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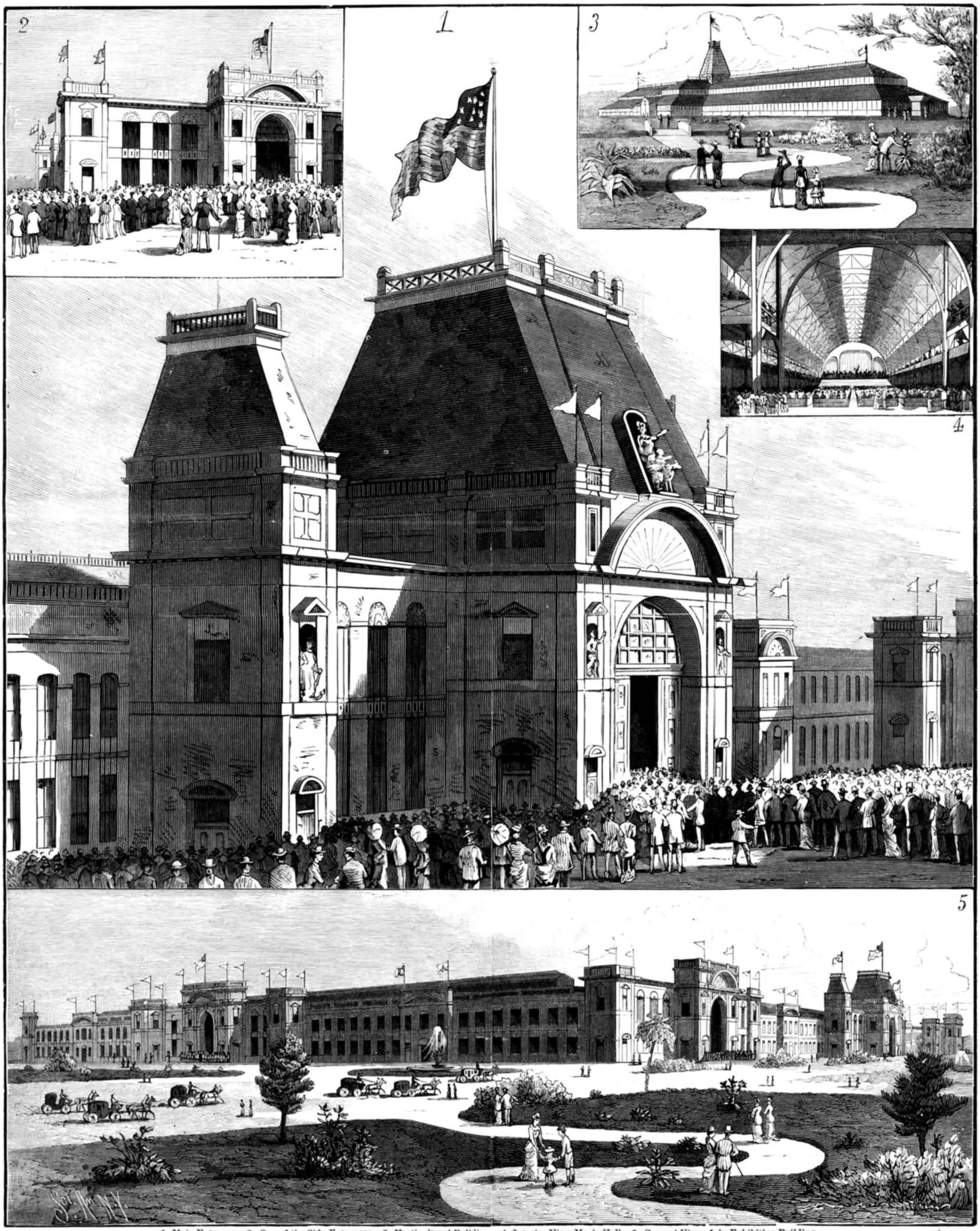

1. Main Entrance. 2. One of the Side Entrances. 3. Horticultural Building. 4. Interior View Music Hall. 5. General View Main Exhibition Building.

THE WORLD'S INDUSTRIAL AND COTTON CENTENNIAL EXPOSITION, NEW ORLEANS.—[See page 413.]

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NEW YORK, SATURDAY, DECEMBER 20, 1884.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 468,

For the Week ending December 20, 1884.

Price 10 cents. For sale by all newsdealers.

THE DECISION IN THE BELL-DRAWBAUGH TELEPHONE SUIT.

The opinion of the United States Circuit Court in the great telephone suit has been rendered by Judge Wallace, the judge before whom the argument on the final hearing of the case took place. In a former number of this journal (October 4) we gave some account of the cause of action, and of the eminent array of counsel and of experts engaged therein. When the immense mass of testimony is taken into account, it will appear that Judge Wallace has been very diligent indeed in rendering his decision. In one part of his opinion he alludes to the difficulty of disposing of so much testimony. After noting that on a single collateral issue the testimony of seventy-five witnesses is produced, he says that it is hopeless to review satisfactorily or analyze minutely the testimony of the five hundred witnesses contained in a record of over six thousand pages. It is evident from the short space of time that the court took to render its decision that the briefs of the opposing counsel were the foundations for it. The high character of these documents was assured by the names of the counsel for the respective parties.

They are anything but brief in the number of their pages. Taking the successful complainant's brief as an example, it forms a large octavo volume of five hundred and thirty-six pages, without counting the index and contents table. It begins with a table of contents occupying fifteen pages. This is so well arranged as to present a summary of the whole case for the complainants. In it may be read the abbreviation of the five hundred pages of argument that follow it in full detail. Even the table of contents is in two divisions, one a summary of the other—the first division giving in some twenty lines the main branches. A short index follows, and then the text commences.

A summary of the whole case occupying thirty pages comes first, constituting in itself a brief of about the average length of such documents in patent cases. Next in order the regular argument appears, and fills up the rest of the volume. Thus as an aid to the reading of this last, a short and longer table of contents are given, followed by a general summary.

The text is most interesting. In it are described Bell's early struggles and experiments, his progress from doubt to certainty, and the bases on which he founded his structure of invention. The story reads like a novel. An interesting explanation of the theory of sounds, and of the subjects of pitch and *timbre* or quality, is given. The endeavor is to show that Bell followed, as far as was consistent with the new path that he was treading, a logical method in his experiments. His indefatigability is well portrayed. He consulted Professor Henry about his work, complaining that he had not the necessary knowledge of electricity. Professor Henry gave him the laconic answer, "Get it." The inventor renewed his experiments, and within a year presented his completed specification for a speaking telephone to the Patent Office. Throughout the period of labor Mr. Bell was very poor. For a part of the time he taught classes, devoting his days to them and giving his evenings to his experiments. At last, as the light of his discovery began to grow brighter, he gave up his classes, and borrowed money to live on. The death of Professor Henry is alluded to, which deprived the complainants of his testimony as to Bell's interview with him.

One of the great points of contest in the suit was as to the operativeness of the telephones of the Bell patent. Their inoperativeness had been testified to in other suits, but where it had been brought to an issue the court had decided in the patent's favor. This applies to former causes. In the present case the defendant's experts contended strongly that instruments constructed on the exact plan and relative scale of the drawings of the patent would not talk. Finally; it was sifted down to this: that the distance of the armature from the magnet was the important thing; and the point was made by, and allowed for, the complainants, that invention was not needed to determine this for each individual instrument.

Mr. Drawbaugh, the rival inventor, has his history minutely analyzed. He made many independent inventions, taking out patents therefor, and one feature of his work is insisted on and utilized by the complainants. In Judge Wallace's brief it is also enlarged upon. It is that the character of his inventions and patents has been that of improvements upon other inventor's productions. Complete originality, it is alleged, cannot be found in his devices. The implication is that he had furnished in his other numerous inventions a gauge of his abilities, and that he had not shown himself sufficiently a pioneer to be the real inventor of the telephone.

But another point against him, and perhaps the strongest, is that he never applied for any patent upon the telephone. This is one of the great centers of dispute. One side claim that poverty prevented him, the other side deny it. Page after page of argument and testimony are devoted by both sides to establishing their view of the matter. Whichever side is right, the lesson to inventors is obvious. It is the old story of diligence. When an invention is perfected, it should at once be patented. The annals of litigation are crowded with verifications of this axiom, but few are so impressive as this one, occurring as it does in the greatest of patent suits, and forming one of the most important issues therein. Too much cannot be said on the duty of early patenting of inventions. Many a meritorious inventor has lost the fruit of his toil from that reluctance to patent which so often is encountered by solicitors. Granting all that the defendants in this suit claim to be true, the failure to patent his invention may be said to have lost the case for Drawbaugh and his supporters.

The opinion of Judge Wallace is unusually long, covering sixty pages of law cap in type writing. In affirming his judgment, he follows to a great extent the views contained in the brief for complainants. A general review of that brief would serve as a synopsis of a great part of the opinion. He rejects the idea that Drawbaugh was too poor to patent his alleged inventions of telephones. He also declares his disbelief in Drawbaugh's capacity to make such an invention, and holds that it is immaterial whether Bell's invention can be traced back of the date of application for his patent. That date—February, 1876—was early enough, in the opinion of the court, to sustain the conclusion reached upon the merits of the issue. The general ground taken as to the burden of proof is contained in Judge Wallace's concluding utterance: "Without regard to other features of the case, it is sufficient to say that the defense is not established so as to remove a fair doubt of its truth, and such doubt is fatal." The decision was rendered December 2, 1884, after the case had been only two months under consideration.

The interlocutory decree was entered in the clerk's office of the United States Circuit Court, December 5, by Dickerson & Dickerson. The Master has been ordered to take and report an account of the gains made by defendants since June 23, 1880.

The recapitulation of the record of the case shows that each side had four volumes, aggregating 1,207 pages of exhibits, 5,239 pages of depositions, giving a total in the record of 6,446 pages. The number of witnesses produced by both sides was 535.

The case has been appealed by the defendants, so the final settlement is in the dim future.

While the case in the United States courts has been decided in favor of the Bell Telephone Company, an attempt has been made to do away with their Canadian patent. Arguments, closing on December 3, on a motion to set aside this patent, have been heard by the Minister of Agriculture of Canada. Three days were occupied, so the case has been very fully argued. The efforts of the disputants have been directed to prove that the patentees violated the Canadian patent law, which includes a number of provisions relative to the exploitation of patents, nothing analogous to which exists in our statutes. Thus it is claimed that telephones were imported into Canada by the Bell Company, that they refused to sell their instruments, and did not place them before the public at a reasonable price. These points, if sufficiently proved, would render a Canadian patent invalid. On the last day of the hearing, evidence was taken to show that the actual cost of manufacturing was $1.87 per instrument only. The defendants claim that they are in some sense entitled to a specially favorable treatment, if they have violated the letter of the law. They have spent enormous sums of money in Canada, and claim that the law should not be too literally applied to them.

The most interesting feature of the case to the United States telephone interest is the effect the decision of the Minister of Agriculture would have on the duration of the American patent had the Canadian patent preceded it in date. If the foreign patent were declared void, it might be construed to render void and invalid the American patent. The important decision rendered by Judge Blatchford some months ago, on the effect of lapsing foreign patents on United States patents, shows the rigorous dealing now awarded to patentees by the Supreme Court. It is among the possibilities that an adverse decision in Canada might thus affect the United States patent very seriously.

In discussing the interests at stake in the Bell-Drawbaugh suit, it is customary to put the sum at $100,000,000. This immense sum is based on the dividends paid by the company. They pay dividends upon such capital, and thus it is assigned as the value of their patents. But this is not a fair deduction. Their capital represents more than a patent right. Their franchises, implied or actual, and their prestige and commercial position, would not be wiped away even if their patent was declared invalid, and the market was thrown open to all competitors.

If any lapse of a foreign patent were to carry with it the American right, it would seem a hardship worthy of any special form of relief that could be granted. This is on the old principle of the meritoriousness and public service of inventors. They should be treated as a class of benefactors, not of monopolists, and should be deemed worthy of special protection. However great Bell's reward already reaped may be, the enormous service done to all humanity by the invention of the telephone should be sufficient to offset it.

HINTS TO INVENTORS.

The long winter evenings are now at hand, and afford an opportunity for those of an inventive turn to put their ideas into practical shape by perfecting devices that they have had in mind, or to cast about for something new on which to exercise their genius. Many manufacturing establishments have reduced their working forces, and railway repair shops have dismissed many ingenious mechanics, who will be idle for some months, and those men can make good use of their time by studying the wants of the people in the way of improvements, and supplying these wants. It is not the easiest matter in the world to know what to invent that would give satisfactory returns for the time and labor expended.

By way of suggestion, we will remark that the list of railway accidents, and the causes assigned for them, will serve to point out some of the inventions that are needed. One of the fruitful causes of winter railway accidents is snow and ice on the tracks. To remove this thoroughly and at the proper time would prevent a great many serious accidents, and although some very good appliances have been brought out for the purpose, there is yet room for valuable improvements in track clearers. As evidence of this, it will be mentioned that in the winter of 1882-83 there were 14 derailments from snow or ice and an equal number of collisions caused by colliding with snow-bound trains in blinding storms. To clear tracks from snow and ice requires two different appliances—one to remove the loose snow and more compact drifts from above the surface of the rails, and the other to clear the flangeway down nearly to the spike-heads. Another matter that inventors will do well to study is to provide some reliable signal by which disabled trains may warn other trains in time to prevent collisions, and also to prevent collisions at crossings. For the year ending Sept. 30, 1883, there were reported 634 collisions in the United States. Some of these were of such a nature as to their causes that no system of signals would have prevented them, but they were few.

There were 403 rear collisions, 191 butting and 39 crossing collisions, and one passing collision. Some of the rear collisions were caused by trains breaking in two, and were non-preventable, and the passing collision could only have been prevented by greater vigilance on the part of the operatives. A system of signals is wanted that will enable the crew of a disabled train to warn trains in either direction without relying on sending signal men, who too often fail to stop approaching trains in time to prevent disaster. In the same year were 44 derailments from cattle on the tracks. This is evidence that a better pilot, or "cowcatcher," is in demand—one that will render it impossible for any animal large enough to cause mischief to get under the wheels. In that year were 92 derailments from misplaced switches, although there are safety switches and many so-called safety signals in use. The general trouble with those appliances is that they are complicated and liable to derangement, and they are not reliable at all times. Besides switch accidents, there were 3 draw-bridge disasters from failures of the signals. Let us have reliable switch and draw-bridge signals that are not too expensive. For the same period 92 derailments are reported from spreading of rails, and from this it seems that something stronger than spikes and ordinary rail fastenings are in demand.

Accidents of this kind are usually serious in their results, and a rail fastening that will effectually prevent them and not shorten the life of ties is wanted. Many lives are lost by contact with overhead bridges. The most effective remedy for this is to build the bridges high enough to clear the head of the tallest man when standing on the top of the highest car; but as this matter is neglected by commissioners and other authorities, it remains for inventors to produce some better means of warning of the approach to such bridges than is in use. Accidents at highway crossings are frequent, notwithstanding the many alarms that have been invented to warn people of approaching trains. A reliable automatic alarm is still among the necessities. Connecting rods frequently break, and a new form of rod is in demand—one that will not weaken by its own weight. Washouts of road bed, cattle guards, culverts, and bridges are frequent cases of mischief. It seems as if it would not require a great exercise of ingenuity to provide some effective means of warning engineers of any displacement of embankments or other substructures by water, or destruction or weakening of bridges, culverts, etc., by fire. Land slides and bowlders come in for a share of causes of serious accidents, and perhaps many of them may be prevented by an arrangement of signals operated by wires so arranged that earth or rocks would come in contact with them on or before reaching the track. The foregoing will give inventors some idea of what is wanted, aside from the safety car-coupler; and although devices for all the purposes mentioned are in use, few of them are satisfactory in all respects, and to remedy the defects in these appliances is an inviting field for inventive minds. H.

THE DELAY OF BUSINESS IN THE PATENT OFFICE.

It has become a matter of universal complaint among inventors and patent solicitors, that business in the Patent Office in Washington is greatly delayed. Over thirty-five thousand patents per annum are now applied for. Soon the number will have increased to fifty thousand. In view of the immense number of interested parties, it may well be asked if there is no way of expediting the work of the Office, and the first remedy for the evil that presents itself is to increase the number of examiners. It is well known that there is a large annual surplus in the accounts of the Office, and it seems only just that this money, which is the contribution of patentees, should be used in furthering their interests. As it is now, it lies idle in the Treasury, and keeps on accumulating from year to year. But so much has been said on this topic that it has become a trite one.

If the Commissioner of Patents were a man of proved executive ability, one who had the power of systematizing work, and supervising its details as executed by a number of subordinates, it would probably make a great difference in the work. In selecting a Commissioner, other things being equal, a good lawyer is supposed to be the proper person. But while good legal attainments are desirable, the power of expediting work should not be underrated. With the same force an energetic business man, who would not occupy himself with unnecessary disputation, could certainly do much more than one who was only a lawyer. In an old established department like the Patent Office, everything is done by routine that has resulted from years of habit. The question is whether the routine could not be improved upon, whether more work could not be done with the present number of examiners and clerks than hitherto.

To bring about any such result, it would be necessary for the Commissioner to take charge of the whole system with its array of officers. He should consider himself the head of the examiners, not merely in a judicial, but in an executive sense. He should give personal attention to the work of each room, and try to bring on the most laggard, by transferring clerical or other aid; thus a great improvement might be affected. It is impossible to resist the impression that from a business point of view the office is allowed to run itself to too great an extent. The examiners are many of them old and tried servants of the government, whose long years of service have conferred upon them prescriptive rights. But the right of being left alone can hardly be included among these. They would undoubtedly resent any direction of their labors, even by their superior, the Commissioner, as an insult, or at least an unpleasant interference. But such interference should take place. The rule in all such offices is that a good shaking up is beneficial. The process should involve no hardship to any one beyond a disturbance of the mere sentimental part of human nature. That such a reorganization is periodically necessary in business offices is an old story. There seems little or no doubt that more could be done in the Patent Office without increasing the force.

The ordinary attorney's fee for soliciting a patent is twenty-five dollars. This is ten dollars less than the government charge for granting one. It does not seem probable that the Patent Office has as much work to do in the matter as the solicitor, yet the government receives nearly one-third more compensation. If a solicitor were to venture to conduct his business on the dilatory principle of the Patent Office, a very few months would be required to dispose of his *clientele*.

The examiner has simply to verify the general correctness of the solicitor's work, and make a search into the novelty of the device. He should be able to dispatch business unusually fast. Unfortunately, the rule of practice appears to be the reverse.

As the matter now stands, the letters patent granted give the merest *prima facie* evidence of novelty. They stand for very little in the courts, beyond a certificate of registration. It may, then, be questioned whether it would not be more satisfactory, and more in accordance with the spirit of the patent statutes, to abandon the long and dilatory search, and let every patentee do his own searching, or have it done by an attorney. If this course were followed, a patent would be just as good in the courts as it is to-day, and a very serious problem would be solved. For as the number of patents increases, not only does the work increase directly with the applications, but the magnitude of the records that are to be searched increases year by year. To add to this latter trouble, the English patents, under the new British law, are increasing almost as rapidly in number as our own.

If every patentee were allowed to be the examiner for his own application, he would have every inducement to do the work well, or have a competent attorney or expert do it for him. He would know, he knows now, that a patent for an invention not new cannot stand in court, and he would have every inducement not to waste his money on a worthless patent.

Color Printing.

The Universal Printing Company, London, have recently introduced a process, called after its inventor the Hoeschotype, for the photographic reproduction of colored pictures. Five colors are used in this process—yellow, red, blue, gray, and black; these five form the base of a large key map of tints, each one divided into five grades, containing, so to speak, respectively one, two, three, four, and five fifths of any of these colors. In combining these tints by printing two or more above each other, a large variety of over 1,600 shades are produced; the colors must, of course, be transparent for this purpose.

To reproduce a picture, for instance a portrait, the painted original is at first photographed and copies printed. One of these copies is now taken in hand by an artist, who by means of his color scale ascertains for each spot in the picture the amount of yellow contained, and he covers that particular spot with an equivalent shade of gray, painting out with white at the same time all those parts of the photographic print which in the picture are to contain no yellow. This process finished, a negative is produced from this painted sheet, and a print taken on sensitized gelatine mounted upon plate glass. It will be understood that this gelatine print only represents a picture of those parts in which the artist wishes yellow to appear, and in different degrees of density. In other words, after this gelatine is washed and rolled up with yellow transparent pigment, an impression can be taken from it on paper.

In a similar manner gelatine printing surfaces are prepared of the rest of the colors—red, blue, gray, and finally black; they are all printed one above the other on one sheet in perfect register, and the result is a reproduction of the original colored picture, as near as the skill of the artist who prepared the copies for the colored plates and the perfection of pigments will admit. Tedious though this process appears, and depending as it does on the skill of an artist, the result is admirable. The glass plates carrying the gelatine film are placed upon the bed of what appears a well built litho press. The ink used is very stiff, and the inking operation, performed in the usual way by rollers, is repeated twice for ever one impression to insure perfect distribution. The sheets are laid on to exact register, and printing by power is performed at the rate of about 100 copies per hour. The presses are capable of printing up to 25 inches by 35 inches in color, and if smaller subjects are worked, two or more can be placed on one plate.

Kinds of Horses Best to Raise Here.

At a recent meeting of the New York Farmers' Club, numerously attended by owners of fine stock, the after-dinner discussion was on the above subject. One member thought the Percheron horse, as one on which the farmer could be reasonably sure of making a little more than his expenses, was about the best for farmers to make a business of raising in the Eastern States. It was a breed which could be used at light farm work from two years old until fit for market, at four, and thus made to pay for its keep.

This breed of horses had the requisite size and muscle to be fit for city trucking work, and they had the peculiar power of impressing their stamp upon all sorts of mares, raising from even a small broncho of 600 or 700 pounds a colt that would sometimes weigh 1,000 at a year old, and be of admirable proportions. The animal is of great endurance, coming to maturity early, but should be broken to halter very soon after birth.

The Norfolk roadster was another horse suggested as admirably adapted for breeding purposes, being short-legged, short-backed, sloping-shouldered, thick-bellied, good-bowed, clean-footed, clean-breasted, with high action and good wind, and a horse which, so far from being exclusively English, could be found in Kentucky of a very high grade. Frenchmen themselves preferred such horses to the Percheron, and the governments of Prussia, France, and Italy had largely imported this breed to improve their own stock for cavalry purposes. Of English horses there are three general grades, the thoroughbred, the coaching animal, and the nag or roadster, the second being considered the most profitable for farmers to raise.

The feeding of ensilage to horses was adversely commented on by one member, who had lost eight horses thereby in a brief period, the cause of the disease being attributed to ergot in the corn of which the ensilage was made.

Boring Insects.

At the International Forestry Exhibition, in Edinburgh, Professor McIntosh recently delivered a very interesting lecture on "The Boring of Marine Animals in Timber." The lecturer stated that so far as we know at present sponges only bored calcareous substances, while annelids never bored wood. The purple sea urchin bores gneiss and granite by means of its teeth. The crustaceans and mollusks were the chief borers of wood. Of crabs, the *Cheluria terebrans* is even more destructive than the common Scotch crab or "gribble" (*Limnoria lignoram*), which Robert Stephenson found so injurious to the Memel beams supporting his temporary beacon on the Bell Rock. The gribble attacks all kinds of timber, and the piles of the Trinity Chain Pier at Leith had formerly to be replaced every four years owing to their ravages. It also bores into submarine cables, thus rendering them faulty. The xycophago, a small bivalve mollusk, is also very destructive of wood, entering it while young and growing to maturity inside. The teredo, or ship worm, is, however, the most fatal wood borer known, and occurs in every ocean. It bores tunnels into the wood from one foot to a yard in length, and is still more wasteful to Dutch and French harbor works than to British.

Two theories are advanced to explain the cutting of these creatures, one chemical, the other mechanical; but traces of acid solvents were only found in some calcareous borers, and they also occurred in animals which did not bore. On the other hand, silicious cutters have been found on some borers, such as the teredo. With regard to preventives, the Dutch Commissioners have recommended creosote for internal application to the wood, and metal sheathing for external. Professor McIntosh, while admitting the value of the Dutch investigation, pointed out that there was still much to be learned on the subject, and recommended it to the new marine laboratories now in progress. He also showed that the function of the borers was advantageous when it resulted in the destruction of sunken ships and waste timber floating on the sea.

The Purchasing Power of Money.

We notice the following in one of Mr. Atkinson's papers, read in 1882: "To the workman, or to the workwoman, it matters not what the measure in money is by which their wages or earnings are defined. The real question is, How good a house, how large a room, how adequate a supply of food and fuel and clothing can I purchase with that money? It therefore follows that every application of science to manufacturing industry, to mining, or to agriculture, by which the aggregate of things is increased while the labor is diminished, tends to increase the quantity of commodities to be divided among the laborers; and as this increase is progressive year by year, the proportion which capital can secure to itself under free contract becomes less, while the proportion which is assigned to laborers becomes greater."

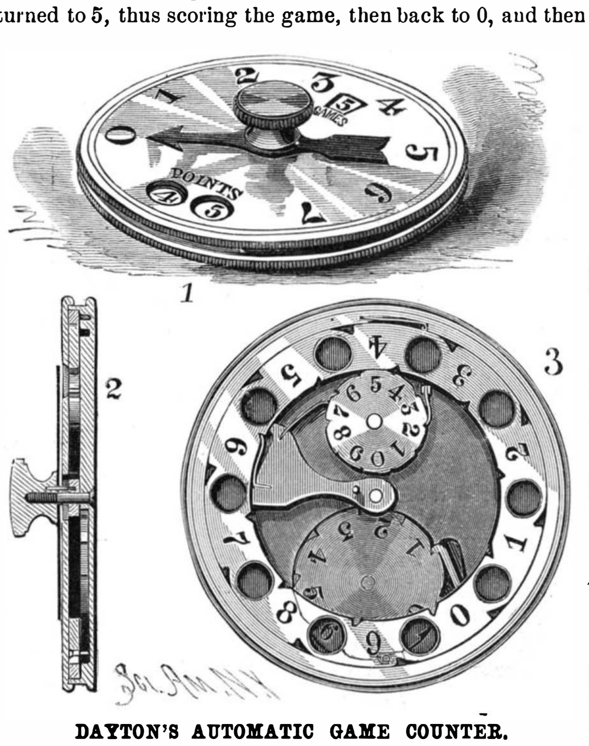
AUTOMATIC GAME COUNTER.

The annexed engravings represent a game counter that is compact, convenient, and useful for nearly all games of cards, and is especially adapted to the modern game of whist. This counter, besides scoring the points made in each game, indicates and records the aggregate number of games and points made during a series of games. It can be readily set for games of five or seven points, and it will record up to nine games and ninety-nine points inclusive. By moving the arrow or pointer in a certain manner, either the games or points can be worked independently of each other.

This counter is supposed to be set for a game of five points. Before beginning the game the arrow should be placed at 0, and the apertures in the dial should also show ciphers. To do this the arrow is turned from 6 to 7 until the aperture "games" registers 0. By turning the arrow from 0 to 6, and forward and backward between those figures, ciphers will appear at the lower apertures marked "points."

As the game progresses and points are made, the arrow is turned by the knob from left to right as the points are made up to 5. When this number is reached the figure 1 appears in the aperture marked "games," and the figures 1 to 5 appear successively as the points have been made in the lower apertures marked "points."

The arrow is then turned back to 0, and as the play progresses in the new game and points are made, the arrow is moved and the number of the accumulated points is registered in the lower apertures, showing the whole number of points made, whether a game has been won or lost. When the game has been won by the opponent, the arrow standing wherever it may happen to be (between 0 and 5) must be turned back to 0 before beginning the new game. If more points are made than enough to finish the game, the arrow must be turned to 5, thus scoring the game, then back to 0, and then forward to the number of points of surplus or laps made. If desired for clubs, etc., the counter can be made so as to register ninety-nine games and nine hundred and ninety-nine points.



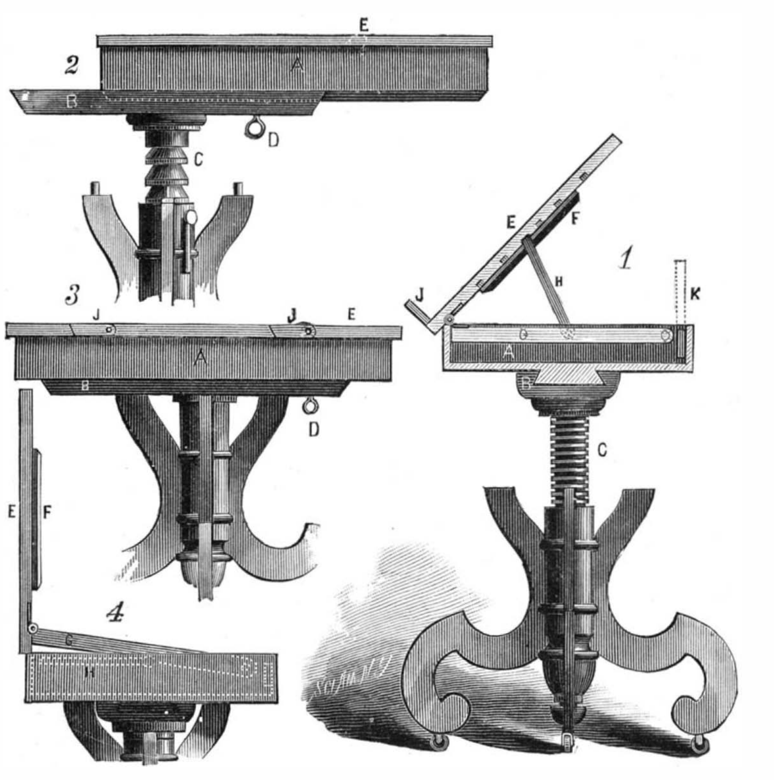
DAYTON'S AUTOMATIC GAME COUNTER.

The counter has been made in nickel plate, and has also been made and set in a watch case, and works in a similar manner as the one above described, the small or hour hand taking the place of the arrow, and noting the points on the dial, the long or minute hand recording the total number of points made, and the second hand recording the games, all worked directly by the stem. The figures on the dial are in two colors, making it a very neat and attractive article. These goods are not on the market yet, but arrangements are being made to place them at a reasonable and moderate cost.

The invention has been patented by Mr. Frank Dayton, of Portland, Oregon; New York address, P. O. Box 1967

A NOVEL TABLE.

The under side of the table is formed with a central track plate which fits in a groove in a plate, B, held on the end of the spindle, C; the track plate is locked in place by the binding screw, D. The spindle passes into the top of a tubular standard supported by a suitable base of any desired shape, and can be screw threaded as shown in Fig. 1, or provided with a series of grooves forming beveled annular shoulders, in which case the standard is furnished with a spring catch (Fig. 2), the end of which projects through the standards so as to engage with the shoulders. When the spindle is formed with shoulders, the upper ends of the arms are provided with upwardly projecting pins that pass into holes in the bottom of the plate to hold the table steady and in place when lowered. The top plate, E, is hinged to the ends of two arms, G, pivoted at the opposite ends to the inner surfaces of the end pieces of the table; both longitudinal edges can thus be swung upward. The braces, H, fold into grooves in the upper edges of the end pieces of the table, and their upper ends enter apertures in the under side of the top plate. When the plate, E, and arms, G, are turned upward together on the points of the arms, they are supported in an inclined position—the reverse of that shown in Fig. 1—by the braces. A mirror, F, is secured to the under side of the top plate, to which are attached the clips, J, that fit in recesses and can be turned upward to prevent the book or paper from sliding off. The table can be adjusted vertically by means of the spindle. When it is to be used as a sick bed, it can be extended laterally by drawing the top in the direction in which it is to project, and locking it in place with the binding screw. It can thus be adjusted to project partly over a bed or sofa, so as to be very convenient for the person using it. By resting the top plate on the arm, K, it may be used as a writing desk. It may be adjusted as a toilet table by swinging the top into a vertical position.



KOSSBIEL'S NOVEL TABLE.

Further particulars may be obtained by addressing the inventor, Mr. Charles Kossbiel, of Cuero, Texas.

Gas from Pinewood.

M. Combe d'Alma, member of the Agricultural Society of La Gironde, has succeeded in producing illuminating gas by the distillation of the sea pine (*Pinus maritima*). M. D'Alma was engaged at St. Nerac (Lot-et-Garonne) in the production of a special kind of macadam; and part of the process consisted in baking clay. This was effected by the aid of the pinewood found in the district, which formed excellent fuel. It occurred to M. D'Alma, however, that it would be more advantageous to employ not the wood itself, but the gas which might be produced by its distillation. He therefore at once obtained permission to conduct a number of experiments at the gas works in the town, and eventually succeeded in producing a gas with which he supplied the public and a considerable proportion of the private lights for two nights in succession.

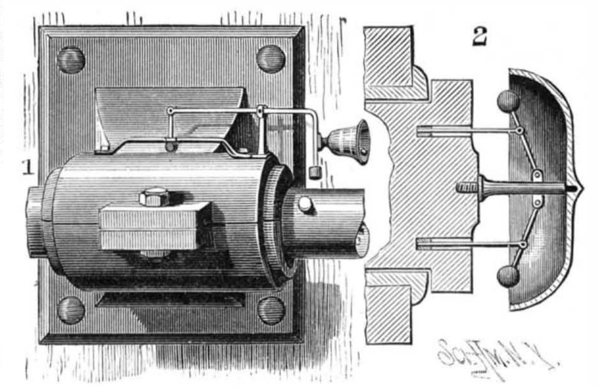
On the first night the effect was not altogether satisfactory, owing to the material used being sodden and of bad quality; but on the second occasion the lighting was entirely successful. The event caused some excitement among the municipal authorities, who appointed a commission to vouch for the success of the experiment. This they did, and have since expressed a desire that the matter may be taken up by the municipalities of those places in the southwest of France where this particular species of pinewood is to be found, with the view to its profitable utilization for gas making purposes. M. D'Alma has satisfactorily proved that the distillation of pinewood in closed vessels is thoroughly practicable; and he believes that the resulting gas could be produced at a much lower cost than that of ordinary coal gas, while the sale of the residual products (charcoal, tar, and an acid liquid) would defray the whole expenses of manufacture.

Close of Another Year.

One more number, and volume fifty-one of the SCIENTIFIC AMERICAN will close, and with it several thousand subscriptions will expire. To save the removal of such a large number from our subscription lists, and insure a continuance of the paper without interruption, subscribers will be benefited and our subscription clerks greatly relieved by the remittance of subscriptions before the year closes.

AUTOMATIC ALARM FOR BEARINGS.

The engraving shows a device for giving an alarm or signal when the bearings of shafting or parts of machinery become overheated by friction. A fusible head is attached to the end of a wire connected with a lever fulcrumed on a post fastened to the box. The outer end of the lever is bent downward to form an arm to which a bell is connected, and the end of the arm carries a foot piece which is struck by a stud on the shaft when the bearing becomes hot enough to melt the fusible head. This head is held in contact with the bearing by confinement beneath a bridge piece, through which the wire passes loosely. It is evident that when the head melts, the weight of the bell will carry the arm of the lever down to the shaft, when the stud, striking the arm, will ring the bell at every revolution.



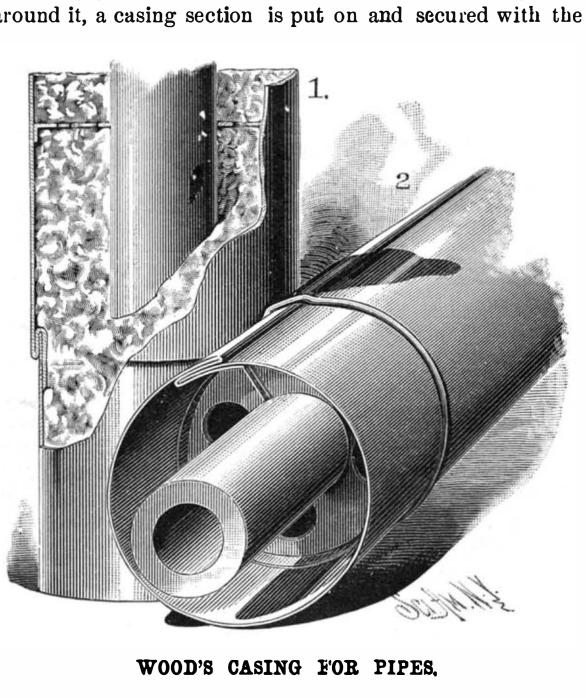
O'CONNELL'S AUTOMATIC ALARM FOR BEARINGS.

Fig. 2 shows the device applied to the crank pin bearing of an engine. The outer end of an arm carries a gong bell. The clappers are loosely connected with the arm and, by wires, with fusible plugs fitted snugly into end bores in the wrist pin. The clappers are thus held out of contact with the gong until the overheating of the bearing melts the plugs, when they are thrown outward by centrifugal force to sound the gong. This device may also be applied to give an alarm by the overheating of reciprocating or sliding surfaces.

This invention has been patented by Mr. John O'Connell, of 309 Broadway, Providence, R. I.

CASING FOR PIPES.

The engraving shows a casing for holding non-conducting material—such as mineral wool, etc.—on pipes, and which can be easily applied and fitted, and closed and locked without requiring the use of solder. A disk formed with a central opening to receive the pipe is of such size as to fit within the casing. It is cut open to permit placing it on any desired part of the pipe, and has its outer edge bent down to form a flange. A series of apertures is punched in the disk to allow the non-conducting material in the different compartments to unite by the fibers passing through. A sheet of metal from which a tube section is made has one edge creased to form a longitudinal pocket for receiving the other edge of the plate; the pocket is formed a short distance from the edge, so that when the free edge is in the pocket the edges will overlap. The joint is shown very clearly in Fig. 2. The edges of the casing sections are overlapped, and then held together by pins or nails passed through holes. The sections can thus be opened very easily to pass them around the pipe and to put in the filling material. One end edge of each section is creased to form an annular pocket to receive the adjoining edge of the next section, as shown in Fig. 1. When a pipe is to be covered, a series of disks is placed around it, a casing section is put on and secured with the pins or nails. When filled with the non-conducting material, another section is placed adjoining it.



WOOD'S CASING FOR PIPES.

This invention has been patented by Messrs. James F. and John F. Wood, of Wilmington, Del.

ENGLISH crown soap is an imported soft soap used by harness makers and the like for rubbing and polishing leather.

Removing Paint from Iron.

Mr. A. J. Bishop, of Cleveland, O., says: The greatest difficulty I have found in using potash has been to have it remain where put, and not run off of the work. By making various experiments, I have found that good lime used in proper proportions with the potash will not only make it remain where put, but is also a benefit to the strength and quickening of the potash, the lime acting upon the grease more readily; when too great an amount of lime is used, it has a tendency to harden upon the work, and then is as difficult to remove as the paint when first starting. One can also, I find, use too great an amount of potash; in like manner, if the liquid is too strong and lime is used, it has a tendency to crystallize and become hard. There are some objections to using potash, as it may injure the hands or clothes of the user, but to avoid this I have made use of hemp packing fastened to a stick, say two and a half or three feet in length; this gives the workman plenty of distance from his work, and he does not injure himself or his clothes, and also gives him a good swab or brush with which to apply the potash.

Another objection is the surplus of potash which may be left to remain upon the work, which, if not thoroughly removed, is injurious to the durability of the paint when repainted; but this can be avoided by extreme care being taken to remove the potash. In making tests to obtain proportions and results of different strengths of potash and lime, I obtained the following: My first was composed of 5 pounds lime, 6 pounds potash, and 7 quarts water; my second, 5 pounds lime, 4 pounds potash, and 7 quarts water; and I found that the latter was two hours the quickest in removing the paint from drivers of the same engine. Another trial was made with 14 pounds lime, 12 pounds potash, and 21 quarts of water for four pairs of drivers, and with this I found that it required equally as much time to remove the surplus of lime left upon the drivers as it took in the first place to remove the paint. Other tests, being made of 1 pound lime, 4 pounds potash, and 6 quarts of water, I found to work much better than any previously tried, and am satisfied that this proportion is about right. These tests were made with crushed potash. The average time required to remove paint from two pairs of drivers has been two men, seven hours, while the time for scraping for same men would reach three and four days for same work. The paint has been removed from a tank by two men in seven hours, and other parts of a locomotive in a proportionate length of time, while with heat for burning same, or scraping cold, the time is beyond mention for comparison.

Ordnance for Harbor Defense.

The report of the Armament Board appointed in pursuance of an act of Congress to make certain tests of artillery has been made to the Secretary of War. The Board interpreted the act of Congress under which it was appointed to refer only to mortars and guns of high power for the defense of harbors, and did not take into consideration the lighter guns required for the flank defense of permanent works. The Board first directed its attention to the depth of water in the channels leading to all of the seaports, and then ascertained the number and thickness of armor of the known ironclads of the world which would enter these harbors. The powers of the guns necessary to penetrate these armors were then calculated, and the number of guns considered essential for a proper defense of the harbors was decided upon. In that determination the Board was guided by a list of guns and mortars which had been prepared by the Board of Engineers for Fortifications after careful study of the subject.

The Board submits tables which embody its views, and which, summarily stated, call for 125 eight inch guns 21·5 feet long, to weigh 13 tons each and to carry projectiles weighing 285 pounds; 226 ten inch guns 26·875 feet long, to weigh 25 tons, and to carry projectiles of 575 pounds; 306 twelve inch guns 35·11 feet long, to weigh 48 tons, and to carry 894 pound projectiles; 50 sixteen inch guns 45 93 feet long, to weigh 107·77 tons, to carry projectile of 1,631·4 pounds each; 512 twelve inch mortars 10 33 feet long, to weigh 13·06 tons; and to carry 610 pound projectiles. These guns will have a penetrating force at 5,000 yards through thicknesses of wrought iron as follows: 8 inch caliber, 10·39 inches; 10 inch caliber, 15·16 inches; 12 inch caliber, 17·25 inches; 16 inches caliber, 23·20 inches.

In conclusion the Board states that it deems it of the utmost importance that the guns and mortars above specified should be procured at the earliest date practicable.

A Formula for Nervous Headache.

From the *Maryland Medical Journal* we note that Dr. A. L. Hodgdon, of Farmwell, Va., recommends the following recipe for nervous headache:

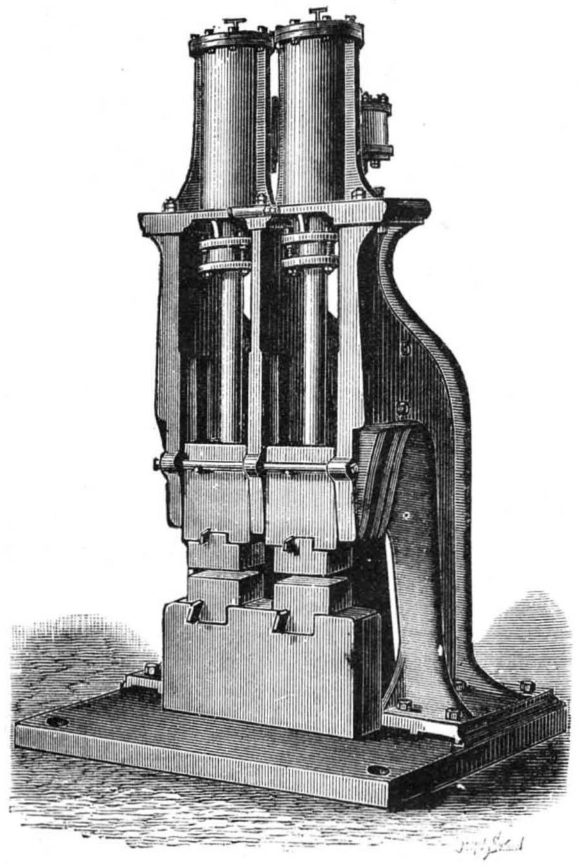
℞. Alcohol dilut. .... ℥ iv.
Olei cinnamom .... ♏ iv.
Potas. bromid .... ʒ v.
Extr. hyoscyam. fl. .... ʒ iss.
Fiat lotio.

S.—One to two teaspoonfuls, if required.

Dr. Hodgdon has used this combination with universal success. It is not disagreeable to take, and has no bad effects.

DOUBLE STEAM HAMMER.

Messrs. B. and S. Massey, of Manchester, have recently constructed for Messrs. Tangye, Birmingham, a specially



DOUBLE STEAM HAMMER.

designed double steam hammer. There are, as shown, two hammers of the same size, which can be worked either together or independently. By this arrangement one hammer may be delivering sharp and rapid blows while the other is striking slowly and heavily, or one may be stopped entirely while the other is at work. This arrangement of double hammers is intended principally for work which requires to be passed quickly from one to another at the same heat, and as the two tups or hammer heads are not more than about 4 inches apart, this can be done with greatest facility. As compared with two separate hammers there is also a reduction in expense, as one base plate, one anvil block, and the central member of the framing are common to both hammers. For the same reason there is also a saving in the foundation and in the floor space required. The falling weight of each hammer, independent of top steam, is 7 cwt. It may be added that the arrangement is applicable to three or more hammers should they be required, and is not confined simply to a pair of hammers, as shown in our illustration

FRANKEL'S REGISTERING DYNAMOMETER.

The apparatus shown in the accompanying engraving is designed for ascertaining the stresses that occur in metallic bars under variable loads, and not only for observing them, but also for writing their true history from instant to instant. It makes the bar itself write this, and allows the observer to ascertain when the experiment is ended and what has taken place, and to draw all the deductions therefrom that he pleases.

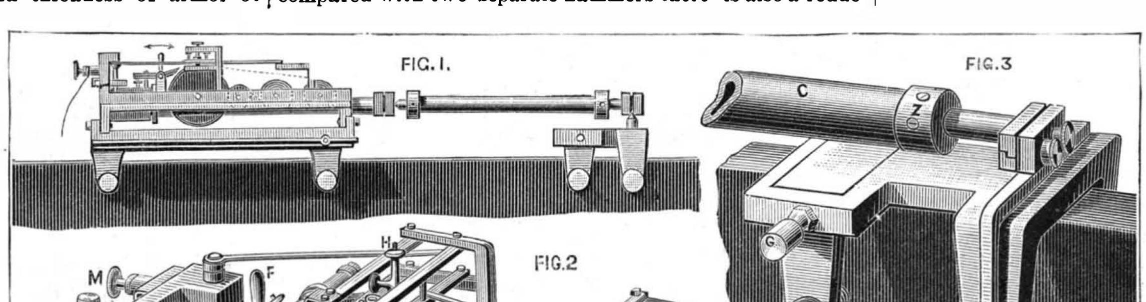
Every one knows that when we pull on a wire or rod it elongates. If the bar be compressed, it shortens. The whole science of the calculation of resistances is founded upon the simple fact that, in the same rod, the elongations or contractions are proportional to the stresses undergone. And, again, such variations in length are proportional to the stresses per unit of section per square millimeter (1 millimeter = 0 0394 inch), for example, in rods of any dimensions whatever. This is what is taught by the theory of elasticity.

It is this very simple property that Dr. Frankel has utilized in the invention of his registering dynamometer.

He takes a certain length of the wire that is to be examined, fixes clamps to its extremities, and makes it inscribe upon an unwinding sheet of paper the variations that it is undergoing in length. For example, knowing that with iron a length of one meter (39·4 inches) increases 0·05 millimeter when the tension that is exerted is one kilogramme (2·204 pounds) per square millimeter, it will be easy, by measuring the elongation inscribed upon the paper, to find how much the section of the bar experimented with has been stretched or compressed per square millimeter.

The principal part of the apparatus consists of a cast iron frame, A (Figs. 1 and 2), which is firmly fixed to the rod experimented with by means of a binding screw, and which carries the registering mechanism. Along one of its sides, and parallel with the bar, there is a round movable rod, whose head, L, projects from the frame and receives a small sphere that belongs to another hollow rod, C, about 0·8 meter (31·5 inches) in length. The other extremity of this latter carries an analogous sphere, which is set into a head like the first (Fig. 3), that is carried by an independent jaw fixed to the bar. The screw, *b*, of this jaw, and the corresponding screw, *a*, of the frame, A, determine the length of the bar on which the experiment is made. The head, L, being fixed to the jaw, the rod, C, will be carried along if the bar elongates or shortens, and, while at the same time keeping at a constant length itself, its other extremity will move with respect to the principal frame, A.

Let us imagine, then, that such extremity has a plane surface, and that against it there presses, under the influence of a spring, a small sphere carried by a lever jointed to a fixed axis. This part is unfortunately hidden by the apparatus (Fig. 2). Every motion of the rod, C, will cause the lever to move, and if the proportions of its two arms are properly chosen, its other extremity will amplify the motions of the little sphere that is in contact with the rod. A new transmission of motion, effected by means of a pinion and a toothed sector, will permit of a further amplification of the motions observed, and, without our entering into details, it will be seen that we shall finally obtain, through the inscribing pencil, H, motions that will be an exact multiple of the deflections of the head of the rod, C. In the apparatus, as constructed, this multiplication is always about 170 times the variation of the length to be measured. In starting from the figure indicated above, it will be readily seen that if a millimeter per meter of real elongation of the rod corresponded to a stress of 20 kilogrammes per square millimeter, one millimeter of the diagram obtained would correspond to $\frac{20}{170}$ = 0·117 k. (4·14 ounces) per millimeter (0·0394 inch).



FRANKEL'S REGISTERING DYNAMOMETER.

The inscription is made upon a paper which unwinds slowly under the pencil. The cylinder, Q, contains a tension spring which does the unwinding, and the motion of the paper is regulated by a clockwork movement in the drum, D. The other, and intermediate, drums are designed for regulating the tension of the paper and keeping it close to the surface upon which the pencil bears. The rectilinear motion of the latter is obtained by an upper parallelogram, and, in order to have a sure datum point, a second pencil, near a lever handle, F, traces a continuous line to which are easily referred the ordinates of the curve obtained.

As the paper unwinds with a certain velocity, it is important that it be not wasted when no experiment is being tried. For this reason the starting may be effected by hand or electrically by means of the lever, F, and it may be rendered automatic, especially, for example, when a train is about to cross a bridge whose working it is desired to examine. The stoppage is effected by the hand of the observer. The same electric current also causes datum points to be marked upon the paper that permit of mathematically ascertaining the instant at which an observation should be made; for example, when the passage of a wheel is occurring at a precise point.

The curves that are obtained upon the paper are much finer than would be expected, in view of the slight variations in length observed. We give herewith two specimens of the tracings, reduced to a small scale, and showing a registering that has occurred during the passage of trains and locomotives.

Fig. 4 relates to an observation made upon a Zove's iron sleeper placed under a rail over which passed, first in one direction and then in the other, a four wheeled locomotive and its tender. It will be seen that one of the wheels, which was more loaded than the other, has produced greater stresses.

In the original, as one millimeter of ordinate represented a stress of 0·12 k. (4·54 ounces) per square millimeter, we conclude therefrom that the iron has undergone during the passage a maximum stress of $0·12 \times 75 = 9$ kilogrammes (19·85 pounds), due to the first wheel of the engine, a little less for the second, and then a stress of 4·92 k. (10·85 pounds) per millimeter,* due to the tender. After the passage, the stress has disappeared with the elongation of the metal.

Fig. 5 gives a tracing produced by the instrument fixed to one of the terminal lattice bars of a bridge girder during the passage of a freight train pushed by an engine. The

Figs. 4 and 5.—SPECIMENS OF THE CURVES OBTAINED.

train having come on slowly and then stopped, the pencil has traced a but slightly varied curve. It seems that during this time an equilibrium was established quite slowly. There will be observed two sudden projections of the curve, due to the machine being momentarily out of regulation; but when the train began to move again it will be seen that there occurred variations due to the successive passage of the wheels at the point corresponding to the diagonal. We can perceive quite clearly (and better yet in the original tracing) every car that is passing. Then finally comes the locomotive, which produces a maximum stress; and after this the bridge, being entirely unloaded, gives no further tracing of the weight that has just left it.

The apparatus is not limited in application to fixed pieces, but, in spite of its apparent delicacy, may be attached to the connecting rods of locomotives, in order to register the alternate tensions and compressions to which they are submitted.—*La Nature.*

The Proposed Saharan Sea.

With reference to the daring French project for flooding the desert of Sahara with what would be virtually a new sea, it may be well, says *Engineering,* to recall the opinion expressed by M. Elisee Reclus, that at one period in the world's history the desert was covered by a sea very similar to the Mediterranean, and that this sea exercised a very great influence upon the temperature of France, as comparatively cold —or at any rate cool—winds blew over it, while now the winds which prevail in the great expanse are of a much higher temperature, and are, in fact, sometimes suffocatingly hot. The appearance of the desert seems to support the theory of M. Elisee Reclus, that it was at one time the bed of a sea of considerable extent, of which the great inland African lakes recently discovered are possibly the remains.

The present vast extent and configuration of the African continent would also appear to support the conclusion that at one time it comprised a less area of land than it does at present. The serious question which arises, assuming that the theory of M. Elisee Reclus is substantially correct, is, What will be the effect of the creation of a second African sea in the room of that which has disappeared? Would the temperature of France, and possibly even of England, be again reduced? It is a geological theory that in the glacial period of the world's history Great Britain was covered with ice and snow very much as Greenland is at present. Some great influences must clearly have been brought to bear upon France and Great Britain, which rolled the ice over so many hundred miles northward. What was this influence? Was it the large African sea which French enterprise is endeavoring to recreate? If it were, we should say that whatever the French may gain in Africa by the realization of a Saharan Sea would be much more than counterbalanced by what they would lose in France itself.

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* Approximately, 1 millimeter = $\frac{1}{25}$ of an inch.

THE NEW ORLEANS EXPOSITION.

This great enterprise, illustrated on our first page, has steadily grown in proportions from the day of its inception to the date of opening. Originally proposed by the Cotton Planters' National Association in October, 1882, to signalize our first exports of cotton one hundred years ago this fall, the plan was successively enlarged to cover also a National and International Industrial Exposition, as the importance of cotton itself, in all its relations to the commerce, the industries, and the general well being of the world, seemed to grow upon the minds of the originators of the project.

With this also there has undoubtedly been a great deal of patriotic emulation among the people of the Mississippi Valley and of the far West, as well as of the entire South, to make this exhibition as pronounced a success as possible, in order thus to promote trade relations with Mexico, the West Indies, and Central and South America, which at present seem to afford the most promising fields for enlarging our foreign commerce.

The main exhibition building, which it was at first supposed would cover all requirements, is of the enormous size of 1,378 by 905 feet, or embracing an area of 33 acres, while the area of the main building at the Philadelphia Exposition of 1876 was only 20 acres. In this New Orleans building there are no partitions, and the interior is surrounded by wide galleries, 23 feet high, supported by the pillars which also support the roof, the latter being mostly of glass. The machinery department occupies a space 300 feet wide for the whole length of the main building, but this has been found insufficient, and large extensions have been made necessary by the great number of applications for space in this section. In the center of the main building is the Music Hall, with chairs enough to accommodate 11,000 people, a platform for 600 musicians, a mammoth organ, etc.

A special building for United States and State exhibits is 885 by 565 feet in size. Congress, besides loaning the management $1,000,000 to forward the enterprise, has made liberal appropriations for a most thorough representation of the leading departments of the government. The department of State will show here samples of cotton, wool, and other fibers, and their products, from all parts of the world. The Post Office department will show all the modern improved facilities in this branch of the public service, besides having working offices on the grounds. The Treasury will exhibit the work of the coast survey, lighthouse, and customs service, engraving, printing, etc. The War Office will make an imposing display of arms, ordnance, engineering, medical, surgical, and hospital service; while the Navy, the Interior, and other departments will all be more fully represented than they ever were before at one exhibition. Collective State exhibits and a general educational display will also be located in this building.

Horticultural Hall, 600 x 194 feet, has been substantially built as a durable structure to subsequently become the property of the city of New Orleans. It has a tower 90 feet high, roofed with glass, beneath which will be a grand fountain in constant play. Around this hall will be arranged a great variety of rare tropical and semi-tropical plants, flowers, and shrubbery. Cash premiums to the amount of $32,000 are offered in this department, and the contributions thereto will be largely from Mexico, Central America, and the West Indies.

The Art Gallery, 250 by 100 feet, is an iron building, calculated for permanent use for such purpose, in its arrangements for mounting pictures, giving them the desired light, etc.

The Mexican National building, 300 by 190 feet in size, will probably afford the most prominent of all the foreign exhibits. The whole space of this building, which was specially erected by the Mexican Government for the display from that country, has been found much too small for the exhibits offered. There is to be a famous Mexican band of fifty pieces in attendance, with a regiment of cavalry and another of infantry of the Mexican army. The Mexican Government appropriated $200,000 to further their national display here, and General Diaz, the Mexican President, announced his intention of being present at the inauguration ceremonies.

Notwithstanding that the opening of the exposition was postponed from Dec. 1 to Dec. 16, there was, as is almost always the case in such great enterprises, a good deal of dilatoriness among many of the exhibitors. This was most conspicuously the case with European participants, the principal portion of their exhibits being placed on the Great Eastern, which was not expected to leave London till Dec. 13. This great vessel, during the time of her stay here, will be not one of the least attractive features for visitors to the exhibition.

Besides the buildings above mentioned, there are several others, for individual exhibits, or as additions to those at first found too small for their original purposes, which are being and probably will continue to be erected for some weeks to come. The applications for space have, from the outset, outrun all the anticipations of the management; but the officers made every exertion to have the exposition in as complete shape as possible on the 16th of December, the day finally appointed for the opening.

The different groupings of exhibits, under which all articles wrought by man or produced by nature are classified, is as follows: 1, Agriculture. 2, Horticulture. 3, Pisciculture. 4, Ores and Minerals. 5, Raw and Manufactured Products. 6, Furniture and Accessories. 7, Textile Fabrics, Clothing and Accessories. 8, The Industrial Arts. 9, Alimentary Products. 10, Education and Instruction. 11, Works of Art.

The grounds on which the exposition is to be held consist of 247 acres, known as the City Park, about four miles from the business center of the city, and with a frontage of about half a mile on the Mississippi River, affording ready landing for steamers, besides excellent rail facilities. The temperature of New Orleans from the 1st of December to the last of May averages about 65° F., the thermometer seldom falling below freezing point, while the fields and forests retain their foliage, and nature presents a most attractive appearance to one visiting the city from the harsher clime of a northern latitude.

For the photographs from which our views are made we are indebted to Mr. E. L. Wilson, who has been appointed Superintendent of the Photography Section of the exposition, and Mr. F. C. Beach, who has charge of the Amateur Photographers' portion of the display.

Steel or Tin Plates.

A correspondent of the *Ironmonger* who has paid a visit to nearly ever tin plate works in South Wales, the principal seat of this industry, says that the trade has nearly passed through a very complete revolution, caused by the introduction of steel bars. It has been found that steel bars made by the Siemens-Martin process are fully equal to, or rather better than, the best charcoal bars made by the old process of refining iron scrap with charcoal refineries, while the price is altogether out of all proportion in favor of the steel. There are makers still using both charcoal and coke iron, but they are anxiously watching the progress of their formidable rival, and will undoubtedly find themselves obliged to abandon the manufacture of iron bars. A considerably greater number of plates can be made from a ton of steel bars than from a ton of coke iron bars, and in consequence of the greater closeness of grain and beautiful surface of the black steel plates before tinning, considerably less tin is required to make a steel plate look equal to one of iron.

Beyond strengthening some of the rolling mills, no alteration of plant is required to work steel. At present, the Siemens-Martin steel is used for bars known as charcoal bars, and the Bessemer for bars known as coke bars. The only difference seems to be a want of reliability and uniformity in the Bessemer bars, which will probably be remedied, as they sometimes come in too hard for working in the mills, and the plates will not always stand the bending test both ways. On this point there is scarcely full knowledge, and it is the opinion of some that it will take years to fully appreciate all that can be done with steel.

With reference to the alleged poisonous nature of some plates, there does not appear to be the slightest ground for supposing that the tin can be adulterated in any way without detection; and the minute black specks sometimes complained of are due to a variety of causes, which may be traced back to a few microscopical portions of manganese being left in the steel ingot. The presence of lead would be at once detected, in however small a quantity. It has been suggested that possibly terne plates may have been accidentally used for canning meat. These, being coated with a mixture of lead and tin, can be safely used for packing dry goods; but if used for wet goods or acids, would be highly dangerous. It has been pointed out that the air acting on the contents of a tin of fish might cause the formation of oxide of tin, and it appears safer to remove the contents as soon as opened to a china jar, rather than use them from the opened tin itself. Palm oil is universally used as a flux in the tinning houses. Some patent oils and a few compositions having resin as a basis have been tried, but have not made any great progress, and palm oil still holds its own. The introduction of the "Morewood" rolls in the tinning pots has quite revolutionized the system, as the coating is much more equal, while much less tin is wasted than by the old listing pot, so that all plates may be said to be coated by this process now. By regulating the speed of the rolls, the maker can arrange the amount of tin to be deposited on each plate to an almost exact nicety.

Hard into Soft Castings.

In a communication to the Academie des Sciences, M. Forquignon states that when white iron castings are heated to a point a little under that of fusion, they become transformed into gray iron. The change is due to the separation of carbon from its previous combination with the metal, and its deposition in the bulk of the casting. By careful experiments recently conducted, M. Forquignon has found the following results: He heated a number of white iron pigs for 172 hours in a stove from which the gas was carefully exhausted, and afterward analyzed the product. The iron originally contained 3 per cent of combined carbon; while the material as taken out of the experimental furnace was found to contain only 0·895 per cent of carbon in combination, and 2·061 per cent of carbon in the graphitic state. This change must have been due wholly to the slow and continued heating of the metal. It is not stated whether there was any perceptible difference between the outside and inside of the metal under treatment, which might be expected under such conditions. The process has a certain resemblance to the usual method of softening steel, in which the effect of continued heating is to decompose the mixture of pure metal and carbon.

Correspondence.

The Position of Mountains.

To the Editor of the Scientific American:

I would like to know if there are any statements of geologists in regard to the comparative slant of the east and west sides of mountain ranges of such steeps as run north and south? According to theory, it seems to me the west incline should be more abrupt, or steepest. Is this verified by fact? Also the west range of parallel ridges should be of greater altitude. Is this true or not?

G. W. R. C.

Ashville, St. Clair Co., Ala., Nov., 1884.

[Answer.—Dana's Manual gives the following: "The position of the great mountain chains along the borders of the continents, and of uplifts, fractures, plications, volcanoes, metamorphism, chiefly on the seaward slope of the chains, proves that while the force from contraction was a universal force over the sphere, the lateral pressure was vastly more effective in a direction from the ocean than in the reverse direction. Now this landward action of the force seems to be a necessary consequence of the fact that the crust over the oceanic areas was and is abruptly depressed below the level of the continental, so that lateral pressure from its direction would have had the advantage of leverage beneath the continental crust, or rather, would have acted obliquely upward against it.

In the case of the Appalachians and the other ranges of the Atlantic border, the mountains front toward the ocean, that is, have their steepest folds on the oceanic side, and this is a common fact The Juras, on the contrary, front inland toward the Alps, and apparently because of their subordinate relations to the Alps, both geographically and genetically. In each case they were on the shoving side; while the greater fractures are usually toward the opposite side.

Our correspondent must not suppose that the slants of mountain ranges have anything to do with the revolution of the earth. They are the results of shrinkage, continental crumpling of the earth's crust Of course this view is controverted by another class of writers, who attribute the mountains to the pressure of immense accumulations of sediments, which, however, does not seem to be sufficiently comprehensive. But the steep side of ranges is apt to be found on the oceanic side, as stated above, or toward the shoving side.

Of Green, Red, and Yellow Rays in Photography.

In a publication on the sensitiveness of silver bromide to light, Prof. Vogel has shown that silver haloid salts, notably silver bromide, are affected by chemically inactive pigments, and he obtained these results by adding substances capable of absorbing the pigment. The value of this process to photographic art, where certain colors, as ultramarine and cobalt blue, are too effective, and thus reduced to white, and other more vivid pigments, like minium and chrome yellow, are rendered black, has been demonstrated by several experimentalists. The fact that the experiments were made with dry plates, and that the tar colors employed as medium of absorption acted decomposing on the photographic preparation, impeded the practical application of the principle. On examination of chromogenes with regard to their deportment toward humid, with silver solution impregnated, and dry collodion and gelatine plates, he observed that the properties of the pigments were altered with the composition of the film.

Collodion silver bromide impregnated with methyl violet and examined in the solar spectrum exhibited an extraordinary sensitiveness to orange, nearly equal to the sensitiveness to blue, while gelatine silver bromide plates possessed but one-fiftieth, and that of wet collodion plates to orange rays was still less. A different result was produced by eosine; a solution of 1 to 400 of this pigment has been added to gelatine silver bromide, and the sensitiveness to yellow was found to be one-third of that to blue; collodion silver bromide, treated in the same manner, indicated no difference in its behavior toward yellow and blue rays; humid, with silver nitrate impregnated collodion silver bromide plates, show a sensitiveness to yellow exceeding that to blue eight or ten fold. The peculiar behavior of eosine toward wet collodion plates has been further studied, and its cause explained by the following experiment:

By mixing a solution of eosine with silver-nitrate a red precipitate of tetra-bromo-fluoresceine silver is produced, which is not affected by dilute acetic acid and which is exceedingly sensitive to light. On precipitating eosine from a collodion solution, by dipping the glass plate coated with eosine collodion in a silver bath, and exposure of the film to different parts of the spectrum, a visible effect was produced by yellow green rays, ranging from D to E. The blue and violet portion of the spectrum did not affect the plate. Eosine silver is thus sensitive to light, especially to green and yellow rays, which is in accordance with its optical behavior—absorption—toward these rays. The same result is observed by treating collodion cadmium bromide with a 5 per cent eosine solution and silver nitrate. Silver bromide and eosine silver are precipitated simultaneously, and the latter acts on the silver bromide as optical and chemical sensitizer. Solution of eosine added to a silver bromide emulsion, free of silver nitrate, does not yield eosine silver. Mixtures of silver iodide and bromide exhibit a behavior to blue and yellow rays which is distinguished by an equal sensitiveness to both rays. And plates with a small percentage of silver iodide are about four times as sensitive to yellow as to blue rays. The property of eosine to absorb green, blue, and yellow rays gives rise to a further study of the optical properties of pigments and the discovery of a substance which will show a similar deportment to orange and red rays, and, like eosine, yield a silver compound Such a substance, which serves well for dry plates, has been found in methyl violet for orange and aldehyde green for red.

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Dyeing of Feathers.

In dyeing of feathers animal and vegetable pigments are used, and also aniline and its derivatives. At present they are employed quite extensively on account of their brilliancy and luster, and have, therefore, diminished the application of the former; aniline colors are more fugitive and subject to fading, especially when exposed to the action of direct rays. The feathers to be dyed are washed with water and Venetian soap, then steeped in tepid water and wrapped in linen cloth. Sulphur is then used to finish the feathers, giving them whiteness and luster; for this purpose flower of sulphur being thrown on glowing charcoal, and the feathers exposed to the vapor of sulphurous acid; they are then dried by application of heat.

The following process is used for dyeing black: 250 grammes of feathers are placed in a bath composed of 50 liters water and 500 grammes calcined soda, washed in warm water, and laid for five or six hours in a bath of iron nitrate of 7° Baume, and rinsed with cold water. They are now introduced in a lukewarm decoction of logwood and quercitron, 1 kilo of each, the temperature being gradually raised, left therein until a rich and deep color has been developed, and padded in hot water. To impart to the dyed feathers gloss, they are passed through a bath consisting of 6 liters water and 250 grammes oil.

Another method adapted for dyeing of inferior articles is the following: The feathers are cleansed by boiling in weak potash lye, are placed for twenty-four hours in a bath of iron acetate, dried, and treated with a hot decoction of nut galls—the acetate of iron being prepared by dissolving 2 kilos iron filings in 2 liters vinegar, and filtration of the liquid.

For dyeing brown, baths made of archil and Brazil wood are employed, and solutions of cream of tartar, tin, or alum. Violet and lilac colors are produced upon feathers by dyeing them red by means of Brazil wood, and finally blue with a weak solution of indigo. Blue is produced by dyeing either with indigo carmine and cream of tartar or with logwood, alum, and copper sulphate. Indigo and catechu are used in dyeing green; Brazil wood and archil for red shades; and safflower for rose-color tints. Yellow and orange are obtained from decoctions of Brazil wood, turmeric, and fustic with appropriate mordants, as alum and cream of tartar.

The most valuable dye is obtained from cochineal, which is applied with cream of tartar and tin solution. These pigments are at present partly superseded by aniline and its derivatives. Feathers to be dyed with these colors are steeped in a cold solution of the respective pigment, the concentration of which depends on the shade to be attained, and are previously cleaned with soda or alum solution. Crimson and rose color are most frequently used in dyeing of feathers, besides fuchsine, coralline, and saffranine.—*Erfindungen.*

Damages for Communicating Whooping Cough.

In a case recently tried in the United States Circuit Court at New York, damages were asked against a person because he had taken his children to a boarding house, when they were sick with the whooping cough. The child of the proprietor took the disease in this way, and some of the boarders left the house and went elsewhere. The court held that damages must be awarded for whatever loss resulted from the bringing of the disease to the house. The opinion of the judge is in part as follows "The defendant took his children when they had whooping cough, a contagious disease, to the boarding house of the plaintiff to board, and exposed her child and children of the other boarders to it, who took it.

"The jury have found that this was done without exercising due care to prevent taking the disease into the boarding house. She was put to expense, care, and labor, in consequence of her child having it, and boarders were kept away by the presence of it, whereby she lost profits. Words which import the charge of having a contagious distemper are in themselves actionable, because prudent people will avoid the company of persons having such distemper. The carrying of persons infected with contagious disease along public thoroughfares, so as to endanger the health of other travelers, is indictable as a nuisance."

Arrow Release.

AT the Newport meeting of the National Academy of Sciences, Prof. E. S. Morse read a paper on "Methods of Arrow Release in Eastern Archery."

He stated that for two years past, he has been investigating the methods of arrow release. The subject is important in anthropological researches, since observations on the affinity of nations can at least be checked by comparing their methods of releasing the arrow. It is of the highest importance to prosecute these investigations vigorously, since arrows are rapidly going out of use all over the world. In some Eastern nations a short ball is already coming into use instead of arrows; and various devices vie with firearms in supplanting the use of arrows.

Different peoples, then, have characteristic methods of holding the bow and arrow. The English hold the arrow between the first and second fingers, or sometimes between the second and third fingers, both grips being shown on ancient tapestries, etc. The thumb assists in the grasp. The arrow passes left of the bow.

Children usually hold the arrow with thumb and forefinger, but no string bow can be so drawn. The Ainos in Japan have this method. They must have very strong hands. Their arrows have a prominent knob to assist them in grasping.

The Japanese grasp the string with the thumb, and bring the forefinger over the thumb, while the arrow passes to the right of the bow. This seems to be the best possible method, because it releases both sides of the arrow equally and simultaneously. It also presses the arrow against the bow. The Japanese wear a glove with a groove for the arrow.

All the Mantchu-eyed people have this method of release. The Chinese use a round horn ring for the thumb. The Coreans use a ring of somewhat different shape. The Turkish release is the same. There has lately been exhumed on the river Oxus a clay tablet associated with coins 200 to 300 B.C., in which the same method is shown as being in use at that date

The Zuni Indians were the first that he examined. He found among them that the thumb and forefinger grasp the arrow, and the second and third finger the string. The same method prevails among all the tribes he has examined.

Among the Assyrian tablets, he found various methods of release portrayed—the Saxon, the North American, and the Aino; but he did not find a trace of the Mongol release.

Dr. Baelze, the most important contributor to this branch of ethnology, thinks there are affinities between Japanese and Assyrians, but the study of bow and arrow methods does not confirm this theory.

Prof Morse recently met Lieut. Murdoch, who reports that at Port Barrow he found the natives using no Mongol nor North American, but the Saxon release Their arrows have a flattened end, so as to pass readily between the fingers.

New Railway Signal.

Railway men, especially train men, know the use of the torpedo in warning a following train of danger saving time, and for other emergencies which arise during the run of a train in sections, where one section is close behind another. The practice has been to drop off a man, or stop the train while the hind brakeman adjusted a torpedo, thereby losing valuable time. J. H. Bevington has produced and patented an instrument which is so arranged that with it a torpedo with steel clasps can be adjusted to the rail from the platform of the car while running at any high rate of speed. A clamp containing a signal flag, another containing a torch which will burn ten minutes for night signals, and one containing a taper which will burn long enough to show the rail while making the adjustment can all be attached to the rail by this ingenious instrument, while the train is running at high speed. These signals are applicable to any code of rules governing the use of torpedoes as caution or danger signals. The torpedoes make a very loud report, and their spring steel clamps prevent all liability of being thrown from the rail by a locomotive passing over them. The torches are limited to burn ten minutes, and no storm will extinguish them until burned out.

A NEW GAS ENGINE.

We give an engraving of a small gas engine, made by the Economic Motor Company, of this city, which may be used wherever gas is obtainable, and we are informed that the engine is being adapted to run with naphtha gas or the vapor of gasoline.

These engines are made in four sizes, the largest being one horse power, and the smallest of sufficient size to run one or two sewing machines, or pump enough water for domestic use. They are well calculated to fill the great deficiency in motors heretofore existing below one horse power. It requires about one-thirtieth of a horse power to run an ordinary sewing machine, and this is probably the smallest use for which a motor is required. The elevation of water for domestic use in our cities requires, ordinarily, from one-eighth to one-sixth of a horse power. Foot lathes, printing presses, and the entire class of machinery operated by treadle or hand power requires an engine of from one-half to one horse power; machinery operated intermittently by hand, and requiring the entire power of a strong man, would require an engine of one horse power.

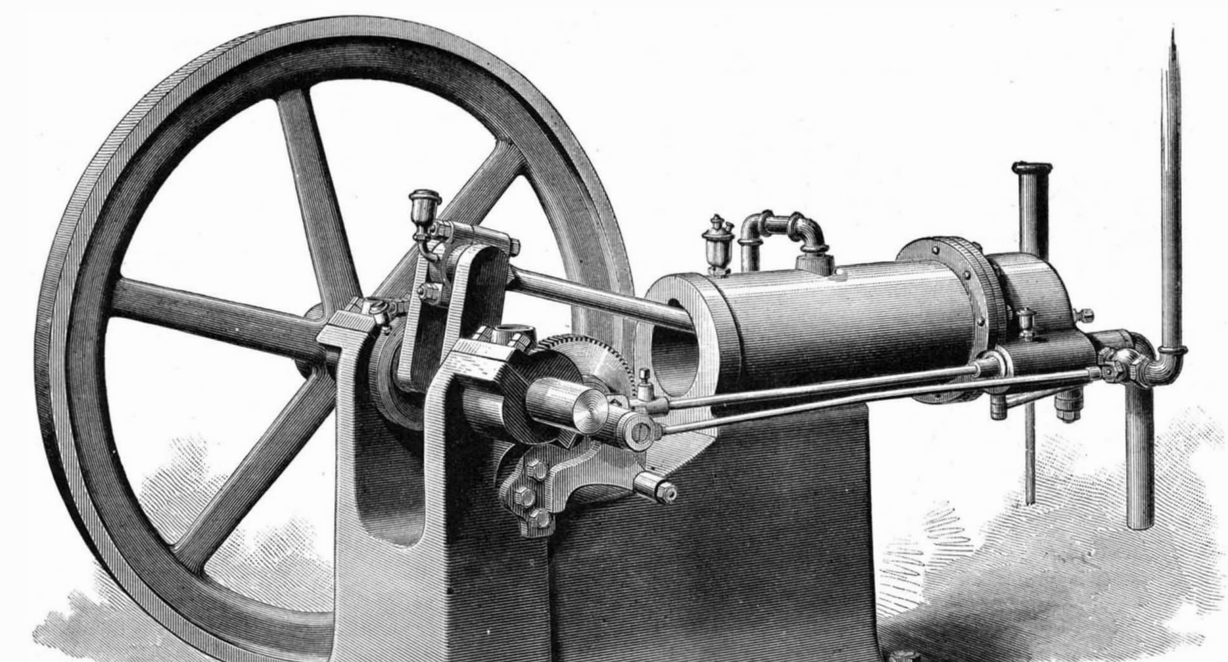
The one horse power engine shown in the engraving has a cylinder 4½ inches in diameter, and a stroke of 10 inches. The bearing surfaces of this engine are extraordinarily large, and designed to wear for years. Steel and bronze are used wherever practicable, and there has been no lack of care to render the engine perfect in every detail. There are no intricacies in its construction; it is as plain and simple as a steam engine, which it very much resembles, both in appearance and in operation. It is always ready for work; the striking of a match and once turning of the wheel being all that is required to start it. It develops its full power at once, and runs steadily, quietly, and uniformly.

These engines are the result of long and careful experimentation, the object having been to produce a practicable, small motor, which would be perfectly manageable, and which would need no delicate adjustments and no special care other than that required by machinery generally.

It is stated that any part of this engine may be thrown out of adjustment ten times the amount due to its natural wear for the life-time of the engine without rendering it inoperative. With respect to economy, as no engineer is required, and as all outlay ceases when the power stops, two sources of the expense of steam power are avoided; it costs nothing to convey the fuel to the place of consumption, and the products of combustion are disposed of without cost. Of course the consumption of gas is the only item of expense, and this is not large. For example, it costs about one-third of a cent a barrel to raise water fifty feet. The sewing machine motor is driven by gas taken from an ordinary gas burner.

Recent improvements in this engine make it impossible to blow out the igniting flame, and a new gas cut-off, which has been applied, prevents the escape of gas, when the engine stops, no matter when or how. These new features render a gas explosion in connection with the engine impossible.

The Economic Motor Company has established in Brooklyn an extensive factory, which is devoted exclusively to the manufacture of these engines. The office of the company is at 12 Cortlandt Street, New York city.



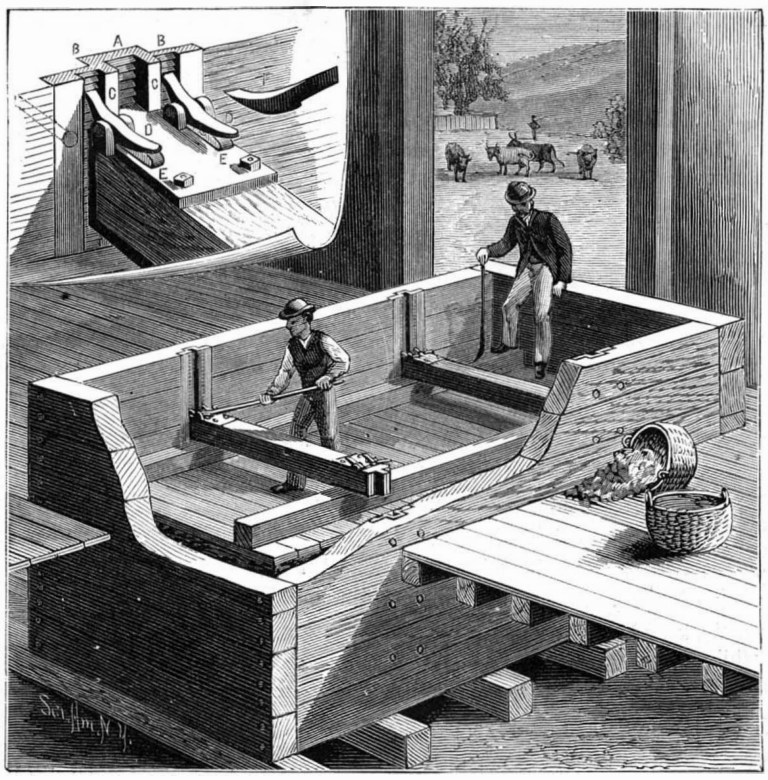
THE ECONOMIC MOTOR CO.'S NEW GAS ENGINE.

Chinese Paper.

Eighteen hundred years ago, says the *Papermaker's Journal* (London), the Chinese, acting upon the wasp's suggestion, made paper from fibrous matter reduced to pulp. Now each province makes its own peculiar variety from the innermost bark of different trees. The young bamboo, which grows six or eight inches in a single night, is whitened, reduced to pulp in a mortar, and sized with alum. From this pulp sheets of paper are made in a mould by hand. The celebrated Chinese rice paper, that so resembles woolen and silk fabrics, and on which are painted quaint birds and flowers, is manufactured from compressed pith, which is first cut up spirally, by a keen knife, into thin slices, six inches wide and twice as long. Immense quantities of paper are used by the Chinese for a great variety of purposes. Funeral papers, or paper imitations of earthly things which they desire to bestow on departed friends, are burned over their graves. They use paper window frames, paper sliding doors, and paper visiting cards a yard long.

Musk.

Although musk has long been well known in the West, yet, says Dr. Macgowan in his report on the health of Wenchow ("Imperial Maritime Customs"), it seems worth while to translate what Chinese writers have to say about it. The musk deer is found throughout the mountains of Yunnan, Szechwan, and Thibet; it is a timid little animal, and often dies of fright. It feeds on juniper leaves and reptiles; snake bones are found in its stomach. In spring its glandular pouch is much swollen and inflamed. The secretion is discharged with the urine. Musk deer always resort to the same place for micturition, and cover their urine with earth. In such places deposits of a superior quality are found, amounting sometimes to fifteen catties (a catty is a Chinese weight of about one and one-third pounds). The article which is most prized is that which falls from the musk deer on to the ground, and is gathered in grains that are as precious as pearls. These deposits are so pungent that, if carried through a garden or woods, it prevents fructification. The poisonous effect of fresh musk on vegetation is shown also by the blighted appearance of places which the musk deer selects for its convenience. For some distance around these places there is an absence of plants, and farther off the leaves exhibit a yellow tinge. This valuable substance no sooner leaves the hunter's hands than skillful manipulators adulterate the article for wholesale dealers, who further adulterate it for the trade, by which time it contains about 10 per cent of genuine musk. Musk is said to be an anthelmintic, and to cure the bites of venomous serpents.—*Lancet.*



JEFFERSON'S IMPROVED SILO PRESS.

IMPROVED SILO PRESS.

The engraving represents an inexpensive silo press, recently patented by Mr. C. W. Jefferson, of Rugby, Tenn., which has strong and durable parts so arranged as to provide for very great compression of the ensilage by the use of a common lever or pinch bar. To the inner faces of the opposite walls of the silo are fixed the metal plates, A. Placed loosely on top of the fodder filled into the silo are planks, across which rest timbers, one at each side. Across the timbers rest press beams set with their ends facing the opposite pairs of plates; when these beams are made of wood the ends are provided with metal caps secured by bolts and formed with lugs in which the pawls, D, are pivoted. The pawls are pressed into engagement with the teeth of parallel racks, B, formed in the wall plates, by springs. The central portions of the plates are set back to form grooves into which enter tongues formed on the ends of the caps; at the backs of the grooves are formed racks. The flanges, C, of each plate project sufficiently to prevent the end shoulders of the beams, or the caps, from striking the plate; by this construction very little friction occurs between the ends of the press beams and the silo walls or wall plates.

The ensilage having been placed in the silo, and the covering boards and timbers adjusted, the press beams are carried downward by means of the pinch bar, the end of which engages with the central rack. As the beams descend, the pawls engage lower teeth of the rack to keep them in position. It is obvious that by the use of this press enormous pressure may be brought to bear on the ensilage to pack it closely for preventing fermentation and keeping it in good condition until consumed.

Whims in Building.

Nothing adds so much to the cost of building as indulgence in whims. To set out deliberately to do a "queer," "fanciful," or, as it is sometimes called, "original" thing in building is always to incur unnecessary expense. If we look through the books that contain pictures of the architecture of all ages and nations, we shall find that, without an exception, in the times all men of taste are agreed in calling the good times, the modes of building have been sensible, founded on the needs of the case, and that whatever may seem fanciful—the whole of what we call picturesque—when its charm has proved enduring, is the result of what we may call, in every case, "accepting the situation." Nothing has been done in such instances for the sake of being picturesque. Good building, good ornament, never poses.

In building, as a rule, every departure from the rectangular form is an added expense. One of the things impressed on the mind of a young man who goes into an architect's office to study the profession is that, if cost is to be considered, which it sometimes is, and sometimes is not, all excrescences and projections must be avoided. A rectangular house is the cheapest. Bay windows, porches, octagonal or circular, external ends to rooms—all these things cost money; and it is by multiplying these features that the expenses of building are often made so great as to deter people from undertaking it, for the things seem so small in themselves, it is not suspected what drains they are on the purse. If a good reason cannot be given for any so-called ornamental feature in a house, if it cannot be shown that something worth while is to be gained by making it, we may be reasonably sure that it is a fancy which will cost, as the country people say, more than it comes to. And, in the greater number of cases, nothing, even in looks, is gained by indulging the fancy.—*The Studio.*

THE history of the discovery of the circulation, recapitulated, divides itself naturally into a series of epoch making periods: 1. The structure and functions of the valves of the heart, Erasistratus, B.C. 304. 2. The arteries carry blood during life, not air, Galen, A.D 165. 3. The pulmonary circulation, Servetus, 1553. 4. The systemic circulation, Cæsalpinus, 1593. 5. The pulmonic and systemic circulations, Harvey, 1628. 6. The capillaries, Malpighi, 1661.—*Dr. Henry C. Chapman.*

THE CAMEL CORPS OF THE BRITISH ARMY.

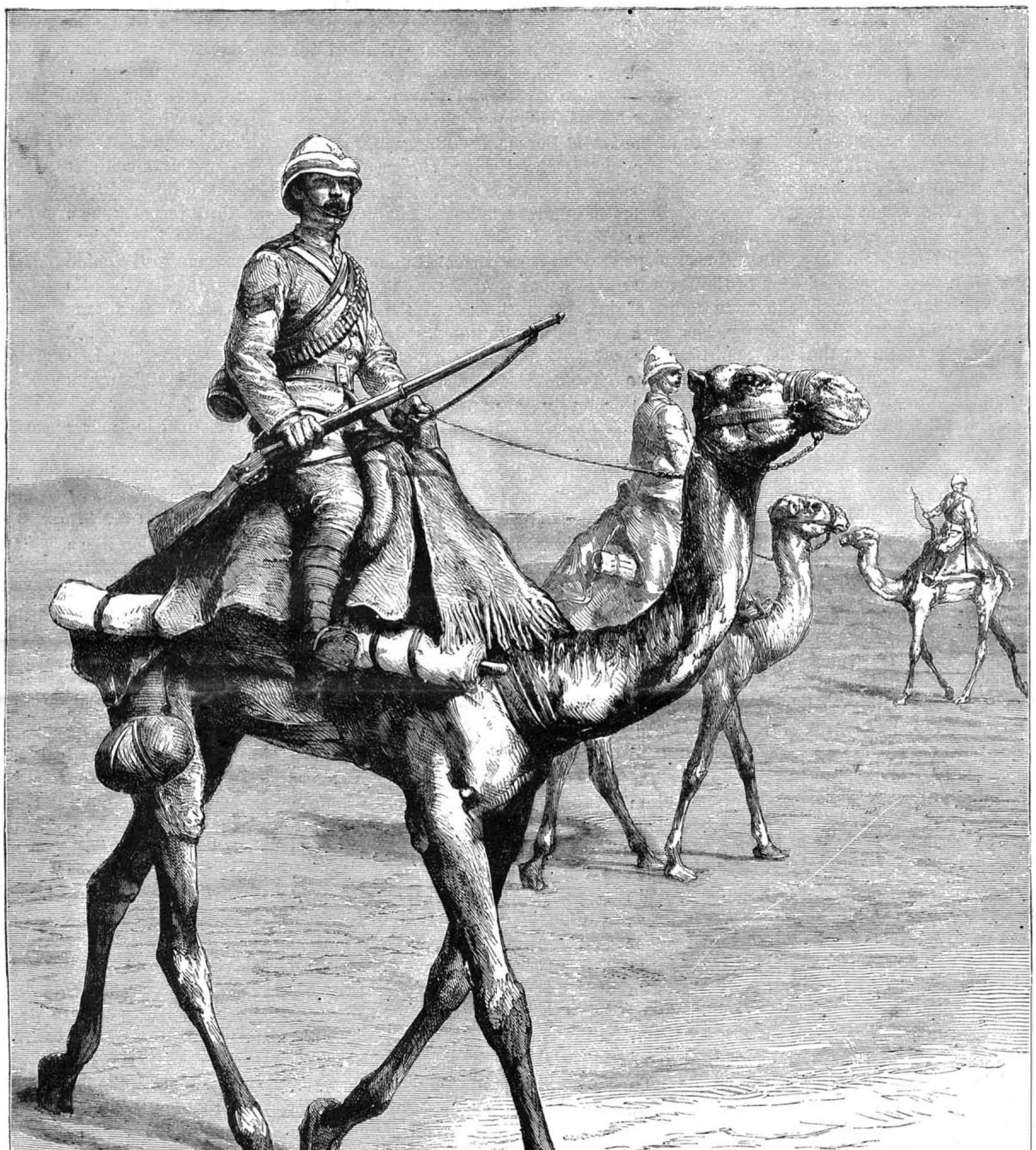
Among the curious features of the British military expedition which is now slowly proceeding up the river Nile, for the relief of Gordon at Khartoum, is a camel corps. It is composed of several thousands of ungainly camels, each carrying a trooper. This body of men and stalking animals is said to present an extraordinary spectacle, especially when in motion.

Our illustration herewith, which we take from the *Graphic*, will give a good idea of how this unique division of cavalry service is equipped. The uniform consists of a red flannel tunic, corduroy knee breeches, and serge leggings, with white pith helmet covered by white cloth. The accouterments are heavy, and include a rolled cloak on the right shoulder, a leather cartridge belt on the left shoulder, a tin mess trap, a water bottle, a brown leather ammunition bandoleer, with fifty rounds of ammunition, and a rifle pocket in which the butt of the rifle is supported. The arms are the Martini-Henry rifle and bayonet, instead of the ordinary cavalry carbine. Each camel also carries the second half of a tent, with pole and guides, besides three days' provisions and water for his master, and food for himself.

These tents afford cover for two men each; a waterproof sheet forms the floor, and on the pole of the tent hangs a leathern water bottle with filtered water, while outside on a tripod is slung a skin containing well or Nile water for ordinary purposes. One end of the tent is closed by a laced curtain, which can be shifted to either end for protection against sand storms.

A good load for a camel is about 600 pounds, though for short journeys it can carry 1,000 pounds; its speed is seldom more than three miles an hour, and the swiftest dromedaries do not exceed ten; but the former rate of travel can be kept up for twenty hours without rest. The hump upon its back affords practically a storehouse for food, as it is slowly reabsorbed during long marches. Its first stomach or pouch has a division (which may be closed by muscular action whose walls are provided with a system of large cells, capable of considerable distention, which the animal can fill with several quarts of water, and thus carry with itself a supply for its own wants for about a week, a supply which it occasionally yields with its life to save that of its master. Its strength, power of endurance, ability to subsist on the coarsest food, to go without water, and to travel over the yielding sand, have earned for it the title of the "ship of the desert." The justness of this cognomen is strongly attested by the British soldiers, one of whom writes that he never felt "more at sea" than when first taking a camel ride, the motion producing such sensations as most people feel at sea in rough weather, the peculiar swinging and jerking gait jolting up the uninitiated in a way anything but pleasant.

The height of the Arabian camel at the shoulder is between six and seven feet, and the color of the rather coarse hair is of various shades of brown. The first attempt to mount one calls for no little dexterity, as the usual mode is to bestride the animal while he is on his knees, and it is no easy matter for a a novice to maintain the correct "center of gravity" when the animal rises. The British soldiers, however, seem to have entered this novel service with considerable enthusiasm, and have been disposed to make pets of their new companions, although they report that thus far it seems to be a most "unsocial beast."



THE CAMEL CORPS OF THE BRITISH ARMY.

Cheap Gas in Pittsburg.

The Philadelphia Company (Westinghouse), which has entered Pittsburg with its big 10 inch line, has fixed the price at 15 cents, and it is stated that in consequence thereof it is almost overwhelmed with orders from householders and others.

The Drying of Timber.

Some twenty years ago, the firm of John Stephenson and Co., of New York, who were then as now engaged in the building of street cars, had an experience in the drying of timber some of the details of which, says the *National Car-Builder*, may be of interest to our readers, and especially to car builders.

During the early part of the war, the concern was engaged almost exclusively in the manufacture of gun carriages, limbers, etc., for the government. For this purpose it was necessary to have dry oak timber of the best description, a large stock of which was usually kept on hand by the government for this kind of work. This was necessary, because the thickness required was some nine inches, and it was out of the question to obtain the dimensions in the open market. The government supply, owing to the excessive demand, was exhausted in a very short time. The large size of the sticks made it out of the question to think of seasoning it in the ordinary way, and no dry stock was available. The proposition to use the timber in a green state was not entertained for a moment by the officers in charge, and hence it became necessary to devise some method of seasoning that should be quick, and an apparatus which should be able to handle a considerable quantity of it in a short time. The plan which was suggested was the application of dry steam in direct contact with the wood. Furnaces were at once erected, and preparations made for the work. When the lumber first came from the furnaces, it was as bright and handsome as could be desired. The external surface was perfect. The seasoning, however, had evidently gone on in a way very different from that of ordinary air dried lumber. Pieces which were rectangular in section became to a certain extent hour-glass shape, measuring less in diameter at the center, on the sides, than at the corners. Air-dried timber, on the contrary, measured more at the centers than at the corners, the surfaces being all convex instead of concave, as was found to be the case with the steam-dried timber. This showed that the drying had taken place from the center. The steam was used at a pressure of 250 pounds per square inch. On opening the sticks, the timber was found to have been completely ruined. The whole interior had been practically converted into charcoal, so that it could be crumbled in the fingers, and was of a brownish-black color. Even so small a stick as an army wagon spoke would have its center portion so destroyed as to leave cracks of an eighth of an inch running through it, while the surface exposed to the direct contact of the steam was apparently bright and sound. This, of course, put an end to all attempts to dry the oak by the use of high pressure steam, and they finally adopted a heat of about 150° Fah., as a maximum. With this they were enabled in three or four days to remove 400 pounds of water from a ton of green oak.

An idea has been generally prevalent that lumber dried by artificial heat loses something of its strength by the process. Just what this loss is, or how it affected the lumber, is not so generally known. The experiment detailed, however, shows that it is a carbonizing process, which can go on at low temperatures, and this harmonizes completely with Count Rumford's experiments. He succeeded in completely charring thin shavings of beechwood with a temperature, we believe, below 212 degrees. We have seen portions of the pine finish of the Hudson River steamer Drew which had been charred, and seemed to be on the point of ignition, by the heat of the steam heating pipes from the boiler. As this vessel carries not over 30 pounds of steam, the temperature must have been less than 251 degrees.

In Mr. Stephenson's establishment at the present time, the practice is to thoroughly air-dry all lumber used, and then, after the stuff has been worked nearly to its finished form, it is placed a short time in a drying room heated to 150°, where the surface moisture which it may have acquired is removed, and drying is carried beyond the point to which it can be carried by atmospheric influences alone. This is also the practice in the best wheel making establishments, the object being to dry the wood when it is put together beyond the point which can be reached by air drying.

Water Pyrometer.

Messrs. Carnelley and Burton have recently described a simple form of pyrometer, not scientifically accurate, but well suited for use in technical operations, and especially so for determining the temperature of hot gases in flues, etc. A coil of copper tubing comprising about five turns is exposed in the flue or other place where the temperature is to be ascertained. It is supplied with water under a constant head or pressure, so as to maintain a regular flow through the coil. Thermometers are fixed to enable the incoming and outcoming temperature of the water to be ascertained. To rate these indications, a series of experiments must first be tried; a number of known temperatures being obtained by using metallic alloys having a known fusing point, or in any other way. From these a table is constructed (which only applies to the particular circumstances under which the instrument is fixed), enabling the observer to tell, by the increase of heat gained by the water in flowing through the coil, the actual temperature. The principle of the instrument consists in the fact that, for any definite temperature to which the coil is exposed, a certain definite increase of heat will be taken up by the water.

Heat Conductivity of Soils.

The author's conclusions are that the heat conductivity of a soil is so much the greater the more densely its particles are packed together. The difference thus occasioned is the more considerable the higher the proportion of water. In a dry soil the heat conduction rises with an increase in the size of the particles of the soil. Water increases the conductivity of the soil considerably, the more the larger its proportion in the soil, other circumstances being equal.—*Dr. F. Wagner.*

Soluble Glass.

Although the manufacture of soluble glass does not strictly belong to the glass maker's art, says the *Pottery and Glassware Reporter*, yet it is an allied process to that of manufacturing glass. Of late soluble glass has been used with good effect as a preservative coating for stones, a fire-proofing solution for wood and textile fabrics. Very thin gauze dipped in a solution of silicate of potash diluted with water, and dried, burns without flame, blackens, and carbonizes as if it were heated in a retort without contact of air. As a fireproofing material it would be excellent were it not that the alkaline reaction of this glass very often changes the coloring matters of paintings and textile fabrics. Since soluble glass always remains somewhat deliquescent, even though the fabrics may have been thoroughly dried, the moisture of the atmosphere is attracted, and the goods remain damp. This is the reason why its use has been abandoned for preserving theater decorations and wearing apparel. Another application of soluble glass has been made by surgeons for forming a protecting coat of silicate around broken limbs as a substitute for plaster, starch, or dextrine.

The only use where soluble glass has met with success is in the preservation of porous stones, building materials, paintings in distemper, and painting on glass. Before we describe these applications we will give the processes used in making soluble glass.

The following ingredients are heated in a reverberatory furnace until fusion becomes quieted: 1,260 pounds white sand, 660 pounds potash of 78°. This will produce 1,690 pounds of transparent, homogeneous glass, with a slight tinge of amber. This glass is but little soluble, even in hot water. To dissolve it the broken fragments are introduced into an iron digester charged with a sufficient quantity of water at a high pressure to make a solution marking 33° to 35° Baume. Distilled or rain water should be used, as the calcarcous salts contained in ordinary water would produce insoluble salts of lime, which would render the solution turbid and opalescent; this solution contains silica and potash combined together in the proportion of 70 to 30.

Silicate of soda is made with 180 parts of sand, 100 parts carbonate of soda (0·91), and is to be melted in the same manner as indicated previously.

Soluble glass may also be prepared by the following method: A mixture of sand with a solution of caustic potash or soda is introduced into an iron boiler, under 5 or 6 atmospheres of pressure, and heated for a few hours. The iron boiler contains an agitator, which is occasionally operated during the melting. The liquid is allowed to cool until it reaches 212°, and is drawn out after it has been allowed to clear by settling; it is then concentrated until it reaches a density of 1·25, or it may be evaporated to dryness an iron kettle. The metal is not affected by alkaline liquors

This glass is soluble in boiling water; cold water dissolves but little of it. The solution is decomposed by all acids, even by carbonic acid. Soluble glass is apparently coagulated by the addition of an alkaline salt; mixed with powdered matters upon which alkalies have no effect it becomes sticky and agglutinative, a sort of mineral glue.

To apply soluble glass for the preservation of buildings and monuments of porous materials, take a solution of silicate of potash of 35° Baume, dilute it with twice its weight of water, paint with a brush or inject with a pump; give several coats. Experience has shown that three coats applied on three successive days are sufficient to preserve the materials indefinitely, at a cost of about 15 cents per square yard. When applied upon old materials, it is necessary to wash them thoroughly with water. The degree of concentration of the solutions to be used varies with the materials. For hard stones, such as sand and freestones, rock, etc., the solution should mark 7° to 9° Baume; for soft stones with coarse grit, 5° to 7°; for calcareous stones of soft texture, 6° to 7°. The last coating should always be applied with a more dilute solution of 3° to 4° only.

Authorities are divided upon the successful results of the preservation of stone by silicates. Some claim in the affirmative, that the protection is permanent, while others assert that with time and the humidity of the atmosphere the beneficial effects gradually disappear.

Soluble glass has also been used in Germany to a great extent for mural painting, known as stereochromy. The process consists in first laying a ground with a lime mortar; when this is thoroughly dry, it is soaked with a solution of silicate of soda. When this has completely solidified, the upper coating is applied to the thickness of about one-sixteenth of an inch, and should be put on very evenly. It is then rubbed with fine sandstone to roughen the surface. When thoroughly dry, the colors are applied with water, the wall is also frequently sprinkled with water. The colors are now set by using a mixture of silicate of potash completely saturated with silica, with a basic silicate of soda (a flint liquor with soda base, obtained by melting 2 parts sand with 3 parts of carbonate of soda). As the colors applied do not stand the action of the brush, the soluble glass is projected against the wall by means of a spray. After a few days the wall should be washed with alcohol to remove the dust and alkali liberated.

The colors used for this style of painting are zinc white, green oxide of chrome, cobalt green, chromate of lead, colcothar, ochers, and ultramarine.

Soluble glass has also been used in the manufacture of soaps made with palm and cocoanut oil; this body renders them more alkaline and harder.

Interesting experiments have been made with soluble glass for coloring corals and shells. By plunging silicated shells into hot solutions of salts of chrome, nickel, cobalt, or copper, beautiful dyes in yellow, green, and blue are produced. Here seems to be a field for further applications of this discovery.

Soluble glass has also been applied to painting on glass in imitation of glass staining. By using sulphate of baryta, ultramarine, oxide of chrome, etc., mixed with silicate of potash, fast colors are obtained similar to the semi-transparent colors of painted windows. By this means a variety of cheap painted glass may be made. Should these colors be fired in a furnace, enameled surfaces would be produced. As a substitute for albumen for fixing colors in calico printing, soluble glass has been used with a certain degree of success; also as a sizing for threads previous to weaving textile fabrics. Thus it would seem that this substance has been used for many purposes, but since its application does not seem to have been extended to any great degree, the defects here pointed out in its use as a fireproofing material perhaps also exist, to a certain degree, in its other applications. In painting upon glass, for instance, it is asserted that the brilliancy and finish of ordinary vitrified colors cannot be obtained.

Our Naval Torpedo Service.

The report of the Naval Bureau of Ordnance briefly refers to the work of Captain T. O. Selfridge, who was relieved on the 1st of November from the charge of the Torpedo Station at Newport. Under the administration of Captain Selfridge, as we have before stated, a complete system of gun cotton ship and boat torpedoes has been perfected under the direction of the Bureau of Ordnance. And, as the report shows, the manufacture of gun cotton, the first of the kind in this country, has been successfully initiated. Instead of two classes of torpedoes for ships and boats, but one is now used, carrying the same charge (31½ pounds) of gun cotton, equivalent to 125 pounds of powder. While the explosive effect has been increased, the weight of the charged torpedo has been reduced from 380 pounds to about 75 pounds. Gunpowder differs from nitro-glycerine and its various compounds, known under the name of dynamite, hercules, giant, atlas, and other powders, as also gun cotton, in not exploding instantaneously, but simultaneously. That is, the whole mass is not ignited at once, and consequently to obtain the maximum effect from gunpowder it must be inclosed in a very strong and therefore heavy case.

On the other hand, gun cotton has at least four times the explosive effect of gunpower, weight for weight, and is so violent and instantaneous in its action as to need no retaining case beyond the incompressibility of the water which surrounds it when immersed. Experiments at the Torpedo Station would tend to conclusively prove this, as well that a maximum saturation of the gun cotton does not affect its explosive condition. In these experiments disks of gun cotton were stowed in a canvas bag around the dry gun cotton detonator, exposed under water for two hours or more, and then exploded with apparently the normal force.

Gunpowder will not explode when wet, requiring, therefore, a perfectly water tight case, while gun cotton is believed to destroy more strongly when moderately wet than when dry. This is for the reason that the interstices in the cotton are then filled with an incompressible fluid, instead of an elastic medium, a condition more favorable to the chemical charge of the molecular construction of the gun cotton. Gunpowder explodes immediately when exposed to flame in a moderately confined state, such as a ship's magazine, while wet gun cotton will not explode if exposed to flame or red hot iron. For these reasons gunpowder is preferable for artillery, in producing less strain upon the walls of the gun, while gun cotton, by its greater explosive power, is preferable for torpedo service, and by it greater factor of safety, superior to all other known high explosives for storage on shipboard. The great weight of the gunpowder torpedo makes it inconvenient and clumsy to handle, and difficult to quickly manipulate, and as issued could only be fired at will.

The destructive range of an ordinary torpedo against a strong target, such as the sides of the modern man-of-war, is very small, probably not more than six feet. It is, therefore, readily understood, when exposed to the hazard of a torpedo attack, an operator might well suppose his torpedo had exploded close to the object and yet outside of its destructive range. Hence, the only sure method is to employ a torpedo that will explode by contact; for then it is assured that the torpedo, by its explosion, has exerted its greatest possible effect; and probably none others will be employed in a real torpedo attack.

The gun cotton torpedoes now issued from the Torpedo Station comprise both service and contact. They contain about the same charge, viz., 31½ pounds, and are alke in all respects, except the primer case of the latter contains a circuit breaker, closed only on contact.

The gun cotton, however, is stored in metal cylinders, instead of being directly packed in the torpedo can, exposing it to disintegration, making it in mass more difficult to ascertain its condition, and requiring a heavier case and more time to prepare it for service. These cylinders containing six disks, of 4½ pounds, are labeled with their gross weight; and water may be added to supply a loss of moisture through a small filling hole in each.

The "service" case resembles a drum, of light sheet iron, with two thin malleable iron heads, the top one movable. When needed for service, the top is taken off, its charge of six cylinders dropped into their places, leaving an annular space in the center, of about 3¾ inches diameter. Into this is placed the primer case, containing only dry gun cotton equal in amount to about one-third the charge of wet. The dry is exploded by a mineral fulminate detonator inclosed in it, which also contains the electric fuse bridge. The wires from the latter pass through a water cap in the cover of the primer case, and the latter must be absolutely water tight. This precaution must be closely observed, for the fulminate cannot be depended upon to explode the cotton if wet.

The torpedo holder is a light tripod uniting into a single piece called the knob. The case is easily and strongly held by the three legs, and the knob fits into the end of the spar from which it is fired. The contact torpedo case has arms projecting from the outside of the bottom cover, which are connected with the interior of the primer case, in which is the circuit breaker. When any one of these arms are struck it will, by an ingenious contrivance, close this break, and if the firing battery is connected in the circuit, the torpedo will immediately explode.

A single wire only is employed when the torpedo is to be fired on contact, but a second is also connected to the torpedo, but not to the battery Should it become desirable to explode the torpedo without waiting for contact, this second wire is attached to the other pole of the battery. The arrangement is such that in this case the circuit breaker is cut out, a complete electrical circuit is established, and the torpedo fired "at will."

Until recently the usual method of exploding boat torpedoes has been from wooden spars. These spars have but one fixed rest, the inner end is secured by a chain, and cocks up in the air when the torpedo is immersed. Consequently the torpedo is often thrown by the pressure of the water head off, or thwart the bows, the angle of immersion is unnecessarily great, large diameter and great water resistance are required for requisite strength, and the spar is frequently broken after one explosion. The steel spars and boat fittings now issued in their place have reduced maay of these objections to a minimum.

The spars are in three sections; two of steel and the outer an inexpensive one of wrought iron designed to protect the steel section from injury, and quickly replaced. They are jointed together like a fish rod, making a single length of 41 feet. The steel sections are thin tubes, 4½ and 3½ inches in diameter, and are re-enforced by forcing thin tubes into them, in such a way that the re-enforce fits very closely the outside tube.

The boat fittings consist of a T iron bar across the gunwale close to the stern, to whose ends guide bars are riveted. In these guides, by means of a chain, slide a traveler through which the spar passes some feet aloft, on each gunwale is secured a swivel clutch with top and bottom rollers, in which the spar rests, and which allows the spar to assume any angle, while it is firmly held in position. The spar rests on rollers, and if the traveler is triced up, it can with its torpedo attached be run out its full length and carried in this position above the water till the moment before attack, when, if the tricing chain is let go, the torpedo will at once reach the desired immersion.

The New Steamer Umbria.

The New York *Herald* prints an interview with William Bryce Douglass, constructing engineer for John Elder & Co., Glasgow, who came over in the Umbria's fiist trip in order to note the working of the engines. He thinks that about 6 days 6 hours is the limit of the Umbria's average speed, and that the limit of single screw engines has been nearly reached, owing to the difficulty of obtaining larger shafts. There is a loss of economy in twin screw engines, and it is never quite possible to get identical results from each engine. The Umbria's engine is the most powerful single marine engine afloat, and indicates 14,500 H.P., or about 1,000 more than the Oregon. Higher steam pressure is carried—110 pounds—and also greater speed, as 70 against 65 revolutions. The screws have the same pitch—33 feet—but differ 3 inches in diameter, the Umbria's screw being the larger, or 24 feet 3 inches.

He thinks the Oregon has done her best in a quick passage in 6½ days, and that the Umbria under favoring circumstances may make it in about six days. He advocates Fox's corrugated furnaces for high steam pressures, admits the utility of twin screws for maneuvering, though unnecessary in Atlantic steamers, criticises the depth of entrance to New York harbor, which deprives the Umbria of 300 to 400 tons carrying capacity, and says that the building of vessels of ordinary type is overdone, that designs for special science are in demand, and the shipbuilding trade is now probably at its lowest ebb. He is now building two engines, one of 3,500 H.P. and one of 1,500 H.P., for the steamships Persia and Batavia, triple expansion, with valve gear of new design, to carry 150 pounds steam, and he expects them to be the most economical ever made to the present day. He advocates well constructed torpedo boats rather than ponderous iron clads for a navy. He says that "marine engine building, although based on strictly scientific methods, is to a large degree an art." In regard to American built steamships, he made in conclusion some very refreshing remarks: "I have seen the latest of them. They are very nice little ships. I think they are very good ships of their kind, but they are very different from ships which are adapted to the Atlantic service. The work is very good, and I could find no fault with the engines."

RECENT DECISIONS RELATING TO PATENTS.

United States Circuit Court.—Eastern District of Pennsylvania.

HATCH *vs.* ADAMS.

A sale of patented articles in the ordinary course of trade outside the territorial limits to which the right of sale is restricted by the patentee's grant is unwarranted.

McKennan, *C. J.:*

This case involves a single question, to wit: Has a purchaser of patented articles from a grantee of an exclusive right to manufacture and sell under the patent in a specified part of the United States the right to sell the articles, in the course of trade, outside the designated limits covered by the grant to his vendor?

In the absence of authority to the contrary, we would feel constrained to answer this question in the negative. While the patent act secures to an inventor the exclusive right to manufacture, use, and sell his invention, it authorizes him to divide up his monopoly into territorial parcels, and so to grant to others an exclusive right under the patent to the whole or a specified part of the United States. Undoubtedly the grantee would take and hold the right conveyed subject to the limitations of the grant, and hence he could not lawfully exercise it outside of the territorial limits to which he was restricted. It would be illogical, then, to assume that he could confer upon a vendee a privilege with which he was not invested, and which he could not exercise himself. It has been held, however, that an unrestricted sale of a patented article carries with it the right to its unlimited use; but the reason upon which this rule rests involves a plain distinction between the right to use and the right to manufacture and sell an invention, and is inapplicable to their definition.

In *Adams vs. Burke* (17 Wall., 455), Mr. Justice Miller thus explains the import and scope of the decisions on the subject:

"We have repeatedly held that where a person had purchased a patented machine of the patentee or his assignee this purchase carried with it the right to the use of that machine so long as it was capable of use, and that the expiration and renewal of the patent, whether in favor of the original patentee or his assignee, did not affect this right. The true ground on which these decisions rest is that the sale by a person who has the full right to make, sell, and use such a machine carries with it the right to the use of that machine to the full extent to which it can be used in point of time. The right to manufacture, the right to sell, and the right to use are each substantive rights, and may be granted or conferred separately by the patentee. But in the essential nature of things, when the patentee, or the person having his rights, sells a machine or instrument whose sole value is in its use, he receives the consideration for its use, and he parts with the right to restrict that use. The article, in the language of the court, passes without the limit of the monopoly; that is to say, the patentee, or his assignee, having in the act of sale received all the royalty or consideration which he claims for the use of his invention in that particular machine or instrument, it is open to the use of the purchaser without further restriction on account of the monopoly of the patentee."

The only question in this case, as shown by the pleadings, involves the right of the purchaser of coffin lids, bought within a radius of ten miles from Boston, the right to make, sell, and use which was restricted to that circle, to use them outside of it. The court sustained the right, saying—

"That so far as the use of it was concerned, the patentee had received his consideration, and it was no longer within the monopoly of the patent. It would be to engraft a limitation upon the right of use not contemplated by the statute, nor within the reason of the contract, to say that it could only be used within the ten mile circle. Whatever, therefore, may be the rule where patentees subdivide their patents, as the exclusive right to *make* or *sell*, within a limited territory, we hold that in the class of machines or implements which we have described, when they are once lawfully made and sold, there is no restriction upon their *use* to be implied for the benefit of the patentee or his assignees or licensees."

Even with this careful limitation of the judgment of the court, Justices Bradley, Swayne, and Strong dissented, insisting that the locality of the use, as well as of the manufacture and sale, of the patented article, was restricted by the grant, and that it ought accordingly to be enforced. It may be said, then, that while this case, with others which precede it, determine, for peculiar reasons, that the lawful sale of a patented article carries with it the right to the unrestricted use of such article as to time or locality, it is the fair import of them that no other "substantive right" conferred by the patent is thereby affected.

Our attention has been called to two cases decided by the circuit court which demand a brief notice.

The first of these was *Adams vs. Burke* (4 Fisher, 392). It was decided by Judge Shepley, and his statement of the law is certainly broad enough to cover the right to sell, as well as the right to use, a patented article outside of a restricted locality; but only the latter right was involved in the case. What was said then by the learned judge touching the right to sell was clearly *obiter*, and when the case reached the Supreme Court (*Adams vs. Burke*, 17 Wall., *supra*) that court expressly treated the right to manufacture and sell and the right to use a patented article as distinct substantive rights, and decided the law only as it related to the exercise of the latter right.

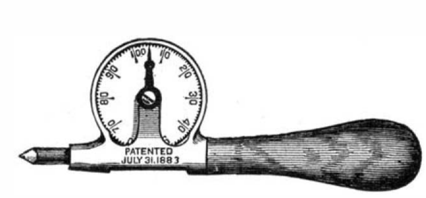
The remaining case (*McKay vs. Wooster*, 2 Sawyer, 373) was ruled upon the opinion of Judge Shepley in *Adams vs. Burke*, evidently upon the hypothesis that an extra-territorial sale of a patented article was a necessary subject of discussion.

But with this scrutiny of these cases we are unembarrassed by the rule of comity, which would lead us to conform our own judgment to that pronounced by the circuit court elsewhere, for the sake of uniformity of decision, and in view of the state of the law as it has been expounded by the Supreme Court we feel authorized to express our own judgment that a sale of patented articles in the ordinary course of trade outside the territorial limits to which the right to sell is restricted by the patentee's grant is unwarranted. There must, therefore, be a decree in favor of the complainant, with costs.

AN IMPROVED SPEED INDICATOR.

The accompanying cut represents a very convenient little instrument for registering the speed of any revolving piece of machinery. The advantage claimed for it over the ordinary indicator is that it will register up to 2,500 revolutions, those usually sold only counting up to 100. This is accomplished by having two dials, arranged back to back, one of which counts up to 100 and the other up to 2,500, the two being connected by suitable gearing. It is used by pressing the hardened steel point of the spindle of the instrument against the center of the revolving shaft of which it is desired to obtain the speed; one dial shows the number of revolutions up to 100, and the second shows the number of revolutions the first has made, or the number of hundreds.

This indicator has been patented by Mr. C. H. Fowler,



FOWLER'S IMPROVED SPEED INDICATOR.

and is now being introduced by Messrs. Goodnow & Wightman, of Boston, Mass., to whom communications should be addressed.

Subjects for Papers.

The Council of the Institution of Civil Engineers, London, invite original communications on any of the subjects included in the following list, as well as on other analogous questions. For these, if approved, they will award premiums, arising out of special funds bequeathed for the purpose, the particulars of which are as follows: 1. The Telford Fund, left "in trust, the interest to be expended in annual premiums under the direction of the Council." This bequest (with accumulation of dividends) produces 250 pounds annually. 2. The Manby Donation, of the value of about 10 pounds a year, given "to form a fund for an annual premium or premiums for papers read at the meeting." 3. The Miller Fund, bequeathed by the testator, "for the purpose of forming a fund for providing premiums or prizes for the students of the said Institution, upon the principle of the 'Telford Fund.'" This fund (with accumulations of dividends) realizes 160 pounds per annum.

Out of this fund the Council have established a scholarship—called "The Miller Scholarship of the Institution of Civil Engineers"—and are prepared to award one such scholarship, not exceeding 40 pounds in value, each year, and tenable for three years. 4. The Howard Bequest, directed by the testator to be applied "for the purpose of presenting periodically a prize or medal to the author of a treatise on any of the uses or properties of iron, or to the inventor of some new and valuable process relating thereto, such author or inventor being a member, graduate, or associate of the said Institution." The annual income amounts to rather more than 16 pounds. It has been arranged to award this prize every five years, commencing from 1877. The next award will therefore be made in 1887. The Council will not make any award unless a communication of adequate merit is received, but will give more than one premium if there are several deserving memoirs on the same subject. In the adjudication of the premiums, no distinction will be made between essays received from any one connected with the Institution (except in the cases of the Miller and the Howard bequests, which are limited by the donors) or from any other person, whether a native or a foreigner.

List.—1. Improved Instruments for Surveying and Leveling.

2. Machines and Measuring Apparatus for Testing Metals and the Equipment generally of Mechanical Laboratories.

3. The Mechanical Properties of Cold Rolled Metal as compared with Hot Rolled Metal, and on the Cold Rolling of Iron Shafting, as practiced in America.

4. The effect produced on Steel by Tempering in Oil and in Water.

2. The Manufacture, Strength, and other Properties of Castings of Malleable Cast Iron and Cast Steel.

6. The Thermic Properties of Metals commonly used in the Arts, especially with respect to Conductivity and Diathermancy at high temperatures.

7. The Manufacture of Steel-faced Armor Plates.

8. Iron Foundry Practice as regards Melting, with Results obtained from various Forms of Cupola, Pressures of Blast, etc.

9. The various Systems of Brickmaking by Machinery.

10. Gaseous Fuel, and the Residual Products of Gas Making.

11. The Manufacture of Artificial Fuel from Small Coal.

12. Steam Boiler Furnaces, with Reference to Fuel Consumption and to the Prevention of Smoke.

13. The Principles to be observed in the Laying-out, Construction, and Equipment of Railways in New Countries.

14. The Theoretical and Practical Effect of Gradients and of Curves on the Speed of Railway Trains.

15. The Application of the Compound Principle to Locomotive Engines.

16. Locomotive Performances, with regard to Weight, Power, Fuel Consumption, and Dynamometer Returns.

17. The comparative merits of Straight Axles and of Crank Axles for Locomotive Engines.

18. The Design and Construction of Locomotive and Carriage Sheds on Railways.

19. Mechanical Power on Tramways, including Steam, Compressed Air, Electricity, Cables, etc.

20. The Principles involved in the Conservation Improvement of any Tidal River or Estuary.

21. Descriptions of recent Graving Docks, Gridirons, and Floats.

22. Promenade and other Piers; with reference to the effect of Sea Water on Wrought and Cast Iron Structures, and the best Means of Preserving the same.

23. The Modern Construction of Marine Engines.

24. On Built Crankshafts for Marine Engines, and on the Liability of Crank and Screwshafts to Fracture.

25. Vessels for Inland Navigation, with the mode of working them by Sternwheels, Screws, etc.

26. The Methods of Removing Rock under Water.

27. Cranes and other Lifting Machinery, employed either in the Construction of Large Works, or for other purposes.

28. Dredging Machinery for Small Harbors, and for Drainage and Irrigation Canals.

29. The Ventilation of Sewers, with Summary of Experiments as to to the Motion, Pressure, etc., of Gas in Sewers.

30. Filter Presses for separating Fluids in Semi-fluids, particularly for the Treatment of Sewage Sludge.

31. Appliances for the rapid Shipment of Coal, with a comparison of different methods.

32. Winding Machinery, Expansion Gear, and Balancing Apparatus, and the cost per ton of winding under different conditions and varying depths.

33. Underground Haulage, especially on the application of Compressed Air and of Electrical Power.

34. The methods employed in securing large and irregular shaped Mineral Workings.

35. Gold Quartz Crushing and Amalgamating Appliances.

36. The Manufacture and Desilverization of Lead.

37. Electro Motors; their theory, practical construction, efficiency, and power.

38. On Gearing for Dynamo Machine Motors, and other high speed Machines.

39. The Transmission and Distribution of Electricity over large Areas for Lighting and for Motive Power, including Electric Railways, Hoists, etc.

40. Electrical Measuring Instruments.

41. Submarine Telegraph Cables, their manufacture, laying, and repair, including deep sea sounding.

42. Telpherage, or the Automatic Electrical Transport of Goods and Passengers.

43. The Measurement of Work by Dynamometers, with descriptions of the apparatus.

Heart Beats.

Dr. N. B. Richardson, of London, says he was recently able to convey a considerable amount of conviction to an intelligent scholar by a simple experiment. The scholar was singing the praises of the "ruddy bumper," and saying he could not get through the day without it, when Dr. Richardson said to him: "'Will you be good enough to feel my pulse as I stand here?' He did so. I said, 'Count it carefully; what does it say?' 'Your pulse says 74.' I then sat down in a chair, and asked him to count it again. He did so, and said, 'Your pulse has gone down to 70.' I then lay down on the lounge, and said, 'Will you take it again?' He replied: 'Why, it is only 64; what an extraordinary thing!' I then said: 'When you lie down at night, that is the way nature gives your heart rest. You know nothing about it, but that beating organ is resting to that extent; and if you reckon it up it is a great deal of rest, because in lying down the heart is doing ten strokes less a minute. Multiply that by sixty, and it is six hundred; multiply it by eight hours, and within a fraction it is five thousand strokes different; and as the heart is throwing six ounces of blood at every stroke, it makes a difference of thirty thousand ounces of lifting during the night. When I lie down at night without any alcohol, that is the rest my heart gets. But when you take your wine or grog you do not allow that rest, for the influence of alcohol is to increase the number of strokes, and instead of getting this rest, you put on something like fifteen thousand extra strokes, and the result is, you rise up very seedy and unfit for the next day's work till you have taken a little more of the 'ruddy bumper,' which you say is the soul of man below."—*Gaillard's Journal.*

ENGINEERING INVENTIONS.

An apparatus for raising water has been patented by Mr. Thomas Arthur, of Bangor, Pa. The invention consists in a combination of tanks, siphons, inverted siphons, water pipes, air pipes, levers, floats, valves, and a stop cock, whereby the withdrawal of air from the initial siphons successively will cause a continuous raising of water.

A car coupling has been patented by Mr. Luther B. Owen, of Cedartown, Ga. The coupling pin, by means of a system of levers and rods, is made capable of being manipulated from the ends and sides of the car, while a bail may be operated from either side of car to control the coupling link without going in between the cars.

A driving belt has been patented by Mr. Gilman Jaquith, of Maysville, Ky. It consists of a single strip of cotton cloth folded repeatedly, with the warp running in the direction of the length of the band, and ends doubled upon itself for connection by a clip or hook shaped fastening, the whole stitched together to unite the folds and prevent raveling.

A compensator for wire ropes or cables has been patented by Mr. Richard B. Ireland, of Trenton, N. J. It consists in a wheel or roller carrying the rope and combined with the operating lever in such manner that normally the wheel is free, and is locked up by the movement of the lever, making an automatic and positive mechanism to allow for the expansion and contraction of wire ropes or cables.

AGRICULTURAL INVENTIONS.

A plow has been patented by Mr. Donald M McAlpine, of Savannah, Ga. This invention covers a novel construction whereby a short beam can be used and the draught attachment can be readily adjusted as the character of the soil may require.

A harrow has been patented by Mr. Phillip Hense, of Dyersville, Iowa. This harrow can be formed of one, two, or three sections, as may be desired, the invention covering a novel combination and construction of parts, to facilitate the operating and controlling of harrows and promote their durability.

A combined gang and subsoil plow has been patented by Mr. William S. Haven, of Shreveport, La. This invention covers a novel construction of a double plow which may be drawn through old ridges, turning the soil into furrows previously formed, so new ridges can be readily completed, and the labor of preparing land for the next crop greatly lessened.

A combined seed planter and cultivator has been patented by Mr. Thomas B. Shannon, of Huntsville, Tex. The construction is such that when the machine is to be used for cultivating plants the hopper and its attachments can be removed, or the clutches can be thrown out of gear with the wheels to prevent the seed dropping appliances from operating.

An attachment for cultivators has been patented by Mr. Frederick Albrecht, of Ohio, Ill. It is made with a clamp secured to the standard of the cultivator, and holding the arm of a crank rod, to the other end of which is secured a blade by a hook bolt, so the blade will be secured to the standard, and can be readily adjusted.

A plow attachment has been patented by Mr. William P. Brown, of Zanesville, O. The invention provides an adjustable connection that will allow the shovels to be made unusually long, so that as they wear away they may be set lower, also allowing one shovel to be set higher than the other, where plants to be cultivated are on different levels, with other novel features.

MISCELLANEOUS INVENTIONS.

A metallic cap for corks has been patented by Mr. Alfred L. Bernardin, of Evansville, Ind. The cap has, in addition to an open ended slot, elevations or nodules upon its upper surface, to effectually hold the binding wire thereon, and thus bind the cap upon the stoppers or corks.

A machine for cutting glass has been patented by Mr. Price C. Claflin, of Stevens Point, Wis. A bed is mounted to be revolved on a suitable frame, with a guide arm to project radially over the bed, a cutter holder for the cutting tool being fixed in a slot in the guide arm, with other novel features.

A churn power has been patented by Mr. Fredrick F. Williams, of Salado, Texas. A vertically movable carriage has a drum with a rope wound on it, the upper end being secured, and from the drum a wheel on the carriage is operated by gearing, the wheel being connected with the dasher staff.

A combined folding chair and bath tub has been patented by Scott J. Beach and Sarah A. Beach, of Norfolk, Conn. This invention covers novel details and combinations of parts for an apparatus which can be adjusted for use as a large or small chair, a large or small cot, or a large or small bath tub.

A lady's bicycle has been patented by Mr. Louis P. Valiquet, of New York city. It is constructed with a frame suspended from and below the axles, in such manner that it can be conveniently used by ladies, and is further designed to promote efficiency in the application of power to bicycles.

A tile ditcher has been patented by Mr. Oscar Booth, of Creston, Iowa. It is mounted on wheels to move over the ground to dig trenches for laying tiles or drain pipes, and is intended to cut a trench to any required depth at one operation, to raise the earth, and to carry it some distance to one side of the trench.

A fire escape has been patented by Mr. Augustus H. Terwilliger, of Newburg, N. Y. It is adapted to be built into the wall of a building, and to be closed when not in use by a sliding shield or cover, and is also calculated to facilitate the entrance of firemen to different stories of a building in case of fire.

A wedge shaped air balloon has been patented by Mr. George Wellner, of Brunn, Austria-Hungary. It has a vertical edge at the front end and a transverse edge at the rear end, with an inverted cone shaped projection on its belly to which the car is fastened, the balloon being calculated to ascend and descend obliquely.

A bag fastener and holder has been patented by Mr. John W. Rickart, of Quincy, Ill. This invention provides for peculiarly constructed hooking appliances, so the hooks of the fastening are not liable to be accidentally detached when the bag is closed, the contents tending to tighten the fastening, and the hooks forming means of suspending the bag when open.

A device for suspending hogs has been patented by Mr. William G. Reed, of Avon, Ind. The object is to take hogs from the scalding tub or bristling table and hang them for further work, for which a special construction is provided, intended to be especially useful on farms and by country butchers doing a small business.

An apparatus for tanning hides has been patented by Mr. Emile de Solminihac, of Lorient, France. A skeleton drum or cylinder is provided, upon the circumference of which the hides or skins are held and stretched, secured by clips, centrifugal action being utilized for causing the penetration of the tanning material through the pores of the hide or skin.

A dynamo electric machine has been patented by Mr. Elisha B. Cutton, of Kingsbridge, N. Y. It is constructed with the parts of the field magnet that receive the wire tapered from the pole pieces to the yoke, to make a sufficiently strong field with less iron and less wire, and consequently a lower resistance and smaller percentage of power than are now used.

A wheel for vehicles has been patented by Mr. Alonzo E. Butler, of Leipsic, O. The invention covers a novel construction and combination of the hub, rim, and spokes, and manner of attaching and adjusting the spokes, making a light, cheap, and durable wheel, in which the spokes can be readily tightened or taken out.

A still for the manufacture of brandy has been patented by Mr. John M. Foy, of San Francisco, Cal. The heater is made in one with the still, the bottom of the latter being double or with a jacket, and there are several novel features enabling the operations to be carried on rapidly, and avoiding the delays usually necessary for charging and discharging.

A device for sharpening machine knives has been patented by Mr. Robert O. Owen, of Lynchburg, Va. This invention covers a peculiar construction and arrangement of a sharpening disk or wheel mounted in a frame and arranged in relation to the machine knife so as to be adjusted to or from the same while the latter is in motion.

An apparatus for making Roman candles has been patented by Messrs. Otto A. Minch, Hermann Minch, and Frank Minch, of Newark, N. J. This invention covers various novel details of construction whereby the clay, powder, stars, and combustible composition can be introduced into the cases in regular order, one, two, or more series of powder, stars, etc., as desired.

A churning device has been patented by Mr. Alexander Cairns, of Mount Hope, Wis. In combination with a block adapted to be coupled to a pivot is a revolving churn box, a shaft connected with the block by a universal joint, and a transverse shaft connected by gearing with the shaft connected with the block, the transverse shaft having crank handles at its ends.

A bone black drier has been patented by Mr. Edward P. Eastwick, of New York city. This invention covers a novel construction for applying currents of air to absorb and carry off the moisture the bone black contains, and to oxidize the organic matter therein. A bone black kiln has also been patented by the same inventor for reburning and revivifying bone black, and especially adapted for use in sugar refining.

A marine record preserver has been patented by Mr. Duncan Sinclair, of Wai-Nui Omata, Wellington, New Zealand. It is constructed with outer and inner cases connected at their open lower ends by an annular plate, and having a cork filling and separable tube attached at its lower end to a cap plate screwing into the annular bottom plate, for preserving records of ships lost at sea, etc.

A polarized telegraphic relay has been patented by Mr. Wirt B. Harvey, of Memphis, Tenn. Combined with a swinging armature, having one end held between the two poles of a magnet, is a coil held opposite the other end of the armature, the coil having a core part screw threaded, so by turning the core and the coil thereon the coil can be adjusted a greater or less distance from the end of the armature.

An axle gauge has been patented by Mr. Hector McQuarry, of Allandale, Ontario, Canada. The object of this invention is to provide a simple, readily adjustable, and reliable tool for bending the arms of vehicle axles downward to give the proper "set" to cause the wheels to travel on a plumb spoke, and forward to give the proper "gather" to the wheels, for which a novel construction is provided.

A printing press has been patented by Mr. Thomas Forknall, of Manchester, Eng. The invention consists in a ring or circular plate held in place on the yoke by screws and having its outer circular edge screw threaded, on which plate a ring nut is screwed, to facilitate the adjusting of the platen according to the thickness of the paper, as by turning the ring nut the platen will be pressed a greater or less distance from the yoke.

A photographic camera has been patented by Mr. Walter Clark, of New York city. It combines an adjustable lens with a device for holding and exposing the sensitive plate, a focusing glass in the top or side of the camera box, a reflector, adjustable into or out of line with the lens, for throwing the image on the focusing glass and afterward exposing the sensitive plate, with other novel features. The same inventor has also obtained another patent for a camera that does not require the plate holder to be removed to obtain a focus, and which has shutters for instantaneous photographing, operated automatically by the lens holder, forfield work, the camera being fitted in a case or bag of novel construction and arrangement.

Special.

LIFE IN SIAM.

In 1841 a young man, named Jno. H. Chandler, felt it to be his duty to go to Burmah and join in the work of Baptist missions in that country. The name of Chandler is an honored one in the literature and labor of the Baptist Church; and on this gentleman and his accomplished wife has fallen a just share of the honor which follows devoted toil. Mr. Chandler at first went only as a lay missionary, but subsequently entered the ministry as a regularly ordained clergyman. He brought to the work the skill of a mechanical engineer and a thorough mastery of the arts of printing and type-founding. He was soon transferred to Siam, and made his home at Bangkok, the capital of the kingdom. Here his ready facility for acquiring the language made him both useful and busy. He wrote several religious and scientific works in Siamese, and rendered himself valuable to the king and his court as translator of important documents. His wife, formerly Miss Crossman, of Utica, N. Y., made herself eminently useful in connection with the work of the mission. Both in Burmah and Siam she was at the head of schools for the natives, and in later years she had at Bangkok a school for the children of the nobles and princes.

One of the almost inevitable results of mission work is the breaking down of the health of those engaged in it. And this is especially the case in such a debilitating climate as that of Siam. This breaking down generally comes after a short term of service. The Rev. Mr. Chandler and his wife were no exceptions, in this respect, to the ordinary lot of missionaries. Their labors had been arduous and various. Mr. Chandler had served with the Foreign Missionary Society till 1856. Then he was occupied with various evangelical and literary duties, until in 1859 he became U. S. Consul at Bangkok. He was also tutor to the present King of Siam, whose full name is Ohra Bard Somdech Paramindur Maha Chulalongkorn Chub Chi Chow Chow Yuhua. The official title of this monarch is simply "Chulalongkorn."

The undermining of Mr. Chandler's health went on gradually for years, until in 1872 he entirely broke down. In Bangkok he received medical treatment, and also on his way to this country and back again in 1876. But the effect of all this was rather to patch up than to cure. It was not until 1880 that he and his wife began to experience substantial relief. But we will let them tell their own story, which will be found exceedingly interesting. Recently a correspondent of one of our daily papers visited them at their home in Camden, N. J., at which place they have been residing since their return from Siam. He found them hearty and cheerful people, considerably past middle life, and giving no indication, either in appearance or manner, of ever having been miserable invalids.

The Rev. Mr. Chandler, conversing freely about his experience, said, substantially:

"After coming to this country in 1876 I returned to Siam with somewhat improved health, intending to stay six years. Such was my condition, however, and that of my wife, that we were compelled to return in three. *I was a complete wreck. My lung weakness was so great that for months at a time I could not write or read. The nerves of my stomach were totally demoralized. My food would not digest. I had to lay aside all my teaching and missionary labor.* I required an attendant all the time, and was *unable to do either mental or physical work.* My sleep was broken and unsatisfactory. I was also troubled with palpitation of the heart, with diabetes *and with an obstinate catarrh of ten years' standing. Altogether I was a very, very sick man.*

"While thus a sufferer, the Rev. Dr. MacFarland, a Presbyterian missionary at Bangkok, called my attention to 'Compound Oxygen.' He had tried it for indigestion and general debility, and had found it very beneficial.

"While I was on my way home I found myself in a very critical condition, and almost gave up the hope of recovering health. On reaching Philadelphia I consulted Drs. Starkey & Palen, and at once began the use of Compound Oxygen. *It acted like a charm.* Very soon I felt signs of returning strength. In the matter of diabetes, the relief was particularly noticeable. *Improvement went on gradually, but surely. I became so that I could eat with regularity and really enjoy my food. In time my old symptoms of wretchedness and weariness passed away, and I was myself again.*"

"To what extent are you able to perform such labors as you formerly could?" was asked.

"You may judge of my strength and health when I tell you that I was with the Siamese Embassy in New York and Washington a few months ago, traveling with them and going about as freely and energetically as any of them. Compound Oxygen has so recruited my system that the unusual exercise of travel had no unpleasant effect on me; *nor was I in any respect the worse for my journey. I think I am now able to endure almost as severe labor as at any period of my life.*"

Mrs. Chandler, who seemed to be in excellent health, then cheerfully gave her experience. She said in substance:

"From my early girlhood I had been ambitious to attain the highest degree of knowledge and of usefulness. I wanted to go as a missionary to some heathen country, and I labored to be prepared for it. My gift for the acquisition of languages proved of great service to me. First, I assisted in a missionary school in Burmah; then I taught schools of the native Siamese; I had, among others, the brother of the present king under my care and a number of the children of the nobility, to whom I taught the English language. I also did much translating. So arduous were my labors that my health, which had for some time been failing, broke down in 1873. I had been of buoyant spirit, *but my nerves were exhausted, and I sank down. Vitality gave out. Endurance failed. I gave up all my work. I was so low that on arriving in this country in 1876 no physician would give me any encouragement.* When I returned to Siam, it was with only partially restored health. *I broke down again, and for months was absolutely helpless. I was nervous to a frightful extent,* and, in spite of the most earnest endeavors, could not obtain satisfactory sleep. We could not see our way clear to leave Bangkok until 1880. When I began to pack, I was afraid I could not go through such a heavy undertaking. In the midst of this terrible state of depression and dejection Dr. MacFarland handed my husband one of the 'Starkey & Palen' books about Compound Oxygen. It seemed to me that this must be a beneficial remedy. On the homeward voyage I improved a little.

"On arriving here I at once sought Starkey & Palen, procured a *home treatment* and faithfully followed the directions. Has it done me good? Look at me now. *I am restored to my old good health. There could have been no severer test than in my case.*"

In concluding a very pleasant conversation, the Rev. Mr. Chandler and his excellent lady both remarked that with gratitude to God for their restoration, they are at **all times free to speak of what Drs. Starkey & Palen** have done for them with Compound Oxygen. Considering the remedy completely adapted to their cases and to similar ones, they have no hesitation in making their recovery known, for the benefit of the great army of invalids who are seeking relief and who may be happy in thus finding it.

A "*Treatise on Compound Oxygen*," containing a history of the discovery and mode of action of this remarkable curative agent, and a large record of surprising cures in Consumption, Catarrh, Neuralgia, Bronchitis, Asthma, etc., and a wide range of diseases, will be *sent free.* Address DRS. STARKEY & PALEN, 1109 and 1111 Girard Street, Philadelphia.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Name and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter**, should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) E. B. H. asks the actual as well as nominal horse power of engine, cylinder 10 inches diameter, 36 inches stroke, 65 revolutions, and 85 pounds pressure on steam gauge. A. Nominal, 39 horse power. Actual at one-half cut-off, 88 horse power. The working power depends upon the point of cut-off, which you do not give.

(2) G. K. G. asks (1) a recipe for violet water. A. 6 pounds violet pomade, 1 gallon rectified spirit; macerate and digest in closed vessel for a month and decant. Then add 3 ounces tinc. orris root and 3 ounces cassia spirit to each pint. 2. Also one for polishing nickel stove trimmings. A. Polish nickel plating with rouge upon soft leather or buckskin slightly moistened; finish dry.

(3) C. F. M. asks if oil poured on the top of a gravity battery will prevent the water from freezing. Also from evaporation. If not, what will keep the water from freezing? A. Oil poured upon the top of a gravity battery will, in a measure, prevent evaporation and the creeping of the zinc sulphate over the top of the jar, but it will not keep the solution from freezing. The only safe way of preventing the freezing of a battery is to place it in a cellar, or inclose it in some way to prevent the frost from reaching it. The gravity battery does not work well in a very low temperature.

(4) Q. P. asks: What power could be got from an electric motor, a ten horse power engine being used to drive the dynamo? A. About 50 per cent of the motive power can be realized in the electric motor, provided the dynamo and the motor are of approved construction.

(5) W. J. asks the difference between the common brass wire and the brass wire that door springs are made of. A. The difference is mainly in drawing the wire. Spring wire is drawn hard and not annealed. You can purchase spring wire from all the prominent brass companies.

(6) C. L.—A thermostatic bar is generally made by riveting or brazing together strips of brass and steel. When the bar is heated, the brass expanding more than the steel causes the bar to spring, rendering the brass side convex and the steel side of the bar concave. We do not know that the thermostatic bars are kept for sale, but they are easily made.

(7) F. S. asks a recipe for making the material used to block or stick the heads of stationary together. A. A quarter of an ounce crude gutta percha; dissolve in bisulphate of carbon to the consistence of mucilage. Apply to the edges of the paper where required.

(8) V. S. W. writes: Being desirous of building a small electric machine, I would like to know how many times I would have to increase the drawings in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, vol. vii., to the best advantage for a 2x4 steam engine. A. We think that the dynamo described in SUPPLEMENT, No. 161, would furnish sufficient work for your 2x4 steam engine, unless your steam pressure is very great. If you desire to make a larger dynamo than that described in the SUPPLEMENT, we advise you to copy one of the more modern machines—Siemen's, Weston's, or Edison's.

(9) S. S. asks: Is there power enough in a bichromate battery of 6 or 8 large cells to run a small incandescent lamp, say of 16 candle power, a Brush-Swan lamp for example? A. We think you would find the resistance of your lamp too great for your battery. There is no economy in running a single lamp by means of a battery.

(10) A Reader asks for a receipt for making white ink, suitable for pen drawing. A. Kilner gives the following: Mix pure freshly precipitated barium sulphate or flake white with water containing enough gum arabic to prevent the immediate settling of the substance. Starch or magnesium carbonate may be used in a similar way. This must be reduced to impalpable powders.

(11) H. W. H. writes: Can you inform me of the property in luminous paint which causes it to emit light in the dark? What chemical reaction, if any, does the paint undergo? A. The luminous property is due to what is termed phosphorescence. It is probably a slow combustion or oxidation. See the article on Phosphorescent Substances, SCIENTIFIC AMERICAN SUPPLEMENT, No. 318.

(12) G. R. F. asks: 1. What is the best liquid to use in a hydraulic lift in frosty weather, when I cannot use water? Would kerosene injure it in any way? A. If you use kerosene or petroleum in your lift, you will require the full quantity necessary for operating it; the only objection will arise from its leakage. Water with 20 per cent crude glycerine will not freeze at zero, and in colder weather will not freeze to give trouble. Whisky has been much used in hydraulic cylinders exposed to low temperatures. Crude petroleum is the cheapest. 2. I am building an ice house; is it necessary or advisable to have ventilation in the roof? If so, why? Will not ventilation promote circulation of air around the ice, and consequently make it waste faster than it would if close or air tight? A. In ice houses the top of the ice is generally well covered with hay or saw dust to keep it from contact with the warm air under the roof. The roof in summer gets very hot from the heat of the sun; the air beneath it becomes much hotter when confined than with thorough ventilation. The roof requires ventilation, not the ice.

(13) W. E. asks: What is used for coating steel mould boards of plows to keep them from rusting after they have been polished? A. Lard oil, tallow, and white lead, about equal parts, brushed on warm, is much used on machinery. If you wish the plows to show the polish, it will be well to varnish the polished parts with a cheap copal varnish thinned with turpentine. Polished hardware is varnished with thin shellac varnish, a little cobalt blue, or other color; the articles to be heated previous to varnishing to about 212°.

(14) J. W. H. writes: It is a common belief that to shingle the hair of children makes it thicker. How is it? A. Professor Wilson in an article on the Hygiene of the Hair, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 102, says: "Cutting does not encourage growth as much as is commonly believed, but it is advantageous in the case of the short, slender hairs, commonly called young hairs."

(15) J. M. L. B.—The flattening of boiler heads is a matter of different practice with boiler makers. Some can turn the flanges without raising the centers, while others manage to warp them, when they are generally straightened cold to avoid the warping effects of heat. If the boring tools are sharp, and lip counter bores used, the plate should not bulge in boring. A bulged head requires tubes of unequal length, which is not good practice. If they become bulged by bad treatment, they should be restored by a better treatment of heating the whole to a black heat or about 700°, and pressing flat upon the flattening plate.

(16) A. A. F. asks: Is there any way to plate or cover a steel knife with tin, or any solution for it? If so, please let me know how to do it? A. Boil 1 ounce cream tartar, 1½ ounces grain tin, or tin shavings, in 1 quart water for an hour. Clean the knife thoroughly, and dip in the boiling solution.

(17) J. F. asks for a recipe for melting rubber. A. Rubber can be melted by heating it over a water bath. In order to get it into a liquid state, however, it is generally brought into solution by dissolving thin strips of rubber in ether, petroleum, naphtha, carbon disulphide, or any other of the numerous solvents. A very full account of the rubber industries will be found in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 249, 251, and 252.

(18) J. E. H. writes: 1. How many horse power will it require to run a dynamo like one in SUPPLEMENT, No. 161, with two incandescent lamps, to light a room 50x100? A. The dynamo described in SUPPLEMENT, No. 161, is too small for your purpose, 2. Which is the best lamp to use with such a machine—the incandescence or the Swan lamp? About how much will one lamp cost me? A. The machine will run two, 3 candle power, incandescent lamps. For the price of lamps address the Edison Company, East Newark, N. J. 3. Can an electro motor be made to run such a dynamo? A. Yes, but the electric current required to drive the motor would operate twice as many lamps as the dynamo driven by the motor. For information on electric lamps consult SUPPLEMENT, Nos. 162 and 370.

(19) P. E. C. writes: I have two good portrait lenses—a quarter and a half Darlot. I would like to use them to improve my magic lantern. Which one should I use, and at what distance from the condensers will I have to nail the board holding the lens? A. The distance between your camera tube and your lantern slide should be about the same as that between the tube and the ground glass in the photographic camera. The quarter tube will answer for ordinary lantern views, and the half tube will do for larger views, provided your condensers are large enough to illuminate them.

(20) R. L. D. writes: I have made a telephone call similar to the one in SUPPLEMENT, No. 162, only used three ounces of No. 30 cotton covered wire on each spool. The current is more than a man can conveniently take if I use wet sponges, but the poles of my magnets are so close together that it is impossible to put the call on the same machine. So I made magnets with five-sixteenths cores 1 inch long, and wound three-quarter ounce No. 36 silk covered wire. The call is so weak that if I make a spring light enough so as to work, the slightest jar of the floor will cause the bell to ring. 1. Is my current strong enough? A. Yes. 2. Will the machine I have described generate a suitable current to work a call over a quarter of a mile of wire? (The line is an acoustic cable of three No. 22 copper wires twisted.) The telephones work well with this wire at this distance. A. Yes, provided you use a polarized bell. 3. Is there any better style of call than that? A. No. 4. How much No. 36 wire does it require for the magnets in call illustrated in SUPPLEMENT, No. 162? A. About 200 feet. 5. How is the call hammer made to vibrate in the company's telephones? A. The armature is polarized, so that it is alternately attracted and repelled as the current is reversed.

(21) M. M. asks if there is any way of preventing mica from scratching, also if the edge can be made so as not to break or ruffle, if sprung into a bevel. A. We know of no way to treat mica so that it will answer your purpose.

(22) B. P. writes: I have never seen in your paper any reference to a kind of electric light described in my Natural Philosophy as follows: "The brightest artificial light known is made by placing two points of charcoal within an inch or two of each other, and connecting them with the opposite poles of a galvanic battery. The space between the points will be occupied by an arch of flame equaling in dazzling brightness the rays of the sun, etc. The charcoal points never wear away, the battery alone having to be replenished." I would like to ask you what has been found the matter with such lights, or have so much betterones been found? A. You refer to the old experiment of producing the electric arc in a vacuum; it is interesting only as an experiment, and has no commercial value. The ordinary arc lights operate on substantially the same principle, the carbons being arranged to feed as they are consumed.

(23) I. B. writes: I am running a 150 horse power engine; the main belt leads up over head, and sometimes is so highly charged with electricity that, when I stoop down to pass under it, I experience a severe electric shock on the bottoms of my feet, if by chance I step on any nail heads in the floor. Sometimes it causes my hair to rise up on end; at other times it has a reverse action of pressing it flat down. Now can you give me the cause of a belt becoming so charged and discharged? In other words, what is the best and most generally accepted philosophy of this strange phenomenon? A. The electricity of belts is of the same nature as the frictional electricity of the electrical machines, and is supposed to be generated by the friction of the belt upon the pulley, or by the friction of the particles composing the belt as it leaves the pulley. The most acceptable theory is, that the belt acts upon the principle of the electrophorus, and generates the electricity by the act of parting from the pulley. 2. I have a double bell whistle 8 inches diameter, cast brass; with 65 pounds steam, how far should the edge of the bells be from the annular orifices? A. The whistle bell cannot be set exactly without a trial. Steam whistles generally have a screw on the spindle, with jam nuts for adjustment. Set your bell month an inch and a quarter from the orifice, and vary it after trials to suit your taste.

(24) W. R. H. asks for the best method for polishing furniture made of open grained wood. A. A furniture polish which has been recently recommended is prepared as follows: Melt three or four pieces of sandarac, each of the size of a walnut; add one pint of boiled oil, and boil together for an hour. While cooling add one drachm of Venice turpentine, and if too thick, a little oil of turpentine also. Apply this all over the furniture, and after some hours rub it off; rub the furniture daily, without applying fresh varnish, except about once in two months. Water does not injure this polish, and any stain or scratch may again be covered, which cannot be done with French polish.

(25) E. F. F. writes: Is there anything that will stop the disagreeable noise to which the pipes of steam heaters sometimes treat us? The noise is often so loud as to make all conversation impossible, and makes the impression as though the pipes were struck with a hammer. What causes it? A. The water hammer in steam heating pipes is mostly owing to defects in planning the steam and return pipes, either in their position or relative size. Sometimes heating engineers are hampered by architectural conditions. Occasionally engineers are negligent in failing to blow the air out of the pipes. Much of the trouble arises from partially opening or coloring the radiators, causing the water to accumulate in them, which when upon fully opening such a radiator the water rushes into the return pipe to disturb a whole building by its vibration. Much more of this trouble occurs in moderate weather, when in most large buildings a large number of radiators are closed or partially so; the connecting pipes leading to such radiators become partially filled with water, the vibration of which causes the noise.

(26) J. L. writes: I find several recipes for preserving eggs, in your paper; I have tried two of them—liquid glass and paraffine. I want to get a recipe for cleaning the shells that will be cheap and quickly done—solvents for the glass and paraffine. A. A little dilute acid or vinegar could be used to cleanse the shell, if desired. Liquid glass is soluble in water, especially hot water. Paraffine is soluble in both benzine or carbon bisulphide. In SCIENTIFIC AMERICAN SUPPLEMENT, No. 317, several methods of preserving eggs are given. Paper can be paraffined, and the eggs can then be wrapped in that material, but it is not as satisfactory as paraffine or soluble glass; various varnishes are also used, the object in all cases being simply to completely exclude the air from the shell.

(27) D. B. writes: What is the process (if any) by which perfect deodorization of sponge from taste or smell can be obtained? We want them for filtration. A. One of the best processes is said to be the following, which has for some time been in use at Bellevue Hospital: Soak the sponges, previously deprived of sand and dirt, by washing in a one per cent solution of potassium permanganate; remove, wash thoroughly, and press. In order to bleach them, continue by placing them in a solution of one-half pound sodium hyposulphite in one gallon of water to which one ounce of oxalic acid has recently been added, and allow to remain fifteen minutes. Remove and wash thoroughly.

(28) J. B. R. asks whether or not the 6 inch pipe from a Sturtevant blower should be smaller near the cupola, that is, tapering like a nozzle, and how much; pipe enters cupola on both sides; and how far from bottom should pipes be for 36 inch cupola? A. It is not necessary to have the blow pipe for cupola tapering. The best practice now is to have a square pipe extending around the shell, and attached to it with mica peep holes in doors opposite the nozzles, the nozzles being only holes through the shell and brick lining, which can be trimmed up with clay at each melting, in the same manner as the draw spout. The distance from the bottom should be as small as the quantity of metal that you wish to accumulate before pouring will allow. Some bed the bottom with sand when they have a small heat, for economy in fuel. You do not say that your cupola is 36 inches inside or outside. If 36 inches inside, you may make the nozzle 8, 10, 12, or 14 inches from bed, according to the manner and amount of work. An economically managed cupola here of 22 inches internal diameter turns out from 2 to 3 tons of castings in 3 hours. Depth of bed from tuyere, 9 inches.

(29) Y. C. writes: Professor Angell, on "Sanitary Examination of Drinking Water," published in the SUPPLEMENT of November 8, says that in 437·5 grains of salt there are 265·5 grains of chlorine. I would like to know from whose formula of NaCl he figures this result. Graham gives a table of equivalents, according to which Na has 24 for its number and Cl 36. The Dispensatory says Cl+Na=35·5+23·3=58·8. Josiah P. Cooke, Jr., says Cl+Na=35·67984+23·12016=58·8. Why is it that there are such differences among authorities? In some works we are taught one thing, and in others the reverse; for instance, *ide* and *uret* are said to have different meanings when attached to names, but are used by others in the same names. A. We know that 1 ounce avoirdupois contains 437·5 grains troy. The atomic weight of chlorine is 35·5 for all practical purposes, and that of sodium 23. (According to Roscoe, 35·37 and 22·29.) In regard to the atomic weights, it must be borne in mind that they are deduced from experimental work, and therefore until all sources of error are eliminated they will be variable, and are given differently in works on chemistry, according to the latest data at command when the book was written. It is therefore best for our correspondent to consult the latest books on the subject. Professor Graham has been dead nearly twenty years, and his figures are no more authority on atomic weights than the census returns of 1860 are valid for Ohio to-day. The molecular weight of sodium chloride therefore is 35·5+23=58·5. To determine the amount of chlorine in 1 oz. av. of sodium chloride we employ the following proportion: The molecular weight of sodium chloride is to the atomic weight of chlorine as the weight of the sodium chloride is to the weight of the chlorine:

$$58{\cdot}5 : 35{\cdot}5 :: 437{\cdot}5 : x.$$

x equals the weight of chlorine, approximately 265·5. *Uret* is the old term for *ide*, and is not used in modern chemical text books. The best advice we can give to you is the recommendation to study the science, either with some good text book or under some competent teacher.

(30) J. C. P. says: In your Notes and Queries, November 15, query 32, E C., asks for glossy marking ink for show cards. Lampblack and turpentine will make a mark, and it sometimes stains the card where it should appear clean and white. Asphaltum varnish is the article for marking show cards. The letters may be first painted with India ink and the varnish put over them, but I use nothing but the varnish.

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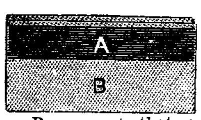

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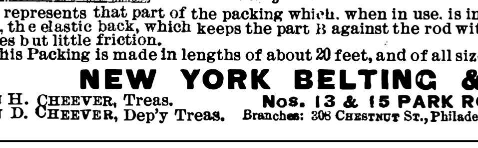

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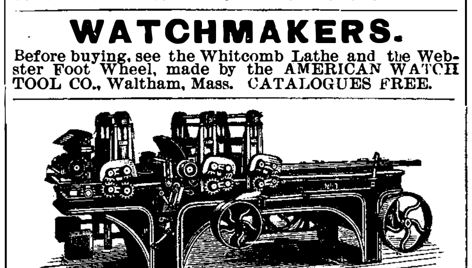

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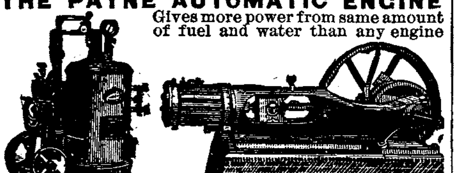

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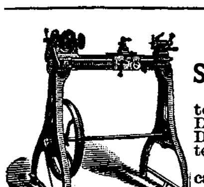

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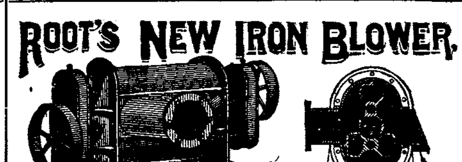

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