 7 inches wide, and the velocity is 3,784 feet per minute. There are 18 ropes, 6½ inches in circumference used to transmit the power to the spinning machinery, and 7 ropes drive the weaving machinery. Each rope, therefore, transmits 40 indicated horse power, and the tension on each is 349 lbs.

At Lindgen's spining mills, at Hochneukirch, 88 horse power is transmitted by 7 cables. The fly wheel is 17 feet 11 inches in diameter; the cable are 5·7 inches in diameter, and the velocity 3·030 feet per minute.

At Heyerdahl's sail canvas factory, in Christiania, Sweden, 270 horse power are transmitted by 13 cables. Diameter of fly wheel is 11 feet 9 inches, and of ropes 5·7 inches; and the velocity is 4,416 feet per minute.

Mr. Durie in his paper draws especial attention to the advantages of the rope system in lieu of belting in rolling mills in this country. He is confident that from the slackness with which the ropes can work, and the hold they have on the grooves of the pulleys, they would be admirably adapted for taking up the shock which is thrown upon the gearing of a train when the iron enters the rolls.

Legal Definitions in Mental Pathology.

A leading English authority, Mr. Phillips, in a late work, lays down the following distinctions in forensic medicine:

"Every person whose mind, from his birth, by a perpetual infirmity, is so deficient as to be incapable of directing him in any matter which requires thought or judgment, is, in legal phraseology, an idiot.

"Every person *qui gaudet lucidis intervallis*, and who sometimes is of good and sound memory, and sometimes *non compos mentis*, is, in legal phraseology, a lunatic.

"Every person who, by reason of a morbid condition of intellect, is incapable of managing himself and his affairs as an idiot or a lunatic, not being an idiot or a lunatic, or a person of merely weak mind, is, in legal phraseology, a person of unsound mind."

Recent American and Foreign Patents.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED MACHINE FOR EDGING LUMBER.

George W. Bobo, Rock Mart, Georgia.—This is a machine for edging lumber while being sawed. It is so constructed that it may be adjusted to edge thicker or thinner or wider or narrower boards, as may be required, and without stopping the mill.

IMPROVED CARRIAGE POLE HEADS.

George Bray, Jr., Deptford, Eng.—This is a simple arrangement of the pole head for securely holding the pole straps. It is easily shifted for connecting and disconnecting, and will disconnect the strap self-actingly in case a horse falls down. The eye pieces for holding the straps are made in separate parts, and are attached to the pole by separate socket pieces, one of which is rigidly fixed on the pole, while the other is capable of turning for opening and closing the eyes. The two socket parts have cam projections, and are fixed with a spring, by which the eyes are kept closed, but which allow them to open, by a certain amount of pressure, to allow the straps to escape.

IMPROVED MACHINE FOR SAWING CIRCULAR SLABS.

John J. Dimond, New York city.—This consists of stationary shafts, on which a saw frame with sleeve-shaped ends is reciprocated by suitable power, the connecting rod being secured to one of the sleeve ends by a collar placed intermediately between fixed collars. When circular slabs are required, the saws are first applied to one side of the block for cutting down a semicircle, being then applied to the other side to cut down the other semicircle until the cuts meet.

IMPROVED DRAFT ATTACHMENT FOR VEHICLES.

George W. Wilson, Batavia, Ohio.—This invention is an improvement in that class of platform spring vehicles in which the draft is applied directly to the front axle instead of the platform springs supported thereon. The double tree, and the draft rods attached thereto, are supported from the front spring by means of jointed bars, which allow the spring to play up and down without changing the position of the double tree, or deflecting the line of draft.

NEW AGRICULTURAL INVENTIONS.

IMPROVED PLANT SUPPORT.

Anthony Daul, Newark, N. J., assignor of one half his right to Emil Krause, New York city.—This consists of an elastic band with a fastening device at each end, and an attaching staple in the middle. It is designed as a substitute for cord or other material for tying up growing plants. Being elastic, it adapts itself to the increasing size of the branches.

IMPROVED HOE.

Eliphalet W. Oakley, Babylon, N. Y.—This consists in a hoe provided with a scoop blade for removing fine mud and sand from the bottom of a ditch. The hoe can also be used for various other purposes with better effect than a hoe constructed in the usual way.

IMPROVED CIDER MILL.

John A. Schwob, Miltonsburg, O.—This mill is constructed of wooden sections, so as to be readily set up, moved to any place, and stored away after use. There is an interior stationary masher of conical form, provided with spiral recesses, and an outer revolving grinder extending around the masher and having recesses running in opposite directions. Both masher and grinder are made of plank, arranged at cross grains and bolted together.

IMPROVED REVERSIBLE PROW.

Daniel F. Vickery and William P. Prickett, Oxford, Ala., assignors to themselves and Richard G. Roberts, of same place.—This plow is so constructed that the beam and handles may be reversed. It will turn the furrow the same way as it is drawn back and forth across the field, whether it be used upon the hillside or upon level ground. The beam and handles are to be turned by and with the team, leaving the plow in position to turn a furrow in the same direction as the preceding one, the two plows working alternately.

IMPROVED FRUIT PICKER.

John Sager, Augres, Mich.—This device embodies spring jaws having cutting knives arranged above the hoop, to which the fruit-conveying tube is attached. The cutters are operated by a sliding rod guided in the handle of the picker, and connected by pivot links with the spring jaws. The picker is placed directly under the fruit, and raised until the hoop comes in contact with the stem. The picker is moved slightly forward to cut the stem as close as possible to the fruit, and the sliding rod is pulled back for cutting. The hose then conducts the fruit to the basket without getting bruised.

IMPROVED FENCE.

John A. Burnham, Delaware, O.—This invention relates chiefly to confining wooden palings by means of wrought iron brackets, whose arms are bent at right angles to adapt them for application to the supporting rods, in such manner that they conceal the rods.

IMPROVED CORN HUSKER AND SHELLER.

George E. Luckey, Paris, Tenn.—In using this machine, the butt of the ear is presented to the husking cutter, which removes the husks, and shells about an inch of the ear. The ear is then withdrawn, reversed, secured in a clamp, and fed forward to the shelling cutter, by which the rest of the corn is removed from the cob.

IMPROVED GATE.

Robert E. Stevens, Owen Sound, Ontario, Canada.—This gate is so constructed that it may be conveniently adjusted higher or lower to adapt it for winter or summer use. It will not sag, may be opened in either direction, will fasten itself as it swings shut, and will receive a small or wicket gate within it.

IMPROVED CORN MARKER.

George W. Graves, Villisca, Iowa, assignor to himself and Amos P. West, of same place.—Two sets of bevelled wheels are arranged on two axles. The rear and longer axle is capable of embracing four rows, and is connected to a short one in front by bars, in such a way that the front axle is capable of moving vertically, independently of the rear one. The invention also includes a peculiar manner of attaching and locking the tongue.

IMPROVED DRUGGIST'S SHELF BOTTLE.

Edward L. Witte, White Mills, Pa.—In order to overcome the defects of the present glass labels which usually are cemented on shelf bottles, this inventor proposes a label, of suitable enamel and colors, that is placed on the shelf bottle and burned into the glass of the same.

IMPROVED BUTTER PACKAGE.

Samuel C. Williams, Peterstown, W. Va.—This consists in the arrangement, in a suitable box, of a series of trays, having muslin pockets for roll or print butter.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED STEP LADDER.

John Dillon, New York city.—This extension step ladder may be folded up into narrow space, extended to its full length without getting shaky or wabbling, and may be changed into two separate step ladders of different height, with great facility, whenever desired. The step and brace sections of the lower ladder are jointed, when detached, by a lateral hinge rod and top step, the step section being made of side pieces, with a lowermost full step and short upper steps dovetailed into the sides. The upper part of the side supports of the lower step section is strengthened by metallic encircling bands, through the holes of which the connecting rod of the upper ladder passes. The brace section is extended at the bottom to greater width than the step section and connected by a lateral screw rod to the brace rod of the upper ladder.

IMPROVED REIN HOLDER.

Ephraim Mears, Attica, Ind.—A follower holds the reins drawn in from the top of the device, which is attached to the dashboard in tight manner, the pressure thereon being increased the greater the strain exerted on the reins. By pulling the reins back the follower clears the recess of the frame and admits the ready detaching of the reins.

IMPROVED UMBRELLA SUPPORT.

Asa T. Martin, Jr., Waverly, Iowa, assignor to himself, Millard F. Potter, and James Brotherton, of same place.—This consists in a plate having sockets formed in it in such a manner that they are capable of holding the umbrella staff either perpendicularly or at any desired angle. This plate is secured to the bottom of the carriage in such a position that its central socket is directly under a screw clamp attached to a metallic supporting frame or to the edge of the seat.

IMPROVED TELEGRAPH INSULATOR.

Robert A. Cunningham and David F. Crowell, Zanesville, O.—This consists in constructing the head of the insulator with a transverse groove which divides the head into two sections, the convex section of which is made higher than the other, so that the wire may be bent around the same, and kinked with a curve corresponding to the transverse groove.

IMPROVED TOBACCO-CUTTING MACHINE.

Eben Goodwin, New York city.—This is an attachment for tobacco machines for applying a sweetening or flavoring liquid to tobacco while being cut. In the front or throat plate of the cutting machine is arranged a series of small tubes, that are connected with a reservoir for containing the liquid. The pipe connecting the tubes with the reservoir is provided with a valve for controlling the flow of liquid.

IMPROVED BRUSH.

George R. Davies, Yarmouth, Nova Scotia, Canada.—This is designed for cleaning the sounding boards of square and grand pianos. It consists of a small spiral brush of sufficient length, that is placed between the wires and revolved in a supporting stand by suitable gearing.

IMPROVED CRACKER MACHINE.

Eli P. Waste, New York city.—This consists in a die for molding and stamping crackers, the same being provided with double discharges, each of which, acting independently of the other, insures a free discharge of a well formed cracker.

IMPROVED FLEXIBLE BLACKBOARD.

John R. Minehart, Brownsville, Penn., assignor to Harry W. Minehart, of same place.—This consists of a blackboard made of suitable fabric with a slate surface, and mounted on top and bottom rollers, being tightly stretched for use by elastic straps of the lower roller applied to nails.

IMPROVED FARE BOX.

Joseph Adler and Heinrich Freimuth, New York city.—This is a fare box for street car conductors, by which the fare or tickets are collected from the passengers and placed directly into the box carried on a suitable belt. The new features relate mainly to a swing guard-plate and other devices which prevent money being shaken out of the box through the orifice by which it is inserted.

IMPROVED SOLAR CAMERA.

Chancy R. Jenne, Okolona, Miss.—It is a new camera for taking and enlarging pictures from a photograph or any opaque object. It is intended to be used by portrait painters for making their drawings. The picture is fastened to one of the wings at 45° to a mirror, and is reflected in it, and is seen by the lens at right angles to it; it is reproduced in a darkened room on a screen or paper.

NEW HOUSEHOLD INVENTIONS.

IMPROVED BROOM.

Theodore B. Lewis and Thomas O. Lewis, Battle Creek, assignors to themselves and Charles Veeder, Hillsdale, Mich.—A piece of wood is bored centrally to fit the lower end of the handle, and is notched to receive the upper end of the brush. The upper edge and ends of this shoulder are rounded to give the required form to the hood of the broom, which is attached to the handle, in the ordinary way, immediately above the shoulder, and is brought down over the body of the brush, and stitched. The shoulder, previous to covering, is nailed to the handle.

IMPROVED TABLE CUTLERY.

Richard N. Oakman, Jr., New York city, assignor to John Russell Cutlery Company, of Turner's Falls, Mass.—This is an improved carving fork, by which an extension of the common pivotal spring guard serves in a very simple and neat manner as a support or rest for the fork when the same is placed on the table.

IMPROVED DRAWER FOR SEWING MACHINE TABLES.

John Mulchahey, Newburyport, Mass.—This is an improved swinging drawer applied to the under side of the table of a sewing-machine, for the purpose of storing sewing machine needles, spools, and other articles. It includes a needle tray, gauging devices, a spool receptacle, and a needle sharpener.

IMPROVED MILK CAN.

Dennis S. Lewis, of Moline, Ill.—This consists in placing a milk can having two compartments—one for a quantity of milk and another for milk from a single cow for children's use—in a larger can having a double cover and a bottom strengthened by wood. Sufficient space is left between the inner and outer can for a body of ice or cold water, and faucets are connected with the compartments in the inner can, that project through the outer can.

IMPROVED BLIND ADJUSTER.

Robert J. Stuart, Yonkers, N. Y.—This is an improved device for adjusting and locking blinds from the inside of the room into any suitable position. A double elbow lever is pivoted to the window sill, adjusted by a spring button having an eccentric pin to an arc-shaped rack, and connected by an outer pin with guide strips of the blind.

IMPROVED SPRING BED BOTTOM.

Caleb E. Brown, Jackson, Mich.—In this spring bed bottom the slats are prevented tipping over, and a bottom of uniform strength and elasticity is obtained. The slats and spiral springs are connected by a U-shaped toe piece, and attached to slats by bottom hooks, so as to alternately unite two adjoining slats.

IMPROVED HEATING STOVE.

Ignatius Droege and Charles Bogenschutz, Covington, Ky.—In combination with the heater chamber, there is a diving and bottom flue extending nearly to the front end of stove, enclosing side and return flues, a rear rising and enclosing flue, and suitable openings for securing direct draught, or causing the products of combustion to pass through the flues as desired.

IMPROVED MEAL BIN.

William H. Mangold and Harry Summerville, Anna, Ill.—This consists of a number of flour and meal bins arranged at the upper part of the pantry, with spice drawers below the same, closed by a hinged kneading board. The dough rollers, &c., are stored in a space below the cornice, while the shelves in the cupboard at the lower or base part are employed to store bread pans, pie plates, and other articles.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED POST AUGER.

Charles W. Pool, Wiscoy, N. Y., assignor to himself and James W. Van Buskirk, of same place.—This consists in the combination of a pair of blades with adjustable supporting arms, which are secured in a socket formed in the lower end of a shank, provided with a suitable handle. The arms are capable of being moved to vary the size of the hole to be bored.

IMPROVED LEAK STOPPER FOR BOILER TUBES.

John McConnell, Glasgow, Scotland.—This consists in the combination of a packing device with a short section of tube in such a manner that, when the tube is placed in the boiler flue, packing rings may be compressed between the exterior of the short section of the tube and the interior of the boiler tube in such a way as to stop the leak and not impair the utility of the tubes.

IMPROVED COAL CHUTE.

Theron Kelsey, South Brooklyn, N. Y., assignor to himself and James E. Kelsey, of same place.—This is an improved apparatus for dropping coal and other material from a height to a floor or pile below, so constructed as to prevent the coal or other material from being broken by collision, and thus avoids the formation of fine coal or dust.

The outflow of the coal may be checked at any time, and may be readily controlled to keep the chute filled to the proper point. The construction also guards against all the coal running out of the chute should a slide occur in the pile below.

IMPROVED MACHINE FOR STICKING NAILS IN HEEL BLANKS.

William E. Forster, Nashua, N. H., assignor to himself and Albert H. Saunders, of same place.—This is an improved machine for sticking nails into the former or heel in rapid manner, so as to dispense with the slow sticking in of the nails by hand. The invention consists, mainly, of a reciprocating shaker for arranging and dropping the nails, a funnel shaped partitioned conductor or guide casing for conveying the nails, an inclined and notched grate with vibrating rapper and clearers for tipping up and sliding the nails in forward direction, and of converging conducting tubes for dropping the nails into the former or heel. This machine is exceptionally ingenious in construction. It simultaneously sticks the required number of nails into any size of heel. To large shoe manufacturers it will doubtless prove very valuable.

IMPROVED ROAD SCRAPER.

Edward Huber, Marion, Ohio.—The invention relates to certain improvements in earth or road scrapers, designed to simplify, cheapen, and improve the construction of the same. It consists, first, in the manner of attaching the handles by extending the plate metal sides of the scraper in the form of an acute angle, and wrapping the end of said extended side around the handle, which, in connection with a bolt passing through the forward end of the handle and the side of the scraper, firmly secures the same to the scraper. It also consists in the peculiar means for the attachment of the bail to the scraper.

IMPROVED BLOW-OFF DEVICE FOR STEAM BOILERS.

Mathew Rhoda, Allentown, Pa—For the purpose of obviating the formation of scale, and for keeping the crown and bottom sheets perfectly clean and efficient for work, a number of radial exit tubes are arranged near the crown and bottom sheets; they are connected by a tube, that extends around the outside of the boiler, and is provided with a blow-off cock which, on opening, admits the ready cleaning of the sheets of any sediments by the powerful agitation of the water caused by the steam.

IMPROVED HORIZONTAL SCREW PROPELLER.

William S. Myers, Southington, Conn.—The wheel or screw is concealed or incased in the bottom of the boat or vessel, and the water conducted to and away from it by a channel formed in the bottom of the boat or vessel. The agitation of the water by the screw, being confined into the casing and flumes, will not, it is claimed, produce any washing of banks when used in canals, the device being also adapted to vessels of war, which require protection for the screw, and to vessels plying in shallow rivers and waters.

IMPROVED BOOT AND SHOE SOLE.

Elisha Hanshew, Brooklyn, N. Y.—This consists of a leather sole made with a beveled recess, extending along the greater part of the ball of the foot, and being filled by a tapering and flanged section or sole of soft rubber. A layer of horsehair, or other absorbent, is placed on the rubber section, and retained by the insole that is skived off at the inner part.

IMPROVED CAR COUPLING.

Samuel W. Kilbourne, Bethel, Me.—This consists of a draw bar with open top, tapering mouth, and recess back of the bottom shoulder, on which the swinging coupling hook locks when passing back of the same. A hinged table swings in the recess, and is connected to the coupling hook of the draw head to raise the head of the opposite hook simultaneously therewith for uncoupling.

IMPROVED CAR COUPLING.

Martin C. Mohr and Newton F. Lawrence, Manchester, Iowa.—This is an improved automatic car coupling that locks with the common link-and-pin coupling in perfectly safe and reliable manner, and without danger. A swinging block is retained by a side recess and a swinging latch-shaped handle pin of the draw head in raised uncoupled position. Top and bottom shoulders of the drawhead, in connection with an extension of the block, secure the extent of swinging motion in the block. The link couples automatically by entering the mouth of the draw head, raising the block, and passing into the middle recess of the locking block, it being uncoupled by swinging the block in upward direction so that the link is allowed to pass out.

IMPROVED MECHANICAL MOVEMENT.

Adolf Hünerwadel, Washington, D. C.—The invention consists in combining a peculiarly constructed crown wheel and worm, with a view to attainment of certain advantages, particularly in respect to friction. For full description, see patent. The device is specially adapted to driving bobbin spindles.

IMPROVED TURBINE WATER WHEEL.

Stephen M. Smith, York, Pa.—The invention relates to certain improvements in turbine water wheels, designed to increase the percentage of power and render the wheel more effective. The improvement consists in inclining the plane of the buckets in the direction of the movement of the wheel, and curving them reversely to the usual direction, so that the water strikes the convex portion of the bucket. This form of bucket throws the water well out to the periphery, where it exerts the best leverage upon the wheel, while the curve and vertical inclination of the buckets, being in the direction of the movement of the wheel, the buckets simply present a sharp edge in entering the streams of water, and do not involve the back lash and loss of power produced by the resisting surfaces which the back of the buckets curved in the usual form affords.

IMPROVED GOLD SEPARATOR.

Thomas W. Irvin, Eureka, Cal.—This is an improved machine for separating gold from the gravel and earth as the same is tunnelled or worked off for removal from the bank. An exhaust fan is connected with a separating tube that is provided with gratings of different width, and with quicksilver at the lowest grating to separate the finer and coarser particles of gold, while the heavy gravel is discharged through the hopper, and the lighter dust through the exit tube of the fan.

Artificial Butter.

To the Editor of the Scientific American:

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

New York City.

Notes & Queries

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters, to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Inquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical enquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact, hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to inclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to inclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

J. A. O. will find an answer to his query as to the relative motion of parts of a wagon wheel on p. 298, vol. 31.—R. W. C. will find a good recipe for baking powder on p. 123, vol. 31. This also answers E. A. H.—W. P. will find a recipe for a depilatory on p. 362, vol. 32.—J. F. will find a description of flexible shafting on p. 217, vol. 35.—F. L. J. will find directions for fireproofing shingles on p. 280, vol. 28.—J. M. will find directions for gilding on China on p. 43, vol. 29.—J. P. will find, on p. 315, vol. 35, a recipe for a white alloy that will do well for fine castings.—C. N. L. will find directions for putting a fine finish on shirt bosoms on p. 203, vol. 31.—W. M. J. will find directions for making his cellar walls watertight on p. 246, vol. 35.—J. P. K. will find directions for putting a fine polish on edge tools on pp. 488, 549, vol. 2, SCIENTIFIC AMERICAN SUPPLEMENT. For a black finish for light-colored woods, see p. 299, vol. 30.—J. M. will find an answer to his query as to the compressibility of water on p. 27, vol. 36.—L. H. R.'s discovery as to evolving electric sparks from rubber is very old.—J. H. K. will find directions for making superphosphate of lime from bones, and the quantity of sulphuric acid necessary therefor, on p. 323, vol. 27.—H. P. will find directions for building an icehouse on p. 255, vol. 31.—G. H. will find a recipe for acid-proof paint on p, 278, vol. 35.—F. D. B. will find directions for lighting gas by electricity on p. 161, vol. 27.—G. W. P. will find directions for making transparent paper on p. 241, vol. 28.—P. F. M. and many others who ask for directions for enameling cooking vessels, are referred to p. 21, vol. 36.—T. H. S. will find directions for making a cheap continuous battery on p. 43, vol. 35.—J. C. D. can dissolve shellac by following the directions on p. 327, vol. 35.—T. P. H. will find directions for hardening rubber on p. 203, vol. 35.—J. L. B. will find a recipe for a hair dye on p. 138, vol. 27. For waterproofing canvas, etc., see p. 282, vol. 32. Paraffin is described on p. 95, vol. 30. To keep cider sweet, see 11, vol. 31. Birdlime is described on p. 347, vol. 28.—O. S. will find directions for proportioning cone pulleys on pp. 26, 73, vol. 25.—P. C. M. will find directions for a dry photographic process on p. 215, vol. 30.—S. M. K. will find an answer to his query as to bodies sinking in deep water on p. 208, vol. 33.—L. M. Y. will find a recipe for a hair wash on p. 138, vol. 33.—J. T. C., C. T., F. C., J. S., J. C. W., E. T. H., F. M., R. J. F., C. J. W., J. G., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) J. F. S. says: In the works with which I am connected, we are running one of the most improved style of cut-off condensing engines. In case we should need more power, which would be the most economical, and which of the two following plans would give the most power: placing another engine alongside the present one to work with it as a pair, or placing another cylinder of about double the size, connected to work with the present one on the compound principle? A. Place another engine alongside of the present one.

(2) R. C. H. says: I have been building a small engine, and find myself fast on one point. How and by what means shall I find the right distance to place my driving box from the cylinder? A. Push the piston crosshead forward until the piston strikes the cover, and mark a line on one guide and guide bar: then push the crosshead back to the amount of the clearance between the piston and cylinder head. Then, the piston being at the end of its stroke nearest to the crank, the length of the connecting rod, less the length of the crank, is the distance of the main journal box from the crosshead journal.

(3) A. M. H. asks: Is it safe to have cast iron packing rings to work in a cast iron cylinder to pump hot water into a boiler? A. Yes.

(4) F. L. A. asks: How are threads formed on lamp burners and collars? A. They are cut.

(5) O. A. L. asks: Will grinding bits, cutters, knives, etc., on an emery wheel draw the temper, if they are not heated in the operation? A. No.

(6) H. J. W. asks: 1. Can I obtain a fine casting from an alloy of 16 parts copper and 1 part tin? A. Try the following: Copper 8 parts, zinc 1 part, tin 2 parts, antimony 1 part. Fuse the copper first, then add the zinc, tin and antimony in the order given. It will be necessary to add a little excess of the tin, as some of it will be lost in the smelting. 2. Can porcelain be used in a mold for a fine casting? Plaster of Paris will not stand a great heat. A. Porcelain or earthenware molds will not answer.

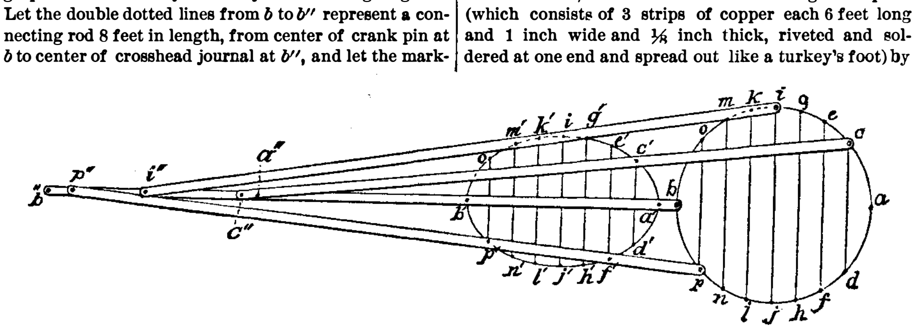
(7) A. S. asks: 1. How much wire and what sizes will I use to make a good coil for a sounder? A. Two hundred feet of No. 23 silk-covered copper wire will make a good coil. The wire can be purchased from any dealer in telegraph apparatus. 2. Will one coil do for telegraphing purposes and for giving electric shocks? A. Yes. 3. Is there any work published on the construction of coils and electric apparatus in general? A. Du Marcel's work on telegraphy is one of the best, but we believe that there is no English translation.

(8) J. F. asks: Supposing the portative force of an electro-magnet to be known, what formula will express its attractive force when its keeper is removed from a distance $x=0$ to $x=$ some finite quality? Is the formula similar to that expressing the attraction of gravity between two bodies $\frac{x\,(a+b)^2}{(a+b+z)^2}$, where $x=$ the attraction, when z, the distance between the bodies, is 0, and a and b are the distances from the center of gravity of the bodies to their attracting surfaces, respectively? A. Mr. Hunt, in a paper read before the Institution of Civil Engineers, England, gives the following figures for the great electro-magnet of the Polytechnic:

Lbs. supported, armature in contact........						220.
"	"	"	$\frac{1}{250}$	inch from cover.		90.
"	"	"	$\frac{1}{125}$	"	" "	50.
"	"	"	$\frac{1}{64}$	"	" "	47.
"	"	"	$\frac{1}{50}$	"	" "	40.
"	"	"	$\frac{1}{30}$	"	" "	36.

(9) J. V. R. says: 1. I have made an induction coil (yielding a spark somewhat more than 6 inches in length), the core of which is composed of No. 14 soft iron wires. Can I add to the length of spark by making the core of smaller sized wires? A. Probably not enough to pay for the construction of a new core. 2. Is there any rule or law indicating the proper size of wire for the core? A. Nos. 18 to 22 are generally used. 3. What kind of wire is the best for the above purpose? A. The purest and softest obtainable.

(10) W. H. P. says, in reply to M. M. C., who asks if a point on a connecting rod, between the centers of the crank pin and crosshead journal describes a perfect ellipse, or is the figure which it describes slightly larger at one end than the other: An instrument constructed upon that principle is a most perfect ellipsograph. This is clearly shown by the following diagram: Let the double dotted lines from b to b'' represent a connecting rod 8 feet in length, from center of crank pin at b to center of crosshead journal at b'', and let the marking point or a pencil be just half way between at b'.



Then, of course, by a half revolution of the crank, the crank pin will be at a and the crosshead at a'' (2 feet stroke. But, while the longitudinal movement of all parts of the rod is the same, the vertical movement of the crosshead is zero. and that of the crank pin is 2 feet; and the pencil being half way between them is just one foot, or the vertical movement of the pencil is at all times just one half that of the crank pin. Obviously, then, we should detach the crank pin from the crank, and, with the crank pin, describe the line, c, d, the pencil would at the same time describe the line. c' d', just one half of the length $c\ d$, and so of all the lines $e\,f$, $g\ h$, etc. Then the lines, $c\ d$ and $o\ p$ being of equal length, it follows that c' d' and o' p' (being just half as long) will be equal to each other, and the figure will not be wider at one end, but a perfect ellipse. When the crank pin is at the points a, c, i, b, p, the crosshead journal center will be at a'', c'', i'', b'', p'', and the pencil at a', c', i', b', p', and as the crank pin passes the successive points, a, c, e, g, i, etc., through an entire revolution, the crosshead traversing a straight line eqnal to the diameter of the circle, the pencil passes through the points, a', c', e', g', i', etc., describing a perfect ellipse. The same will obviously be the case if the pencil be placed at any other point in the rod, the major axis of the ellipse being always equal to the length of stroke, and the minor axis in the same proportion thereto, as is the distance between the crosshead and the pencil to the length of the rod.

(11) A. C. G. asks: How many lbs. will an electro-magnet, 6 inches long, with a core ¾ inch in diameter and each pole being wrapped with 2 lbs. cotton-covered No. 20 wire, with a 4 cell Grove battery, lift? A. This is best determined experimentally. The same weight of No. 18 wire would doubtless give better results with 4 Grove cells.

(12) O. F. says: I have made a small induction coil: the primary coil is of No. 16, and the secondary coil of No. 35, copper wire, wound with silk (about ⅛ lb. of the latter). The current breaker is a vibrating armature over a small electro-magnet. The adjusting screw over the armature has a hardened steel point. Will a platinum point give better satisfaction than the steel one? A. Yes. 2. Would the condenser described in your last volume, No. 22, be of any benefit? A. Hardly enough to pay for its construction for so small a coil.

(13) H. P. K. asks: 1. How can I make an electro-magnet? I made one by coiling the iron core wire covered with cotton, the cotton being coated with shellac varnish, but it would not work; then I left the shellac off, and still it would not go. Where is the difficulty? A. Cores about 1¼ inches long and ⅝ inch diameter, wound with 200 feet of covered copper wire, No. 22 or 23, will make a good magnet. Commence winding each core at the end that joins with the yoke piece, and wind in the same direction; when done, connect the inner ends together. 2. I want to make an electro-magnetic machine. How fine a wire will I have to use for the armatures, and how shall I insulate it? A. We presume you mean a magneto-electric machine; for that purpose cores as above, ½ inch in diameter, answers very well. 3. How many turns of wire are necessary? A. The same amount of wire also will do, but stronger shocks are given if smaller wire is used. Ordinary silk covering is sufficient insulation.

(14) E. L. S. says: I wish to use horn, heating it in pressing; but I fear I shall render it brittle. Is there any process by which I can preserve its pliability? A. Boil well in water till it becomes flexible, and then press it.

(15) E. E. N. says: Why cannot I make nickel stick well to steel knives, when I have no trouble with brass or copper? I am sure the knives are clean. A. Cover the steel with a thin film of copper from an alkaline solution first, and you will have no trouble.

(16) R. S. B. asks: What is the refractive index of the glass for the objective described in "Notes and Queries" of February 19, 1876? A. Index of flint =1·601, index of crown =1·528. Dispersive proportion, 0·683. Specific gravity of flint=3·432, of crown=2·514. The above index is for the fixed line E in the solar spectrum.

(17) A. S. asks: What will dissolve asbestos, so that I may use it as a paint or coating? A. Asbestos is not soluble without decomposition in any menstruum. It is made into a paint by grinding with oil.

(18) A. C. H. K. asks: Can you tell me what substance is best adapted to the cutting or channelling of soft sand stone in quarrying? A. Use a plain blade of soft iron or copper. Diamonds are not necessary. Well crated corundum pebbles will answer very well in such stones: quartz will not give satisfactory results.

(19) H. E. W. says: We have just been building a church the tower of which is 112 feet from the ground to the highest point. We propose putting up a lightning rod consisting of 12 No. 14 copper wires; twist them in form of a rope making about ½ inch diameter. This rope is close to the spire and is firmly soldered to all the tin and iron work of the spire. The point is of solid copper with a sharp point terminating with a platinum point about ½ of an inch long; the point from rod to platina tip is silver plated. This projects above the spire about 2 feet. The rope of copper extends into the earth a sufficient depth to reach permanent moisture; it is then attached to the ground plate (which consists of 3 strips of copper each 6 feet long and 1 inch wide and ⅛ inch thick, riveted and soldered at one end and spread out like a turkey's foot) by solder. The rod is packed in charcoal and filled up. Is this sufficient? A. The rod is an excellent one, and the ground connection better than the average, but we should increase the earth plate still more. Painting the rod will not interfere with its conducting properties.

(20) J. S. H. says: I am trying to make a magneto-electric machine. I took a pasteboard tube 1 inch in diameter and 6 inches long, on which I wound about 100 feet of each of No. 20 and 23 cotton covered wire, in four layers. The wires are wound alongside of each other, 290 times around the tube. For a magnet, I used a piece of steel ½ an inch thick and 3 inches long, around which I wound an insulated wire 60 times, and connected the ends to the battery; it will lift two ounces. The vibrating armature will not work. A friend says that, if each layer is not leveled off before the next is wound on it, it will be no good; another says I must have five or six numbers of wire in the coil. Please give me some information. A. The instrument is too small to give much of a shock, and the core should be of soft iron instead of steel. One thousand feet of No. 28 or 30 wire will answer much better than Nos 20 or 23

(21) G. W. C. says: I wish to make a galvanic battery of 20 elements. If I move the last terminal wire backwards along the series, shall I get a current from only those elements between the two terminal wires, or from the whole number, as they are all connected? A. From the cell included between the terminal wires only.

(22) A. L. B. asks: 1. How can I electrotype? I have found several difficulties. My moulds, made of plaster of Paris, will not come off, but stuck to the type; if made of beeswax, they crack in cooling. A. Rub the object with a little sweet oil before taking the plaster casts. The latter, before being covered with black lead, should be baked gently to drive off moisture, and then thoroughly saturated with tallow, stearin, or paraffin. 2. I use 2 cells of Daniell's battery, covered my mould with black lead, and immersed it, and it was in about 10 days before it covered. Why was it so slow? A. The ordinary article to plumbago sold for household use cannot be relied upon; it is best bought of a dealer in scientific apparatus. The gas carbon used for battery plates, if very carefully ground in water, answers perfectly.

(23) F. R. says: I have seen a preparation applied to house lamp chimneys which acts as a reflector. It will not wash off in hot water, and resists heat. It very much resembles the preparation applied to mirrors. Please inform me how it is made? A. Use an ammoniacal solution of tartrate of silver, and deposit on glass with gentle heating.

(24) F. S. asks: How many Bunsen batteries (two gallon jars) do I need to run an electric light? A. From 30 to 40 Bunsen cells will give a fine light, but you will require an electric lamp if a steady light is wanted.

(25) J. V. R. asks: Is there any substance other then sulphate of indigo that can be added to an iron and nutgall ink without causing precipitation, something that will answer the purposes of the indigo as a coloring medium? A. There is nothing of the kind that we know of which will satisfactorily replace it. You can try soluble Prussian blue.

(26) J. S. N. asks: What is the cheapest and best mode of making a still for distilling essential oils from herbs? A. Any small retort of glass or stoneware, with a suitable condensing-worm of glass or tin, will answer the purpose.

(27) H. D. & CO. says: 1. We have used crude glycerine with great success as a scale solvent in our boilers. We use artesian well water, heavily charged with lime, soda, and magnesia. Can you tell us as to the chemical action of the glycerine? It softens the old scale, and in many cases seems to get under it and detach it from the iron. A. Its chemical action would be probably due to the power possessed by many organic substances of taking up oxide of iron and holding it in suspension, instead of allowing it to deposit on the boiler and compact the mineral salts precipitated out on boiling natural waters. 2. Would it be better to put a week's charge in on Monday, or feed it in daily? A. When in solution in water, glycerine will slowly evaporate and distil off. For this reason it would be better to put in small charges at shorter intervals. 3. At what temperature does glycerine evaporate? We carry about 75 lbs. pressure, and usually run from Monday morning to Saturday night without stopping, using the same boilers. A. Glycerine is slightly volatile at the boiling point of water. But if an attempt is made to distil it at this temperature, the greater part of it undergoes decomposition, intensely pungent vapors of acrolein, being disengaged, which excite a most painful irritation of the eyes. Glycerine was originally proposed by Asselin in the *Zeitschrift des Vereins Deutschen Ingenieure*, as a preventive of boiler incrustations. Asselin claimed that it increased the solubility of gypsum. That it formed a soluble compound with calcic sulphate, and that it formed precipitates of a gelatinous character which could be readily removed, which were not carried along with the steam, and which did not corrode the valves.

(28) F. Q. B. asks: I am using large quantities of glue, which, during the cold weather, troubles by freezing. In place of drying after I have applied it. Can you suggest something which would obviate this difficulty? A. Try mixing it with a little warm acetic acid.

(29) C. W. W. says: 1. I wish to know what size and style of boiler is best for an engine with a bore of cylinder of 2⅞ inches and stroke 4 inches? The diameter of fly wheel is 12 inches, and the wheel weighs 15 lbs. A. A boiler 2 feet in diameter and 3 feet high will probably answer. 2. I tried my engine with a 4-horse boiler, and it would run very well, but not fast; and the more steam I let in, the *slower* it would run. I would like to know why? A. From your account, we imagine that the valve is improperly proportioned, or set, so that the exhaust is choked, or there is some other derangement.

(30) R. H. F. says: I have made two or three small electric engines, and have just completed one to run a watch lathe, using 1-inch round iron for the magnets. I used 2 magnets and No. 16 cotton-covered copper wire, 1½ lbs. of the latter on the 2 magnets. The armature wheel is 7 inches in diameter. For a battery I used 2 stone 1 gallon jars, with a closely fitting copper hoop next the jar, and a zinc tube 4 inches across, and 6 inches long. I used sulphate of copper for the fluid. I first connected the wires on the magnets so as to be continuous, and the machine would barely run. I next cut the wire, and attached so as to split the current, and it did better. I tried it with the jars as an intensit, and then as a quantity battery, but it did not make much difference. I next cut the wire so as to make four branches, one to each leg of the magnets, and I joined the zincs together, and the copper also, and it went in fine order. Have I proportioned it rightly? A. We should think from your description that the engine does reasonably well for the amount of wire used. A single cell of large plates is better than two cells formed of the same amount of metal and joined in parallel circuit; and a large size bichromate potash battery will be found preferable to the sulphate of copper. 2. Would a battery as above described make the air of a close room impure? A. It is always best to avoid breathing the battery fumes; in this particular, however, the sulphate of copper is least objectionable of all batteries. Both sides of the plate are usually counted.

(31) M. R. C. S. asks: 1. How can I make a battery so as to furnish an electric light capable of lighting a room 100 feet long by 50 feet wide and 15 feet high, the walls of which are old uncolored wood? A. The best apparatus for that purpose is a magnet-electric machine, to be run by steam or water power, and it is best bought of a manufacturer. 2. Can the light be contained in a glass globe 1 foot in diameter? A. The lamps used for the electric light occupy, as a general thing, less than a cubic foot of space. 3. How can I prepare carbon plates? A. Plates cut from the densest of graphite obtained from gas retorts are the best; but on account of the difficulty in sawing, they are expensive.

(32) P. H. C. asks: Can you give me directions for making dye colors for painting on muslin? They leave the muslin flexible so that it may be folded, and they are applicable for theatrical scenery, panoramas, charts, etc. A. Use the analine colors directly upon the lightly sized canvas. These colors are soluble in water or mixtures of spirits of wine, or wood spirit and water. 2. Please give receipes for grease paints, used on the Italian and German stage? They are stick pomatum, somewhat hard, and of different colors, and give off their color very easily. A. We know of only one preparation of this kind. In this the colors are incorporated with oil and soap. It is not manufactured in this country.

(33) C. J. H. says: I want to paint flowers and letters on parchment with chloride of gold, to make them shine without burnishing. How can it be done? Have tried a solution of chloride, 1 part to 4 of water, and exposed it to hydrogen gas; but it has not shone "with all the splendor of burnished gold," as promised by this recipe. Have any of your readers tried this plan with success? A. Use a stronger solution of the gold, dry the drawing, place it back downwards upon a large hot brick, with a piece of copper foil between it and the brick. It is best to have the drawing in full, strong sunlight, and to have the hydrogen warm or hot. The gas should be pure and dry. This will reduce the gold perfectly, but the drawing is much improved by a little burnishing.

(34) O. B. M. says: I notice on the telegraph poles a new insulator. It seems to be an iron cylinder about six inches long, with two iron (?) pegs on the under side, to which the wire is fastened. Can you explain it? A. The insulator referred to consists of an outside iron cup, within which is placed a thin glass cylinder containing an iron hook for supporting the wire; the whole being consolidated by plaster and paraffin.

(35) J. F. M. asks: What is brewer's varnish and how is it made?—G. R. W. asks: 1. What is the greatest range yet attained by artillery? 2. The printed description of the 14 inch Krupp rifle at the Exposition stated its range to be 15 English miles. Was not this an exaggeration?—A. N. asks: Please give a me good rule for finding the dominical letter for any year since the commencement of the Christian era?—W. H. G. asks: 1. Please inform me how to prepare and wire together a skeleton, taken just as it comes from the dissecting room? 2. Is there any wash used in preserving the bones?—H. D. asks: How long should a rifle be, to shoot accurately at 1,000 yards, and what should be the form and twist of the grooves?—T. J. L. says: I read as follows: "the seed of sunflowers is the most healthy feed that can be given to horses in winter and spring; half a pint a day keeps them in health and spirited, with sleek coats, and more animated than any other feed. It prevents heaves and some other diseases." Is there any truth in it?

(36) J. J. B. asks: 1. With two plano-convex lenses, ⅜ inch in diameter and of ¾ inch focus, and one of $\frac{3}{16}$ inch diameter and ¾ inch focus, can an eyepiece be made to show objects not inverted? A. Yes, but not as well as with four lenses. 2. How should the lenses be made? A. Place the two larger lenses 1½ inches apart, with their flat sides toward the object glass; then place the small lens 1 inch from these on the side toward the eye, with the flat side outward. The distance of this eyepiece from an object glass of 30 inches focus is 30¾ inches, and power 80.

(37) J. E. R. asks: How can I dry Carolina tar so as to mix it with oil, for paint? A. The only practicable method is to keep it at a temperature of 212° Fah. until all the water is all expelled. The tar is sometimes mixed with a small quantity of powdered caustic lime, which completely absorbs all traces of moisture. This is, however, in many cases, objectionable.

COMMUNICATIONS RECEIVED.

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

On a Night Light. By L. L.
On Beet Sugar. By H. P. K.
On the Gardens of Civilization. By J. H.
On a Metcor. By M. W.
On Christmas. By S. W. E.
On Diatomaceous Earth. By C. L. P.

Also inquiries and answers from the following:

L. T.—A. X.—J. J. H.—W. F. H.—A. J. B.—F. S. H. E. B.—T. D. J.—W. S.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who makes steel springs, of given power? Who sells the Jacquard portraits of Washington and other great men? Who makes the best envelope machines? Whose is the best boiler plate iron? Who sells preserved eggs, and is the preparation really made of eggs? Who manufactures acetic acid in large quantities? Whose are the best mathematical instruments? Who sells the best rifles, for target practice?" 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.

Up to the hour of going to press, the list of patents issued during the week ending December 5, and bearing that date, hadnot arrived from Washington.

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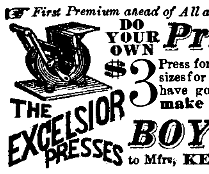

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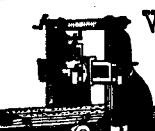

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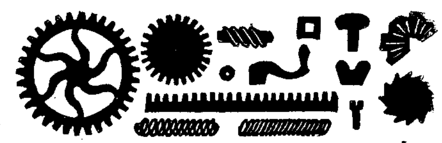

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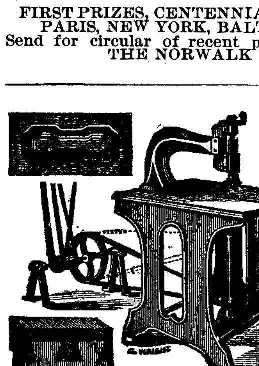

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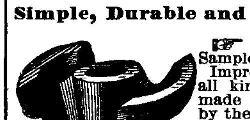

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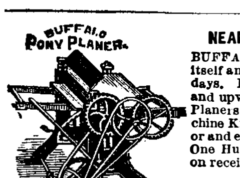

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