SCIENTIFIC AMERICAN

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LOCOMOTIVE BOILER EXPLOSION, WALLINGFORD, CONN.

We illustrate on this page a remarkable explosion of a locomotive boiler. It occurred at 6:30 A.M., December 19, 1890, at Wallingford, Conn. The engine was an old one, having been built 29 years ago. It was engaged in hauling freight trains, and was the property of the New York, New Haven and Hartford Railroad, doing most of its work on the Hartford branch of that road.

At the time of the accident it was pulling out a train of freight cars from the station, with the throttle full open and reversing lever dropped down, but was only moving slowly, as it was just starting. The engine had barely passed the station when the explosion occurred. Its violence is shown by the fact that it was heard at a distance of several miles from the scene. It is asserted that the noise was perceived six miles away in each direction.

The outer shell was torn away in an irregular band or zone, after the accident pieces being found thrown in different directions. The tubes were bent and displaced, but few were drawn out of the tube sheets. The connecting rods, main rods, and side rods were bent, the front driving axle was broken, and the cab was demolished. No signs of low water were reported.

The rails under the engine were spread seven-eighths inch; the fence near the track for about fifty feet was blown down. Glass in all the houses near the scene was demolished, and bricks were thrown from a chimney 300 feet away. After the explosion the engine ran 150 feet and stopped.

At about the same distance was a house, shown in the smaller illustration. The sand box of the engine was blown high in the air, and descending struck the roof, as shown. The cover, which accompanied it up to this point, fell off, and was found outside of the building. The box went through the roof, falling on one side of a partition, on the other side of which two children were in bed. A bushel of the sand which it had contained entered the house with it.

The engineer was blown off to the left of the engine to a distance of some forty feet. Thus he must have crossed the rear of the engine, as his post is on the right side. As the engine was stopping the fireman fell out, dropping near the engine and on the engineer's side. Thus each man left the footboard on the distant side, the two occupants of the cab crossing each other in their flight. Neither was fatally injured.

The engine was No. 69, built by Danforth & Cooke. It was a soft coal burner with 16 by 22 inch cylinders. The boiler plate was ¼ inch thick, and showed no sign of corrosion. The cause of the accident is unknown.

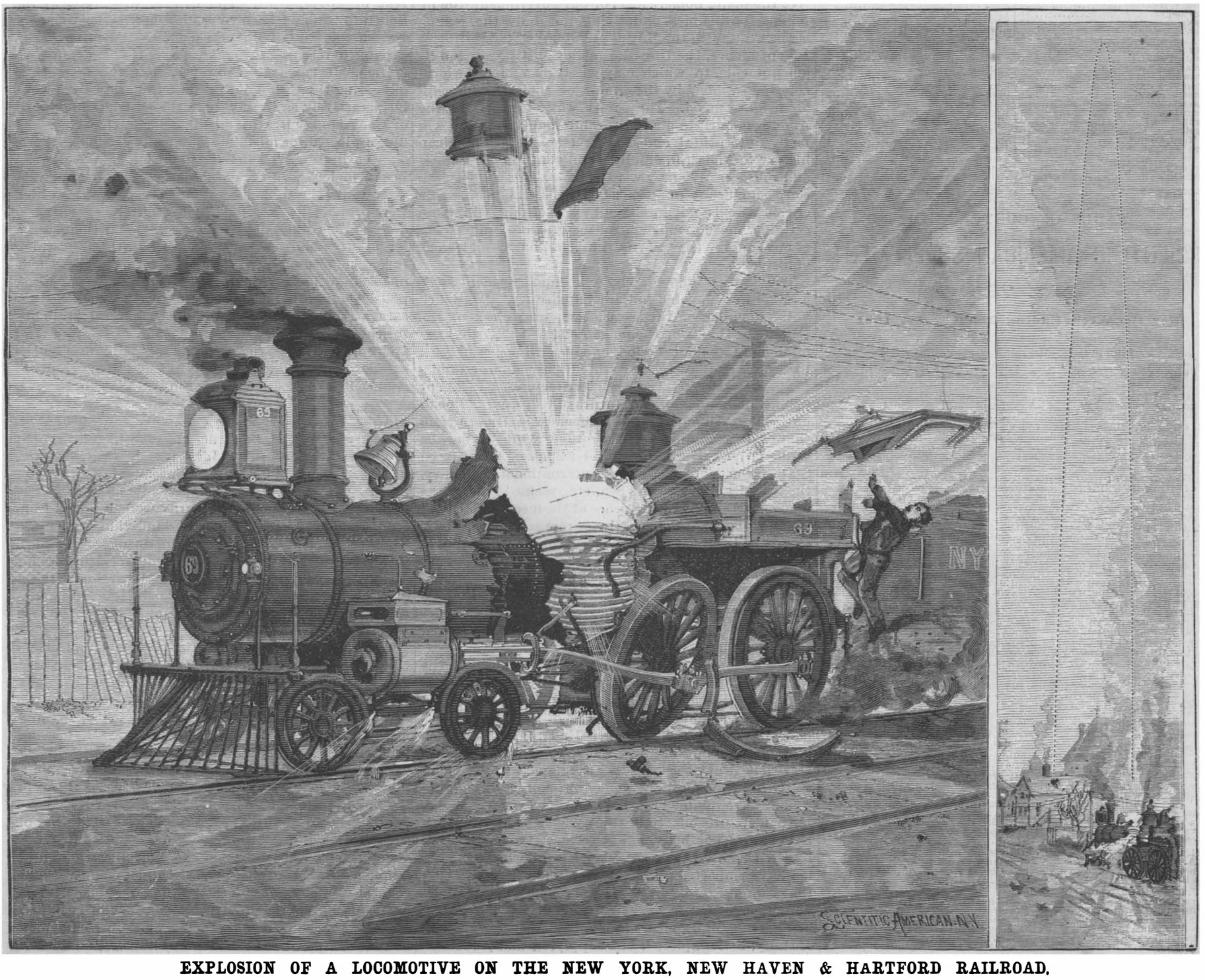
The Famous Death Valley in Colorado to be Explored.

From *The Telegram* we learn that Secretary of Agriculture Rusk has been some time engaged in organizing an expedition to explore the famous Death Valley in Colorado. This region is a veritable *terra incognita*. The heat there is so intense that dead animals do not decompose. Water in the valley is unknown, and the expedition will carry water and food for mules and men. It is a question whether the animals will be able to survive the expedition. Two of the chief botanists of the department are at present working their way into the valley from Southern Nevada, while another expedition is on the march from Southern California. The two expeditions are expected to meet, if nothing goes wrong with them, at a point previously decided upon in the valley. Professor Merriam will leave in a few days to take charge of the expedition.

There is reason to believe that there are rich gold and silver mines in the region named. A story is told of an adventurous miner who some years ago penetrated into the valley and found the skeleton of a miner. A wooden pail was lying near it, and in it a chunk of gold of great value. On his return to California he showed his find to a group of miners. Their cupidity was so excited that, other means failing, they tortured him to make him confess where he had found the gold, believing that he had discovered a gold mine, the location of which he would not reveal.

The scientific men with the expedition will map the country and procure specimens of such animals and insects as exist there, if any do exist. Secretary Rusk regards the expedition as of great importance.

BRASS is, perhaps, the best known and most useful alloy. It is formed by fusing together copper and zinc. Different proportions of these metals produce brasses possessing very marked distinctive properties. The portions of the different ingredients are seldom precisely alike; these depend upon the requirements of various uses for which the alloys are intended. Peculiar qualities of the constituent metals also exercise considerable influence on the results.



EXPLOSION OF A LOCOMOTIVE ON THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD.

Scientific American.

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NEW YORK, SATURDAY, JANUARY 17, 1891.

Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 785.

For the Week Ending January 17, 1891.

Price 10 cents. For sale by all newsdealers.

STUDENTS OF AMERICAN HISTORY.

History reposes on authenticated facts as proved by living witnesses or written records. To gather and digest such materials demands critical and painstaking investigation carried on with as much freedom from prejudice as possible, by men qualified to see and accept the facts of politics, society, and religious life just as they really are. This task has been made difficult in our own country by the acrimony of party strife, the overwhelming mass of new materials and fresh discoveries launched upon us continually, and the innate tendency of a free and vivacious people to deal in exaggeration of former or passing events. In order to rescue the important facts of our own history from oblivion, to sift out facts from traditions, to arrange these facts under the discriminating eye of trained observation, and to teach aright the vital lessons that may be drawn from them, the American Historical Association was organized, which has just held its seventh annual meeting in the city of Washington, with a large array of distinguished names and a long series of extremely interesting papers and addresses.

The inaugural address prepared by the president, Hon. John Jay, LL.D., of New York City, was read in his absence by Hon. Wm. Wirt Henry, of Richmond, Va. He claimed that the national importance of the work done by the society, and its improved methods of study, had been properly recognized by its incorporation with the Smithsonian Institution, and the generous privileges accorded as to collecting materials, making exchanges and distributing reports. But he also lamented our being yet so far behind European students as to justify Professor Emerson's caustic remark that "history has been taught very badly in America, or rather, to be honest, it has hardly been taught at all." We are surprisingly forgetful of historic lessons, and too much importance cannot be attached to what is now being done by this association, and by such aids as those furnished by Harvard, Yale, Cornell, Columbia, and especially by the Johns Hopkins University, to give true historic expositions of the principles and policy of this republic as exhibited in congressional acts and judicial decisions. From these high sources the lessons go down to the common schools, so that everywhere the demand arises for new histories and historic primers, by means of which the young Americans shall be taught in a way at once correct and attractive the plain, homely facts of our government, the intelligent principles underlying not only the Magna Charta, but also the Bill of Rights, the Declaration of Independence, the United States Constitution and its amendments, to which may wisely be added the local coloring supplied by the annals of their own immediate neighborhood. The surest way of preserving the American spirit in its purity and manly strength will be by the truthful and earnest teaching of American history to American children and youth in our schools and colleges. We may wisely ponder President Harrison's significant question: "How shall one be a safe citizen who is not intelligent?" Nothing will more certainly develop and control the growing brain power of our country than the faithful and impartial lessons of history.

The papers immediately following President Jay's address were devoted to Canadian history. Dr. Bourinot, a member of the association, and clerk of the Canadian House of Commons, claimed that the Dominion of Canada is no longer a "province," as styled by Secretary Blaine, but is rapidly becoming an independent power, with a vast territory, an intelligent people, and a magnificent future of its own in a line of national development diverging more and more from that of this country. His protests against what he termed the extraordinary pretensions of the United States, *e. g.*, as to the lines of international boundary, the fisheries, the Behring Sea, etc., seemed liable for a moment to endanger the peace of the meeting. But at the right moment Senator Hoar arose and poured much oil on the troubled waters, disclaiming any wish on our part to bring Canada into the sisterhood of States till she could come in willingly, denying any spirit of conquest, and asserting that the boundaries of the two countries that marched side by side for 4,000 miles must compel them to the closest relations of amity and commerce.

New material was adduced by Prof. Rand as to the New England settlements in Acadia. There had been two great migrations, one of 11,000 persons between 1760 and 1770, and another in 1784 of about 23,000 disbanded soldiers and loyalists. Had the original idea been carried out at an earlier day of colonizing the Maritime Provinces from New England instead of directly from the mother country, it is probable that we should have retained our hold on them.

An idea prevails that the "village community" is the germ of our body politic. This was controverted by Dr. C. M. Andrews of Bryn Mawr, who held that it was an imported notion gaining later recognition in the original State. Following in somewhat the same line, Prof. Gross, of Harvard, made a plea for reform in the study of English municipal history, a rich field of study, little explored, but supplying many facts as to our own colonial period.

A lengthy and able account was given by Prof. Cohn of the formation of the French Constitution. The fate of Diedrich Flade, the most eminent victim of the witch persecution, who sacrificed himself to save others, was fully explained from records that had been lost for a century, but had now turned up and were in the possession of Cornell University. The connection between the liberal movement in Germany, led by Karl Follen, and the subsequent development of American freedom, was shown in an interesting paper by Prof. Francke, who explained how Follen, after having posed as a nihilist, was led by Lafayette's genial sympathy to the higher ground taken by our purest patriots. A sketch of Bismarck, the typical German, portrayed him as the fit product of a land of castles, whose conservatism is the outgrowth of the castle system; yet who detested bureaucracy and strongly admired sterling honesty, while consistently seeking the unity of the German empire.

In a paper on "Amendments to the United States Constitution," Mr. H. V. Ames, of the Harvard graduate school, stated that upward of 1,300 resolutions, containing over 1,700 propositions to amend the Constitution, had been offered down to the close of the Fiftieth Congress, in March, 1889. In summarizing, it was found that besides the fifteen amendments now a part of the Constitution, only four had been proposed by Congress to the States for ratification. The speaker said that nothing of strength had been added to the Constitution, except in the case of the reconstruction amendments, and these were carried only after a civil war.

The great land speculations in the Yazoo territory, now divided between Georgia and Alabama, were described by Dr. C. Haskins, of the University of Wisconsin, who showed that, among other results, the discussion of these frauds caused the first split in the Democratic party, and that the decision of the Supreme Court as to the claims arising from them originated the present interpretation of the law of public contracts. These claims were finally compromised by the act of 1814.

Miss Mary Tremain enjoys the distinction of being the first woman to lay a paper before the Historical Association, which was an interesting sketch of slavery in the District of Columbia. She stated the fact that slavery played no part originally in the choice of the seat of government. The capital was given to the South to win Southern votes, but there is no proof that the surrounding influences made the government incapable of resisting the encroachments of the Southern system. It is certain, however, that the fear of endangering the Union did prevent Congress from legislating actively as to slavery in the District. The fault of Congress lay less in mistakes made than in remedies neglected for mistakes found already in existence. The earliest movement for abolition in the District began in 1805, and the discussion was continued year after year, through a great variety of phases which were graphically described by the writer.

Numerous other papers were read, and there was a large attendance at every meeting; the remaining topics being mostly with regard to the best methods of teaching history, in its philosophical, economical, political and other aspects, the organization of historical material, the co-operation of the several State historical societies, the importance of geography and archæology to the student of history, and finally the extent of governmental expenditures in behalf of studies like those espoused by this association.

VITAL STATISTICS OF JEWS IN THE UNITED STATES.

A very interesting bulletin (No. 19), which is devoted to vital statistics of the Jews in the United States, has been issued by the superintendent of the late census. Circulars asking for census items were sent to a number of families, and returns were received from 10,618 families, representing 60,630 individuals. Of the heads of these families, about 13 per cent were born in this country, most of the others had resided here for fifteen years or over. The returns, therefore, give a good idea of the position of the fixed Hebrew population, and illustrate well the characteristics of the race as settled in the United States.

Their excellent home sanitation is shown in the statistics of births and survival of children. Of children under five years the proportion is less among the Jews than among the other population of the country in the ratio of 9 to 13. But between the ages of five and fifteen it is greater, in the ratio of 29 to 23, indicating their success in averting infant and child mortality.

The social condition and comfortable position attained is shown by the fact that nearly two-thirds of the families keep one or more servants. Yet the poorer families show a slightly lower death rate than that of the richer ones, reversing the ordinary course of things.

The occupations of 18,115 male members of these families reveal the selection of employments. Eight general classifications of occupations were made. The most intelligible way to express the results is in percentages; 80·1 per cent were engaged in commercial pursuits, 33·7 per cent in the wholesale and 46·4 in the retail branches; 11·4 per cent were engaged in the

trades, while but half of one per cent were laborers, servants, etc.

For the past five years 2,062 deaths were reported. This gives an annual death rate of only 7·11 per thousand, but little more than one half of the annual death rate of the United States in general. This astonishing figure is discussed in the bulletin, and the conclusion reached is that there is every ground for trusting its accuracy. If the deaths for the year 1889 only are taken, a death rate of about 10 per thousand is given, which is exceedingly low.

The life tables naturally show great powers of survival to old age. Thus out of 100,000 individuals there are of survivors at the age of 85 over 20,000 Jews, against an average of about 4,000 general population by English life tables and nearly 7,000 by the Massachusetts five years' life tables. The above figures for the Jews are based on the year 1889 only. For the five years 1885–1889 the record is still more favorable. The expectancy of life therefore is on the average much higher, ranging for some ages up to thirty per cent more than that given by the general English and American life tables.

In causes of death the mortality from tubercular and scrofulous complaints is less relatively than from diseases of the respiratory, digestive, circulatory, and nervous systems.

Of different occupations, the commercial pursuits show the smallest death rate.

The marriage rate and birth rate appear to be less for this class than for the average population. This coincides with the latest summary of rates in Europe. With prolonged residence in this country the death rate seems to tend to increase, and the birth rate to diminish.

As regards the defective classes, deaf and dumb, blind, idiotic, etc., the returns indicate so few among them that the figures are not trusted by the census experts.

The bulletin is only a preliminary one, but makes an exceedingly interesting presentation of the subject. The figures we have given can hardly rank even as a summary of the exhaustive tables contained in it. The compilation of the statistics was performed by Mr. A. S. King, chief of the Division of Vital Statistics. The discussion of the results is by Dr. John S. Billings, one of the leading authorities on these subjects.

THE AMERICAN ECONOMIC ASSOCIATION.

Among the national societies that recently held their anniversaries at Washington, D. C., was one organized in 1885 for the special study of social and economic problems. It has proved itself to be a popular and highly useful body, having drawn into its membership more than seven hundred individuals, representing every part of the country and every department of business. This does not include the numerous branch associations that have been started all the way from Maine to Texas. The chief aim of this society is to facilitate a free and unreserved interchange of opinions regarding the vitally important matters that naturally come before it for discussion. One of its peculiarities, in which it differs from most similar bodies, is its very liberal system of prizes and fellowships, whereby it is intended to stimulate the efforts of economists to perfect and elaborate their ideas on questions of the day. Among topics thus treated are: "The Evils of Unrestricted Emigration;" "The Housing of the Poor in Cities;" "State and Local Taxation;" "The Economic Aspects of Patents;" "The Silver Question;" "Factory Legislation," etc. These essays are to be published and widely distributed for the information of the general public.

Hon. Francis A. Walker is president of the association; Prof. R. T. Ely, secretary; and Mr. Frederick B. Hawley, treasurer. A council for the management of the society was also chosen, including the names of sixteen men.

Glancing over the reports of the discussions from day to day, we find that Hon. C. D. Wright, of the U. S. Department of Labor, led off in a series of practical and timely papers on American statistics, claiming for our statisticians that their work equaled that of any other country, as to quantity, although still falling below the standard as to quality, as compared with certain European efforts. But rapid progress is being made in the scientific character of what is done, and there has been a constant elevation in the value of the reports of the various bureaus and departments. Col. Wright also analyzed in detail the work done in taking the census of 1890, and suggested the co-operation of the States with the general government as a means of saving expense and as a course that might lead ultimately to the establishment of a permanent census bureau. After this introduction, special topics were treated: *e. g.*, "Street Railway Statistics;" "Statistics as a Means of Correcting Corporational Abuses," etc.

The subject of "Crooked Taxation" elicited great interest, being opened by Mr. T. J. Shearman, who claimed that this phrase was far more nearly correct than the popular one of "indirect taxation," meaning exactly the same thing. In nearly all nations a system prevails according to which taxes are paid by persons who are expected and even authorized to recover the amount from some one else, with interest and profits up to a certain limit. But no one can tell, under a system of this sort, what any one person contributes to the support of the government, nor what proportion of what is paid goes into the public treasury and what to some private purse; only that it is surmised that nine-tenths of the final tax is perverted; in other words, that private property is forcibly taken for private uses, which every court in the civilized world regards as robbery. And yet this same robbery has been so legalized that men who regard themselves as honest go into it intentionally and deliberately, meaning to manage matters so that the whole burden of maintaining the government shall be thrown upon the consumer, while property is practically exempt. In other words, the system makes the rich richer and the poor poorer, and in addition its methods of operation are such as to promote bribery and corruption, and force into existence a class of men who live by legalized robbery.

Prof. Seligman, of New York, showed that so far as the real estate tax was concerned, it properly had two branches, the land tax and the city tax. In taxing city property there were four systems, (1) taxing the land owner—the single tax idea; (2) taxing the house owner—the continental idea; (3) taxing the ground owner, who is at the same time the land owner—the American system; and (4) taxing the occupier—the English system. He explained the working of these systems, claiming that, under existing conditions, the main burden is actually shifted on those least able to pay; whereas the tendency of the "land tax" is to make the burden rest on one who is able to carry it, namely, the land owner, instead of on the tenant, who is presumably poorer than the owner. Of course, all this looked toward free trade and the single tax theories of Henry George. There were not wanting those that stood ready to oppose such ideas; and in short, we do not see that this distinguished association has yet quite succeeded in "squaring the taxation circle."

Prof. Folwell, of the University of Minnesota, read a paper on "A Syllabus of Political Economy," being mainly an argument for the recognition of public economy as a distinct, though related, science, running parallel with private and social economics. He explained his communication by a set of nine charts, devised by him and submitted to the judgment of the association. Prof. S. N. Patten, of the University of Pennsylvania, spoke on the "Educational Value of Political Economy." Other topics discussed were on the "Municipal Ownership of Gas Works;" "Land Transfer Reform;" "The Growth and Economic Value of Building and Loan Associations;" and on "The Extension of the University System." Among those participating in the discussions were Professors Newcombe, Bemis, Dewey, McAlister, Moulton, of England, and others more or less widely known.

Healthful Homes.

The following, from a source unknown to us, contains so much sound advice we are sure some reader will be benefited by its publication in these columns. The editor regrets that he does not know to what paper to give the usual credit.

A cemented floor under the whole area of a house is a sanitary necessity, because the "air in soils" is more or less impure at best. There is no excuse for building underground apartments in the country. They are never wholesome anywhere, and if families are compelled by stringent reasons to live in the city, where basement dining rooms and underground kitchens are the rule, they should endeavor to have an upper sitting room and live in it as much as possible. The very placing of a house on any ground and living in it under ordinary circumstances causes suctions into its interior of impure soil air, because the air of the house is warmer than the air beneath it, and this induces a rush of the cold air to the warmer house atmosphere. The concreted floor will, in a great measure, do away with this difficulty, but not altogether. Ventilation of cellars must, therefore, be attended to, no matter how clean and perfectly built they may be, in town or country. Annual lime whitewashing, an old custom, is decidedly a wholesome precaution, and every cellar should thus be treated, especially in the autumn, as the cellar will be kept closed more than in spring and summer.

Very important are the floors, woodwork, walls, and ceilings of a house. Their condition influences in a greater degree than might be imagined the health of the family. There cannot be a doubt that papered walls are not wholesome, that is, if the paper is of the ordinary kind in use, which is highly absorbent. There is a paper made, I think, in England, called "sanitary paper," which has a finely glazed surface, which may be scrubbed without injury to its texture or colors. This paper is probably as free from the objection named as any texture could be. This paper is much wider than the ordinary wall paper, and as it is very strong and durable, does not cost more in the long run than ordinary wall paper, even if the first outlay is more than that expended for the less expensive grades of ordinary wall paper. Painted walls are the best for all living rooms, that is, sitting rooms and bed chambers. They are also best for dining rooms, where there are always so many odors of food to absorb. Stained and varnished woodwork or else painted woodwork should rule, as neither is absorbent. The floors, especially, should never be left in the natural state, and I should advise all builders of houses to have their floors painted before living over them, where they are to be carpeted or otherwise covered, and stained and varnished where the intention is to show a portion or all the surface. These measures, renewed as wear necessitates, will prevent your house attaining that peculiar smell which is associated with old boards almost invariably, no matter how often or how vigorously they have been scrubbed by the neatest housewife. Part of this smell, indeed all, is due to the decay of absorbed matters, which in some cases include disease germs. Paper may be varnished, however, and thus rendered non-absorbent.

As it is not the privilege of every one to move into a perfectly new house and do just as they please, one must say a word to those who, unhappily, are obliged to live in houses of other people's building and ownership. To insure healthy conditions in an old house, go to work and do all possible cleaning with soap and soda and water. Strip down all old papers from the walls. Sometimes there will be found as many as six different layers of dilapidated paper of different colors and designs. To remove old paper, wet it all over with a damp cloth from time to time, so that the water will soak through, and in an hour or two it will be so loosened that one may peel off the layers with comparative ease. The walls should all be washed down with soda and water, and it will be well to add a little carbolic acid to insure the better purification of the apartment. The ceilings, too, are very important, and should, if possible, be painted, or at any rate thoroughly cleaned and given a fine coat of tinted lime wash.

Loosely laid floors become a source of evil smells, and a hiding place for vermin and disease germs. Hence, it is well worth the expense to have new floors tongued and grooved and blind-nailed, and old floors taken up, planed, and relaid, blind-nailed, then painted with two coats of paint. Old floors, having finished their shrinking, will not again give any trouble by reason of open seams to collect dirt and noxious substances.

Opening of Northeastern Siberia to Commerce.

A correspondent of the London *Times* says that two ships and a tug for river work, dispatched from London last August, in 39 days reached Karaoul, 160 miles up the Yenissei, without accident. They remained there 19 days, and took 26 days to return. They were thus only 2 months and 23 days away from the London docks. At Karaoul they met the river expedition, which "returned safe to Yenisseisk a few days ago, and is now landing and warehousing there the valuable cargo sent out from England." The same correspondent points out that the real *crux* of the expedition lay in the 160 miles of estuary between Golcheka, at the mouth of the Yenissei, and Karaoul, at the head of the estuary, which the Russian government had assigned as the port of discharge.

It is unfortunate, says *Nature*, that Captain Wiggins was accidentally prevented from completing the work with which his name has been so intimately associated, but it was he who showed the way, and to him, more than to any one, belongs the honor of having provided this new outlet for British commerce. That it may become an outlet of the highest importance is the conviction of no less an authority than Baron Nordenskiold. In a letter congratulating the promoters of the undertaking, he says: "I am persuaded that its success will once be regarded as an event rivaling in importance the return to Portugal of the first fleet loaded with merchandise from India. Siberia surpasses the North American continent as to the extent of cultivable soil. The Siberian forests are the largest in the world. Its mineral resources are immense, its climate, excepting the *tundra*, or swamps, and the northernmost forest region, healthy, and as favorable for culture of cereals as any part of Europe." He goes so far as to say that the future of Siberia may be "comparable to the stupendous development which we at present see in the New World."

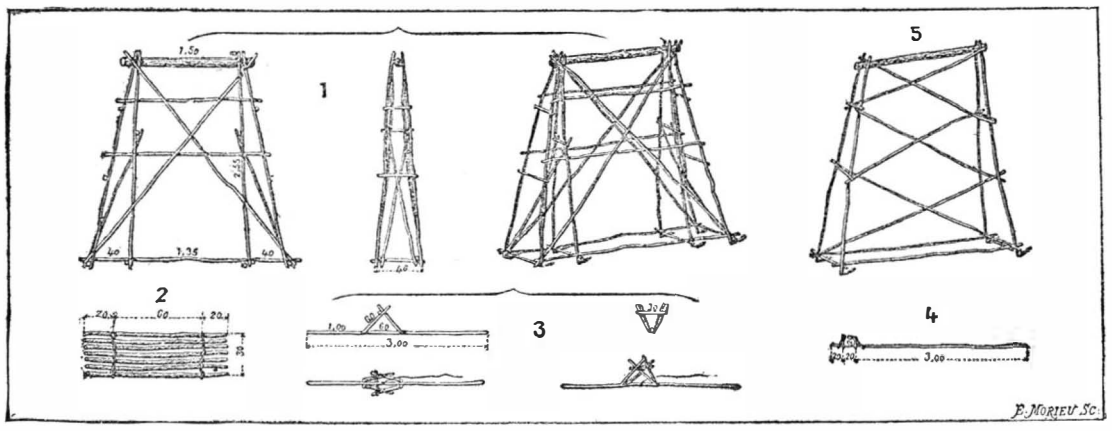
The Oroville, California, Orange Groves.

In a recent SUPPLEMENT (No. 777) we published an account of the "Fruit Gardens of California." In the Northern Citrus belt, 170 miles from the ocean, over 3,000 acres are now planted with orange and lemon trees. Originally famous for its mineral gold, the favorable climate and early ripening of fruit grown there is bringing this region more prominently than ever to the front. It is considered that fruit ripens in this belt, protected by the foot hills of the Sierras, six weeks earlier than elsewhere in Southern California. Oroville, whose name is suggestive of gold, lies in this favored region, and has already produced navel and seedling oranges of unsurpassed qualities.

AN IMPROVISED PORTABLE FOOT BRIDGE.

The adoption of smokeless powder, which is now by so good a right occupying the attention of all who are interested in matters pertaining to the army, is going to favor the formation, in the infantry, of the detached groups recommended by General Lowal. These groups are called upon to give powerful aid to bodies of reconnoitering cavalry in a service that has become very difficult in the face of an enemy whose presence is shown only by the firing of projectiles, the sound itself giving no exact indication as to the point occupied.

It is necessary to give every facility to the men charged with this mission, in order that they may triumph over the obstacles in their way; and, as regards this, the foot bridge devised by Captain Cavarrot, who is in charge of the school of bridges of the third regiment of engineers, seems destined to render genuine services. Doubtless it will not permit of crossing large watercourses, but a stream 6 feet deep and 12 or 18 feet wide will arrest the marching of troops if the usual bridges have been destroyed, or if a passage at a spot at a distance from them becomes necessary, for the art of swimming is not widely known among us and all times are not favorable to cold baths.



Figs. 1 to 5.—DETAILS OF PORTABLE FOOT BRIDGE.

This bridge possesses the following advantages: The elements of it are found everywhere, and the improvements and accessories are simple—pruning knives, or pocket knives even, a few small nails or iron wire, or string even. It may be prepared, too, far away from the crossing selected, and be brought in pieces by men, without fatigue, to the edge of the watercourse, and be placed in position without any noise, in a very short time. It will prove very valuable in cases where preparations are being made for a surprise. All the other improvised means of crossing a stream are accompanied with more or less noise in their construction. The infantry officers who, in 1888, followed the course of instruction at the School of Campaign Operations at Arras, appreciated the merit of this invention, and special instruction was given in certain corps of the army during last year.

The construction and erection are very simple, and it suffices to have performed these operations but once in order to know them sufficiently well.

The elements of the bridge are: (1) Eight-legged trestles (Fig. 1) made of poles of a diameter of about an inch, connected with each other and with the top by small iron nails, one at each crossing. The top is formed of a round piece of wood two and a half inches in diameter and five feet in length. A height of 11½ feet may be given to the trestle, as the bridge does not have to rise over two feet above the level of the water. (2) A flooring consisting of three poles of a maximum length of 11 feet for the longest spans (from 10 to 10¼ feet), with a mean diameter of 2½ inches and a spacing of 16 inches apart; and of hurdles (Fig. 2) 12 inches in width by 3 feet in length, made of 7 poles 1 inch in diameter, connected by two withes spaced 20 inches apart. The hurdles are nailed to the string pieces or are fastened to them with wire. A trestle 10¼ feet in height weighs 58 pounds; a span of 10 feet weighs, for the three string pieces, 62¾ pounds, for the five hurdles, 42 pounds, or, all told, 162 pounds for a single element of the bridge. Seven men can easily carry the elements of a span and one trestle. The parts can, therefore, be made at quite a distance from the point chosen for crossing, and any noise of a nature to attract the enemy's attention be thus avoided. A ten-foot span with trestles ten feet in height supports the weight of ten armed and equipped men. Now, normally, there can be but five or six men upon a span at a time, seeing the spacing of the hurdles.

The trestle has very great stability on account of its form and of the dimensions of the head piece with respect to the base; and the stability is further increased by the bracing of the string pieces. The trestles offer little resistance to the current. They may, moreover, be weighted with stones attached firmly to the lower cross pieces.

The species of wood to be preferred for making the trestles and the hurdles are oak, hornbeam, ash, birch, hazel, elm, chestnut and willow. To these may be added, as proper for making the withes, the Virginia creeper, the tamarind and the osier.

The tools are pruning knives, pocket knives, hammers and a fret saw; and the accessories are string and wire.

In the experiment made October 15, 1888, on the Scarpe, with a width of stream of 34 feet, and a depth varying from 5 to 7 feet, it took 35 minutes to prepare the bridge, exclusive of the time necessary to cut the wood, the work being done by three non-commissioned officers and thirty-one men. It took 41 minutes to erect the bridge, counting from the arrival of the first man upon the bank of the Scarpe. In reality, the operation lasted 32 minutes. A preliminary sounding is, of course, necessary. The infantry crosses the bridge in Indian file, with a fast gait, but without skipping. Each man on stepping upon the bridge must avoid using the same foot as the one who precedes him.

In addition to the materials mentioned above, boards, laths and rafters may be used. Finally, by employing wood of a diameter of from 1 to 1½ inches in the middle, four-legged trestles may be made (Fig. 5).—*La Nature.*

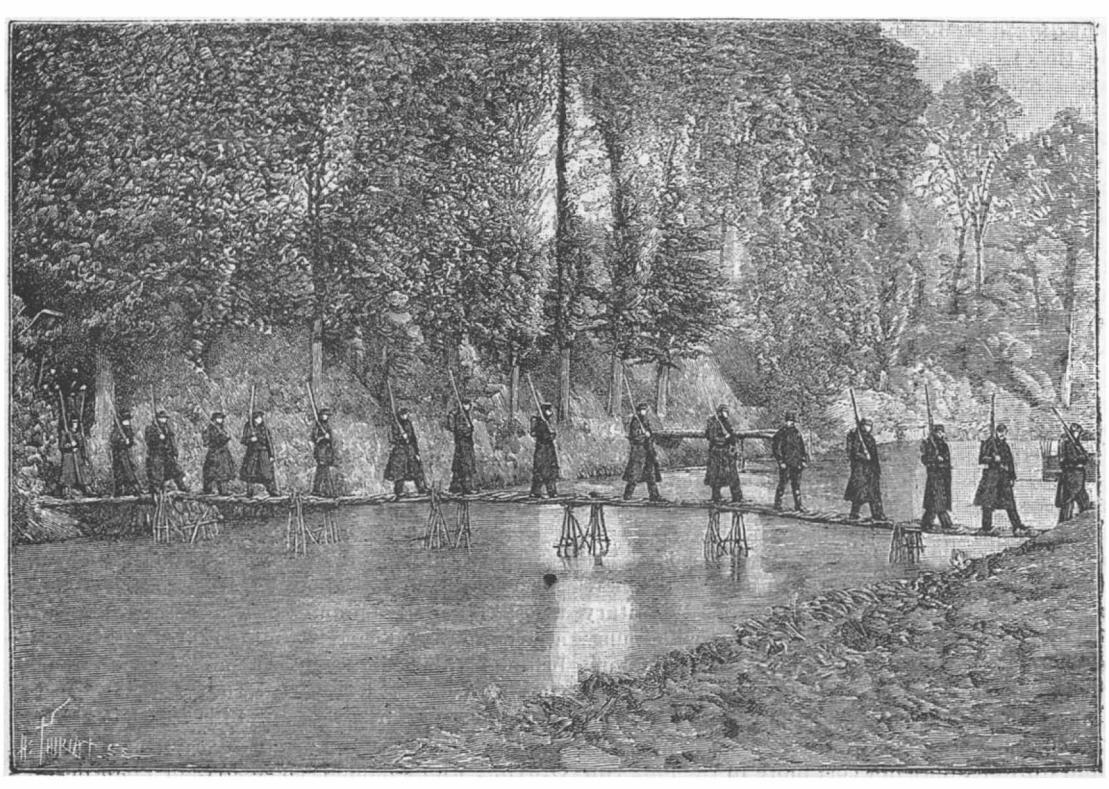


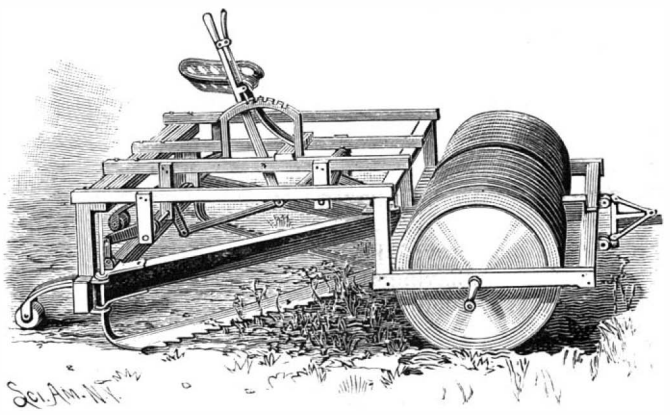
Fig. 6.—PORTABLE FOOT BRIDGE.

Singular Electric Effect.

A peculiar and instructive accident recently occurred in the city of Lynn, Mass. The electric lighting station caught fire, and the wires carrying the current from the powerful dynamos were burnt off, thus breaking the circuit and cutting off the current. Relieved of the work of producing the current, the 700 horse power engine became unmanageable, and started off at such a rate of speed that the large fly wheel was broken into fragments by the centrifugal force, and flew in all directions, causing much damage to the building. This occurrence is an excellent illustration of the principle of the transformation of energy, as the power produced by the engine, instead of being transformed into electrical energy, was, on account of the breaking of the circuit, suddenly changed into the centrifugal force which caused the wreck of the fly wheel. It also shows plainly, the *Popular Science News* avers, that it really costs something to produce electricity, and that it is not an unlimited and costless source of power, as many suppose.

A LEVELER FOR USE ON MEADOW LANDS, ETC.

The illustration represents a machine designed, when drawn over the ground, to effectually remove hummocks, level the earth, and cut off or draw up growing brush. It has been patented by Mr. Peter M. Thompson, of Anaconda, Montana. In the forward part of the frame, journaled in its side beams and an intermediate longitudinal beam, is an axle on which a drum is loosely mounted. The axle projects beyond the side beams, and is adapted to receive supporting wheels when desired, and the drum has on its periphery a series of disk-like cutters. Upon a transverse beam at the rear of the drum is secured a series of downwardly and forwardly curved fingers adapted to clear the drum and its cutters of any earth which may cling thereto.



THOMPSON'S MEADOW LEVELER.

Upon parallel beams on the top of the frame is a crossbar on which is secured a support for the driver's seat, beneath which is held an essentially triangular frame.

To each of the side beams of this frame is attached a cutter, consisting preferably of a steel plate, having a series of teeth with forward cutting edges. By means of front and rear rock shafts, pivotal arms connected by links, and a lever extending to within convenient reach of the driver, the frame carrying the cutters may be readily raised or lowered as desired, and may be so raised horizontally, the heel and toe of the frame being raised and lowered at the same time. The lever has a thumb latch adapted for engagement with a rack, whereby the frame may be held in adjusted position. The rear end of the main frame is supported by caster wheels, and when the machine is to be carried from the field, or is not in operation, supporting wheels of greater diameter than the drum are placed upon the forward axle. In operation, the disk-like cutters upon the drum are designed to chop the surface of the earth and partially level it, the evening and leveling being further carried out by the cutting frame, the teeth of which cut down or pull out any weeds or brush.

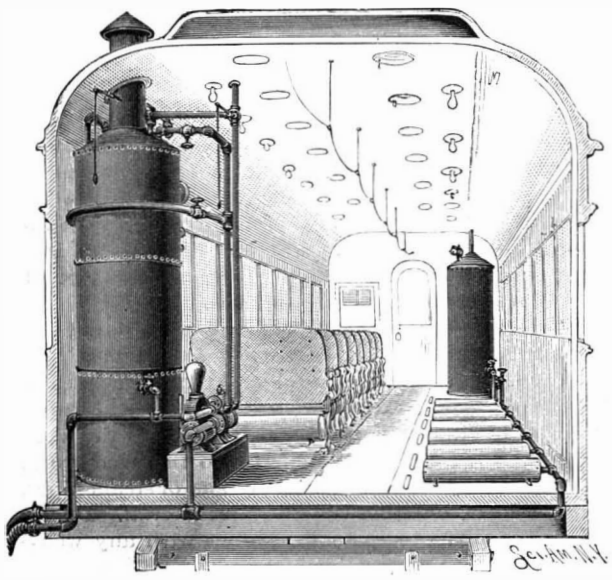
The Toxic Principle of Insect Powder.

The active principle of pyrethrum flowers is, according to Schlagdenhauffen and Reeb, an acid (pyrethrotoxic acid) soluble in alcohol, amylic alcohol, ether, and chloroform, which may be isolated by means of ether, after having been converted into an alkaline salt and decomposed by tartaric acid in aqueous solution.

When pyrethrotoxic acid was hypodermically injected into animals, it was observed that the poison produced its effects in two distinct stages. In the first there was an excitement more or less pronounced, proportional to the quantity administered, in the second there was a complete prostration, accompanied always by paralysis of the lower extremities, which might disappear after a time, or be the precursor of a fatal issue, the respiration and circulation being affected only in the latter case.

A RAILWAY CAR FIRE EXTINGUISHING APPARATUS.

The illustration represents an equipment for a railway car by means of which fires on the cars, bridges, or at stations or structures along the route may be extinguished. It forms the subject of a patent issued to Mr. William H. Beach, of Winona, Minn. A steam boiler is located in one corner of the car, and in connection with it is arranged a steam pump, the exhaust extending out through the roof, but being connected with the smoke stack of the boiler by a branch pipe. In a diagonally opposite corner of the car is a reservoir and heating drum, connected with the boiler by piping which extends around the car. Beneath the seats of the car, or in any other convenient position, are additional reservoirs, connected with the pipe extending around the car, the latter pipe being also connected with the suction chamber of the pump, while a pipe leads from its delivery chamber to a coupling nozzle. Coupling sections are also provided to effect a continuous circulation throughout the cars of a train equipped with this system. In addition to the coupling nozzle provided for connection with a delivery hose, the pump has a pipe or plug for establishing connection by means of a suction hose with the tank of the tender or any other convenient water supply, when a fire on a structure near the track is to be extinguished, such pipe being also utilized in filling the reservoir. The latter has a heating pipe arranged within it whereby the water may be heated by either the live or the exhaust steam, the necessary connections therefor being controlled by conveniently arranged valves, and when it is desired to pump water from the main reservoir alone the auxiliary reservoirs may be cut off from connection therewith.

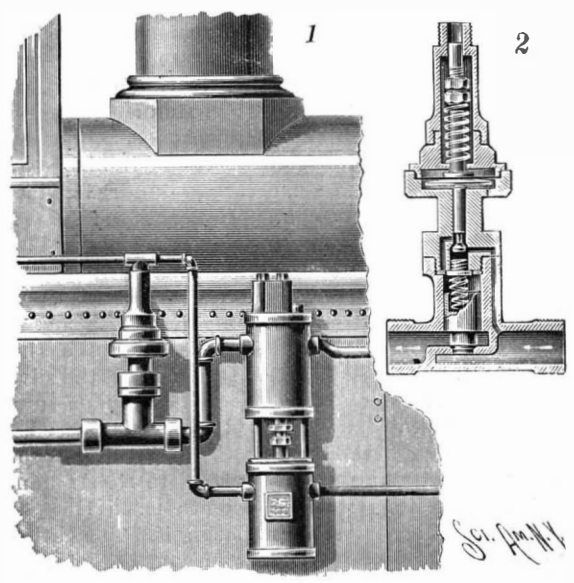


BEACH'S RAILWAY CAR FIRE EXTINGUISHER.

AN IMPROVED AIR PUMP GOVERNOR.

The illustration shows a sectional view and the application in position of an air pump governor adapted for use with air brakes, which is designed to be simple and durable in construction and effective and positive in operation. The steam inlet in the base of the governor casing is connected as usual with the boiler, while the steam outlet leads to the pump, as shown by the arrows. The inlet port is adapted to be closed by the reduced end of a hollow main valve in which is a coiled spring, which presses also against a plug screwing in one end of a cylinder above, of somewhat less diameter.

The upper end of the latter cylinder has a valve seat closed by an auxiliary valve on the reduced end of a stem sliding in a cylinder in the upper part of the casing, and of still smaller diameter. The first cylinder of reduced size is connected by a port with the steam inlet, and the smaller cylinder is connected by another port with the upper end of the cylinder in which slides the main valve. The upper end of the valve stem of the auxiliary valve abuts against a disk held in an upper chamber, the disk being held on the lower end of a vertical stem, while on the top of the disk is arranged a diaphragm. The stem projects into an upper cap, an opening from which is connected with the air pipe of the air brake, the upper end of the stem being quite slack, so that air will pass down to press on the top side of the diaphragm. On the stem is a coiled spring, the tension of which is regulated by adjusting nuts, and the lower part of the chamber in which the diaphragm is located is connected by an opening with the outside, to serve as a drip for any water of condensation.



ORD'S AIR PUMP GOVERNOR.

When the diaphragm is depressed by air pressure on its top side, the auxiliary valve is pushed off its seat so that live steam can enter and pass it, then passing into the upper end of the cylinder to press the main valve downward, the total pressure on the top of this valve being greater than that on the bottom, on account of the spring and the weight of the valve, so that the valve starts and moves downward as soon as the auxiliary valve is pushed off its seat. When the air pressure is reduced or taken off, the spring in the upper cap draws the stem and diaphragm upward, when the steam pressure on the reduced end of the main valve causes the latter to slide upward, and communication is established between the steam inlet and outlet.

This governor has no atmospheric exhaust; when the auxiliary valve is closed, the steam, which was holding the main valve on its seat, passes down the sides of the large cylinder into the pump, where it sustains warmth, and the remaining volume will be finally overcome by the pressure acting on the small end, which in opening applies pressure to the whole bottom side of the main valve before it has time to pass up to the top—hence the accelerated opening motion. But it will quickly settle to its working position by the steam in outlet equalizing upward into top end of cylinder, when it acts as an ordinary check valve, simply holding a slightly higher initial pressure on inlet side.

This pressure, if allowed to flow into the top end of the large cylinder by auxiliary valve opening, will cause the main valve to descend, thereby contracting the port opening, causing the pressure on outlet side to drop quickly, and as it is this outlet pressure which acts on part of the lower side of main valve, the downward motion of main valve will be accelerated till it reaches its seat, where the small end alone at the bottom is subjected to the same initial pressure as that which acts upon the whole top area. Hence the positive action.

For further information relative to this invention, address Mr. Craven R. Ord, No. 40 Law Street, West Toronto, Ontario, Canada.

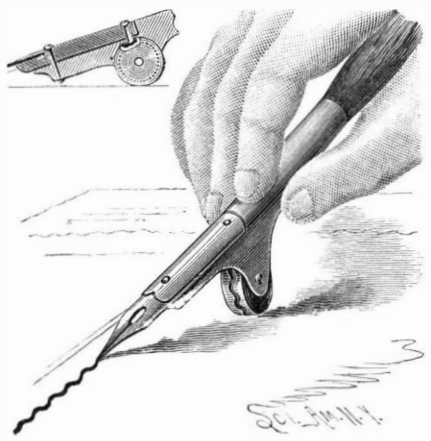
A COMPACT AND POWERFUL FLOORING CLAMP.

The illustration represents a strong and readily operated device to facilitate the laying of floor boards, whether they are straight or warped on their edges. It has been patented by Mr. James H. Giesey, of No. 2235 Chapline Street, Wheeling, West Va. Fig. 1 is a side view of the device secured to a joist in operative position, Fig. 2 being a top plan view in section. The clamp is designed to be self-locking to the joist it is mounted on, the act of pushing the presser bar against the floor board tightening the grip of the device on its support, while its withdrawal releases the clamp. The clamping sections are pivoted in ears of a base plate, limbs of these sections extending below the pivotal points and having adjustable set bolts near their free ends, the inner ends of these bolts being pointed to afford secure engagement with the beam. Above the pivotal points the clamping sections have each an integral arch, and the rear portions of their limbs are curved outwardly and upwardly in opposite directions on each side, producing cam curves on the arch portions, the curved top surfaces of both arches being serrated to produce ratchet teeth. At the center of the base plate is pivoted an operating lever having a sliding locking dog loosely held on the lever to reciprocate vertically a limited distance. The usual tripping handle is jointed to the operating lever, and connected by a link bar to the dog. The presser bar, pivoted upon the operating lever, has a forked front end, each limb of which is bent upward at the edges so that the faces of the limbs will fit squarely over the tongue of a floor board. When this clamp has been made to straddle a joist, and the pointed bolts have been properly adjusted, the pushing forward of the operating lever brings these bolts into engagement with the joist and at the same time moves the presser bar against the floor boards, the locking dog holding the lever at any point of rocking adjustment.

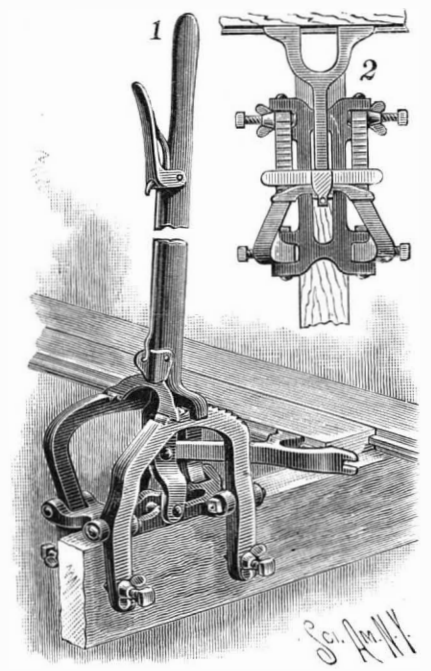
THE surveyors' instruments, drawing appliances, and similar articles manufactured and imported by the Keuffel & Esser Company, of New York City, embrace such a wide variety of goods as to require a catalogue of nearly three hundred pages for their enumeration, with but the briefest description. The firm has been long established, has well earned a high reputation, and conducts a very extensive business.

A PEN HOLDER TO FACILITATE MAKING WAVED LINES.

A pen holder with which waved or irregular lines may be made with facility is shown in the accompanying illustration, and has been patented by Mr. George H. Richardson, of Old Town, Me. This pen holder is made in two parts, the front portion, carrying the pen, being pivoted near its forward end to the forward part of the main portion. The latter carries a wheel or roller which rests on the paper as the instrument is moved along, and on the periphery of this wheel is a zigzag groove corresponding to the waved line or lines it is desired to produce on the paper. A stud or pin at the rear end of the pen-carrying portion of the holder, as shown in the sectional view, engages this groove, and causes the pen to vibrate as the wheel revolves. The device is designed to be especially useful to draughtsmen and others in making fancy borders, as well as in ruling checks, drafts and other papers in business offices.



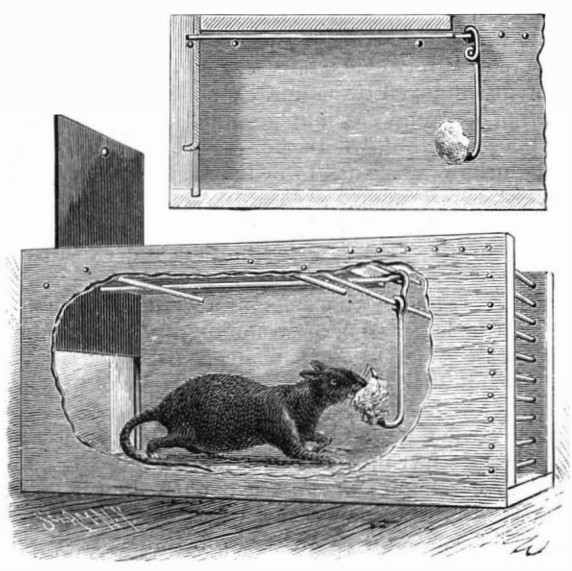
RICHARDSON'S PEN HOLDER.



GIESEY'S FLOORING CLAMP.

A SIMPLE AND RELIABLE TRAP.

The accompanying illustration represents a trap, patented by Mr. Walter Pead, of Durban, Natal, South Africa, adapted to catch animals alive, and which may be made strong enough to capture wild animals of various kinds. One end and a portion of the top of the box is closed with wire rods, admitting light, so that the bait can be readily seen, and at the opposite end of the box are grooves for the reception of a sliding gate, of metal, and of sufficient weight to assure its quick descent when released. The bait hook is pivotally suspended on a transverse wire rod, and an



PEAD'S ANIMAL TRAP.

eye is turned on the upper end portion of the hook to receive a hook on a longitudinal trigger bar supported to slide on transverse rods near the top of the box. In the sliding gate are two small orifices, one of which aligns with the trigger bar when the gate is raised, and the other when it is closed, and on the outer face of the gate are two projecting lugs, which strike against a stop bar, limiting the upward movement of the gate, this bar passing through the side walls of the box in the same plane with the trigger-supporting rods, and the bar also holding loosely the extremity of the trigger bar, as shown in the sectional view. When the bait is placed in position on the hook, the trigger bar is passed through the lower orifice in the gate in such way that the weight of the raised gate will rest on the extreme end portion of the rod. On the touching of the bait by a mouse or rat, or other animal, the end of the trigger bar is dislodged, and the gate released, falling behind the animal, the end of the trigger bar then entering the upper hole and locking the gate shut.

For further information relative to this invention address Messrs. Arkell & Douglas, Kemble Building, No. 15 Whitehall Street, New York City.

Mapping the Southern Sky from a Mountain Peak 14,000 Feet High.

Upon various mountain peaks in the heart of the Andes, from 4,500 to 14,000 feet above the sea, there have been in use for nearly two years past two portable houses, built in Boston in the fall of 1888, and forming the home of a corps of scientists from Harvard University. They are making a map of the southern heavens, after a plan similar to that of mapping the northern heavens, which has been in progress at the university observatory for some years. The first expedition for this purpose was formed late in 1888, led by Professor S. I. Bailey, with his brother, M. H. Bailey, as first assistant. It set out in February, 1889, and among the equipments were the two portable houses and such photographic and meteorological instruments as would be necessary for accurate observations. Upon arriving in Peru and spending several weeks in looking over the country, Prof. Bailey selected as an observatory a mountain summit, 6,650 feet high, eight miles north of Chosica and twenty-six miles inland from Lima. This location was deemed high enough to be always from 1,000 to 3,000 feet above the fogs of the coast, and far enough from the interior to escape its rains. The portable buildings were put up, and three other small houses were built for the assistants and servants. The summit was named Mt. Harvard, and observations were begun in May, 1889.

The instruments used for observation were a photographic telescope of eight inches aperture, a meridian photometer, a six inch field glass, and various meteorological and other instruments. At the end of four months much success had been attained. The plan followed was to cover the entire sky from 15° to the south pole four times, once with photographs of spectra having an exposure of an hour, which included stars to about the eighth magnitude; secondly, with an exposure of ten minutes, giving the brighter stars; thirdly, with charts having an exposure of an hour, permitting a map of the southern stars to the fourteenth magnitude inclusive; and, fourthly, with charts having an exposure of ten minutes, including stars to the tenth magnitude. The meridian photometer may be described as a double telescope instrument, especially constructed to make a more accurate measurement of the magnitude of stars than had previously been attempted for the southern heavens. This instrument was also used with great success.

During September and October, 1889, the sky became so cloudy that a new location of the observatory was made January 6, 1890, at Pampa central, on the Atacama desert, with an elevation of 4,535 feet. Late in February, the expedition returned to Mt. Harvard, where it has remained until news was received, on January 3 of this year, that the observatory had been removed to Vincocaya, in the neighborhood of Arequipa, with an elevation, according to a report of the Boston *Herald*, of 14,110 feet.

This removal was not a sudden one, but had been contemplated for some months. Prof. Bailey was undoubtedly annoyed by clouds, as he had been in the winter of 1889, and has simply sought a new permanent location southward, where the average of cloudless sky through the year seemed to be much larger than at Mt. Harvard, Chosica.

The press dispatch which brought the news of the removal of the observatory said that the expedition was soon expected to be joined by a new expedition from Harvard with the most improved instruments. One of the latter is a new photographic telescope, which cost $50,000. This telescope is of 24 inches aperture, and will take the place of the one of 8 inches aperture which Prof. Bailey has been using. The instrument, when placed in position, will be principally used for the study of the distribution of the stars, for complete catalogues of cluster, nebulæ, double stars, and for the spectra of faint stars.

The plates as now taken by Prof. Bailey, with the small instrument in his possession, have to be enlarged three times for the maps. With the new instrument the same results will be attained in the original photographs without enlargement. The new instrument is known as a photographic doublet, and its use will, undoubtedly, produce the most successful and interesting results.

Teeth Germs in Infants.

The development of teeth germs from infancy to mature life, a writer in the Pittsburg *Dispatch* thinks, is one of the most interesting phases of human growth. Pass the finger along the tiny jaw of the newcomer. Not only is there nothing which presages future teeth, but the jaws themselves seem too delicate and frail to become the sockets for such hard-working portions of the anatomy. Yet we are assured that there are fifty-two teeth germs hidden there. Twenty of them are for the temporary teeth, with which in due time the child will begin to gnaw or chew his way through life; the others include the permanent set and the molars, none of which begin to make their presence known until the child is six years old, and the "wisdom" teeth do not usually appear until about the age of eighteen.

The little pulp germ grows and develops till it approximates the shape of the tooth it is to become; then it begins to calcify, forming the dentine part of the crown, while the enamel is deposited by an independent process. The surface of the crown attains its full size before the process of elongation commences. Then gradually it pushes its way outward through the gum, absorbing its tissue as it advances till the pure white enamel peeps out, to the mother's great delight.

The process of "teething" is invariably one of disturbance, especially if the outer membrane or skin of the gum proves tenacious. In this case it should be lanced—an operation which is humane, in that it relieves the discomfort of the child, and is entirely harmless, as there is seldom any hemorrhage worth the name, and if there should be a slight flow of blood it readily yields to simple treatment. The application of a dust of powdered alum is usually sufficient.

Hints to be Heeded.

The Western Manufacturers' Mutual Insurance Company and the Factory Mutual Underwriters' Union have issued a circular which should receive the special consideration of every manufacturing concern, and storekeepers and householders will do well to regard some of the many good hints embodied in the circular.

Special attention should be given at this season of the year to protecting fire apparatus against cold weather during the winter, and to ascertaining that all appliances are in order, and everything in its proper place, so as to be able to extinguish a fire, should one occur, with the smallest possible loss. As defective stoves, furnaces, stove and steam pipes, chimneys and other flues are the most prolific source of fires, they should also have proper attention at this season of the year, when they are about to be put in constant use for the winter months.

In this precautionary work for the winter all hydrants and valves should be carefully examined and oiled, preferably with heavy mineral oil, which will not corrode the brass. All hydrants and standpipes and all branch hydrants should be opened after the pipes are emptied, to let out any entrapped water, which may have leaked past the valve when the pipes were full, and care taken that all the drip valves are in good condition.

The rotary pumps should be oiled, and if exposed to freezing, turned backward to empty them of water. Pipes exposed to freezing should be emptied, and care taken to let the water out from above the check valves. All valves should be marked with an arrow, showing the proper direction to open them.

In all buildings equipped with automatic sprinklers, where it is impracticable to keep the buildings or rooms warm enough to prevent freezing, the system should be changed to an approved drypipe system. It is very important that some reliable person or persons should be put in charge of the fire apparatus, and that they should know the working of the same, and that every part is in order, and they can be sure only by making a thorough inspection as often as once a week. A fire organization among the employes is essential to the handling of the fire apparatus.

Buckets of water are the most effective fire apparatus, as any person can handle them. They should be kept full and distributed in abundance through the various rooms or floors of nearly all risks other than dwellings. They may be placed on shelves, or hung on hooks, as circumstances may require. Galvanized iron or indurated fiber pails are better than wood. They should be marked "For fire only." Casks of water are generally needed to furnish a further supply to the fire pails. To prevent freezing, add chloride of magnesium or salt to the water.

Stoves should be in order, and free from cracks, set firm on metal legs, and floors underneath should be protected by zinc or stone, or inclosed with scantling nailed together and filled with brick and mortar or cement. They should not stand nearer unprotected wood work than three feet. Any wood work nearer than three feet should first be covered with asbestos paper, and then covered with tin, or protected in some other equally safe manner. A good guard is made of gas pipe securely screwed to the floor, and should be placed about stoves where there is a liability of stock being piled against them in manufacturing establishments.

Ashes should always be placed in a fireproof receptacle when taken from stoves and furnaces.

Stove pipes should be thoroughly cleaned and all unsound lengths replaced by new ones. All stove pipes should enter good brick chimneys and should enter the chimney horizontally, with but one elbow. In all mills and factories where there is considerable vibration, or where dust is liable to accumulate, the horizontal pipe lengths should be carefully riveted together and an additional pipe placed outside, leaving at least one inch air space between the inner and outer pipes, supported at frequent intervals by wires, also well wired to hold it in the chimney. In all cases where pipes pass through wooden or lath and plastered partitions, there should be a double collar of metal, with from two to four inches air space, and holes for ventilation, or at least eight inches of masonry about it.

The chimneys should be examined carefully, especially where they pass through floors and roofs, as the settling of the building may cause cracks that would let sparks escape. A long-bladed case knife serves well as a probe for this purpose.

All pipe holes not in use should have close-fitting stoppers. There should be no woodwork of any kind framed into the chimney, and the entire surface of the trimmers and headers next to the flue should be entirely covered with tin or light sheet iron.

Where steam pipes pass through floors or partitions, the woodwork should be cut away from around the pipe at least two inches, and covered with asbestos paper, and then covered with tin. Cut a V-shaped piece out of the tin where it passes through the wood on both sides, and nail securely to the woodwork. The pipes should be supported by gas or steam pipes, earthen rings, or other equally safe material. Do not permit the pipes to come in contact with any woodwork or other inflammable material.

The Electric Motor's Work.

The New York *Sun* thus speaks of electric power, in which the work of the motor is summed up as follows:

"In some cities, so far has the use of electric motors gone, that it is possible for a man to-day to drink at breakfast coffee ground and eat fruit evaporated by electric power. During the morning he will conduct his business with electrically made pens and paper ruled by electricity, and make his records in electrically bound books, his seventh story office, in all probability, being reached by an electric motor elevator. At luncheon he will be able to discuss sausages, butter, and bread, and at night eat ice cream and drink iced water due to the same electrical energy. He will ride all about the place in electric cars, wear shirts and collars mangled and ironed by electric motors, sport in a suit of clothes sewn and a hat blocked by the same means; on holidays ride a merry-go-round propelled by an electric motor, or have his toboggan hauled up the slide with equal facility; be called to church by an electrically tapped bell, sing hymns to the accompaniment of an electrically blown organ, he buried in a coffin of electric make, and, last of all, have his name carved on his tombstone by the same subtile, mysterious, all-persuasive and indefatigable agency. This may sound like a wild and exuberant flight of fancy, but it is simply a faithful statement of the manner in which electricity is being applied to every one of the necessities and luxuries of life in America."

Maple Sugar.

In a paper read before the American Association on "The Indian Origin of Maple Sugar," by Mr. Henry W. Henshaw, of Washington, the point was as to whether the Indians learned to make sugar of the whites, or *vice versa*. The argument drawn from the maple tree festivals and linguistic evidence showed the red men were in no way indebted to the whites for sugar, no more than for the cultivation of corn, the pumpkin, bean, and tobacco. Their simple process was aboriginal, resulting from their own observation and inventive powers. They collect the sap in birch-bark vessels. These hold in some cases a hundred gallons. They take advantage of cold April nights to freeze the sap, and in the morning throw out the ice. They evaporate it by throwing hot stones into the reservoirs of sap. The sugar is eaten mixed with corn. Sometimes the pure sugar is their only diet for a month. They boil venison and rabbits in the hot sap as they evaporate it. They also make sugar from the silver maple and box elder. That the Indians made sugar from times unknown is proved by their language, their festivals, and their traditions. Several authors of early times, telling of their visits to the Indians, mention maple sugar, and one of them, in 1756, describes the Indians' mode of preparing it. The gathering of sap and making of sugar formed one of their annual religious ceremonies.

Correspondence.

Chicken Surgery.

To the Editor of the Scientific American:

The result of a little experiment which I have recently tried may be of interest to some of your subscribers. It was original with me, though I have since learned that it had been tried before.

A full-grown pullet became "crop bound," and after trying for several days unsuccessfully to force the contents of the crop along in its regular channel, I finally decided to try another method of relief. I wrapped her with innumerable turns of twine, tightly pinioning her wings and legs to her body, then placing her on her side on a narrow board, I tied her down firmly. Then, by tying back the longer feathers and plucking five or six small ones, a space of about one-half inch wide and one and one-half inches long was made bare. Then with a very sharp lance I cut a gash about one inch long directly through into the side of the crop, removed the contents, using a button hook for the purpose, washed the edges of the cut, sewed up the crop, and then sewed up the skin.

Scarcely a drop of blood was drawn, and by feeding the subject on soft food for several days she soon recovered. D. H. DECKER.

Washington, D. C., Dec. 27, 1890.

The Cartesian Diver—a Simple Modification of the Experiment.

To the Editor of the Scientific American:

For experiments with the Cartesian diver, I use a large flat bottle and a small vial, such as is used for homeopathic medicines. I completely fill the bottle with water. I then fill the vial about half full, a few trials determining exactly how much to use, and invert it in the bottle. The bottle is then corked, the cork being put in with more and more of force, followed by repeated careful loosenings of it, until the vial *barely floats*. Then, taking hold of the bottle and pressing the sides, the volume is decreased, and the vial descends, rising again when the pressure is removed. This method of showing the transmission of pressure is not new, but I think it is not generally known.

I believe, however, that the following modification of the experiment is original with myself: Having corked the bottle so that the vial will barely descend, and remain at the bottom, I find that pinching the flat bottle edgewise, instead of flatwise, increases the volume of the bottle enough to cause the vial to rise to the top. The force needed in this latter case is, of course, greater than that required in the former.

One who has never used this simple apparatus will be astonished at the remarkable sensitiveness to pressure which may be obtained.

CLARENCE M. BOUTELLE.

Decorah, Ia., Jan. 1, 1891.

The Obliquity of the Planetary Orbits.

To the Editor of the Scientific American:

In an article from *La Nature*, printed in your issue of Oct. 4, 1890, the opinion is expressed that "the only plausible hypothesis to explain the inclinations of the axes of planets upon their orbits" is that at some time they have been struck by comets. The writer, no doubt, infers this from the ring theory of Laplace. If the sun, at the time of the formation of a planet, were a perfect sphere, it is difficult to see how the planet could be formed, by natural causes, in any other way than as a ring. But was the sun a sphere? It seems to me much more probable that, during its nebulous state and during the generation of the planets, the sun was an irregular mass of vapor, some parts being more distant from the center than others. Such higher parts, situated toward its equator, but not necessarily in it, would have a greater velocity than the general surface, and thus would be compelled by centrifugal force to separate, one after another, from the main body, to become planets.

If this be so, they were thrown off, not in rings, but in masses, the largest ones first, as on the separation of each one the sun would become more regular in form and the protuberances smaller. These bodies, thus torn from the main body, would not be likely to assume revolution on axes exactly perpendicular to their orbital motion, and I would thus account for the obliquity of their orbits. In the meantime the parts of the sun toward its poles, having less rotary velocity than the equatorial parts, would fall more rapidly toward the center, and thus contribute to its spherical form.

There is no sign anywhere of ring planetary formation, unless in the case of the rings of Saturn, and perhaps that of the asteroids, which may be fragments of a broken ring. But we see that in neither of these cases was a globe the result. E. HUNTINGTON.

787 Willoughby Ave., Brooklyn.

[This theory is fully as plausible as the one advanced by Leotard in the article on "The End of the World," in our issue of October 4. Yet both, being of accidental nature, do not accord with the uniformity of axial and orbital inclination of every individual body forming the solar system, the only exception being the system of minor planets, which seem to be the remains of an accident to some large planet originally occupying a normal place in our system. The axial positions and orbital relations of all the bodies of the solar system, from the sun to the remotest planet, seem to be due to the slight perturbations from the irregular flight of comets, meteors, and of interplanetary gravitation through the vast myriads of years that have elapsed since the dawn of their individualities.—EDITOR.]

The Destruction of Animal Life and its Consequences.

MRS. N. PIKE.

Everything that has life preys on other life is an old truism—from man to the smallest animalcule; but mainly for subsistence—an inevitable law of nature; but with few exceptions man is the only animal whose bloodthirsty instincts urge him to wholesale slaughter of races, either from a sheer love of killing or greed of gain.

There are few of the lower animals that are not of some use to man, and the wholesale destruction of any useful creature will surely be repaid fourfold. Nature will ultimately assert her rights, and generally metes out severe penalties for our abuse of them. If the sportsman, with his boasted reasoning powers, would only exercise them when bent on making a score, or the merchant when sending out his emissaries to bag game large and small irrespective for trade, much serious loss and future scarcity would be avoided. But when did either ever pause, where sport or gain were in question? I will quote a few instances where grave consequences are already developing themselves from the reckless slaughter of beast, bird, fish, and reptile life.

See the devastation such men as Gordon Cumming and others have made among the great elephants of Africa and Asia. Many are yearly killed for their tusks as ivory is one of the principal exports in eastern and western Africa. Yet how many have been slain yearly wherever they have been in reach of the sportsman, for the sake of boasting that so many have been killed before lunch or dinner, and the huge creatures left for the wolves and vultures! Slowly, but surely, are elephants receding from man to the vast tracts as yet unknown save to a Stanley or a Livingstone in Africa, and to the dense jungles of India, where man has difficulty in following them. At their present death rate the twentieth century must see the extinction of the last of the giant pachyderms that have flourished on the earth.

Where are the vast herds of bisons that once spread over two-thirds of this immense continent? Butchered by thousands, not as they once were for their flesh and hides for the support and tents of the aborigines at certain seasons, but in sheer wantonness by the white man, till, if the remnant be not well cared for, they will be soon but relics of the past fauna of the country. Fortunately the buffalo has found a home in Australia and takes kindly to its new habitat. Then there are the elk, moose, caribou, and common deer, all fast disappearing, owing to the incessant warfare against them. Equally with the bisons of America, the great marsupials are being exterminated in southern Australia, either hunted down for sport or to protect the grass of the sheep runs from being devoured by them. Now, people are awakening to the fact that kangaroos are of the greatest use, both for their flesh and hides, and there is consternation over their rapid decrease; and unless care is taken to breed and protect them elsewhere, they will take their place with the mammoth and dinornis of bygone ages. Our only marsupial, the opossum, from the insatiable appetite of the negro for its savory flesh, and the excitement of its chase, will soon be a *rara avis*. The coon is known for its cunning ways and fondness for persimmons, but it is not a generally accredited fact that a family of opossums are the best hunters a farmer can have on his land, especially for large grubs, boring beetles, and other insects, which they seek for persistently.

Look at the yearly massacre of the whales and other great marine mammals. From their fecundity there would be abundance of all these animals for every purpose of commerce, but the cupidity and avarice of men are killing the goose for the golden egg but too surely. A most notable instance is the *Rhytina gigas*, or Arctic sea cow, one of the most useful animals in the far North. Many a shipwrecked whaling crew has been kept alive by its flesh, and so abundant was it in the 18th century that the southeast of Behring's Island was named Cape Manati, a name it still bears, but only as a record of what was, but is not. The young ones weighed over 1,200 pounds and a full-grown one between 8,000 and 9,000 pounds, and were invaluable to the Kamschatkans, as their fat never turned rancid, and even one was a godsend on that inhospitable shore, as every part of the creature was useful. Little more than a century elapsed from its discovery before it was extinct.

The sperm and finback whales once were so plentiful in the ocean world that their pursuit gave employment to thousands of people. A few years ago over 900 vessels were engaged whaling from New Bedford, Mass., and the destruction of these leviathans of the deep has been so great that they are now very scarce in many seas where they were formerly abundant.

Every report from the seal fisheries brings news of the limits of the range of these valuable animals being contracted under the most relentless persecution. The still more precious sea otter is so rarely found that unless stringent laws as to their capture are made and enforced, the beautiful creatures must soon be exterminated. So it is with the fish products of the ocean. Every device that man can invent is used, not to meet the demand for wholesome food, but to sweep them in by shoals as long as they last. A case in point is the menhaden, caught in such vast numbers for rendering into oil, etc., that it is supposed bluefish and others that feed principally on them are gradually leaving us to seek elsewhere their favorite nutriment.

In bird life the same waste is and has been carried on. See the great auk and other birds, rare and beautiful, supposed to be extinct, and would be now unknown save for their record in books or a specimen in some museum. Ducks, geese, and many other wild marsh birds are scarcer every year now—once so plentiful. In England a raid was made on the blackbirds, bulfinches, and other fruit-loving birds till there was danger of their extermination. Very soon the farmer found out, when he had killed each bird he could get a shot at, that his orchards were being devastated by every kind of insect pest. It was hard for him to believe that such deplorable results could follow from killing the birds; but when convinced of it, he was only too glad to have them back, even at the cost of some of his cherries.

So it is here. The insectivorous birds are being so ruthlessly destroyed. The boys are bad enough, but every man of every nationality thinks because he has a gun (perhaps for the first time in his life) and America a free country, he is at liberty to slaughter every living thing that bears fur or feathers. See the pretty woodpeckers of so many species, how indefatigably they work on our trees, sounding step by step, and when they hear the note of warning, in goes the sharp bill till the insect is found, and they never cease till the tree is cleared. Thus they fulfill a double mission, working for their own sustenance and befriending man at the same time. Many a noble orchard has been saved by the very birds every sportsman aims to destroy. Think of the flocks of bright birds that are sacrificed yearly to the rage for feathers for ladies' hats, etc.! Land and sea shore are both laid under contribution, woods innumerable, where once the joyous notes of the varied song birds resounded, are now silent forever, and the true lover of nature feels the loss keenly, while many a fallen giant shows how insidiously its enemies have worked till it was laid low, with no little industrious friends to save it. Insect devastation is burdening the agriculturist with a load almost beyond endurance—then save the insectivorous birds. Over two millions of birds are killed annually for the milliners! Surely there are lovely flowers enough, our legitimate ornaments, and more appropriate to feminine beauty than feathers, so that the fashion for them will, I trust, die out; and it might but for the imperious Dame Fashion.

Of all created animals, I suppose the alligator is one of the most repulsive and ferocious. Every one for years that could get in a shot has fired at the huge saurian, till in some parts of the South it is becoming scarce. Yet, ugly brute as he is, he fills a not unimportant place in nature, and his loss is being felt, whether slain for his skin or mere sport. In the vicinity of the rivers and lagoons where alligators once swarmed in Florida are extensive corn fields, and these the creatures frequent for their favorite rodents that they are expert in catching. The wholesale destruction of alligators has caused the rats to infest the corn fields to such an extent that the consequences are already serious, and I see the governor of Louisiana is issuing a decree for their protection—a wise man in his day.

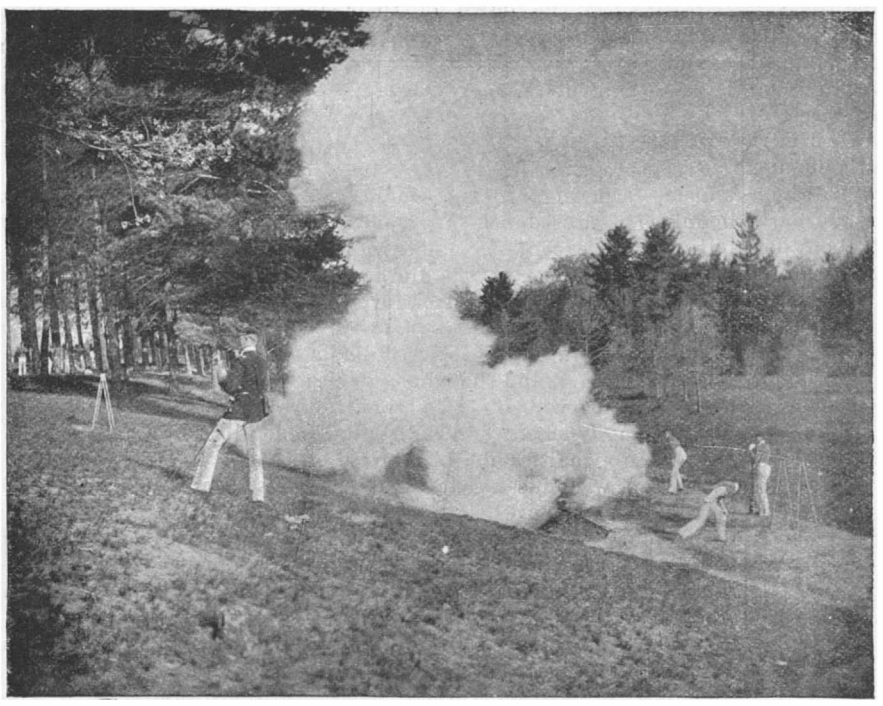
To leave the larger animals: Instances are occurring every year to show that even reptile life has its uses; many quite unsuspected by us, who are often willfully blind to what goes on around us, or, worse still, we allow our prejudices to warp our judgment. As a rule, the old fiat "every man's hand against them," is literally carried out, where snakes are concerned. Yet in mercy to us, thousands have been made harmless to man, and not only so, but useful to him. Let a common garter, black, or milk snake show but the tip of his tail, when he is pursued till slain, as if he were a rattler or copperhead. Yet their principal food is rats, mice, beetles, and others so destructive in the harvest fields. As all the above mentioned snakes are non-venomous, spare them by all means. I could cite fact on fact, but trust I have said enough to rouse those who have the power as well as the will to try and stop the wholesale destruction going on in all animal life, either for sport or profit, for it surely will be sooner or later followed by the gravest consequences to man, and in the near future too.

PHOTOGRAPHY OF A CANNON BALL IN MOTION.

To the Editor of the Scientific American:

In firing an eight inch mortar recently, we were successful in making an instantaneous photograph of the same, catching the shell about twelve feet from the mouth of the mortar, as you will see by the inclosed cut. The practice firing was under the command of Lieut. Frederick S. Strong, U. S. A., commanding the cadets of this academy. I think that you will agree with me that this is an exceptionally fine view, and worthy of publication in your excellent journal.

J. SUMNER ROGERS,
Col. and Supt. M. M. A.
Michigan Military Academy,
Orchard Lake, Mich.



CANNON BALL PHOTOGRAPHY.

A New Asbestos Mine.

The wonderful asbestos mine found near Hamilton has been uncovered in a ledge for a distance of seventy-five feet, and at the cropping, or as far as the discoverers have been able to go in this brief time, says the Olympia *Tribune*, the ledge proved to be eight feet in width. The rock taken from the ledge after the surface crusting was removed is pure asbestos ore, as white as chalk and fine as silk, the feathery fibers being as long as the pieces of rock from which they are pulled, in some cases reaching the entire length of eighteen inches. From the remarkable progress made, it is estimated that one month spent in development would so open the easily accessible store as to enable the valuable contents to be removed in almost any quantity. The mine is being opened at an altitude of about 2,000 feet. Asbestos is found in Switzerland, Scotland, Virginia, Vermont, and on Staten Island, off the coast of New Jersey. The finest quality discovered up to this time is in Italy. It is used extensively in the manufacture of fireproof roofing, flooring, clothing, hose, steam packing, lamp wicking, safe filling, and as a non-conducting envelope for steam pipes.

THE "IRON GATES" OF THE DANUBE.

The work of blowing up the masses of rock which form the dangerous rapids known as the Iron Gates, on the Danube, was inaugurated on September 15, when the Greben Rock was partially blown up by a blast of sixty kilogrammes of dynamite, in the presence of Count Szapary, the Hungarian Premier; M. Baross, Hungarian Minister of Commerce; Count Bacquehem, Austrian Minister of Commerce; M. Gruitch, the Servian Premier; M. Jossimovich, Servian Minister of Public Works; M. De Szogyenyi, Chief Secretary in the Austro-Hungarian Ministry of Foreign Affairs; and other Hungarian and Servian authorities. Large numbers of the inhabitants had collected on both banks of the Danube to witness the ceremony, and the first explosion was greeted with enthusiastic cheers. The history of this great scheme was told at the time the Hungarian Parliament passed the bill on the subject two years ago. It is known that the Roman Emperor Trajan, seventeen centuries ago, commenced works, of which traces are still to be seen, for the construction of a navigable canal to avoid the Iron Gates.

For the remedy of the obstruction in the Danube, much discussed of late years, there were two rival systems—the French, which proposed to make locks, and the English and American, which was practically the same as that of Trajan, namely, blasting the minor rocks and cutting canals and erecting dams where the rocks were too crowded. The latter plan was in principle adopted, and the details were worked out, in 1883, by the Hungarian engineer Willandt. The longest canal will be that on the Servian bank, with a length of over two kilometers and a width of eighty meters. It will be left for a later period to make the canal wider and deeper, as was done with the Suez Canal. For the present it is considered sufficient that moderate sized steamers shall be able to pass through without hinderance, and thus facilitate the exchange of goods between the west of Europe and the East.

The first portion of the rocks to be removed, and of the channels to be cut, runs through Hungarian territory; the second portion is in Servia. The new waterway will, it is anticipated, be finished by the end of 1895, and then, for the first time in history, Black Sea steamers will be seen at the quays of Pesth and Vienna, having, of course, previously touched at Belgrade. The benefit to Servian trade will then be quite on a par with that of Austria-Hungary. Even Germany will derive benefit from this extension of trade to the East. These, however, are by no means the only countries which will be benefited by the opening of the great river to commerce. Turkey, Southern Russia, Roumania, and Bulgaria, not to speak of the states of the West of Europe, will reap advantage from this new departure. England, as the chief carrier of the world, is sure to feel the beneficial effects of the Danube being at length navigable from its mouth right up to the very center of Europe.

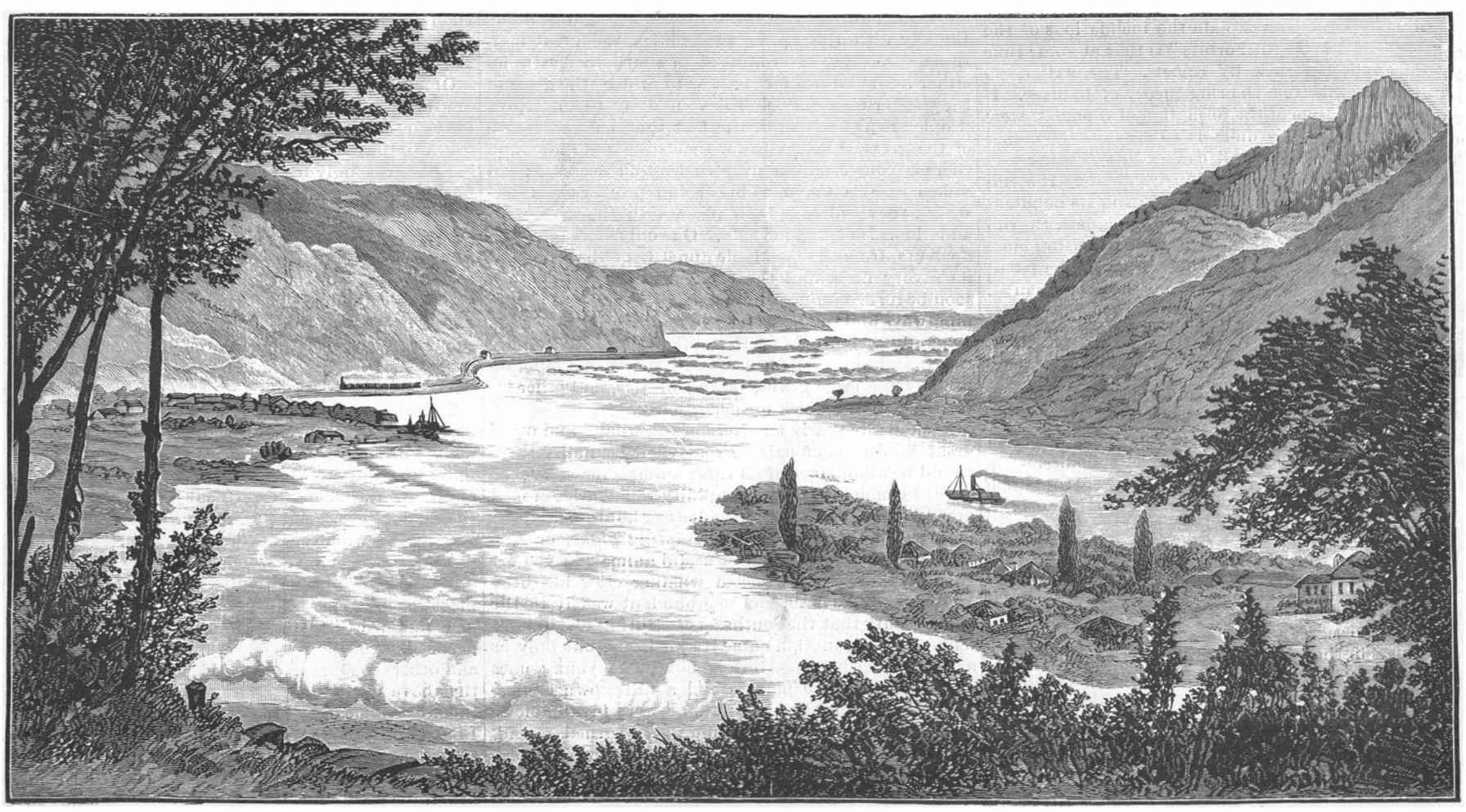
The removal of the Iron Gates has always been considered a matter of European importance. The treaty of Paris stipulated for freedom of navigation on the Danube. The London treaty of 1871 again authorized the levying of tolls to defray the cost of the Danube regulation; and article 57 of the treaty of Berlin intrusted Austria-Hungary with the task of carrying out the work. By these international compacts the European character of the great undertaking is sufficiently attested.

The work of blasting the rocks will be undertaken by contractors in the employ of the Hungarian government, as the official invitation for tenders brought no offers from any quarter. The construction of the dams, however, and the cutting of several channels to compass the most difficult rocks and rapids, will be carried out by an association of Pesth and other firms. The cost, estimated altogether at nine million florins, will be borne by the Hungarian exchequer, to which will fall the tolls to be levied on all vessels passing through the Gates until the original outlay is repaid.

Sad Condition of the Panama Canal.

The Panama Canal is actually a thing of the past, and Nature in her works will soon obliterate all traces of French energy and money expended on the Isthmus. Reports of October 25 say that the late heavy rains have caused vast slides into the canal from the hilltops near Obispo, and the canal excavation at Circaracha is entirely filled up. Only one dredge of the American company now remains at Colon, the Nathan Appleton. The dredge Ferdinand Lesseps, of the same company, was sunk about sixty miles from Colon, while being towed to Greytown. Lieut. N. B. Wyse, acting for the Panama company, writes from Bogota, under date of October 20, that owing to the exacting terms sought to be imposed by the Senate committee, "it appears that it will be impossible to reach an understanding."

MR. A. C. WILLIAMS, of Elk Falls, Kansas, a former signal service man, is conducting experiments tending to show a variability of the earth's gravity.



THE "IRON GATES" OF THE DANUBE.

SMALL ELECTRIC MOTOR FOR AMATEURS.*

BY GEO. M. HOPKINS.

Every piece of electric work done by a student or amateur is of value, not only as an addition to his collection of apparatus, but as a means of acquiring a positive knowledge of electricity and of electrical apparatus. The annexed engraving shows a simple and easily constructed motor, which very fully illustrates the construction and operation of the Gramme motor, and is well adapted to various uses requiring only a small amount of power.

This motor was built by Mr. W. S. Bishop, of New Haven, Conn., after the general plans of the simple electric motor already illustrated and described some months since in these columns, but the construction here shown is more simple and more easily carried out. The perspective view here given is two-thirds the actual size. The detail views (Figs. 2 and 3), showing the armature in process of construction, are full size.

The field magnet is formed of a yoke of Norway iron $\frac{5}{16}$ inch thick, $\frac{1}{2}$ inch wide and $2\frac{1}{4}$ inches long. In the yoke, near its ends and $1\frac{5}{16}$ inches apart, are drilled holes for receiving the quarter inch Norway iron cores of the magnet, which are driven into the yoke.

The polar extremities of the field magnet are curved to form a circular opening $2\frac{1}{16}$ inches in diameter. The winding of the field magnet may be applied to the magnet cores, as shown in the engraving, or the wire may be wound upon spools fitted to the cores. The spools are 1 inch in diameter and $1\frac{1}{8}$ inch long between the heads. Upon each spool is wound one ounce of double-wound, cotton-covered magnet wire. The yoke of the field magnet is fastened to the wooden base piece of the motor by screws passing upwardly through the base into threaded holes in the yoke.

The armature consists of a small Gramme ring mounted upon a wooden disk secured to the armature shaft. The armature core, *c*, is a ring formed of a piece of annealed iron wire, No. 13 B. & S. gauge, having its ends beveled and drilled transversely to receive a pin, as shown in Fig. 2. A core of this kind, although theoretically not as efficient as a laminated core, answers every purpose in this very small motor, and greatly facilitates the construction of the armature. The core has an outside diameter of $1\frac{7}{8}$ inches. The outside diameter of the armature is 2 inches, and the inside diameter $1\frac{1}{2}$ inches. Upon the armature core are placed 12 coils, *b*, of silk-covered, single-wound magnet wire, No. 25 B. & S. gauge, separated by rings, *d*, of soft iron wire No. 13, the rings forming polar extensions which add to the efficiency of the motor. The armature coils are formed in a lathe on a mandrel, separately, as shown in Fig. 3. This mandrel consists of a piece of No. 11 wire having two collars $\frac{3}{8}$ of an inch apart, one of the collars being fixed and the other being removable. To allow for any contingency, it is advisable to make the distance between these collars a little less than that given, say $\frac{1}{32}$ inch less. Each coil contains 4 feet 4 inches of wire wound in five layers.

To facilitate the removal of the coil from the mandrel, the first layer is wound loosely. After winding, and before removing the coil from the mandrel, the wire is cemented with paraffine or wax melted on the coil with a warm iron. After twelve coils have been completed, they are strung upon the armature core, *c*, in alternation with the iron wire rings, *d*, and when the core is filled, its ends are brought together and secured by means of the pin, as shown.

The wooden hub of the armature is now fitted to the ring, but before the ring is secured on the hub, twelve equidistant holes are drilled transversely through the hub, near its center, and in each hole is inserted a piece of No. 12 copper wire one-half an inch long. The ends of the pieces of copper wire are allowed to project one-sixteenth of an inch beyond the sides of the hub. The ring is placed on the hub, and ends of the wire projecting from adjacent coils, *b*, are twisted together, and attached by means of solder to the copper wire pins extending through the hub and forming the commutator bars, the covering being removed from the extremities of the wire. It will thus be seen that to each commutator bar is connected the beginning of one coil and the end of the adjacent coil, so that by means of these connections the winding of the armature becomes continuous.

* Full size working drawings for use of amateurs who wish to construct this motor were published in SUPPLEMENT of January 3, 1891, No. 783.

The posts in which the armature shaft is journaled are perforated near their upper ends with a hole of a size adapted to receive the armature shaft, and these holes are counterbored from the inner surfaces of the posts, and a wire of the same diameter as the shaft is placed in the position of the armature shaft, and Babbitt metal or type metal is poured into the open-

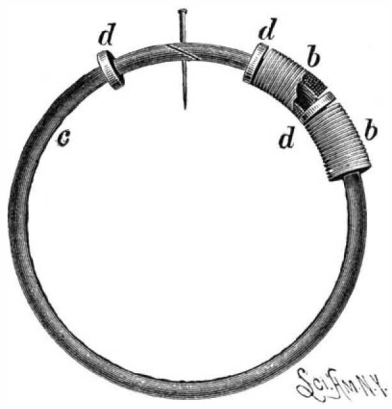


Fig. 2.—ARMATURE OF SMALL MOTOR IN PROCESS OF CONSTRUCTION.

ings around the shaft, forming the journal boxes. A hole is bored in the top of each post before casting the metal, to form an anchorage for the journal box, and after the casting, the anchorage is drilled through to the opening of the journal box, to form an oil hole for the armature shaft.

The journal box on the side of the commutator is made to project beyond the inner face of the post, to receive the disk which carries the commutator springs. This projection is made by clamping to the post a piece of wood having in it a hole corresponding with that in the post. After the journal box is cast, the extra piece of wood is removed, leaving a sleeve upon

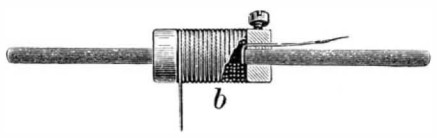


Fig. 3.—APPARATUS FOR WINDING ARMATURE COILS.

which to place the disk. This disk is an inch and a half in diameter and $\frac{1}{16}$ of an inch thick.

To the inner face of the disk are clamped the commutator springs by means of small blocks, as shown in the perspective view, these blocks being held in place by screws passing through the disk into threaded holes in the blocks. The commutator springs are curved outwardly and their ends are turned backward toward the disk, and their extremities rest upon the commutator bars, as shown in Fig. 1.

The commutator disk and the clamping blocks are made of vulcanized fiber, which is strong and at the same time a good insulator. The commutator springs are hard-rolled copper, and their inner ends are adjusted so as to lightly touch diametrically opposite commutator bars. The best adjustment for the commutator springs is found by moving the disk in one direction or the other. It will be found that the maximum effect is secured when the contact surfaces of the commutator springs are nearly in a vertical line.

The commutator disk is clamped in any desired position by an ordinary wood screw, which passes loosely through the post and is screwed into a wooden thumb nut bearing against the outer surface of the post. The terminals of the field magnet are connected directly with the binding post and also with the outer ends of the commutator springs as shown.

With one cell of dry battery the motor makes about 1,800 revolutions per minute, but it does not develop its maximum power until one or two cells are added in parallel. Any of the dry batteries will run it for short periods, but if it is required to run it continuously for any length of time, one or two cells of Bunsen or Fuller battery should be used.

The motor being shunt wound, is practically self-regulating. Its speed with any amount of battery power does not much exceed 2,000 revolutions per minute.

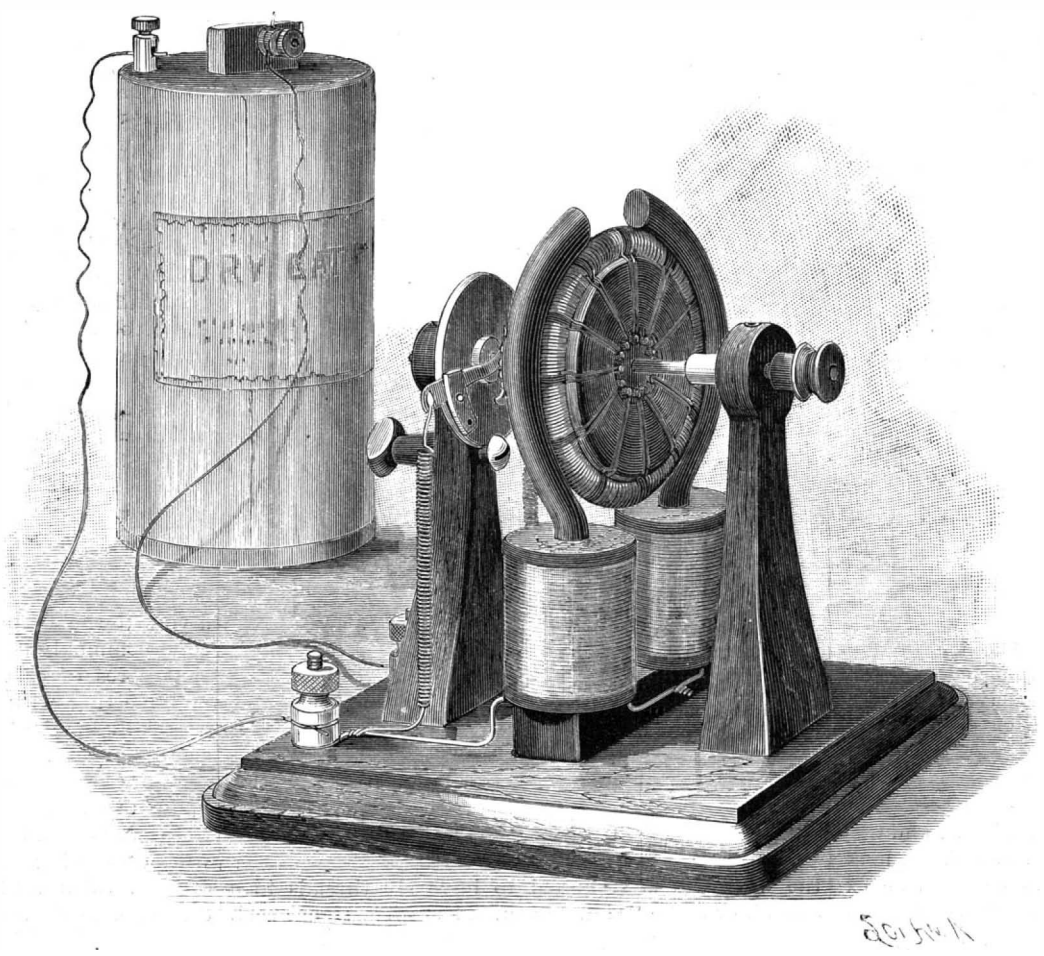


Fig. 1.—PERSPECTIVE VIEW OF A SMALL GRAMME RING MOTOR.

A Mechanical Cotton Picker.

The *Waco Day*, Texas, describes as follows the operation of a new cotton picker by Mr. Campbell, lately tried at that place:

The essential feature is 330 fingers or spindles projecting through and from a hollow cylinder. These fingers are ten inches long, and have at the end a brush or tip of fine wire, and set in four grooves radially is horse hair, clipped so it projects from the fingers about one-twelfth of an inch, the tip and the hairs on the side being the means of getting the cotton from the bolls. The fingers or spindles are given a whirling motion by a system of cog gear inclosed within the cylinder. Moving forward, the cylinder revolves, the fingers come in contact with the cotton, the whirling motion of the fingers entangles the cotton lint, and it is picked, then carried upward and backward until cleaned from the fingers by brushes, and thrown into receptacles holding sixty pounds of seed cotton.

The revolutions are so timed that the fingers which project at the spokes of a wheel strike the plant without a raking motion, for that would damage the plant. No injury comes to the leaf or boll from running the machine over the plant.

With a width of four feet, length seven feet, and height of five and one-half feet, the machine, complete, weighs about 1,200 pounds, and is of easy draught for two mules.

The rows were 185 yards long, and were gone over twice, the result being the cotton was cleanly picked out of the bolls, the machine being as thorough in this respect as the fingers of the negro. No injury to foliage, bolls or branches of the plant was noted.

In the morning, when the cotton was slightly damp, a gathering from one row made by the machine weighed a little more than thirty pounds. The waste knocked on the ground by the machine was picked up by hand and weighed five ounces. In the afternoon, with the cotton perfectly dry, the cotton picked weighed over twenty-eight pounds, and the waste picked up weighed nearly three and one-half pounds.

The time made was about five pounds a minute, or 300 pounds an hour. Allowing time, liberally, for emptying the receptacles, stopping for repairs, meals, and so on, the machine could easily work ten hours a day and would gather 3,000 pounds at a total expense of not more than $3 per day, making the total cost of the picking for each bale $1.50. At present prices the cost is fully $16.

Jamaica International Exhibition.

Shoe manufacturers of New England who are desirous of opening up business relations with South American countries will find an excellent opportunity for showing their goods at the international exhibition which opens at Kingston, Jamaica, on the 27th of January, and all the arrangements are made on a liberal scale, which gives assurance of success. Space is free, and all goods intended for exhibition will be admitted duty free. Kingston is an important point for distributing goods to Central and South America, as well as the neighboring islands. Jamaica, with 600,000 inhabitants, is only 90 miles from Cuba and about the same from Haiti, having direct steam communication with the other West Indian islands and the center of their trade.

Artificial Production of Cyanides and Ammonia.

A series of experiments upon the synthetical production of cyanogen compounds by the mutual action of charcoal, gaseous nitrogen, and alkaline oxides or carbonates, at high temperatures and under great pressure, are described, says *Nature*, by Prof. Hempel in the new number of the *Berichte*. Bunsen and Playfair long ago showed that when charcoal and potassium carbonate are heated to redness in an atmosphere of nitrogen, a certain quantity of cyanide of potassium is formed. Since that time Margueritte and Sourdeval have further shown that barium carbonate may be used in place of the potash, and that the barium cyanide produced may be again decomposed by steam into ammonia and barium carbonate. These reactions afforded a theoretically continuous process for the conversion of atmospheric nitrogen into ammonia, a process which, if it could only be worked on the large scale, would doubtless be of immense value. Unfortunately, however, only small proportions of the substances appear to enter into the reaction at ordinary pressures. Hence the yield is not sufficiently large to render the process economical. Prof. Hempel, however, by means of a simple pressure apparatus, has shown that the reaction is very much more complete, and when potash is used, very energetic, under the pressure of sixty atmospheres.

His apparatus consists of a strong cylinder closed at one end, and worked out of a single block of steel. The steel top screws tightly down, so as to form a closed chamber, and is pierced with two apertures—one for connection with the compressing pumps, and a second to admit the passage of an insulated copper rod. Within the steel cylinder is placed a smaller cylinder of porcelain, in which the mixture of the alkaline oxide or carbonate and charcoal is placed. Through the center of this mixture passes a rod of charcoal, which is connected above with the copper rod and below with the steel cylinder itself, in such a manner that when the wires from a strong battery or dynamo are connected with the projecting end of the copper rod and the exterior of the steel cylinder respectively, the rod of charcoal becomes heated to redness. The pumps are then caused to force in nitrogen gas until the desired pressure is registered on the gauge. Experimenting in this manner, it was found that the amount of barium cyanide formed in fifteen minutes under a pressure of sixty atmospheres was nearly four times that formed at ordinary atmospheric pressure; while in the case of potassium carbonate the reaction was so energetic that in a few seconds the heated carbon rod itself was dissolved. Hence it is evident that the formation of cyanides by heating together alkaline carbonates and charcoal in an atmosphere of nitrogen is greatly accelerated by largely increasing the pressure under which the reaction occurs.

Novel Life-Saving Belt.

Mr. Rossi-Gallico, from Italy, lately read a paper on the merits and adaptations of this invention before the members of the Balloon Society of Great Britain, London.

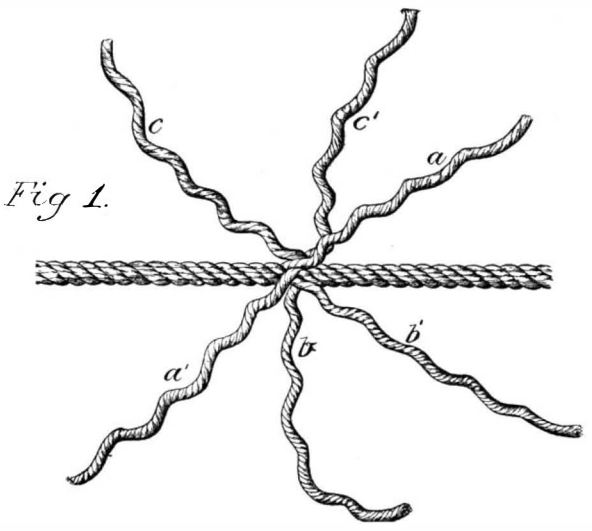
The belt is very compact, light, portable, and, in a non-inflated state, flat, and can be worn without the least inconvenience. Its inflation is effected by carbonic acid gas, instantaneously produced by the combination of acids and alkalies with which the compartments of the belt are charged on its being brought into contact with water. The one intended for passenger use inflates, as we have said, on touching water; that intended for the use of officers and seamen is made different. It is easily understood that a belt which would inflate simply by being brought into contact with water would be rather inconvenient to wear for those whose duties expose them more or less to a wetting. So to avoid this a special arrangement is made. The acid and alkali are introduced into the belt in a liquid form, and when the moment arrives for the services of the belt being required, all the wearer has to do is to pull two small tassels, which at once allows the chemicals to mix, and the belt is at once inflated. This was demonstrated at the lecture by Sig. Rossi-Gallico, who inflated both classes of belts, the one by wetting, and the other by pulling the strings, in something like fifteen seconds. The belt was also shown inclosed in a brass bomb furnished with cord to allow of its being swung to a distance from the ship, and is so constructed that on its touching the water it sinks for a second, and then a fully inflated belt appears on the surface with sufficient floating power to support two men for forty hours. The belt can also be discharged by rocket to a drowning person quite 1,000 yards away, and may carry a line with it to draw to shore or deck the person to be rescued.

The Atlantic Ocean Mail Steamers.

The Teutonic, City of New York, Majestic, and City of Paris will next year be run on different dates, making together a weekly service such as cannot be excelled in the world, since they are all 20 knot boats, and all come within a few minutes of each other in the duration of the now very fast transatlantic trip—about 5 days 20 hours.

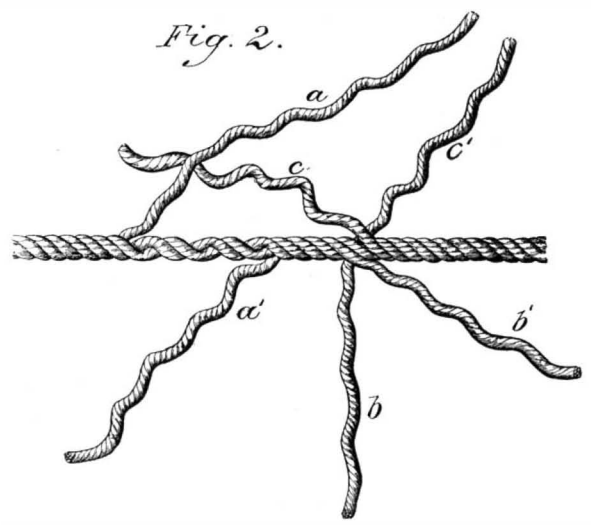
LONG SPLICE FOR ROPES.

The illustrations show how to make a long splice by a method somewhat different from the regular way. It is especially valuable for uniting ropes used in

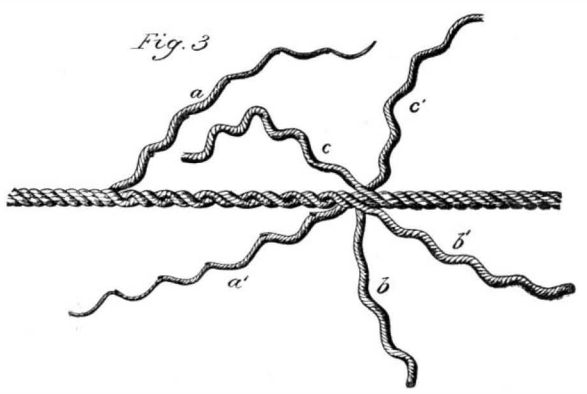


power plants. The union can be made so neatly as to be indiscernible.

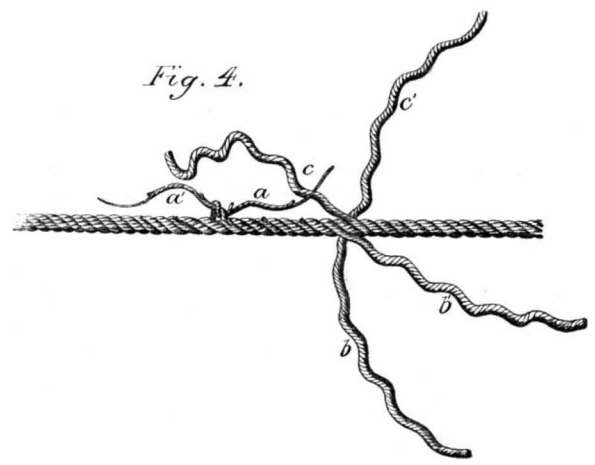
The ends to be united are first unlaid for at least as many turns as there are threads in each strand. The ends are then "crotched," as shown in Fig. 1. The process of making a regular long splice is started.



Strand a is unlaid and strand a' laid in its place. In regular practice this would be done without any reduction or tapering, which regular method is shown in Fig. 2 in process of execution. Then, when at a sufficient distance, a and a' would be allowed to meet. Half of each would be cut off, and the other half would be knotted and stuck away beneath the strands.



In the method now to be described, a systematic tapering takes place. The place where the strands are to unite having been settled upon, half as many turns of both strands as there are threads in a strand, counting backward from the place where the two strands are to meet or unite, are unlaid. The rope shown in



the drawings is supposed to have six threads in a strand, or to be "eighteen thread stuff." Hence each of a given pair of strands, say a and a', is unlaid three times, counting backward from the place of meeting, and at that point a single thread is cut and removed. They are laid up each one more turn, and a second thread is removed; one more turn brings them together, when a third thread is cut out of each, leaving each of half the original thickness. Here they are knotted or twisted, as shown in Fig. 4, a right-handed knot being used. This knotting and consequent doubling of the reduced strands, it will be seen, maintains the original thickness of the strand, each strand at this point being three threads in thickness. The ends of the loose strands are again wrapped around the laid-up tapered strand until the next turn is reached, when an additional thread is cut out, leaving two. This reduced portion is twisted around the laid strand, which, at this point, is four threads in thickness, until the next turn is reached. There another thread is cut out, and the single thread left is wound around the laid strand, here five threads in thickness, and is finally cut off.

It will be observed that this leaves the strands in all places of the exact original thickness of six threads.

In ropes in which the number of threads are uneven, one strand is unlaid one turn further back and is reduced one thread more than the other at the first knot, and the same principle is carried out, the twisted or united strands always being kept of uniform thickness.

In Fig. 3, the reduction of the strands thread by thread is shown. It is better practice not to reduce them all at once, but to do it turn by turn as fast as they are laid up, as described above. The reduction after knotting is best accomplished in the same way, although the operation can be carried out as shown in Fig. 3 and Fig. 4. The threads too should be cut off so as to lie underneath the strand, and so be hidden, if a very neat job is wanted.

Strand c is unlaid in the opposite direction, or to the right, and c' is laid in its place. These are treated exactly as a and a' were.

Strands b and b' are each unlaid for half as many turns as there are threads in each, in the present case for three turns, and reduced one thread, laid up one turn each and reduced by another thread, laid up a second turn and reduced by a third thread, and are knotted and twisted as described, the loose strands being reduced one thread for each turn given in the finishing twisting.

This splice has been used with great success by Mr. W. A. Wood, of this city. He has employed it on rope driving bands of rawhide, as well as on manila rope, and it has given the greatest satisfaction. The splice being of uniform thickness, the band runs better and the spliced portion lasts as long as any other part.

Resuscitation of the Apparently Drowned.

In the *Transactions* of the Medico-Chirurgical Society of London, Dr. Bowles gives the following excellent advice: After the patient has been placed for a moment with face downward, to allow the escape of water from the mouth and throat, he is turned on the side and *kept on that side* continuously, except when (about fifteen times a minute) the body is rolled for a few seconds on the face again. By *keeping the same side always up*, the lung on that side becomes clear. Turning first one and then the other side up is dangerous, because thereby the partly cleared lung is suddenly flooded with fluid from the lung which was downward. It is better to clear one lung entirely than to have both half cleared. Each time the body is turned upon the face a little more froth and water escapes from the mouth and nostrils. If one lung is thus cleared it may escape the inflammation which results from the inspiration of water. When the upper lung has been almost cleared, it is useful to raise the upper arm above the head as in the Sylvester method, since the entrance of larger quantities of air into the lung is now safe. Pressure upon the back at each pronation assists the escape of water somewhat, and it has a good influence on the heart, aiding the propulsion of the blood toward the lungs. The continued use of the prono-lateral method is an excellent mode of keeping the pharynx clear of obstruction. The *Medical Record* speaks approvingly of this treatment in a recent editorial, and considers it superior to the usual Sylvester or Marshall Hall method.

Carbon Cores for Casting.

The well-known difficulty experienced by both iron and brass founders in making smooth, true holes in castings by coring has led to various experiments with a view to the discovery of something better than the cores commonly used. Mr. E. R. Dale, C.E., writes us that cores of carbon are coming into use in England and meeting with favor for work of all kinds, but especially for the class of work requiring long holes of small diameter.

At present they are supplied in 10 inch lengths from ½ inch to 1½ inches in diameter. They are smoother than sand cores, and will keep for any length of time without wasting. Holes may be cored in many kinds of work which would otherwise have to be bored. The carbon core does not break in the mould, and often may be used the second time.

These cores are said to resemble electric light carbons, and are perforated longitudinally.

Making a Will which will Stand.

Some time last summer a young man in Pittsburg, Pa., tendered his own will for filing in the office of Register of Wills, which was refused as contrary to law. The matter has been widely commented upon in the newspapers, the main point insisted upon being the perfect authenticity which must attach to such a will, and the unlikelihood of any contest. But the prime fact is here lost sight of that the law regards a will as going always with the testator, and as being open to amendment, variation, or destruction by him so long as he lives. It is of no legal effect during the testator's life, and the common law rule has been that a marriage and the birth of a child after the execution of a will operated to revoke it, unless by provision made in the will or by other competent evidence an intention by the testator that there should be no such revocation was shown; while by the statutes of this and many other States any children born after the will is made and not mentioned or provided for by the will take such share as would come to them if the father had died intestate.

The different States have various statutes limiting to some extent the manner in which a testator may dispose of his property—as, for instance, in New York State, no person leaving a wife, or child, or parent can devise more than half of his or her estate to charitable or educational institutions, etc.; and all statutory limitations, as well as proof that the will itself is *bona fide* and sufficient, must, if called in question by any person interested, be passed upon by the proper court, before good title can be conveyed under the will. The contest over the Fayerweather will in New York is probably due, principally, to the great increase in the value of the estate from the time of making the will, in 1884, to the death of the testator, six years later. The increase is estimated at three million dollars, all of which was to go to the executors, although it is said they had private written directions as to the disposition they were to make of it. Therefore a will to stand, if contested, must have no provisions conflicting with statute law at the time of the testator's death, at which date only the will becomes operative and falls under the provisions of the law.

The plan of filing wills with probate or other public officers during the testator's life may therefore be considered worse than useless. Ninety-nine hundredths of the will litigation is not on the question of actual execution, but (a) upon the condition of the testator's mind at the time of execution, as to competency and freedom from undue influence; (b) the meaning and effect of specific provisions contained in the will; (c) the legality of specific provisions in view of positive statutes and rules of law.

Upon all these questions the plan of the Pittsburg young man would produce more harm than good.

Value of Observation.

The late Rev. Henry Ward Beecher once said that he never saw anybody do anything without watching to see how it was done, as there was no knowing but that some time he might have to do it himself. This habit of observation once served him in good stead. "I was going," he says, "across a prairie when my horse began to limp. Luckily, I came across a blacksmith's shop, but the smith was not at home. I asked the woman of the house if she would allow me to start a fire and make the shoe. She said I might if I knew how. So I started the fire and heated the shoe red hot, and turned it to fit my horse's foot, and pared the hoofs, and turned the points of the nails out cunningly, as I had seen the blacksmith do, so that in driving into the hoof they should not get into the quick, and I shod the horse. At the next place I went to I went straight to a smith and told him to put the shoe on properly. He looked at the horse's foot and paid me the greatest compliment I ever received in my life. He told me if I put on that shoe, I had better follow blacksmithing all my life. Now, I never should have known how to do that if I had not looked on and seen others do it."

Another writer in a contemporary on the same subject says:

Every one should cultivate the faculty of observation. If he does so designedly, it will not be long before he will do so unconsciously. It is better to learn a thing by observation than by experience, especially if it is something to our detriment. One would prefer to know which is the toadstool and which is the mushroom by observation rather than by experiment, for the latter might cost him his life. There is hardly a vocation in which observation is not of great service, and in many it is absolutely essential. It adds to the proficiency of the chemist, the naturalist, the mining expert, and the bushman. Observation quickens experiment. It leads to inference, to deduction, to classification, and thus theories are formulated, sciences established. An observing boy will become an observing man, and, as boy and man, he will have an advantage over those who have not cultivated the faculty. He knows a thousand things that the unobservant boy does not know. He does not get the knowledge from books or from others, but acquires it for himself, through the use of his eyes and ears, and properly appreciates it for that reason. A child may know more than a philosopher about matters that may not have come under the observation of the philosopher. A little girl entered the study of Mezerai, the celebrated historian, and asked him for a coal of fire. "But you haven't brought a shovel," he said. "I don't need any," was her reply. And then, very much to his astonishment, she filled her hand with ashes and put the live coal on top. No doubt the learned man knew that ashes were a bad conductor of heat, but he had never seen the fact verified in such a practical manner. Galileo noticed the swaying of a chandelier in a cathedral, and it suggested the pendulum to him. To another inventor the power of steam and its application was suggested by the tea kettle on the stove. A poor monk discovered gunpowder, and an optician's boy the magnifying lens.

New Submarine Boat.

The French submarine boat Gymnote was recently tried at Toulon, and demonstrated its ability to pass through a blockaded line and escape attention in spite of systematic efforts to watch, trace, or discover its course. According to the *Revue Industrielle*, it plunged and remained under water forty minutes. It rose to the surface in a distance of more than two miles and a half from its point of departure, and had passed under the watched line of demarkation without being seen. After having ascertained where it was, it remerged to return. It again crossed the line, but this time two of the parties on the lookout for it got a glimpse of it, not, however, sufficiently distinct to enable them to trace and pursue it. The course of the boat was in both instances rectilinear.

THE Crosby Steam Gauge and Valve Co., of Boston, with branches in New York City, Chicago, and London, has recently issued an illustrated catalogue of its goods, including the steam pressure gauge, pop safety valve, water relief valve, steam engine indicator, cylinder lubricator, bell chime whistle, pressure gauge testing apparatus, etc. Those looking for the most improved appliances in this line will do well to send for a catalogue.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

STATION INDICATOR.—James N. Winn, Darien, Ga. This is a device to be placed on the cars of a steam road, to be operated by the engineer from the cab by compressed air or steam transmitted through flexible couplings, to indicate approach to the different stations, the invention covering an improvement in construction and arrangement on a formerly patented invention of the same inventor.

CAR DOOR. — John W. Crumbaugh and Leander C. Prater, Kansas City, Mo. A combined bridge and cross bar is connected to the door jamb, to slide integrally therein, and adapted to be fastened across the door space or let down to form a bridge or gangway, the device facilitating the opening of the doors of stock cars, strengthening them, and enabling cattle conveniently to pass in or out in loading or unloading them.

CAR COUPLING. — Charles W. Manchester, Feesburg, Ohio. The drawhead of the car is, by this invention, provided with a central opening adapted to register with a like opening formed in a revoluble cylinder pressed on by a spring, with other novel features designed to form a simple and durable construction which shall be very effective in operation and automatic in coupling.

CAR COUPLING. — George H. Duke, Hotchkiss, Col. The drawhead of this coupling has a depending beveled flange in its upper side, a spring-pressed drawbar having a beveled forward end and a locking shoulder, with a coupling link beveled and having a shoulder to engage the shoulder of the drawbar, the forward end of the latter being pressed against by a central boss, the coupling being effected automatically.

RAIL JOINT.—Frank F. Hoeffle, Meridian, Miss. This invention provides for a metal plate or box having upwardly extending flanges between which a rail may rest, there being gripping devices between the flanges adapted to clasp a rail, a wedge pointing upwardly between one of the flanges and a gripping device to hold it firmly against the rail, the device being designed to obviate the use of bolts, nuts and nut locks.

Mechanical.

WATER WHEEL.—Levi M. Sharps, Lake View, Oregon (deceased, W. M. Sharps, administrator). This invention relates to a former patented invention of the same inventor, and covers a novel construction and combination of parts forming an improved wheel designed to be very simple and durable, and very effective in operation.

TICKET PRINTING MACHINE.—Gideon B. Massey, Mamaroneck, N. Y. (deceased, Sarah R. Massey and Stanley A. Bryant, administrators). This invention provides a machine to print and number tickets in successive series, the blanks being supplied from a roll of continuous paper and cut off as delivered from the machine either singly or in strips, the invention being more especially designed for printing railway, ferry and bridge tickets, etc.

Electrical.

GALVANIC BATTERY. — George A. Smith, Halifax, Canada. A cell contains the exciting liquid, in connection with elements formed of rods of zinc and rods of carbon, and a mechanism is provided for plunging and lifting the elements and holding them at any desired height, the construction affording a large surface for the action of the liquid, and making a simple and powerful battery for the use of physicians, surgeons and experimentalists.

TELEGRAPH BLANK. — John O. Donnell, Lowville, N. Y. This a blank for telegraph, telephone or other messages requiring an answer or a duplicate for reference, and consists of a perforated double blank divisible into independent blanks, with opposite perforated end flaps, whereby the blanks may be made to form their own envelopes and be folded up and sealed.

Agricultural.

PLOW. — William W. Leak, Montgomery, Ala. This is an improvement in that class of plows in which the points or sweep blades are made of metal sufficiently thin to form an edge, to avoid the necessity of sharpening and resharpening the blades, the brace frame and bars dispensing with all useless material and lightening and cheapening the construction, while permitting the free passage of soil thrown up in operation.

Miscellaneous.

RAPID TRANSIT APPARATUS. — Lieut. John S. Parke, U. S. A., Rosebud Indian Agency, Rosebud, South Dakota. This invention provides for the construction of a railway track having a rack formed of plates arranged at an incline lapping one another; and provided with cushioning plates, while the locomotive has a revolving group of cannons or barrels arranged to fire a piston against the rack, to utilize the explosive force of gunpowder or some analogous material to attain great speed in the running of carriages or trains.

SALT PAN. — Daniel Shirley, Hutchinson, Kansas. This is an apparatus having a furnace under the evaporating pan, in connection with a settling pan having a flat float resting on the liquid, while flues extend through the settling pan below the float, the construction being designed to prevent the buckling or warping of the pans and obtain the best results from the fuel used.

COMPOSITION FOR ROADWAYS, ETC.—Henry Benjamin, Montreal, Canada. This is a composition of matter also designed to serve for sidewalks, fireproof roofing, vault linings, and various building purposes, and has for its ingredients finely divided iron particles, such as the waste products from iron mines or iron sand, and a bituminous substance, mixed and incorporated together by heat to a pasty consistency.

AXLE BEARING. — James S. Patten, Baltimore, Md. This is a self-oiling bearing, the axle having a spindle portion with longitudinal groove communicating with an oil reservoir, a spring-actuated rod sliding in the groove, and the axle box having a cam also acting on the rod, the invention being an improvement on a former patented invention of the same inventor.

STOCK HITCHING DEVICE.—Andrew L. Hinchman, Lowell, West Va. This invention consists of a guide with independent movable clutch blocks, a latch on one block engaging the other block, and cords for pulling the blocks together to retain the halter, with other novel features, for securely hitching and unhitching animals without entering the stalls, and simultaneously unhitching any number of animals.

TYPE WRITING MACHINE.—Gilbert L. Depuy, Garland, Texas. A keyboard carriage is pivoted on a threaded shaft in a light frame, and an inking attachment and mechanism moves the carriage along the shaft as the writing proceeds, the machine being very small and adapted to be carried in the pocket, for use to do the work of a pencil or pen.

TYPE WRITER FOR THE BLIND.—Lizzie Sthreshley, Austin, Texas. This is a machine to produce writings for the blind under the "point" system, and embraces improvements in the construction and combination of parts in the carriage feeding, the spacing, and the embossing mechanism.

BOOK STAND.—Julius W. and Charles T. Knipp, Napoleon, Ohio. This is a stand for conveniently supporting a dictionary or other large book, and the construction permits of tilting or turning the table in any desired direction, while it can be locked in place in such position as wanted, the stand also presenting an ornamental appearance.

TEMPORARY BINDER. — George A. Blackburn and Daniel J. Brimm, Columbia, S. C. This is a binder especially designed to hold catalogues, indexes, scrap books, and newspaper files, and has but few and inexpensive parts, while designed to be easily operated and securely hold such papers and documents in place.

MUSIC LEAF TURNER.—James Maret, Mount Vernon, Ky. Combined with a series of fixed ratchets are sleeves carrying leaf-turning arms, and having volute springs at their outer ends with hooks to engage the ratchets, there being also clasps to engage the leaves and spring catches to hold the arms, whereby the leaves may be turned in succession by the liberation of spring-actuated arms, the arms being used independently of each other.

COUPON ACCOUNT BOOK. — David F. Parker, Red Cloud, Neb. This is a book with leaves having memorandum spaces and smaller side spaces on each of which is formed a coupon representing dollars or fractional parts thereof, and adapted to serve as a substitute for the ordinary pass book used by purchasers of goods at retail.

PREPARING CHOCOLATE. — Victor Tobias and Heinrich Fischer, Berlin, Germany. This invention relates to the making of a liquid chocolate thoroughly free from fat, which can be preserved for a very long time, and consists of a process in which whey or poor milk is heated to a boiling point, adding cocoa and sugar, cooling the mixture, and removing the cocoa butter.

SIGN. — Henry Britten, London, England. This sign is composed of tubes arranged at right angles to each other and connected by couplings, letters being suspended by links from the horizontal tubes, forming a sign for conspicuous display with large letters on the tops of buildings, and so made that there will be but little strain upon the framework.

CELLAR DOORS. — Charles E. Golden, Oskaloosa, Kansas. This is an attachment for raising and lowering doors, whereby the door when released will be automatically opened, and may be automatically closed when desired, by means of a weight on a crank arm acting as a pendulum.

ADHESIVE PLASTER. — Richard K. Gregory, Greensborough, N. C. This plaster is of cotton or linen or similar material saturated with a compound of gum turpentine, alcohol, tannic acid, cane sugar, gum camphor, bichloride of mercury, carbolic acid, etc., for use over a wound, the ingredients of the plaster being insoluble in water, and possessing superior antiseptic and anæsthetic properties.

CUP HOLDER. — James Sutherland, Honolulu, Hawaii. This invention consists of a ring adapted to receive a cup, and a spring clamp formed on the ring at right angles to it, adapted to engage the rail of the table, the device being made of a single piece of steel wire, and specially designed to hold cups, glasses, etc., to the table on board of a ship.

PIPE STOPPER. — William Baguley, New York City. This invention provides a simple and inexpensive stopper specially designed for closing the ends of waste pipes when a test is applied to discover flaws and imperfections which would permit the escape of sewer gas.

BOTTLE STOPPER. — Michael J. McHugh, Jersey City, N. J. This is a sectional stopper, the sections of which may be easily fitted together and will be self-securing when so fitted and applied, the stopper being one which may be conveniently inserted in bottles and will be efficient in use.

BOTTLE DISK. — Alfred L. Bernardin, Evansville, Ind. This is an improvement in the tin or other metallic disks or top plates fitting upon the tops of corks in tightly corked and wired bottles, the construction being designed to operate to secure the desired spreading and compression of the cork at its top.

ANIMAL TRAP. — William T. Mellon and John A. Best, Atlantic City, N. J. Combined with the cage is a tilting platform having a trigger post, there being a pendent wicket within the cage and a latch dog to lock the wicket when it falls from the trigger post, the device being adapted for use without a bait, and especially designed to catch rats and mice, etc.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE ELECTRICIAN. Electrical Trades Directory and Handbook. 1891.

We have received the prospectus for this well known publication, which is now reaching its ninth year of publication. It includes a review of the different phases of electrical progress, particularly in the industrial fields, and care is taken not to allow it to assume too insular a complexion. The English house which publishes it makes special reference to its colonial, American and foreign features. A biographical section with portraits is a specially interesting department. When the work appears, we shall hope to review it for our readers' benefit.

THE ELECTRIC TELEPHONE. By George Bartlett Prescott. Second Edition. Revised and enlarged. New York: D. Appleton & Company. 1890. 8vo. cloth. Pp. 795. 516 illustrations. Price, $6.00.

This is a comprehensive work describing all the principal forms of telephonic apparatus, as well as many minor experiments of interest. Prominence is given the history of the telephone, and the facts regarding its origin and development, so far as they are obtainable, have been given. The entire subject is covered down to the present time.

OUT OF THE ASHES.—Among the many attractive novelties issued for the holiday season is an artistic publication bearing the above title and issued by the well known art stationery manufacturers, Dempsey & Carroll, New York City. The book contains specimens of engraved visiting and invitation cards, illuminated crests and monograms, besides specimens of every variety of note paper manufactured in this country or abroad.

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.

Names 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 Written Information on matters of personal rather than general interest cannot be expected without remuneration.

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

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(2692) L. B. & Co. ask: Can you give any information regarding the application of steam direct to lumber for the purpose of drying same, prior to putting on blast forcing hot air through same? We have one of B. F. Sturtevant's devices, consisting of fan drawing hot air through a system of tubes having in them steam for the purpose of heating same, but under this process we have not been enabled to raise the temperature of our kiln over 130° F. at highest, and usually we are enabled only to get same from 100° to 120° F. The idea occurred to us, could we first steam the lumber thoroughly, it would be advantageous. A. The blowing of hot air through the lumber is only a superficial drying process. Steaming the lumber and then injecting air for drying at only 130° temperature will not help you. Put heating coils under the lumber, and steam both the lumber and the coils within a tight room, so as to get a temperature of 200°, and then shut off steam from the room, and keep up the heat in the coils. This drives the moisture from the interior of the lumber. Then ventilation by the hot air blower will season the lumber without checking.

(2693) G. P. A. asks: Are celluloid collars unhealthy to wear? A They are not; the white pigment used in making them is oxide of zinc, which has no bad effect on the skin.

(2694) C. A. S. asks: Can you tell me where I can find detailed information respecting occurrence and working of brine or salt wells, percentage in salt, whether profitably worked, and whether plant for the extraction is costly? A. An excellent article on the above subject will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 102, and in the SCIENTIFIC AMERICAN December 13, 1890.

(2695) R. H. writes: 1. There is an etching ink on the market for etching on glass. Will you kindly send me a formula for such an etching ink? A. Diamond ink is made by mixing with hydrofluoric acid, enough barium sulphate to give it consistency, so that it will not spread, and show well on the glass. Ammonium fluoride may also be added. After the writing has stood some time it is washed or dusted off, and the etching appears. 2. Also if you know of a good gold or other paint, which may be applied to glass without spreading, and which will not dissolve off with water. A. Use bronze powder and a proper vehicle. Copal varnish is very good.

(2696) R. S. W. writes: 1. Asking how to make a rubber stamp by a paper mould or phlong. I am a stereotyper, but there is a man here who makes his rubber stamps on the same principle as I make my stereos. He gets his phlong the same way as I do, but that is as far as I can trace it. His paste is made just the same as mine, common paste, a little pipe clay, and French chalk. A. Cover your stereotype matrix with thin tinfoil, press mixed and uncured rubber down on it with a hot plate of iron. Keep it at about 280° F. until the rubber is cured, say 3 minutes to ½ hour. 2. I should also like to know how to make the rubber stamp ink. A. It is made from glycerine and alcohol colored with aniline. Dilute with water until it works well.

(2697) G. C. N. asks: 1. What causes an explosion when filling a kerosene lamp? A. If bad oil is used, or if the lamp has been overheated, the space above the oil may become filled with or contain some vapor of hydrocarbons. On pouring oil into the body of the lamp, this is displaced and escapes, and will light or explode if it comes in contact with a flame. 2. Is there any danger in filling a large Rochester lamp while burning? A. Yes. Never fill any lamp when burning, as it is highly dangerous. 3. Please criticise my writing. A. It is very good, but is as yet hardly formed. It should improve with practice.

(2698) C. C. M. asks: Can you tell me what lubricant is used by organ builders on places where two pieces of wood rub, such as the bellows handle or pedals? A. Use ground plumbago to lessen the friction on wood surfaces. In some places a little grease may be used, mixed with the plumbago.

(2699) V. G. writes: I am sending you by this mail a sample of a natural product in this country. There is a lagoon here producing some 2,500 tons per year of that stuff, and it was mainly used for the manufacture of lye for soap-making purposes; but lately it has been displaced in the market by caustic soda. I think that a process of rendering this natural stuff more active would be of advantage to make it take its former place in the market. Is there any means of making caustic soda out of such stuff, if possible by a cold process, or at any rate by a cheap process, whatever it may be? A. The substance contains carbonate of soda and chloride of sodium or common salt. The latter is in such large quantities that it would make any treatment expensive. It might be concentrated by some process depending on the difference in solubility of salt and carbonate of soda. The carbonate could be rendered caustic by the addition of lime.

(2700) H. A. S. wants an iron developer that can be used for time exposures and that can be easily modified so as to admit of development of instantaneous work. A. Make a saturated solution of neutral oxalate of potash, and another of sulphate of iron and water. Acidify the iron solution with sulphuric acid, 1 drop of acid to 10 ounces of solution. To prepare developer, take 6 ounces of the potash solution and add 1 ounce of iron solution. For time exposures take ½ ounce of the iron solution to 6 ounces of the oxalate; always add the iron to the oxalate.

(2701) J. H. S. asks (1) if chloride of gold and sodium can be made from c. p. chloride of gold; if so, can it be done by an amateur with very little knowledge of chemistry? A. Yes. 2. What effect does a solution of citrate of sodium have on an untoned print of ready sensitized paper? A. If the print has been fixed, it will have no effect. If unfixed, will have a tendency to turn print red. 3. Can you tell me of some means to clean a porcelain toning tray of a precipitate of gold, something similar to that formed in a tray used for the iron developer? A. Let a mixture of 1 part nitric and 3 parts of hydrochloric acid stand in it overnight. 4. Will you give me a formula for producing black tones, similar to a professional photograph, with ready sensitized paper? A. Use a borax toning bath. 5. Can you describe a ray filter for me such that when yellow or the rays of a common gas light be passed through, they will be turned white, or in other words can be printed with? A. No. None has been invented. 6. In your number of October 25 I noticed that if a certain chemical, allyl thio-carbamide, be added to the eikinogen developer, a reversal in development will be produced; in regard to this chemical, is it poisonous or explosive, and can it be compounded by a druggist, sufficiently pure to produce the desired result, according to formula given? A. The substance is easily made and is safe to work with. We have not had any success as yet in our trials with it.

(2702) S. Y. O. asks: What is the form of the solar orbit? I mean the small orbit of the sun around the center of gravity of the solar system; and what is the period of its revolution? What is the period and direction of the revolution of the ellipse of the moon's orbit? What work on astronomy is explicit on these and other similar points? A. The solar orbit is a volute or series of spirals expanding over a space nearly twice the diameter of the sun. A complete revolution in one orbit requires about 2,372 years, and of the series about 7,117 years. This is mathematically demonstrated in a paper by Professor G. W. Cockley, read before the American Astronomical Society and published in their transactions for 1887. The complete revolution of the moon's nodes takes place in 18 6 years. The latest work is Young's "General Astronomy," $3 mailed.

(2703) T. D. W. asks: Can you tell me some remedy to prevent prints from turning yellow, after they have been toned and fixed? They are toned by the formula sent with the paper, which gives a beautiful tone, but generally about half of them turn a dark yellow in the lighter parts, while being washed for the last time. At first I thought that it was rust from being washed in a tin dish, but they turn the same if I wash them in a wooden tray coated with asphalt varnish. A. Silver prints sometimes turn yellow after toning and fixing by leaving them in the hypo longer than necessary to clear them, or by too acid a fixing bath, which can be remedied by adding a drop or two of ammonia, or by too old a hypo bath. Keeping the paper long between sensitizing and fixing also makes yellow prints. If the least quanity of hypo gets into the washing water, it also causes yellow stains. The asphalt tray is better than metal. A little alum will do no harm.

(2704) C. N. asks how to transfer engravings on glass for magic lantern slides. A. Coat the glass with dammar varnish, letting it dry till it becomes quite sticky. It should stand nearly two days. Then wet the paper in soft water, and carefully lay it on the glass, rubbing it with the finger gently to expel air bubbles, the engraving side in contact with the varnish. Let the paper dry for a day, then with the wetted finger rub off the paper from the back. The whole paper can be thus removed, leaving the ink on the varnish. Coat the glass with another layer of varnish, which makes it more transparent, and when dry the slide is ready for the lantern.

(2705) G. B. asks: 1. How far does a common sound reflector 2×3 inches reflect a whisper so as to be understood? A. A small reflector will not do well for reflecting sound. The distance cannot be stated; it depends on the whisper. 2. Is there any difference in plaster holding on a large ceiling or a small one? A. There is no difference. 3. Is there a plumber's cyclopedia published? If so, what is its price? A. We can supply you with "Standard Practical Plumbing," by Davies, price $3.

(2706) C. B. S., Jr., says: Would you kindly tell us, if you have the data, how much faster the water in the center of an 8 inch pipe will travel than the water around the outside of same pipe at say 60 pounds pressure on the main; and what comparative difference there would be between the water column traveling in the center of a 6 inch pipe and 8 inch pipe, 60 pounds pressure being on both mains; and how much more pressure would be delivered out of the end of the 8 inch pipe than the 6 inch pipe, both pipes being 1,000 feet long and both having 60 pounds pressure at the entrance? A. We have no data as to the retardation of the outer stratum of water flowing through a closed channel or pipe. In open channels the variation increases from the perimeter toward the center, ranging from 75 per cent in parts of the central velocity. The pressure does not materially affect the friction, which is due to velocity. The pressure at the ends of the 6 and 8 inch pipe with equal head pressure will be alike only when there is no water flowing. With open ends the flow will be nearly as the square of their respective diameters. With restricted openings the pressure would be inversely as the proportional area of the holes to the area of the pipes.

(2707) E. P. F. writes: Will you oblige me by letting me know which is the best way to connect the 8 light dynamo for use as arc, *i. e.*, the mode of connecting field coils together and the field with armature, etc.? I am well pleased with the book "Experimental Science." A. Connect your field magnet in series, *i. e.*, let all of the current from the armature flow through the coils of the field magnet. Introduce a resistance of from 3 to 10 ohms into the circuit with the lamp.

(2708) F. H. B. asks if there is any solution in which charcoal can be soaked and thus render it fireproof or prevent it from burning away so rapidly when used in melting and soldering gold upon it. There is such charcoal, and how it is treated I would like to know. A. A very durable carbon can be made from charcoal dust or ground coke agglomerated with sirup, molasses, or coal tar, and baked in moulds. For general description see the SCIENTIFIC AMERICAN, vol. 60, No. 20. As a solution for common charcoal, phosphate of soda might be of some use.

(2709) F. J. R. asks: 1. Give the formula to make the putty or cement used to make the joints of stoves tight. A. Mix iron powder to a paste with solution of silicate of soda. 2. Is there any cement stronger than common glue to fasten wood together? A. The best quality of glue or gelatine is about as strong as anything for the purpose.

(2710) G. S. A. writes: In reference to an article in your paper of November 20, page 326, cocoanut butter, I should like to learn full particulars of its manufacture if possible. A. You will find it treated under Oleum Theobromæ in the United States Dispensatory. It is made by grinding the seeds, mixing with ten per cent of water, and pressing between hot iron plates. It is sometimes made by decoction and by exhaustion with bisulphide of carbon or other solvent.

(2711) E. A. H. asks: How much wire, in weight, of each of the two sizes, Nos. 18 and 24, is required to make the motor described in SUPPLEMENT, No. 761? A. About ¾ pound of No. 24 on field magnet and 1¼ pounds No. 18 on the armature.

(2712) J. W. asks: 1. What taste has the common chloride of antimony? A. A metallic taste, we presume. 2. How does common sulphuric acid affect the black sulphuret of antimony; what taste? A. Soluble in hot acid with evolution of sulphureted hydrogen. Taste highly acid. 3. Will nitrous acid dissolve sulphuret of antimony? If so, what taste has the solution? A. Yes, giving the sulphate; taste metallic. 4. Will sulphurous acid precipitate antimony from any of its solutions? In blocks or how? A. No except by the addition of water, in which it is dissolved. Antimony is a violent poison, and its salts are not tasted to any extent.

(2713) U. K. asks for the process used in the manufacture of oil clothing, such as is used to take the place of rubber clothing. A. Simply paint with boiled linseed oil colored to suit. It must be done in very hot room or in a bright sunlight. A shoebrush is the best for applying it. A little patent drier may be added. It is said that the Chinese use a mixture of one ounce each of beeswax and soft soap with the oil which is then boiled down. If the surface seems tacky varnish with shellac varnish. In any case apply the oil as thin as possible and let it dry perfectly between successive coats.

(2714) F. C. asks: 1. Is aluminum a conductor of electricity? A. A very good conductor. 2. Can it be melted? If so, at what heat? A. Yes; about 1,300° Fah. 3. Where can I get a casting? A. Buy

the metal and have a brass founder cast it. See SCIENTIFIC AMERICAN, vol. 62, No. 26, page 402, for full directions for working aluminum.

(2715) A. A. says: Please allow me to intrude on your valuable time for a decision on a little matter in dispute. The question is, is there any more pressure in the steam space of a boiler than there is at the base of a boiler where the water is? For example if a locomotive boiler has 100 pounds steam on it, is there 100 pounds pressure in the water leg of the boiler? It is being argued that the pressure is lighter where the water is than in the steam space. A. There is more pressure in the bottom of the boiler leg than in the steam space by the value of the weight of water above. If there is 4 feet of water, there will be about 1¾ pounds more pressure per square inch.

(2716) P. V. W. W. writes: I wish to learn what solution will dissolve bromide of silver besides sodium hyposulphite and potassium cyanide. A. Ammonia to some extent.

(2717) R. R. says: Please inform me what is the velocity of upward flow of water through a smooth iron suction pipe 5 inches diameter, held perpendicularly 15 feet high, with a perfect vacuum? A. With a constant flow under vacuum, the velocity will be 31 feet, per second, less the friction of the pipe, which will lessen the velocity about 3 feet, or a resultant of 28 feet per second.

(2718) H. P. asks: Will you please tell me through your columns how to arrive at the speed a train is running by the number of clicks made by the wheels and rails? How many editions of Haswell are there, their subjects or names, and price? How many pounds of stone (limestone) to the cord? A. Count the clicks per minute and multiply by 30, the usual length of rails in feet, divide the product by 5,280 for miles per minute. The ordinary rule is to count the clicks in 20 seconds. This gives approximately miles per hour. The error is less than 2 per cent. The 54th edition of Haswell's "Mechanic's and Engineer's Pocket Book," 1890, price $4 mailed. A cubic foot of limestone weighs about 170 pounds, 24¾ cubic feet in a perch, 128 cubic feet in a cord.

(2719) J. H. H. & J. W. R. say: Kindly advise if ice was ever known to sink in water and under what circumstances. Also if you know of any record where ice in a lake or pond has been known to sink any time during the winter or spring, or otherwise disappear before having been melted. A. The ice on rivers and lakes becomes crystallized in the form of vertical needles with their interstices saturated with water, supposed to be produced by the increasing intensity of the sun's heat in the spring. This weakens the ice to such an extent that by stamping upon it at the critical time it breaks up into fine needles. At such times, on any disturbance of the surface by wind, or sometimes without apparent cause, the whole surface disintegrates, and the crystals mixing with the warmer water below are melted. If examined at the moment of breaking up, the fine acicular crystals will be found floating on the surface, although at a short distance nothing can be seen but the water surface. It is a matter of common observation that ice 8 or 10 inches thick becomes so weak from crystalline disintegration near the critical time for breaking that it will not bear pressure, and will break through with a person walking upon it. We have no record of ice sinking from the surface in a body, but have noticed the surface sometimes flooded with several inches of water from overflow. The Hudson River and Lake Champlain are noted for the exhibition of this phenomenon. But ice never can sink in water unless drawn under by some current, or sunk by stones and earth which it may have picked up.

(2720) F. V. M. asks for receipt formaking albumen paper. Albumen paper is a special photographic paper coated with a film of albumen. It is manufactured on a large scale and is sold by dealers in photographic materials, cheaper than it can be made in a small way. For gelatino-bromide emulsions, see Abney's book on "Photography, with Emulsions," which we can supply.

(2721) O. M. asks how the lacquering of brass is done. My work proves all streaked, not even and nice. How thick should the lacquer be, and how warm should the brass be? A. The lacquer should be made thin and clear as wine, only 95 per cent alcohol used. Settle for a day or two and decant the clear lacquer. Heat the articles to about 160° Fah., or a little hotter than the hand can bear. Brush the lacquer over the work quickly with a flat camel's hair brush. A stove oven moderately warm is a good means for heating. After lacquering return work to the oven for a few minutes to dry and glaze. Zapon lacquer advertised in our columns may be applied without heat and without showing brush marks.

(2722) E. E.—The number of passenger cars used on the steam railways of this country is estimated at thirty thousand, and their average value three thousand dollars each.

(2723) W. S. V.—Chemically prepared paper for autographic and automatic telegraphy is prepared by soaking it in either of the following solutions: Nitrate of ammonia 2 pounds, ferricyanide of potassium ½ ounce, gum tragacanth 2 ounces, glycerine 2 ounces, water ½ gallon. Or, iodide of potassium ¼ pound, bromide of potassium 1 pound, starch ½ ounce, water 2 quarts.

(2724) S. asks: What is the composition of ordinary japan? A. "Japan" has several meanings. The liquid drier contains linseed oil, litharge, and often some salt of manganese. For japanning tin or metal by heat the basis is linseed oil to which some gums and other ingredients are added. Black japan is made by dissolving 48 pounds Naples or certain other foreign asphalts in 10 gallons of linseed oil; 8 pounds of gum animi are mixed with 2 gallons of hot oil and added. To this 2 gallons of amber are added, mixed, with 2 gallons more of hot oil; it is boiled for some time, driers are added, and it is thinned with turpentine. Brown japan is a composition of shellac dissolved in linseed oil. In Spons' Encyclopedia a great many formulas for japans for fine japanning are given.

(2725) W. H. W. asks: 1. Is the induction of the current the same on the wire wound on the inside of the Gramme ring of the armature in the dynamo explained in "Experimental Science," Fig. 485, or does it only act as connection for the other half of the coil on the outside? A. The wire on the inner side of the Gramme ring acts only as a conductor. It is practically of no use in generating the current. 2. Does an armature wound with the wire only on the outside of Gramme ring answer the same purpose as one in Fig. 485, or is this one (Fig. 485) best, and for what other purpose than that in case one of the coils should burn out (I am speaking now of a more expensive machine) it could be replaced without unwinding all of the wire? A. It is unnecessary to unwind from a Gramme ring anything more than the damaged part. Rings with sectional core are common. These are provided with coils made separately and applied. 3. Please recommend one or two books on aluminum, price not to exceed $2. A. We recommend "Aluminum," by Richards, which we can supply, price $5.

(2726) M. A. asks for something for restoring writing. I have an army discharge of my husband's, and he is dead. It is on some kind of skin and got oil spilled on it, and blurs the writing where it was filled out, and makes some of it so dim that you cannot see it to read. Please mention a restorative as best you can. A. Try washing over with a solution of tannic acid. We advise you to have it done by an expert. The solution should be applied carefully with a brush. There is danger of washing all away.

(2727) E. C. L. M. asks how the round wooden eaves troughs and conductors are made. Are the smaller sizes sawed out of the center of the large ones? If so, how? Two gentlemen in this vicinity were once speaking of the size of pipe that could be used as a siphon. One of them, a practical engineer, said that large pipe would not carry water as high as small pipe of the same length, if it would work at all. The other thought that one would work as well as the other. Which one was in the right? If large pipe will not work, will you please explain why? A. Wooden eaves trough may be made on a heavy wood-shaping machine. There is no reason why a large pipe siphon will not work efficiently for the full height that any siphon will operate. They only require caution against leakage and provision for keeping out air.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the numbers therein given:

(2603) *White Finish for Shoes.*—I would suggest to inquirer 2603 that if he will use the following, he will get a good white finish on his shoes:

Best white bonnet glue	1	lb.
Sulphate zinc c. p.	1½	"
Sulphate copper, ground	2	"
Pipe clay bolted	1	"
Sulphate magnesia	1	"
Light yellow ocher	2	oz.
Water	4	gals.

Mix and let it stand until all is dissolved, then bring to boiling point and add 2 pounds oxalic acid and gum tragacanth q. s. Iron or gum brush, in the usual way, and wax. If this is properly used, the red color will not work through.—C. A. H.

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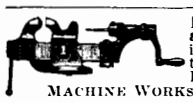

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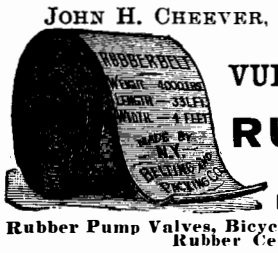

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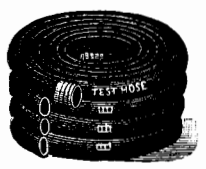

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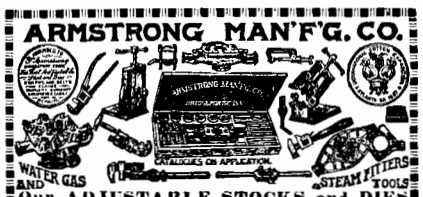

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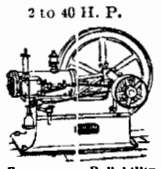

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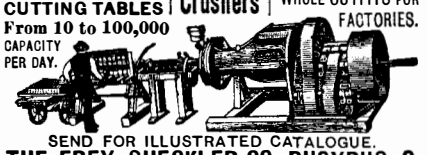

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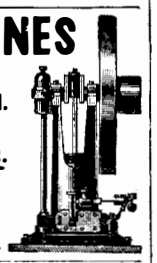

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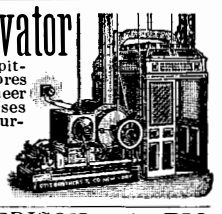

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