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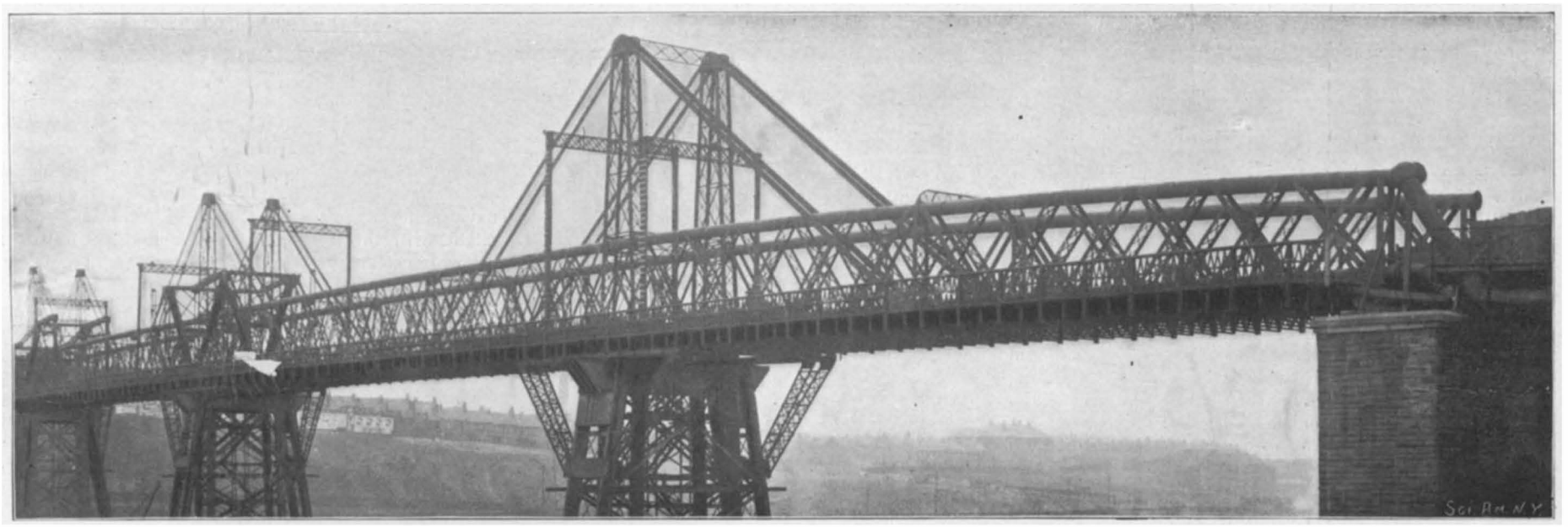
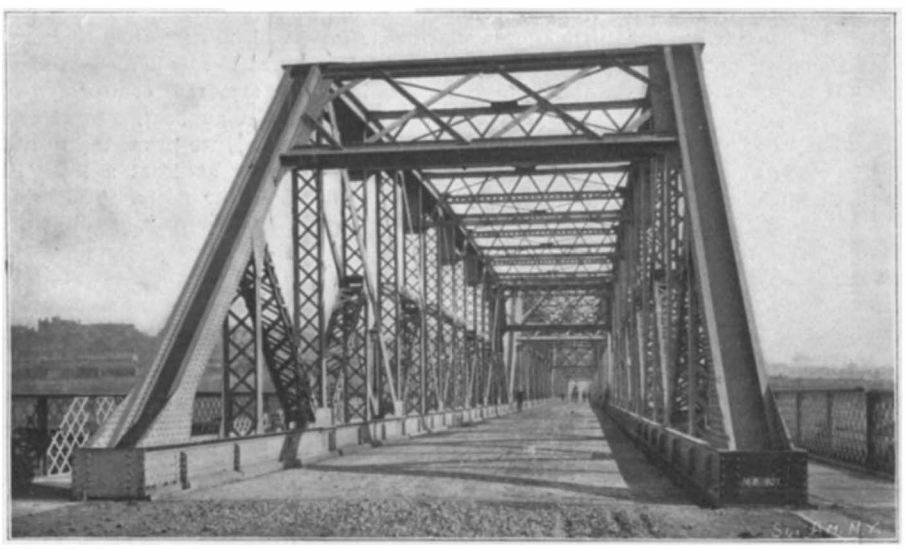
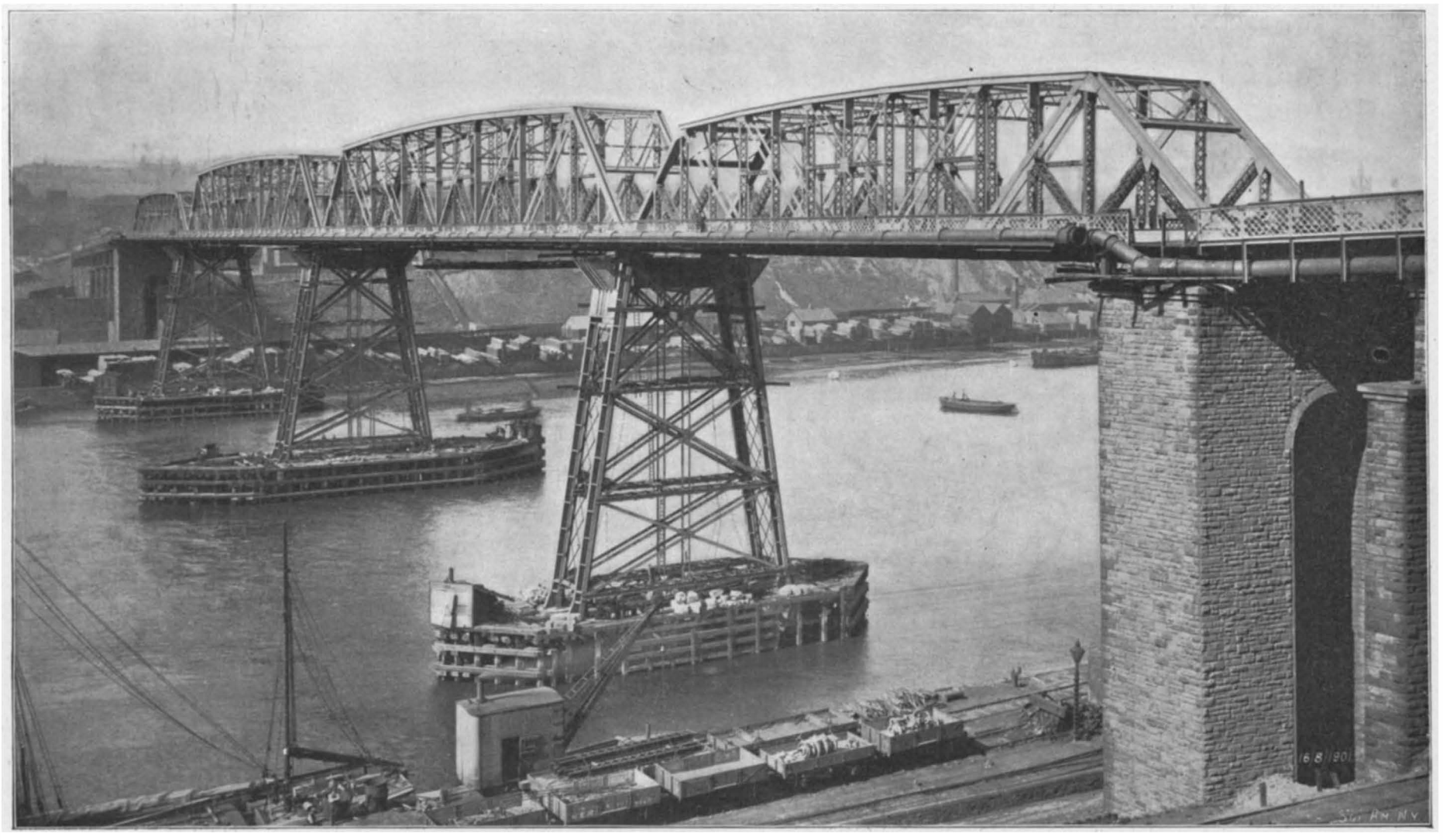


The Old Bridge—Top Chords Utilized as Gas Mains, Bottom Chords as Water Mains.



Portal View of New Bridge.

Old and New Trusses During Construction.



RECONSTRUCTION OF THE REDHEUGH BRIDGE, NEWCASTLE-ON-TYNE.—[See page 122.]

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.NEW YORK, SATURDAY, FEBRUARY 22, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

REVIVAL OF THE OLD HUDSON RIVER TUNNEL SCHEME.

The publication of the plans of the Pennsylvania Railroad Company for the construction of a system of tunnels connecting Manhattan Island with New Jersey and Long Island has naturally revived interest in the old Hudson River tunnel, which, after being completed for some three-quarters of the distance from Jersey City to New York, was abandoned because of the financial embarrassments of the company that had it in hand. What is known as the New York and Jersey Railway Company has recently been incorporated for the purpose of completing this tunnel and building the necessary terminals at either end. For some time past the work of acquiring the land for the terminals has been quietly carried on, and all the needed property has been secured. The present tunnel, which was constructed by an English syndicate, has been constructed beneath the Hudson River for a distance of about 3,900 feet from the starting point on the New Jersey side, and only 1,580 feet remain to be built to connect with the shaft on the New York side. It will also be necessary to build the approaches to bring the tunnel up to street grade on each side of the river. The abandonment of the tunnel was due to purely financial causes, and there was no physical reason why it should not have been pushed through to completion at the original attempt. The difficulties encountered were chiefly due to the fact that the tunnel was laid nearer to the bed of the river than would now be thought desirable for convenience and safety of construction. At one point in the tunnel the extreme looseness of the silt rendered it difficult to keep the head of the tunnel clear of water by the usual pneumatic process, and it was not until a considerable amount of artificial filling has been laid upon the shallow, overlying bed of the river that it was possible to proceed with the work of driving. The difficulty was, however, overcome, and had the necessary capital been at command, there is no doubt that the tunnel would have been finished many years ago.

The tunnels consist of two parallel tubes, which measure internally 18 feet in height by 16 feet in width, and are oval in section. The line of the tunnel, as originally located, commenced in Jersey City at Jersey Avenue and 15th Street, from which point it ran east to Hudson Street; thence it passed beneath the Hudson River to the New York city bulkhead line at the foot of Morton Street; from which point the line swung slightly to the south and was carried to Broadway. From the western terminus, as designed, to Hudson Street, was 3,400 feet. From Hudson Street beneath the Hudson River to Morton Street, was 5,500 feet, and from this point to the eastern terminus at Broadway was another 4,000 feet. The work that has been done upon the tunnel was confined to that portion of it that lies immediately below the Hudson River. Two shafts were sunk near the bulkhead lines in New York and New Jersey and the work of driving was pushed forward on the tunnel from each end. Actual construction commenced in 1874 and was carried on amid many vicissitudes of a financial and physical character until the southern tunnel had been advanced from the Jersey side about three-fourths of the distance across the river, and a start of a few hundred feet had been made on the same tunnel from the New York side. Considerably less work was done on the north tunnel. The terminal station on the New York side will be in the block bounded by Christopher, Tenth, Greenwich and Hudson streets. On both the New Jersey and New York side connections will be made with the street railway lines, and the location of the New York terminal will render it convenient for passengers who wish to transfer to the elevated system.

Originally the tunnel was constructed with a view to giving the trunk railroads that terminate in Jersey City an entrance to Manhattan Island. The plans of the new company contemplate the use of the completed tunnel for street railway purposes only. In view of the fact that the Pennsylvania Railroad tunnels are to be used exclusively by the Pennsylvania Railroad system, one would have expected that the other competing lines, such as the Erie, and Lackawanna, would have taken hold of this tunnel to complete it for their own use. It is certain that these railroads will have to secure some compensating advantage to place them on even terms with the Pennsylvania system as regards the through passenger service to New York city, and we may confidently look for the development of other tunnel schemes in the near future; unless, indeed, these railroads feel that the volume of traffic will warrant them in the joint construction of a Hudson River bridge.

THE DARIEN OR SAN BLAS TUNNEL CANAL ROUTE.

In view of the fact that an expert commission has been engaged for the past two or three years in a thorough examination of all possible routes for a canal across the Isthmus, and that this commission included some of the most distinguished engineers that could be gathered together for the purpose, and in view, further, of the fact that over one million dollars has been expended in making this examination so absolutely thorough as to render any further examination superfluous, one would have thought that the report, as recently given to Congress, would have been accepted as final, and that there would have been an end to suggestions for the sending out of more surveying parties into a territory that has been so thoroughly explored.

Therefore, we much regret to see that a joint resolution has been offered to Congress for the appointment of a Board to examine into the practicability and cost of a tunnel ship canal by what is known as the San Blas route. We regret it, not so much on account of the expense involved, for this is comparatively insignificant, an appropriation of only $15,000 being asked for the purpose, but because the mere proposal that such a survey be made is disturbing, and calculated to confuse the general public. The suggestion that there is anything more to learn about San Blas will be taken at its proper worth by practical engineers, and by that large and increasing section of the public who by studying the canal question for themselves, have grasped its main details, and are able to form an intelligent individual opinion as to where the canal should be built. It is upon the average citizen, who has not the time or opportunity to gain anything more than a superficial knowledge of the canal problem, that this continual agitation of the question of routes is so confusing. Evidence of this is shown in the letters which reach the editor's desk, asking whether a short tide-level canal, with a tunnel through the hills, is not preferable, even to the short and easily-navigated Panama canal. It is impossible to reply to these correspondents in detail, so we take this opportunity of saying that the possibilities of constructing a tide-level canal by tunneling through the hills were thoroughly investigated by the Isthmian Canal Commission, and estimates were given for the cost of such canal at four different routes; one of them at San Blas and three of them on what is known as the Caledonia route. It was found that at San Blas 4.2 miles of tunnel would be necessary; while in the Caledonia district 1.6 miles would be required on the Sassardi location, on the Aglaseniqua location 3.6 miles, and 4 miles of tunnel on the third alternative location. It is certain that the advocates of a tunnel canal have no adequate idea of the stupendous nature of the excavation required. To accommodate steamers of the size that will pass through the Panama Canal a vast cavern would have to be blasted through the mountains (the term tunnel is quite inadequate to express its magnitude, so absolutely insignificant in comparison is the ordinary railroad tunnel), which would be 165 feet in height by 130 feet in width, and the whole of it would have to be lined with a mass of concrete from 5 to 7 or 8 feet in thickness. A single mile of this tunnel would cost $22,500,000 to construct, and the 4.2 miles of tunnel necessary at San Blas would cost alone $94,500,000. The approach to the tunnel at each end would necessitate the construction of an enormous open cut, deeper in places than the Culebra cut at Panama, which, with the other excavation along the 37 miles of the canal, would bring up the total cost of excavation outside of the tunnel to $132,800,000. The total cost of the canal along this route would be $289,770,000.

Now, it is not by any means certain that the estimate of $22,500,000 per mile for the construction of the tunnel would be sufficient to cover the actual cost, for the engineers in making this estimate, assumed that they would meet with material that was favorable for excavation; that is to say, that there would be no material encountered that would tend to slide as soon as it was disturbed by excavating. If such material should be encountered, it is perfectly certain that the engineers would be helpless in the presence of it. In proof of this we refer our readers to the account, in our issue of February 8, of the construction of the Aspen tunnel on the Union Pacific Railroad. In the excavation of this work, which is absolutely insignificant compared with the enormous cavity which would have to be opened up at San Blas, the pressure of the sliding earth was such that twelve-inch shoring timbers were splintered into match-wood and heavy steel I-beams were twisted out of shape. The mere possibility of encountering such conditions would render it absolute folly to commence the construction of a tunnel of this magnitude in any location, and especially in the Central American regions, which are subject to volcanic disturbances.

NAVAL DEVELOPMENT DURING THE NEXT DECADE.

In the current issue of the SUPPLEMENT will be found a reprint of an article, contributed by Rear-Admiral George W. Melville to the Philadelphia Record, in which he indicates the probable line of development of the United States Navy during the coming decade. The writer strikes the true keynote of our naval policy when he says, "Only by right, and not by might, will this nation fulfill her highest destiny"; yet we must always bear in mind that "it is as essential to be in readiness to restrain by military and naval forces the foes that are beyond the boundaries of a country as it is to effectively control, by local police, the turbulent within a community." In reviewing the causes which have contributed to the remarkable development of our navy, the first place is given to the attitude and action of the general press, which has been unanimous in urging the development of our naval power. This advocacy has been supplemented by the lecture field, which has played no inconsiderable part in familiarizing the public with our warships. The ships themselves have been thrown open to the public on every possible occasion, and have greatly conduced to the general interest, as have also the dozen naval stations and navy yards scattered along our seaboard. There are ten shipbuilding firms that build battleships and armored cruisers, over fifty firms that can turn out a gunboat, and several hundred firms that can manufacture naval stores and supplies, and all of these have at least a financial interest in the enlargement of our fleets. The army of tourists and commercial travelers who annually go abroad; the commercial and maritime associations of our leading seaports, and the shipping interests in general are other influences that have worked strenuously toward the same end. Lastly, it must not be forgotten that every Secretary of the Navy and every President, for the past twenty years, has urged the progressive development of this branch of the military service. The annual appropriation has gradually increased, until now it is nearly treble what it was five years ago, the estimates submitted this year calling for about one hundred million dollars.

Our readers will remember that the SCIENTIFIC AMERICAN has always claimed that the possession of the far-distant Philippines, with their thousands of miles of coast-line, must, of necessity, be the dominant factor in determining our future naval policy, and we notice that Rear-Admiral Melville is of the opinion that it will be near the Philippine Islands that we shall have to fight our future decisive battles. "It is certain," he says, "that we must eventually renounce all sovereignty of the Philippines or else prepare ourselves to hold these islands against an efficient naval power whose base of operations may be much nearer than our own." For this reason he urges that we should establish in some harbor in the Philippines large engineering shops, where machinery could be built or repaired and warships docked and built. Other arguments for an increased naval establishment are found in the construction of the Isthmian canal, which, however strongly fortified, would require a powerful navy to insure its safety and neutrality when completed. It is the opinion of the writer that before the end of the present decade we shall rank next to England as a sea-going power, and he suggests that in view of the fact that we may be suddenly required to increase our naval force, it might be the proper thing to make a wholesale purchase of warships from some nation that has "greater temporary need of gold coin than of steel guns." We agree with the Admiral that every increase in the strength of our navy undoubtedly makes for the general peace of the world.

As to the constructive and mechanical progress of the future, development will be in the direction of making the individual unit more formidable, and ships will be built more rapidly. Hitherto it has taken five years to design, build and commission a warship; and unless the private firms are going to show greater celerity in completing their contracts, "the government may undertake the task of building its own warships," something, by the way, which we think the government ought in any case to do, if it would safeguard the interests of the navy. Armor will continue to improve, and it is probable that in addition to the two establishments that now turn out first-class armor a third firm will soon be in a position to compete for

contracts. There will be a change in the size of the main battery of warships. Admiral Melville contends that the 12-inch gun is too heavy and cumbersome for existing needs, and that the new 10-inch weapon, which is more powerful than the 12-inch gun of five years ago, is the largest piece that should be mounted on a modern warship. He also draws attention to a phase of the armor and gun controversy which has not been investigated to the satisfaction of naval engineers, although they have called attention to its importance, namely, the indirect damage within the interior of the ship by the impact of 8-inch or larger shells upon armor which they fail to penetrate. The continued impact of heavy shell upon the armor protecting the machinery compartments will, Admiral Melville considers, be certain to disable some important auxiliary engines. Moreover, the effect upon the hull itself may be greater than is anticipated. "Structural and machinery steel will withstand strain and pressure, but it will not resist shock, and not only will the auxiliary connections in the way of piping and electrical conduits be damaged, but it is extremely probable that some sections of the hull riveting will be greatly impaired, since experience has shown that the rivets can be easily sheared by shock."

This last point is unquestionably a most important one, and we have recently had practical evidence in the high-explosive shell tests at Sandy Hook, when 12-inch armor supported by a section of the side of the "Iowa" was attacked, that the structural material of the steel backing, even where penetration is not effected, will suffer serious injury, just where Admiral Melville indicates, by the shearing of rivets and opening up of joints. At the same time, we are free to admit that the point thus raised somewhat nullifies the Admiral's advocacy of lighter guns; for the racking effect of a 12-inch gun is enormously greater than that of the lighter 10-inch piece which he would substitute for it.

STEAM BOILER INSPECTION.

It is only in the presence of a fatal and destructive explosion that the public fully appreciates the tragic possibilities that are wrapped up in every one of the two or three hundred thousand boilers that nestle among the teeming multitudes of our cities, or speed to and fro on steamboats and locomotives. Steam boiler explosions date from the very first use of steam under pressure, and the records of the early growth of steam engineering are punctuated with many a sad accident due to faults of material or design in the early boilers. With the increase of pressures which came at the time of the introduction of multiple expansion engines there was a call for special care in the testing of the materials and in the construction of steam boilers, and there is no doubt that measured against other forms of constructive mechanical work the boiler of to-day will hold its own on any point of comparison.

If the security of the user stood solely upon the quality of his boiler, and there were no such thing as rapid depreciation due to neglect or unsuspected decay, there might have been relatively but little work for the steam boiler inspector, and no development of the great steam boiler insurance companies whose organization and operations mark them as among the most perfect insurance institutions in the world.

The absolute necessity of inspection is so fully realized that, in some States, the inspection of boilers is compulsory, and the State provides inspectors for this work. In such cases, a fee is charged by the State for the service. In other States, there is no compulsion about inspections; and in all cases, if the boilers are inspected regularly by a boiler insurance company in good standing in the State in question, additional inspection by the State is not required.

In most of the States, locomotives on railroads are expressly exempt from State inspection. It is presumed that the railroad owning the locomotive will provide a master mechanic or other expert, who will be competent to pass upon the fitness and safety of their locomotives. This presumption does not appear to be altogether realized in practice, for railroad locomotives constitute a class of boilers which explode almost as often as any other class that can be mentioned. Omitting city elevated railroads, the total number of railroad locomotives in the United States on December 31, 1900, was 38,065.

Steamboat boilers are inspected by the United States government, and are therefore exempt from inspection by the State, or by any other authority. For this service the United States government employs sixty-three inspectors of boilers. There are over 7,000 steamers in the deep sea, coastwise and river service of the United States.

The total number of stationary boilers now in use in the United States was not ascertained in the last census. Neither are they enumerated in the census of 1890; but the census of 1880 shows that at that time there were 72,304 stationary boilers in this country. It was estimated by The Locomotive that on December 31, 1890, there were approximately 100,000 stationary boilers in the United States. The same authority estimates that at present there are about 170,000 boilers under insurance.

The methods of inspection adopted by the various companies, though they vary in detail, are carried out upon the same general lines. We have been informed by Mr. J. M. Allen, president of the Hartford Steam Boiler and Inspection Company, that at the present writing this company has 83,907 boilers under insurance, and the system employed may be taken as representative of the best modern practice. The inspection, as such, is divided into three classes: (1) hydrostatic tests, (2) external inspections, and (3) internal inspections.

The hydrostatic test consists in applying a cold-water pressure to a boiler that is completely filled with water. The pressure is usually applied by a pump that the inspector carries with him. The usual test pressure that is applied, hydrostatically, is 50 per cent greater than the working pressure at which the boiler is run. In Philadelphia, however, the law states that "a hydrostatic test of one-third greater than the boiler is rated to carry" will be considered sufficient.

When the boiler is under hydrostatic pressure, the inspector looks it carefully over, in all parts, to see if there are any signs of leakage, or of distress of any sort. This test is usually applied to new boilers, or to boilers upon which extensive repairs have recently been made, or upon boilers the interiors of which are not accessible, either because of their small size, or for any other reason. In some places, however (notably in the city of Philadelphia), a hydrostatic test is required by law on all boilers. Authorities differ about the advisability of applying the hydrostatic test, some maintaining that it is much better than the "hammer" test, to which we shall presently refer, because the actual pressure may develop a defect that the inspector, armed only with his hammer, might overlook. Other authorities claim that there is danger of straining the boiler by subjecting it to a test 50 per cent greater than it will ever have to withstand in practice. The hydrostatic test is not considered to be injurious to the boiler, when it is applied by a man with good judgment, but the hammer test is preferable when that can be applied.

"External inspections" are those made by merely looking the boiler over from the outside, to make sure that the attendant is not running it at a higher pressure than is allowed; that he is carrying plenty of water in the boiler; that the safety valve will blow off freely, and at the pressure that is allowed; that the water gages are in good condition; that the boiler is not showing any signs of leakage, nor any bulges over the fire sheet, nor any signs of distress of any kind. Of course, the attendant is not notified in advance when the company makes an inspection of that kind; for the object of the visit is, to see the boiler in the condition in which he usually runs it, without giving the attendant any opportunity to "fix up" for the inspector's benefit.

"Internal inspections," or hammer tests, as they are sometimes called, are made by the inspector entering the boiler through the manhole, and looking the interior over very carefully. He makes a similar examination, also, of the outside of the boiler, crawling into the furnace and all about, everywhere that he can go. Among the things that he has to look out for are these: Deposit of sediment or muddy matter, hard incrustation or scale on the tubes and plates, corrosion of any part of the boiler, both inside and outside, fractures of the plates, heads, headers, etc., leakage around the tube ends, seams and all other places where such leakage is possible, defective bracing of the flat parts of the boiler, grooving of the plates or heads, burned or blistered parts, and defective accessories of all kinds; water gages, feed pipes, blowpipes, safety valves, pressure gages, and everything else that can get out of order in any way whatever.

As an example of the magnitude and extent of the work of insurance and inspection it may be mentioned that the company above referred to employs a regular force of 198 inspectors, and in the year 1900 made 92,526 complete internal and external inspections (i. e., "hammer tests"), and in addition subjected 10,191 boilers to hydrostatic pressure; while from the beginning of the company's business down to January 1, 1901, 1,176,097 complete internal and external inspections were made, and enough external inspections to bring the total up to 3,049,203. Also 162,586 hydrostatic tests were made and 13,215 boilers were condemned as unsafe, good and sufficient reason for the condemnation being given to the owners in every case. During this time there were discovered and pointed out to the owners 2,226,256 defects of one sort and another, 245,210 of which were quoted as dangerous.

It is upon data of this sort that a steam boiler inspection company bases its claims to be considered as a great public safeguard. We have no way of knowing how many explosions work of this kind may have prevented, nor how many lives it may have saved, but the claim can fairly be made that the total number of lives saved has been great, and that the loss of property that has been prevented has been enormous.

OUR FORTHCOMING AUTOMOBILE AND OUTING NUMBER.

To those who are interested in the automobile—and who is not?—it will be a pleasure to know that we are bringing out a Special Automobile and Outing Number of the SCIENTIFIC AMERICAN. The Editor is making every effort to render this issue so comprehensive and detailed that it will put our readers in touch with the very latest developments of automobilism, considered both as an industry and a pastime. The issue will open with a number of special articles on such subjects as the Chicago Automobile Exhibition; the history of automobile racing; the best form of outfit for touring; the question of proper storage, repair and supply depots, both in the city and country; and a history of the rise and growth of automobile shows in this country and their influence in promoting the development of the automobile. Following the general discussion of the subject, there will be a series of elaborately illustrated articles descriptive of the leading types of automobiles manufactured in this country. The machines thus treated of will be grouped under the three heads of steam, gasoline and electric automobiles, and between fifteen and twenty different types will be described in this section of the issue. Under the head of Special Devices will be shown a large number of the latest types of motors, transmission gears, carbureters and storage batteries. There will be a lengthy article on the subject of automobile tires, showing their construction and the different methods adopted in making emergency or shop repairs. While the issue will be devoted chiefly to the automobile, there will be articles illustrating the latest types of houseboat, and one or two of the fastest pleasure craft that are now under construction for the forthcoming yachting season.

SCIENCE NOTES.

One of the latest novelties in the boot and shoe line are rubber boots for dogs, which are sold by several dealers in leather goods in New York. They cost about $4.75 for a set of four. The idea comes from Paris.

One of the omnibus lines in London has adopted the system of using acetylene for lighting their buses. Owing to the keen competition of the underground electric line, the omnibus lines were compelled to adopt radical innovations to retain their patronage.

The plow is certainly the oldest and probably the simplest of agricultural implements, being represented among the hieroglyphics on the ancient tombs of Egypt, dating back more than 4,000 years. As early as the year 1000 B. C. the plow was described by a Greek historian as consisting of a beam, a share, and handles.

The New York Zoological Society has received $3,000 from Miss Caroline Phelps Stokes for the nucleus of a fund looking toward the protection of our native birds. At the present time there are 1,674 live animals in the Zoological Park, of which 416 are mammals, 659 birds and 599 reptiles. During last season more than half a million people visited the park.

It is announced that the British War Office will abandon the khaki uniform with the termination of the war in South Africa. The khaki was originally intended as a working dress in addition to the regular dress uniform, but it became so popular that it in a great measure supplanted the other. It has now been decided to adopt a working uniform of drab color, which is of a more neutral shade and, it is said, more adapted for the uses of the army.

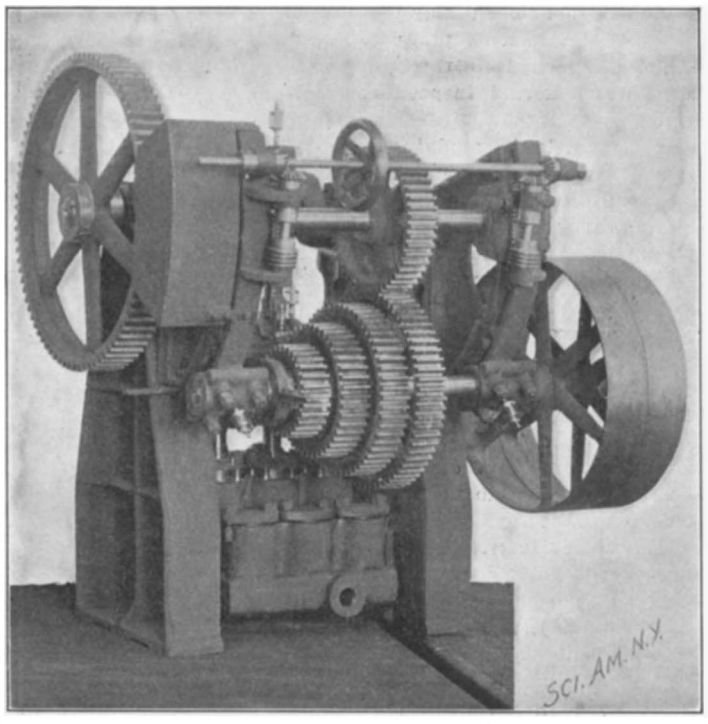
The work of the Jesup expedition into the extreme northwestern part of Siberia has ended, and according to a dispatch from St. Petersburg, the members are on the way to their respective homes. The expedition was under the leadership of Norman C. Buxton, and the object was, if possible, to trace the American Indian to some Asiatic origin. The party has collected one hundred boxes of specimens, which will be turned over to the American Museum of Natural History in New York.

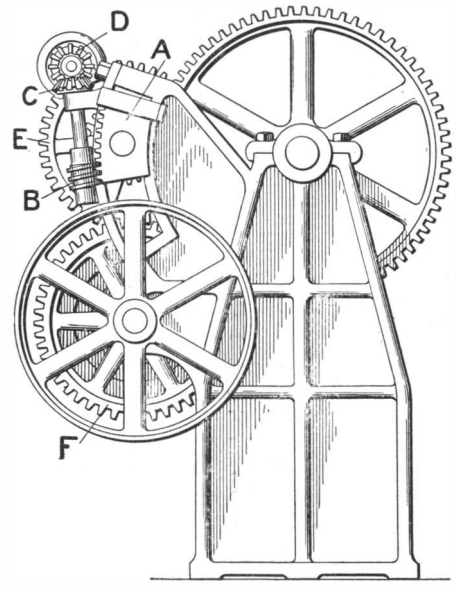
With regard to the glass hospital which is to be erected at Philadelphia for the cure of consumption, with isolation for each patient and a constant supply of rarefied air, a similar experimental hospital is already in use in London. The patient sits in a glass cubicle, breathing an atmosphere specially treated by ozone. The value of oxygen, or ozone, in the treatment of ulcers, burns, wounds, lupus, etc., has been proved there by several cures of hitherto incurable cases during the past five years. Great as has been the actual relief thus afforded, this oxygen hospital exists equally for purposes of demonstration and experiment.

A VARIABLE SPEED GEAR FOR PUMPS.

The variable speed gear shown herewith is the joint invention of Mr. Charles O'Connor, of 142 Norman Avenue, Greenpoint, and of Mr. George C. Ahrens, Blissville, New York city. The accompanying diagrammatic side elevation, together with the photographic perspective view of a triplex pump, will serve to illustrate the broad features of the invention.

The frame of the pump carries on each side arms for a segmental support, the arc of which is struck from the center of the pump-shaft. In each case a journal-box, *A*, is arranged to travel. The projecting convex edges of the boxes are provided with teeth, meshing with a worm, *B*, the shaft of which carries at its upper end a bevel-gear, *C*, meshing with a bevel-gear, *D*. The journal-boxes, *A*, serve to journal a driven shaft provided with an attached gear, *E*, at its middle, and with a pinion at its one end, which pinion meshes with a large gear carried by the pump-shaft. The main drive-shaft carries a cone of gears, *F*, which can be shifted along the shaft by a lever. The gear, *E*, is designed to mesh with any one of the series, *F*.





A VARIABLE SPEED GEAR FOR PUMPS.

By turning the shaft carrying the bevel-gear, *D*, through the medium of a handle or crank, it is evident that the worm, *B*, will raise or lower the journal-boxes, *A*, and with them the shaft carrying the gear, *E*. By raising the journal-boxes, *A*, the gears, *F*, can be shifted to the right or to the left, in order to bring the desired gear, *F*, into alinement with the gear, *E*. By lowering the journal-boxes, the alined gears will be caused to intermesh.

The device is particularly noteworthy for the rapidity with which speed can be changed.

PHOTOGRAPHING BY ELECTRIC HEADLIGHT.

BY WALDON FAWCETT.

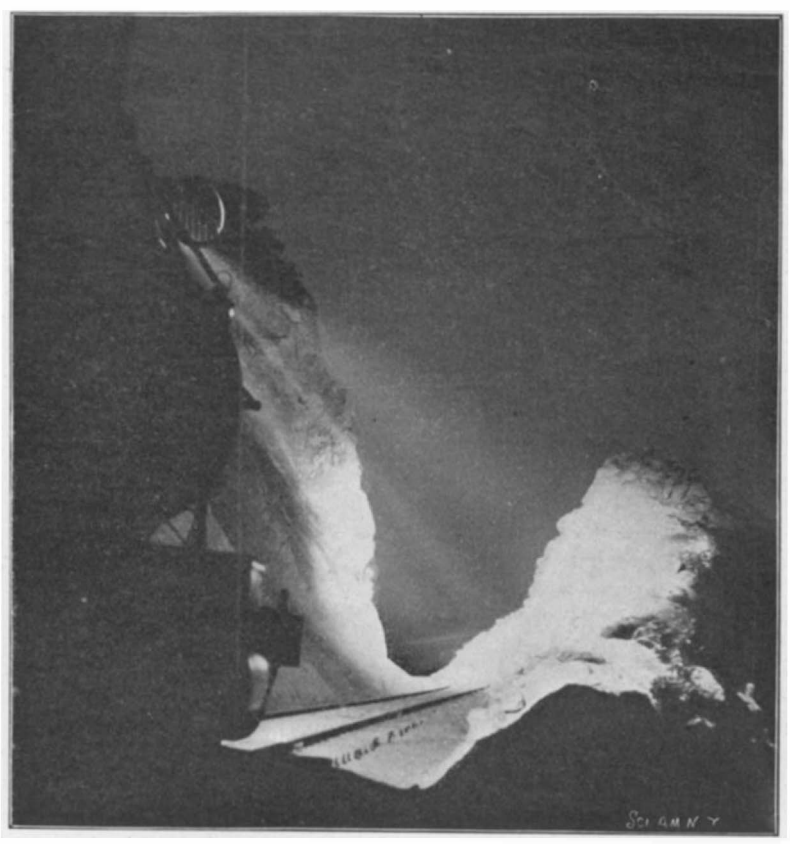
Some very remarkable specimens of night photography were recently secured on the line of the Colorado Springs and Cripple Creek District Railway—a new Colorado mountain road and in many respects one of the most interesting railway lines in the world—by Mr. George R. Simmons, of the executive staff of the operating company. The photographs, specimens of which are presented herewith, were secured by means of an electric headlight, and were taken in bright moonlight between the hours of nine o'clock in the evening and midnight. A Premo camera was employed, and extra rapid plates were utilized.

Perhaps the most interesting feature of the work was found in the length of the time exposure. The Cripple Creek Railroad, which is only forty-five miles in length, probably has, on the basis of total length, the highest average altitude of any railroad now in operation in North America. The altitude ranges at various points from 6,076 feet to 10,000 feet. In planning for the photographic work along the road, it was taken into consideration that at this altitude the rarefied condition of the atmosphere is conducive to more rapid action of the light waves than would be found at a lower altitude.

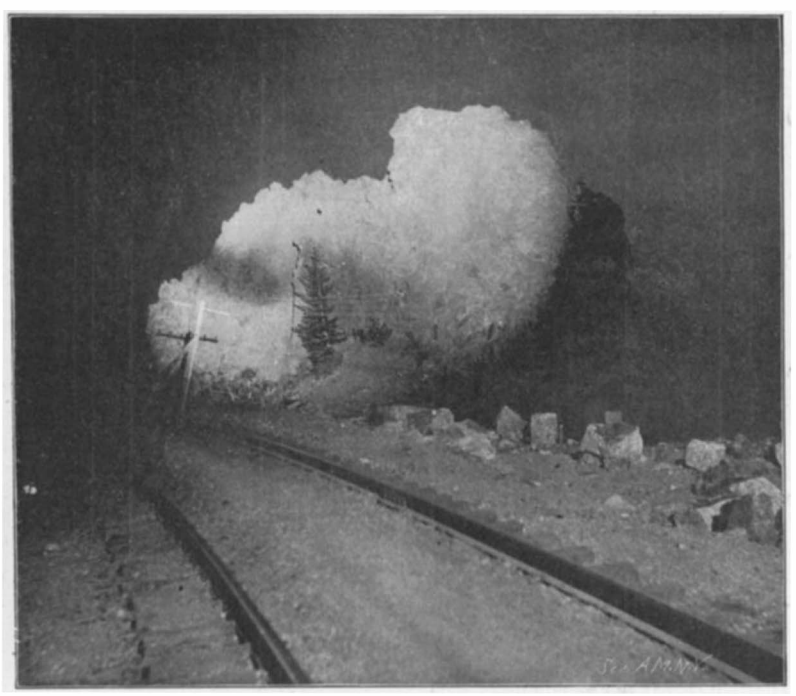
In securing the negatives of the night scenes, the time of exposure varied from twenty-three to thirty-five minutes, each of the plates being over-exposed. As the result of the demonstration thus afforded, Mr. Simmons believes that even better results may be obtained by reducing the time of exposure to an interval not exceeding fifteen minutes, and possibly limited, in some cases at least, to ten minutes.

Still greater interest will center, however, in still another experiment to be undertaken in the near future by this mountain photographer; namely, an attempt to move the locomotive carrying the camera on a curve of the road so as to take in the entire field of the lens. This can be done without interfering with the photograph in any way, inasmuch as the changing of the light rays will change the portion first photographed in darkness and bring into the light an entire new scene, thus covering the entire field.

The Cripple Creek Railroad, which, by the way, is designed to afford a short line of communication to the richest gold-mining district on the continent, is admirably adapted for experiments of the character of that last outlined, inasmuch as the entire line is little else than a continual succession of curves, many of them very sharp. It may be noted also that the headlight employed in the photographic work described is the standard locomotive headlight operated by a steam dynamo located just forward of the engine stack



PHOTOGRAPH OF A ROCK CUT TAKEN WITH THE AID OF THE ELECTRIC HEADLIGHT.



PHOTOGRAPH OF TRACK LIGHTED BY ELECTRIC HEADLIGHT.

Electric Railroads in Sweden.

BY PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The Swedish government has lately appointed a commission of engineers and railroad men to examine the question of replacing steam by electric traction upon the State railroads, making use of the numerous waterfalls of the country. After a careful study of the problem and an examination of the country, the Commission has presented a report which is favorable to the use of electric traction, and considers that the financial advantages which would result are so incontestable that the government should not hesitate to make the considerable sacrifice resulting from the abandonment of steam and the transformation of the rolling stock. The introduction of electric service would have the result of suppressing the long trains which are now towed by two and even three locomotives, and they would be replaced by lighter and more frequent trains. This would be necessary in order to obtain a more economical working of the system, and also the desired continuity of the service. Relative to the utilizing of the waterfalls, they find that there are a number of falls that might be used for the purpose, especially in the provinces of Norrbotten, Westerbotten and Jentland; besides there are other good falls in the Gefleborg and Halland districts. The Commission has made a thorough study of the existing falls, and in the present report only considers those which during the low-water period give at least 1,500 horse power, and which on account of their geographical position make it possible to transmit the energy without great loss to the nearest railroad station. They recommend utilizing the celebrated fall of Harsproenget, although it is distant more than 25 miles from the nearest railroad, because the enormous power developed here would permit of supporting a considerable loss in the transmission line. It is considered that electric traction might be introduced first in the lines of the Botten region, especially on that of Lulea, on the Norwegian frontier, and after that on the Bracke-Storlien railway, then on the two main lines which traverse the upper and lower Norrland, and lastly on all the government railroads of the Southwest. Electric traction will be especially advantageous upon the Trans-Scandinavian railroad (Gelivara-Ofoten) where a reduction of the rates would favor the exportation of Swedish minerals. An important consideration is the fact that Sweden is obliged to import nearly all her coal, and therefore the use of electric traction would economize a considerable sum. As a result of this report the Swedish government has decided to hasten as much as possible the preliminary projects which the question involves, so that the matter may be presented at the next session of Parliament.

A few drops of turpentine added to the starch prevents flat irons from sticking.

A SIMPLE METHOD OF ETCHING PICTURES.

The desire to draw and sketch is an almost universal one. There is a singular delight in the ability to put on paper that which has pleased the eye or caught the fancy. There have been many processes devised for the purpose of aiding the unskilled to gratify this ambition, probably the oldest and most familiar being the transparent sheet of glass, back of which are placed prepared sketches to be traced. There have been other forms of this same idea, some of which are too elaborate to answer the popular demand. The camera has in a great measure filled this rôle, and its immense popularity gives convincing evidence of the desire of the masses to dabble in the picture-making art. But the camera has its drawbacks, principally in that it is not selective, but accurately registers on the sensitive plate all that is within its field of view. The worker with the pencil and brush, on the other hand, exercises great discrimination in the matter, picking out only the telling features of the view and rejecting everything else from the canvas or pad before him.

Benjamin Hawley, an artist of Philadelphia, is the inventor of a device which has been recently patented, by which works of art can be produced by anyone without any previous tuition or particular aptitude for handling the pencil. The instrument is called the etchograph, and its shape, mode of working and samples of the work done by its use are all shown herewith.

A STUDY MADE WITH THE ETCHOGRAPH.

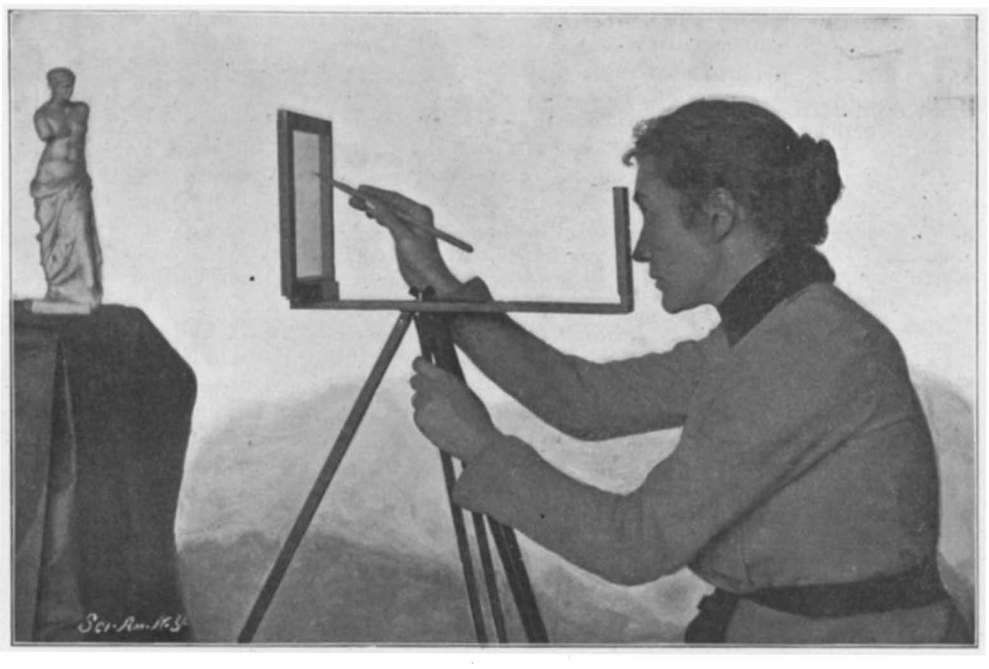
A SCENE ETCHED BY THE HAWLEY METHOD.

On the top plate of a tripod, a support is carried, comprising a longitudinal bar and a lateral bar. At one end the longitudinal bar carries an adjustable frame to receive a glass plate coated with a transparent film of gelatine or collodion; at the other end, the bar is formed with a slot to receive a holder for a vertically adjustable lens. The lateral bar serves as an arm rest. The tripod having been set up in proper position, the engraver looks through the lens, and sharply focuses the image transmitted through the glass plate by sliding the holder in the slot of the longitudinal bar. The reduced image, being apparently projected on the plate, can then be engraved on the prepared surface of the glass.

By this means anyone can make a satisfactory picture without the least knowledge of art or even acquaintance with the use of the pencil; but with the skill which soon comes of practice and observation, some very artistic effects can be obtained. For instance, by allowing a small amount of ink to remain on the plate's surface instead of thoroughly cleansing it, and then by a broad sweep here and there with a wad of cotton, the print made can be given all the appearance of an etching.

The method here offered is also of value to the student just beginning his career of art. It teaches him to see, and greatly simplifies the understanding of perspective. That things are seldom what they seem becomes at once evident to the art student when he makes his first endeavors to make a plane reproduction of solid form. For instance, when an oblong box is viewed in perspective, its long side may appear shorter than its short side, and in the drawing of such a box the line representing the short side may actually be shorter than the line representing the long side. To the beginner such appearances are most confusing, and the labor of learning to see is often so tedious that many are discouraged at the outset. It is evident that with the aid of some such device as this, perspective and form as well are revealed at a glance. Thus it can be made a great help to the beginner. It has received the indorsement of a number of artists for this purpose.

The etchograph is also a valuable assistant to the scientist and student, particularly in botany, zoology or anatomy. With its aid he can reproduce just such parts of the floral specimen as he desires, rejecting all superfluous and confusing details.



THE ETCHOGRAPH IN USE.

An International Exposition will be held at Lille from May to September, 1902. Its character will be of a general nature, but special attention will be given to the subject of the application of alcohol to the purposes of lighting and heating. The office of the exposition company is No. 35 rue National, Lille, France.

THE SANTOS-DUMONT AIRSHIP NO. 7.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

M. Santos-Dumont is actively engaged in carrying out his projects for the aerostatic park at Monaco, from which point he is to make his experiments, first along the coast and then across to Corsica. At the same time he is superintending the construction of his new balloon which is being built at the Lachambre establishment in Paris. It will be considerably larger than the former, the No. 6, and is especially designed for high speed. Since the last description of the new No. 7, Santos-Dumont has made some important modifications in the dimensions of the balloon proper and the lower beam. As at present designed, the balloon has the form of an elongated ellipsoid having 142 feet on the long axis and 22 feet in the middle diameter, making it 22 feet longer than was intended at first. It is terminated in the front and rear by two cones. Its volume is 1,640 cubic yards, and the surface about 850 square yards, counting the overlaps and seams. The envelope is composed of two thicknesses of French silk joined by varnish in a single layer. The weight of the envelope is estimated at 730 pounds. The balloon is divided into three compartments having each a volume of 546 cubic yards. The two partitions which form the compartments, of unvarnished silk, have a surface of 217 cubic yards and weigh 15 pounds. Santos-Dumont will use the displacement of the guide-rope in the horizontal sense to vary the conditions of equilibrium of the airship, and besides will make use of the interior air-bags, originally designed simply to keep the balloon swelled out, for the same purpose. To effect this, he places near each end of the balloon an interior air-bag or small balloon, and both air-bags are in communication with a blowing or aspirating ventilator-fan. According as the forward or rear air-bag is swelled up by the ventilator the balloon will take a correspondingly inclined position. Besides, air may be removed from one bag and introduced into the other, giving a considerable latitude for the maneuver. This ingenious process, which Santos-Dumont has been able to realize by means of special devices, was indicated by M. Wilfrid de Fonvielle in 1884 at the time of Renard and Krebs' experiments. The two small air-balloons have each a volume of 90 cubic yards. The surface is 154 square yards and weight 66 pounds for the two. Accordingly, the total weight of the envelope will be 796 pounds.

The main beam, or keel, suspended below the balloon by steel wires, will have 93 feet length and will carry two motors of the Buchet pattern (such as are used for automobiles, but of heavier build) giving 40 horse power each, with a total weight for the two of 352 pounds. The motors will be thrown into action by friction clutches in aluminium with an interior steel band to keep them from sticking. The clutches will have a compressed-air device for throwing them on very gradually. In front and rear of the keel will be fixed the two helices, of similar construction but turning in the inverse sense and at different speeds. The center of the beam will be occupied by the aeronaut's car.

Since our Paris correspondent sent us this article, M. Santos-Dumont met with a serious accident to his airship. On February 14 he left Monaco at half past two o'clock in the afternoon. On account of solar radiation, the balloon mounted to a dangerous height. The plucky aeronaut did not lose his presence of mind, but opened the valve of the balloon, which fell into the sea. Fortunately, he was not injured, as assistance was promptly brought by a steam launch. He could be distinctly seen from the shore watching the various parts of the airship. It was thought for a moment that he would be dashed on a reef of sharp rocks. In the meantime the steam launches in the bay were making toward the spot. The motor stopped and the airship descended until M. Santos-Dumont was immersed to the armpits in the water. He was perfectly cool and gave directions to those on the launch, and finally half-clambered and was half-pulled over the gunwale of the boat. It was impossible to save more than the silken envelope of the balloon, and the motor sank. He made this statement: "I am not discouraged. My trip to Cape Martin is only postponed. I will start again as soon as I can get ready. This accident was due to the entanglement of the guide rope with the screw and wires of the balloon. The balloon was not fully inflated when I started. Seeing that an accident was inevitable, I pulled the emergency cord, but pulled it harder than I intended. This made a bigger rent than I wanted. Consequently the airship collapsed too quickly, and for a moment there seemed to be danger of the casing falling on me. But luckily this danger was averted. I shall try again."

Milk Flour in Sweden.

Dr. M. Ekenberg, of Gothenburg, has made a discovery which will be of importance in dairy farming, says Consul R. S. S. Bergh. He claims to have invented an apparatus by which milk can be brought into the form of powder, like flour in appearance, but possessing all the qualities of milk in concentrated form, moisture excepted. It is said that this milk flour is completely soluble in water, and can be used for all purposes for which common milk is employed. The milk flour does not get sour, does not ferment, and in the dry state is not sensitive to changes in the weather. It can be kept and transported in tin cans, barrels, bags, etc. The cost of production Dr. Ekenberg has estimated at about 27 cents per 106 quarts (1 öre per liter), and he thinks that flour made from skimmed milk can be sold for about 13 cents per pound (1 krone per kilogramme). At a recent meeting of the Academy of Agriculture, Dr. Ekenberg exhibited samples of the milk flour, which received favorable comments. It is considered that the invention will be of the greatest importance for the utilization of skimmed milk, which heretofore has largely been wasted, but in the dry form can be transported all over the country without losing any of its original good qualities.

The product mentioned is considered superior to the casein products "proton" and "proteide" now manufactured from milk by the aid of rennet, acid, or lye.

THE NEW REDHEUGH BRIDGE AT NEWCASTLE-ON-TYNE.

The accompanying illustrations, for which we are indebted to the engineers of the bridge, Messrs. Sandemann & Moncrieff, show an important work of bridge reconstruction, which embodies several new features that give it a special interest outside of that which attaches to the magnitude and importance of the bridge itself. The river Tyne, which flows between Newcastle and the adjacent town of Gateshead, passes through a deep depression, that serves effectually to separate the two cities as far as pedestrian and vehicular traffic is concerned. The celebrated high-level bridge, built by Stephenson, was the only convenient communication between the two towns until the erection in 1871 of the old Redheugh Bridge, which has recently been removed to make way for the more modern structure. The old bridge was one of those curious compound structures, which serve as landmarks in the history of the development of bridge designing, and shows how this important branch of engineering was gradually feeling its way from crude, complicated and indeterminate forms of fifty years ago up to the few highly scientific and simple systems, to one or the other of which all modern bridges belong. The old bridge consisted of four spans with a masonry viaduct approach on each side. The lengths of the spans were, commencing from the Newcastle side, as follows: A shore span 168 feet in length, two river spans 252 feet in length, and a shore span on the Gateshead side of 167 feet. The total length of the approaches was 348 feet, and of the whole bridge 1,187 feet. From high water to the under side of the bridge was 86 feet 7½ inches. The old bridge had a total width of 41 feet, and was made up of a 20-foot roadway and two 7-foot sidepaths for pedestrians. The superstructure was a continuous lattice girder which possessed the extraordinary feature that the continuous upper chords, which were circular in section, were used as gas mains and the trough-shaped lower chords were utilized as water mains. These conduits belong to the Newcastle and Gateshead gas and water companies, both of which corporations are large shareholders in the Redheugh Bridge Company. Our photographs show clearly the circular gas main which formed the upper chord of the old bridge. Associated with the trusses was a set of suspension chains, two for each truss, which were carried by latticed towers above the piers, and extended down to a connection with the bottom chords at about the middle third of the length of the spans.

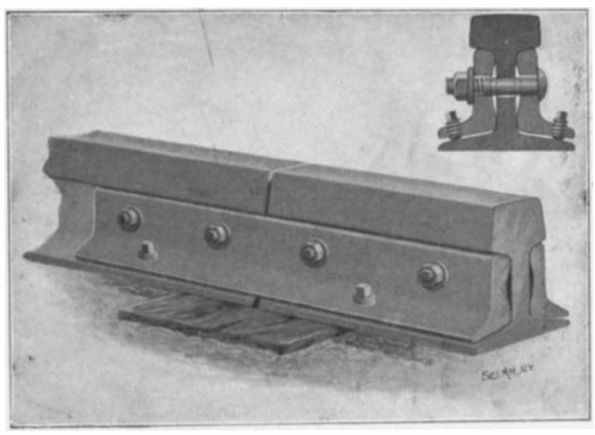
The contractors for the new bridge were required to remove the main spans and the river piers down to low water; to remove the old bridge viaduct down to the springing of the arches; to remove the old gas and water mains; to erect an entirely new main bridge; new cylinder foundations, new steel girder approach spans, and to set in place new steel gas and water mains; all this, moreover, was to be done without any interference with the roadway, which was to be kept open until such time as it became absolutely necessary to close it.

The new bridge is carried on three river piers, and the new superstructure consists of two shore spans of 168 feet and two river spans of 252 feet between centers of end pins. The total width of the new floor of the bridge is 53 feet, including a 20-foot roadway, two 7-foot sidewalks, and a lateral extension of the floor beams on each side for carrying the gas and water mains. In preparing the foundations for the new bridge, in the case of each pier four 8-foot steel cylinders were sunk by the pneumatic process to depths ranging from 50 feet upward. These cylinders were located on the outside of the old foundations, at a distance from center to center, transversely to the axis of the bridge, of 55 feet, and were carried up to a height of 6 feet above high-water level. The interior of the cylinders was filled with concrete. Upon these cylinders were erected the four inclined legs of the new bridge pier. These were built up of standard steel shapes, and were strongly trussed both in the direction of and transversely to the axis of the bridge. Each column foots upon a cast-iron bedplate, and the columns average about 80 feet in length. The main trusses are 252 feet in length and 35 feet 4 inches in depth. The upper chords are spaced 23 feet apart between centers. They are 1 foot 10 inches in depth by 2 feet 6 inches in width. The lower chords measure about 2x2 feet in section. The general details of the truss are shown clearly in the accompanying illustrations. It is built up of standard, rolled-steel shapes, the compression members being latticed and the tension members consisting of rolled-steel bars.

Special interest attaches to the erection of the bridge. The new structure was built with its axis parallel to the axis of the old bridge, one truss of the old structure being within and the other on the outside of the new truss. The new floor was built above the level of the old floor, and the overhead wind bracing at the panel points of the new bridge was arranged to clear the top chords, or gas mains, of the old bridge. The new structure was built entirely by overhang from the piers, the two river piers being constructed by this method until they met in the center, and the two shore piers being tied back to the river trusses, and built out by overhang until they reached the shore abutments. The work was carried out under the supervision of the resident engineer, George Huntley, from the plans of Messrs. Sandemann & Moncrieff, the designers. It was constructed by Sir William Arrol & Company, the contractors of the great Forth Bridge.

IMPROVED RAILJOINT.

We present an illustration of an improved rail joint, for which a patent has been granted to A. M. Wilson, of Cherokee, Ia. The object of the invention is to provide a simple and inexpensive device that can be applied to any angle-bar joint of the standard type for the purpose of giving it extreme stiffness and rendering the joint permanently secure. The improvement consists essentially of the provision of four set-screws, which are adjusted in four threaded holes in the base-flanges of the angle bars. The two set-screws in each angle bar are placed approximately half-way between the abutting ends of the rails and the outer ends of the angle-bars, as shown in the accompanying drawing. The angle-bars may be, and in most cases will be, of the standard fish-plate type, clamped one on each side of the rails and held in position by four or six screw-bolts, as the case may be. After the angle-bars have been adjusted in the ordinary manner, the four set-screws are screwed down with a wrench or other suitable tool until they bear upon the base of the rail. The further tightening of the set-screws gives the angle-bar a rocking or clamping movement, such as would result from the driving in of a wedge between the rail-base and the flanges of the angle-bars. This movement will tend to crowd the angle-bars more firmly in under the head of the rails, thereby greatly increasing support at the most critical point in a rail joint. The importance of this result is seen when it is borne in mind that, with the slightest loosening of the screw-bolt nuts, the



IMPROVED RAILJOINT.

joint becomes loose and the rail ends are deflected under passing wheels. Another important feature in this improvement is the fact that when the set-screws are screwed down there is a resulting tensional stress put upon the screw-bolts, and this stress is greatest at the lower edge of the nuts. The resulting pressure will act upon the nuts with a locking effect which will prevent them from working loose and will tend to hold the rail joint in permanent adjustment.

The Domestic Manufacture of Portland Cement.

The development of the rock and Portland cement industries in the United States during the past decade forms one of the most interesting chapters of the building trade and manufacturing industry. It was not until about ten years ago that any decided effort was made in this country along this line, the greater portion of the cement used being imported from England, Germany and other European countries. The total manufacture of Portland cement in this country for the year 1891 was 454,813 barrels, which was equal to but 13.2 per cent of the product used in this country in that year, the exportation for the same year amounting to 2,988,313 barrels. During the next five years the importation of Portland cement varied but little from that of the afore-mentioned year, and at the same time the manufacture of the product at home had a rapid growth, the domestic production for 1896 being 1,543,023 barrels, or 37.4 per cent of the product used in this country in that year. Coming down to 1897, we find a domestic production of Portland cement of 2,677,775 barrels, while the importation of the same product for that year was 2,090,924 barrels, the domestic production being equal to 56.8 per cent of the consumption in the country and exhibiting a gain of over a million barrels over the previous year. In 1898 we manufactured 3,692,284 barrels of the product and imported 2,013,818 barrels. Taking up the figures of the industry for 1899, we find a gain of over a million tons in domestic production over the previous year, and 1890 shows a similar gain over 1899. To-day the domestic production of Portland cement equals more than 80 per cent of the entire consumption of the product in this country, and within a few years the importation of the product into this country from Europe will have gone the way of many other European products formerly used in this country, but now supplanted with similar products of domestic manufacture.

The wonderful development experienced by the building trades during the past year or two has been largely instrumental in stimulating the development of the domestic Portland cement industry. It has not been so long ago since New York, Pennsylvania and Ohio produced all the Portland cement manufactured in this country; and while these States are still the centers of this important industry, there are now at least fifteen States engaged in the industry. Pennsylvania leads in the industry, producing more than one-half of the some 8,000,000 barrels which now make up our annual domestic production; while New Jersey, New York and Ohio are prominent factors in the industry, their places in the annual production being in the order of their mention above. For a long time our importation of the product was chiefly from England, Germany finally supplanting the English product, and the German product having more recently been supplanted by the domestic product.

This indispensable building product takes its name from the fact of its close resemblance to the oolitic limestone formation on Portland Island in the English Channel, the industry having been instituted on the banks of the Thames and Medway, where an admixture of chalk and clay dredged from the river beds formed the basis of the product. While the industry as evolved in this country is based upon the same lines as originally used in England, the mixture of materials now used has been worked out by a long series of experiments. At the great Portland cement establishments in Lehigh County, Pennsylvania, blue-gray crystalline limestone and a dark gray siliceous variety are ground and mixed in the desired proportions. This mixture is then molded into a brick form and burned to the condition of slag. It is then ground to a powder in the form of cement. A natural cement rock in the form of impure limestone of the Upper Silurian formation is present near Buffalo, N. Y., and the Rosendale cement is made from water limestones of the Lower Helderberg group in Ulster County, N. Y.

In all sections where the industry is carried on, limestone in one form or other forms the basis of the product. The limestone deposits in the Lehigh Valley in Pennsylvania, now the leading center of the industry in this country, are similar to the argillaceous limestone deposits in Belgium. The Belgium product is made by the direct burning of a limestone of approximately the composition of a correct cement. The Lehigh Valley limestones contain a slight excess of clay over the amount required; and to obviate this a small amount of pure limestone is ground with the rock in order to produce the correct mixture. When pure limestone and clay are employed in cement manufacture they must be ground very fine, hence the cost of production is much greater than when the natural cement rock is used; and attempts at manufacturing Portland cement in this country from pure limestone and clay have not been attended with success. Blast furnace slag has lately come into use as a material in the manufacture of cement. The molten slag is granulated in running water, dried, ground and mixed with limestone and slaked lime, and the clinker produced is ground in the same manner as the regular Portland cement clinker. While marl now enters largely into the manufacture of Portland cement, the production from this material is equal to less than one-fifth the production from limestones.

There is a close relationship between the original Roman cement and modern Portland cement. The former product was manufactured from an admixture of volcanic ash or sand and mile. The English Roman cement is made by calcining septarian nodules dredged from Chichester Harbor, off the coast of Hampshire, and from the Whitby shale beds of the Lias formations in Yorkshire. These latter departures of the cement industry have a close parallel in the Portland cement made from marl formations in this country. The presence of 15 per cent or more magnesia in some of the Portland cements now produced forms a serious objection to them, the imitations coming chiefly from Belgium. Owing to the abundance of the natural materials in this country, there is no necessity for resorting to the manufacture of imitative cement.

The development of this industry in this country has necessitated the evolution of much in the way of improved machinery. For a long time vertical continuous and intermittent kilns were chiefly employed in the Portland cement industry. Four or five years ago the rotary furnace was perfected, and was at once adopted by leading Portland cement manufacturers. To-day nearly three-fourths of the product manufactured in this country is burned in this improved type of furnace. There has also been marked improvement in grinding machinery, screens, and in machinery for handling the raw material as it comes from the quarries.

W. G. I.

Automobile News.

American capitalists are reported to have taken the initial steps toward establishing a system of public automobiles in the city of Manila.

Ten automobiles have been delivered to run between San José and Alviso, Los Gatos and Saratoga, giving a rural passenger service. Another automobile line is contemplated in the oil districts near Bakersfield, Cal., thus connecting the Southern Pacific and Santa Fé Railroad systems.

A party of six persons started from Paris in a 30 horse power Panhard car for Pekin by way of Berlin, Moscow and Siberia. It will be interesting to see how far the automobile will proceed before it is permanently disabled. Such trips have been tried repeatedly, and have always ended in failure.

As between automobiles and horse-drawn vehicles the braking facilities of the former are usually far superior to those of the latter. The average American-built motor vehicle of whatever type may be brought to a standstill from a 20-mile-an-hour rate of speed in less space than can a team being driven at a moderate trot—say, seven miles an hour.

The Austrian military authorities have a motor under construction at the motor factory at Vesselsdorf, in Moravia, which is to be used by the Austrian army for the purpose of reconnaissance, and also for racing. The car is being fitted with three separate motors, which will work independently of each other. The maximum speed is stated to be 120 kilometers, or 74 miles, per hour, and an entirely new system of transmission is to be used.

The battle between the French builders of electric vehicles still goes merrily on. Last summer's record of 289 kilometers on one charge was recently surpassed by a vehicle designed by M. Kreiger, which covered 307 kilometers before its batteries were exhausted. The difficulty about increasing the traveling radius of electric vehicles seems to be that the weight to be carried also increases with each added kilometer.

Eastern and Western automobilists are at loggerheads over the formation of a national body. It appears that a New York organization with the resounding title "The Automobile Club of America" desires to retain the supremacy it has acquired by virtue of its wealth and by being first in the field in this country, while the representative clubs of other large cities desire recognition on the basis of membership figures. This would enable a combination of representatives from the smaller clubs to take the management of affairs from the New Yorkers. A call sent out by the Chicago club has been either not received or ignored by the A. C. of A. In the meantime an organization which everybody seems to have forgotten—the American Motor League—formed on October 29, 1895, has stepped into the breach, and will hold a meeting in the near future to which the warring factions will be invited.

The last Alcohol Exposition was such a great success that it has been decided to hold a new one in May. It will be held as usual under the auspices of M. Dupuy, Minister of Agriculture. Like the preceding exposition it will consist of apparatus utilizing alcohol for the production of motive power, light and heat, also of various types of carbureted alcohols. The exposition will be preceded by a series of competitive tests, and those upon alcohol motors and automobiles will be of especial interest. The automobiles will no doubt be tested as before by taking them through a run in the vicinity of Paris. According to the programme, three sections are provided; first, the fixed motors, portable motors and carbureters; second, automobiles and boats; third, lighting and heating devices. The Automobile Club is taking an active part in the event, and there is no doubt that it will show an increased improvement in the alcohol motors since last November.

M. R. Mathot, a Belgian engineer, has invented a device which is applied to explosion motors and serves to register their performance in the same manner as the indicator of a steam engine. It communicates with the explosion chamber by a small pipe and has a registering device somewhat similar to that of an indicator, except that the record is made upon a band of paper which rolls out continuously. The cylinder contains a small piston which works back and forth under the action of the varying pressures of the motor. The cylinder is connected to the tracing device which presses the pencil against a drum driven by clockwork. As the temperature is high on account of the heat of the explosive gases, the cylinder is surrounded by a water jacket in which a rubber tube assures the circulation. In this way a series of interesting diagrams are obtained which are of great utility in studying the performance of the motor. The cycle of the motor is clearly indicated, especially the periods of compression and explosion. Variations in the carburetion and in the ignition are also registered. This instrument will no doubt be of great service in the study and designing of explosion motors.

Engineering Notes.

An oil well on the ground which is rented from the Crown in Russia, for 5 kopeks a pood, by the Baku Naphtha Company started gushing at the rate of a million poods daily. Work was stopped, owing to the fear of a conflagration.

While drilling for oil in the Colorado desert in Southern California, the drilling tools, which reached a depth of 500 feet, were suddenly thrown out and the well began to spout hot water and steam. Volcanic substances were showered about the surrounding country, says the Railway and Engineering Review, and the men lost no time in escaping from the derrick. Some distance from the point where the well was drilled is a region where signs of volcanic conditions underneath frequently appear, and it was thought that the well was drilled down to this stratum.

There is at present a great boom in the manufacture of metal cars. Besides the new plant of Charles T. Schoen for the manufacture of car wheels of pressed steel, there are several others under way, notably those of the Structural Steel Car Company at Canton, Ohio, and the National Rolled Steel Car Company, which will locate near Pittsburg. The head of the Structural Company is Elwood C. Jackson, formerly of the firm of Jackson & Sharp, of Wilmington, Del. The Rolled Steel Company will engage in the manufacture of trucks principally.

Experiments to determine the liability of liquids and compressed acetylene to explode were tried recently at Berlin. Several cylinders loaded with 4 kilos of liquid acetylene were placed in position, with a valve at the top. The gas which collected at the upper part of the cylinders was under a pressure of 725 pounds per square inch. A cartridge containing one kilo of picric acid was then applied and exploded by electricity, with the result of blowing off the top of the cylinder, but the acetylene was not detonated, and the cylinder emptied itself on the gaseous acetylene. Another cylinder was charged with 3½ kilos of liquid and a 200-gramme cartridge placed in the bottom; when the electric current passed through into it the liquid acetylene exploded, destroying the cylinder. A cylinder of liquid acetylene was fired at with a rifle without explosion resulting, neither was a cylinder of acetylene disturbed by the explosion of a quantity of picric acid close to it. The experiments proved that acetylene is undisturbed by sympathetic discharges, but that the liquid will explode always if a detonator is in contact with it.

Mr. Arnold Foster, English financial Secretary of the Navy, lately objected in a speech against the great variation of types and of dimensions in the machinery of vessels of war and machinery of the government generally, saying in effect that it was dangerous and obstructive to the service. Mr. Foster says there is one set of tests for the navy, another for the army, a third for the Board of Trade, a fourth for one of the great railway companies, a fifth for another railway, and war vessels go to sea with lots of tubes for condensers and boilers, all having different standards of gages. He impugns the value of the English destroyers, and says not one of them is fit to guard a battleship at night in a storm. Their ability to do this will be the standard in future, not to test how fast they can race over a measured mile. The destroyers of the future should be built of standard types, so that if anything goes wrong with one of them, interchangeable parts can be supplied at once. This is very well for a suggestion, but has the Honorable Secretary taken into consideration the time required to put it into execution?

Mr. Patrick Dagnall, a retired Royal Engineer sergeant of the British army, has devised a new cartridge contrivance for the magazine rifle, which is intended to supersede the present bandoliers, which contain several disadvantages militating against their efficiency. The apparatus is only a few ounces heavier than the existent bandolier and consists of a thin circular box, 8 inches in diameter by ¾ inch deep. One disk has loops at the back for fastening it to a strap round the man's waist. A second disk, to which short tubes for receiving the cartridges are attached, revolves freely on a central pivot attached to the first disk, the rim of which forms a complete cover and protection for the cartridges, which can only be taken out at one point, where an opening is left for that purpose. Cartridges cannot possibly fall out by accident, yet when wanted they drop as quickly into a man's hand as he can possibly transfer them to the magazine of his rifle. In a trial with the bandolier a soldier loaded his rifle from the Dagnall contrivance and discharged 20 shots in two minutes, whereas in the same time he only succeeded in firing 16 rounds by loading the rifle magazine from the bandolier, thus showing a decided advantage in rapidity of firing. The containers are devised so that they can be worn either on the left or right side. With one on each side a soldier can carry just as many rounds as in two leather bandoliers, and the incumbrance is by no means so great.

Electrical Notes.

The General Electric Company has recently received an order from Tokio, Japan, involving $750,000. It is for the erection of a trolley system in that city.

The city of Carlsbad, Bohemia, is about to have street cars. This is probably the only city of its size in the world without modern methods of transportation.

The American Electrochemical Society is just being formed, and over two hundred names have been enrolled. The first meeting for the purpose of organization and for the reading of appropriate papers will be held in Philadelphia early in the coming spring.

The power house of the branch of the Pennsylvania Railroad running from Burlington to Mt. Holly, N. J., burned a short time ago, and the company announces that it will not be rebuilt and that the line will hereafter be operated by steam locomotives instead of by motors.

The operation of main line railways from Switzerland has been occupying considerable attention. The abundance of water power, scarcity of coal and the considerable grades make the project feasible commercially. Preliminary studies will probably be carried out very soon.

It is stated that the London, Brighton and South Coast Railroad, one of the leading trunk roads in the South of England, is seriously contemplating the substitution of steam traction by electricity throughout the whole of its system. The company has recently engaged the services of Major Cardew and Mr. Philip Dawson as consulting electrical engineers. These two engineers are the leading experts in electric traction in England. The reason for this development is probably due to the fact that another company has been formed for constructing an electric railroad on the "tube" principle between London and the fashionable southern seaside resort Brighton. As the London, Brighton and South Coast Railroad is the only line at present serving this important center, the construction of a tube railroad would offer a serious menace to their interests.

The City and South London Railway, the pioneer electric tube in the English metropolis, has opened to the public its extension to Islington. A service of two and a half minutes will be run during the busy morning and evening traffic, and a four minutes' service during the less busy hours of the day. The complete journey from Clapham Common, the terminus on the south side of the river, to the Islington terminus in the north will take just twenty-seven minutes. The new trains are to be composed of four coaches, instead of three, as at present. By this plan there will be an increase of 33 per cent in the carrying capacity. There is to be a subway communication at the Elephant and Castle with the Baker Street and Waterloo Railway, and a foot-passenger subway right into the London, Brighton and South Coast Railroad Company's trunk station at London Bridge from the City and South London Railway station. There will also be subway communication between the Great Northern Trunk Line and City line, both at Moorgate Street and Old Street, in the City.

The Marconi system of wireless telegraphy has been established between Newhaven on the south English coast and Dieppe on the French coast. A regular service of mail boats is maintained between these two ports on either side of the English Channel, about 60 miles apart. The installation will be utilized to signal the departure of the boats, with instructions as to the amount of luggage, number of passengers carried, and other useful information, and it will no longer be necessary for friends of passengers to wait for hours at either end when fog or other causes have delayed the boat. By the existing cable, messages have to be sent via London and Calais, and sometimes have taken three hours in transmission. Both time and expense will thus be saved by the Marconi installation. Lloyds have also decided to adopt the use of Marconi's system at all their stations, and a contract has been entered into between Lloyd's and the Marconi company for ten stations to be fitted immediately for a term of fourteen years. Lloyd's will also take over Marconi's existing stations, and a rental will be paid by them for every station fitted.

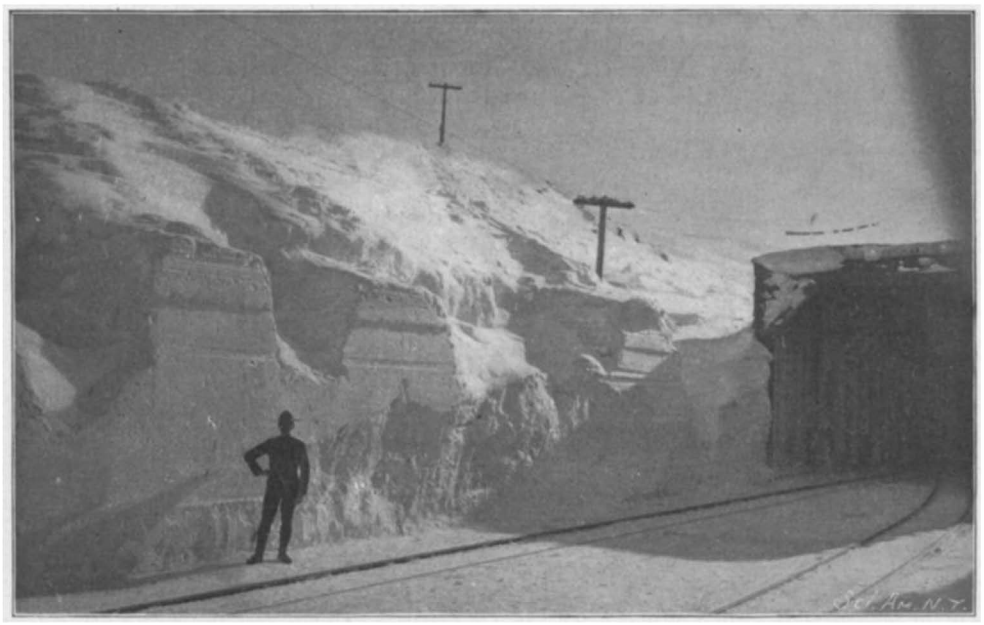
The Current Supplement.

The current SUPPLEMENT, No. 1,364, has for the subject of its front page engravings the recent Paterson fire. "The Early Inhabitants of the Danish West Indies" is a most timely article, and is elaborately illustrated with seventeen engravings. "Charleston and Its Exposition" describes this exhibition, which is now open. "Naval Development During the Next Decade" is by Rear-Admiral George W. Melville. "Aerial Navigation Problems" is a letter by Carl E. Myers, the aeronautical engineer. "The Paris Alcohol Motor Exposition" describes some new and interesting motors. "Recent Science," by Prince Kropotkin, is concluded in this number.

WINTER RAILROADING IN ALASKA.

BY ENOS BROWN.

The labor in maintaining an open track on the single Alaskan railroad can be understood from an inspection of the illustrations which accompany this article, which were taken expressly for the SCIENTIFIC AMERICAN. In the warmer months it is necessary to guard against obstruction of the line by avalanches of rock and gravel, which are constantly falling from the sides of the deep cuts through which the track passes. In the season of frost the work of keeping the track clear is trebly increased. From Skagway the ever-open port on the Pacific, to the summit of White Pass, 21 miles distant, the road ascends 2,400 feet, over a track that winds around the precipitous sides of the mountains, through tunnels, and a long series of deep cuts, at last emerging at the summit of the divide and continuing to the terminus at the head of navigation on the Yukon River. The same enterprise that surmounted the financial and physical difficulties in building the White Pass and Yukon route has to be employed in keeping it open. Traffic continues throughout the year. There is not a day upon which a train does not run on schedule time. Supplies for the mining communities at Dawson and elsewhere are brought down the river, during the season of navigation, from White Horse Rapids. Stocks are thus accumulated during the closed season and this requires that the route over the pass be kept open at all times. Snow begins to fall on White Pass about October 15, and continues with rare intervals until the 1st of May. The average accumulation on the level is 20 feet. Winds are violent and incessant during the winter, and the utmost effort is required to keep the deep cuts free from snow. Two large snow plows continually move back and forth on the track. Rarely a train starts out during the winter that is not preceded by one of these snow plows. In January the thermometer sinks to 60 deg. below, and then is the time when the snowfall is greatest and the wind fiercest. Cuts are filled up and the track obliterated. With two engines pushing the centrifugal plow, the attack is made upon the huge drifts, and with the help of all available shovelers, the track is soon cleared. The most dangerous season on an Alaskan mountain railroad is not when snows are deepest, or the frost most intense, but in early spring when thaws begin, and snows on the mountain sides form avalanches, which, without warning, slide down over the track and engulf it. The utmost vigilance is then required, for a whistle of the locomotive has been known to bring down thousands of tons of closely-packed snow.



SUMMIT OF THE PASS SHOWING THE DEPTH OF THE SNOW.

ROTARY SNOW PLOW AND CREW.

Purdue University will soon inaugurate a new department of instruction in telephonic engineering. This step is taken in response to the increasing demand by telephone interests for men trained in the particular branch of electrical engineering pertaining to telephony. Investigations have disclosed the fact that students completing the course in electrical engineering must devote upward of two years additional work to acquiring special details of telephone practice before they are sufficiently equipped with a knowledge which is valuable to merchants and consumers of telephone material.

Garbage-Consuming Plant.

At Darwen, England, has been established a plant for consuming household waste, and the resulting energy is utilized to operate the electric tramway system of the town. The plant, although not one of the largest, is interesting in many respects. The waste is consumed in two furnaces of the Meldrum type, with an automatic feeding apparatus. The furnaces and boilers are established in a building alongside of the electric station. The latter contains 3 engine and dynamo sets, including 2 Siemens 150-kilowatt generators driven by 250 horse power engines, and one Mather & Platt 300-kilowatt generator with a 450 horse power engine. The boilers are of the Lancashire type and measure about 8 by 27 feet. The average combustion of household waste is sufficient to furnish steam for supplying 3,500 incandescent lamps of 8 candle power, or equivalent. The quantity of waste consumed varies from 32 to 38 tons a day, although the plant has a capacity of 70 tons. The calorific power of the waste is estimated at about one-fifth that of ordinary coal. The plant has been in operation for some time and has proved quite successful, as the garbage of a city of 40,000 inhabitants is destroyed inoffensively and at the same time there is produced energy equivalent to 400 horse power for 12 hours per day. By using accumulators this may be increased to 260 horse power during the 18 hours service of the electric tramway. The annual production of energy is estimated at 900,000 kilowatts.

Dr. Hrdlicka has started on his fourth expedition into the country of the cliff-dwellers and Pueblos in the southwestern part of the United States and northern Mexico. These trips are made under the auspices of the American Museum of Natural History, the money being supplied by F. E. Hyde, Jr., of New York.

Experiments of M. Moissan With Hydride of Potassium.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The hydride of potassium is a compound about which little has been known up to the present, and accordingly M. Henri Moissan has undertaken the study and preparation of this body, and has been quite successful in his experiments. If potassium is kept for several hours in an atmosphere of hydrogen, at a temperature of 350 deg. C., it soon becomes covered with a transparent and crystalline layer of hydride, through which the brilliant surface of the unattacked metal is visible. In his present experiments, Mr. Moissan uses potassium in the form of metallic wires, which are placed in a small iron vessel. The latter is disposed in a horizontal tube of Bohemian glass and a current of pure and dry hydrogen is passed through. Using a Deville hydrogen generator he could pass a current whose tension exceeded the atmospheric pressure by 10 centimeters of mercury. When the experiment was carried out at 350 deg. C. (the temperature of boiling mercury) the formation of hydride was very slow, but after 8 or 10 hours' heating there was seen to form at the end of the vessel opposite the hydrogen entry a small bunch of white and intermeshed crystals which had the appearance of cotton filaments. If the experiment is repeated at 440 degrees, (the temperature of boiling sulphur), metallic potassium comes off and is condensed in the cold parts of the tube, and on each side of the vessel there is formed a ring of metal and a white ring of the hydride. The best method was found to be to heat the lower part of the tube and the vessel to 360 deg., when the hydride condensed in the upper and cooler portion. It was thus obtained in a felt-like layer of fine white crystals which do not contain free potassium. M. Moissan has studied the properties of this compound, and finds it to be one of the most easily decomposable bodies known. It takes up the moisture of the air with great rapidity and decomposes at once, giving off hydrogen and leaving potassa. It decomposes cold water, producing at the contact a noise like that of a red-hot iron, with a violent disengagement of hydrogen gas. This body is insoluble in turpentine, benzine, ether and bisulphide of carbon, but dissolves in fused potassium. Its density is found to be 0.80. When heated *in vacuo* below redness it separates into potassium and hydrogen. This property enables its composition to be determined. Upon contact with fluorine, cold, it takes fire at once, and the heat disengaged at first is so great that the rest of the hydride is violently decomposed. The hydrogen then combines with the fluorine and the potassium burns more slowly in the excess of fluorine. When the hydride is projected into chlorine gas it becomes incandescent and gives hydrochloric acid and potassium chloride. It takes fire in dry oxygen with great heat, forming potassium hydrate and water. This body is difficult to handle in the air, as it takes fire when removed from the tube in which it is formed. With melted sulphur, decomposition takes place with incandescence, forming sulphide of potassium and hydrogen sulphide. When slightly heated in carbonic acid gas the hydride reacts with incandescence, and the same phenomenon is shown with hydrogen sulphide; here potassium sulphide is formed and hydro-

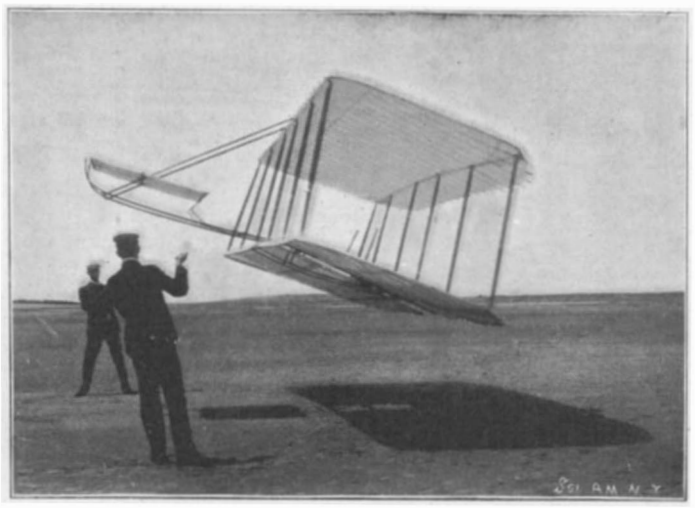
gen given off. It acts as a reducing agent when mixed with copper or lead oxides, and the metal is set free. M. Moissan has made a number of analyses of this body and finds that it has the formula KH.

SOME AERONAUTICAL EXPERIMENTS.

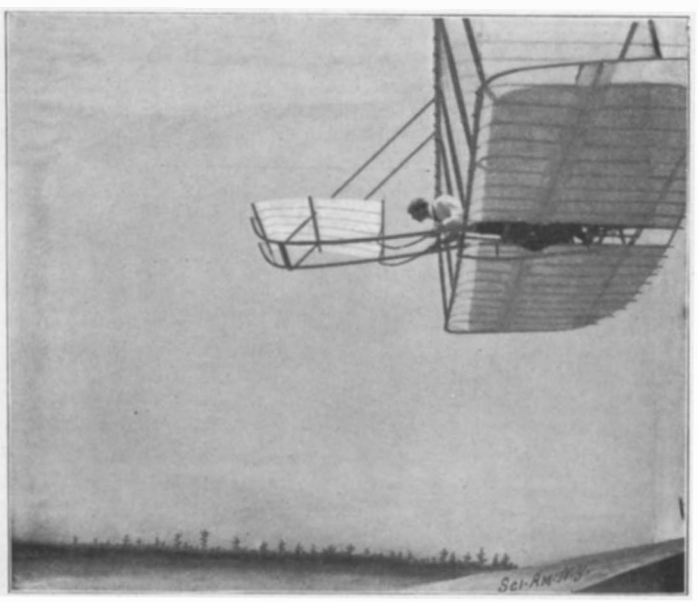
Mr. Wilbur Wright, of Dayton, Ohio, recently read a most interesting paper before the Western Society of Engineers, entitled "Some Aeronautical Experiments," and this paper was afterward published in the Journal of the Society. Through the courtesy of the Society we are enabled to present a series of engravings illustrating the article. Mr. Wright's attention was drawn to the study of aeronautical problems a number of years ago, and his active interest dates back to the death of Lilienthal in 1896. The experiments of Pilcher and Chanute also stimulated Mr. Wilbur Wright and Mr. Orville Wright to try some experiments in 1900, which were conducted on the seashore of North Carolina. These gentlemen have been bold enough to attempt some things which neither Lilienthal, Pilcher nor Chanute dared to do. They have used surfaces very much greater in extent than those which hitherto have been deemed safe, and have accomplished very remarkable results. It was the plan of Messrs. Wright to glide from the tops of sandhills. It seemed reasonable that if the body of the operator could be placed in a horizontal position, instead of the upright, as in the machines of Lilienthal, Pilcher and Chanute, the wind resistance could be very materially reduced, since only one square foot, instead of five, would be exposed. As a full half-horse power could be saved by this change, they arranged to try the horizontal position. The first machine had an area of only 165 square feet. It was first tested as a kite, and valuable data as to the angles were obtained. They then turned their attention to making a series of actual measurements of the lift and drift of the machine under various loads. The results obtained were most astonishing, for it appeared that the total horizontal pull of the machine, while sustaining a weight of 52 pounds, was only 8½ pounds, which was less than had previously been estimated for head resistance of the framing alone. On the other hand, it appeared sadly deficient in lifting power as compared with the calculated lift of the curved surface of its size.

Their attention was next turned to gliding, and a small hill which rose from flat sand to a height of more than 100 feet was selected, the slope having an inclination of ten degrees. A dozen glides were made with the wind blowing at 14 miles an hour. The operator placed himself in a horizontal position, and two assistants started the machine. Neither machine nor operator suffered any injury. The control of the apparatus proved even better than they had dared to expect, responding to the slightest motion of the rudder. With these glides the experiments for the year 1900 closed. The new machine for 1901 was exactly like the previous machine in theory and method of operation, but its lifting power was increased from 165 square feet to 308 square feet, although so large a machine had never before been deemed controllable. A special building was erected to house the apparatus. Quite a party went south to view the experiments, which were begun with the wind blowing 13 miles an hour. Various glides were made in order to find the center of gravity of the operator. The machine sailed off and made an undulating flight of a little more than 300 feet. To the onlookers this flight seemed very successful, but to the operator it was known that the full power of the rudder had been required to keep the machine from either running into the ground or rising so high as to lose all headway. The experiments also showed that one of the greatest dangers in machines with horizontal tails had been overcome by the use of a front rudder, and the operators escaped from positions which had proved very dangerous to preceding experimenters. In subsequent experiments the machine, with its new curvature, never failed to respond promptly to even small movements of the rudder. Many glides were made whenever the conditions were favorable.

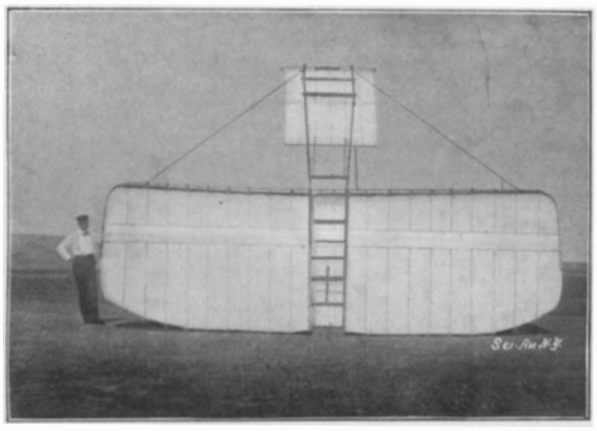
A most interesting series of photographs were taken, some of which we reproduce. Our readers are referred to Mr. Wright's original paper for an elaborate technical description of the principles involved in the experiments.



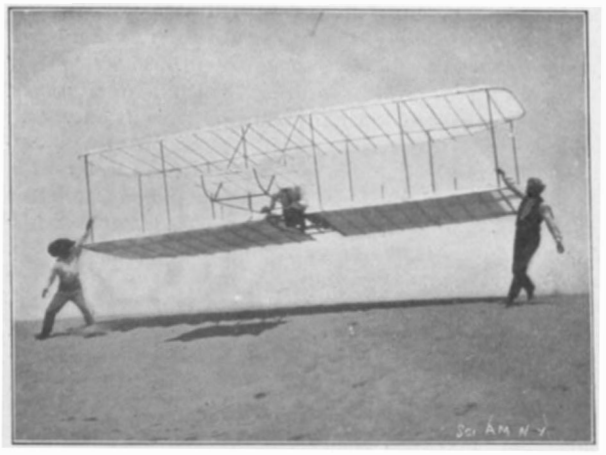
In Midair.



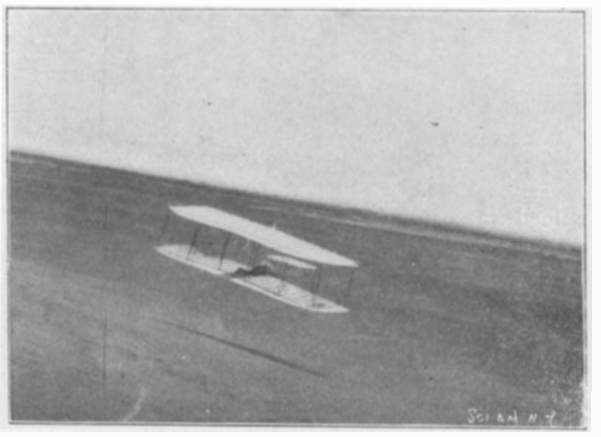
Soaring.



A Bottom View.



Beginning of a Flight.



A Low Glide.

SOME RECENT AERONAUTICAL EXPERIMENTS.

Alloys for Brass and Bronze.

Manufacturers of door trimmings, locks and hinges, etc., may find some valuable hints in the subjoined matter from a recent article by Percy Longmuir, condensed by us from The Foundry.

The author says: The term gun metal was given to various alloys of copper and tin for the purpose of making ordnance in days bygone, but, although no longer used for that work, the same alloys are exceedingly valuable for art work generally. Triple alloys, that is to say, copper, tin and zinc, have replaced the old double ones—copper and tin only—and in some alloys four or five different metals can be found. Zinc, lead, aluminium and manganese are all employed for specific purposes, and are therefore considered in this discussion. The properties of alloys have distinct qualities, and range from very hard and rigid to soft and to some extent elastic, and a general grouping includes the subjoined properties: They should be more or less elastic when cast, and have good torsional strength, together with a low melting point and fill the molds sharply. The range in alloys of the kind mentioned is very wide, and most founders have their own formulæ, which differ but slightly from those in use by others, but these very differences, minute though they be, have a great effect in some directions upon the character of the work turned out. A low percentage in the use of a deleterious element in the metal for a brass bearing may cause the same to heat badly, and similar alloys for high pressure boiler work may be dangerous. This last should have a composition somewhat as follows: Copper 86 to 88 per cent, tin 8 to 10, and zinc 2 to 6 per cent. The tensile strength is 12 to 16 tons per square inch of section, with 8 to 14 per cent elasticity in a length of two inches. This composition is an expensive one, and where the tin is high and the zinc relatively low does not machine well. A composition for a good average quality of metal is made with copper 80 per cent, zinc 10, lead 6, and tin 6 per cent, or a change in quality can be made by using the same proportion of copper and only 5 per cent of lead and 5 per cent of tin.

These cast sharp and machine well. Ordinary brass castings usually contain a greater or less proportion of scrap brass; it is usually obtained from dealers and is by no means uniform in quality, and must be sorted and graded carefully. The common proportions of scrap brass are copper 70 per cent, lead 4, tin 4, and scrap 18 per cent; but according to the grade of the scrap almost any grade of alloy can be produced. The addition of lead, up to a certain point, gives a good color, renders the metal easy to machine, and very much reduces the cost, so it is an inducement to use it as much as possible.

Bearing brasses should have a special composition, much harder than common brass; the following proportions are found to serve the purpose well: Copper 80 to 82 per cent, tin 10 to 14, zinc 2 to 4. Some use this formula: Copper 84, tin 12, and zinc 4. A cheaper bearing brass is made from copper 51 per cent, tin 8, hard scrap 41 per cent. To some extent the mixtures just described are being displaced in favor of certain proprietary bronzes and by anti-friction white metals, but there is always occasion for the use of the formulas mentioned previously on standard work.

In preparing alloys of any kind experience and skill are indispensable; in some cases the several metals are melted and cast into ingots, to be subsequently remelted when ready to pour into castings. In the latter operation the copper is melted first and the more volatile metals, tin and zinc, added afterward. For ordinary castings alloys may be used direct or in conjunction with scrap. A charge for a 150-pound crucible would be 100 pounds of new metal and 50 pounds of scrap. During melting there is always more or less loss by volatilization, oxidation and absorption of gases; these losses should be allowed for in weighing out the charges, but the loss varies in different furnaces, so that it is necessary to standardize the working of the furnace, after which no difficulty will be found in charging for given weights.

The rate of melting is a matter of some importance, the ideal condition being, whether in a reverberatory furnace or crucible, to bring the alloy to a red heat and then quickly reduce the composition to the melting point. Dull, pasty metal, so called, is very liable to absorb gases like a sponge, which is liable to spoil the casting, while the reverse is the fact with metal more quickly melted. Alloys high in tin and copper and relatively low in zinc are very sensitive to the conditions above mentioned, and every-day experience in brass founding enforces the importance of the question of temperatures. It will be found that castings melted at low heats show in the fracture that the several metals of which they are composed have separated and crystallized in masses by themselves.

Low temperatures when melting often result in cracked castings, the shrinkages and contractions being unequal from the segregation of the component metals.

All alloys suffer from the presence of impurities, some of them when very minute quantities are present, and by absorbing gases from the air which are prejudicial. Oxygen has an affinity for many metals, silver in particular, which will absorb twenty-two times its bulk of that gas when melting, but gives it up again upon solidifying; steel also dissolves oxygen in melting, but does not part with it again, and it is disseminated through the mass as ferrous oxide unless special means are used to dispel it. Copper acts similarly, as all who have tried to cast pure copper in sand are well aware, but there are many deoxidizing agents which can be used to prevent the difficulty mentioned. Of these charcoal is the most commonly employed; floating on the surface it acts mechanically as a shield against the introduction of air and prevents the absorption of oxygen. Manganese is another agent; in the form of cupro-manganese it combines with oxygen to form oxide of manganese, resulting in slag. Sodium carbonate and potassium nitrate are other deoxidating agents which can be used with good results, for in conjunction with charcoal they absorb most of the slag and prolong the life of the crucibles, which are greatly eroded by it. Phosphorus is a very active deoxidizing agent, and is energetic as well, so that very small quantities only must be used, 0.02 per cent being the greatest quantity allowable; the greater part of this will slag out, leaving scarcely a trace in the casting. The effect of arsenic upon copper and brass castings is very noticeable, increasing the tensile strength about 33 per cent, but bismuth is extremely prejudicial to this last quality, as it causes brittleness when present in very minute amounts.

Forestry Work in the Philippines.

BY E. A. STERLING.

The fact that the art and profession of forestry is flourishing quite as well, if not better, on the islands which constitute our new Philippine possessions than in this country is very conclusive evidence that American push and industry are actively engaged in the betterment of conditions in these islands. Especially striking is the fact that a profession, which is yet so new in the United States that it meets opposition because of the popular ignorance and misinformation as to its aims and motives, should so early become firmly established in the Philippine Archipelago.

It is of historical interest that the Spaniards had quite a complete forestry service in the Philippines for many years prior to the Spanish-American war, yet it was too poorly managed to be of any real efficiency. Some forty foresters and eighty rangers were employed, but the positions were created for the benefit of political favorites, and hence little real forestry work was done, either in caring for the forests or in securing the revenues due from the cutting and sale of timber. The result was that when the United States came into possession the forest lands near Manila and other shipping points were in a denuded condition. When the United States took military possession of Manila, the decrepit Spanish Bureau of Forestry was handed over to our care. Then came the difficult task of reorganizing the Bureau and establishing an efficient forestry service under American guidance.

The man selected for this work was Capt. George P. Ahern, of the Ninth Infantry, who was appointed director of the Forestry Bureau at Manila, and the success which has been attained shows the wise choice made in the appointment. Capt. Ahern is a graduate of West Point, and of the Yale Law School, and has for some years been an enthusiastic advocate of forestry in this country. Under his energetic management the success of the Philippine forestry service is assured.

It soon became evident that the great need of the Philippine Bureau of Forestry was a corps of young Americans, with a forestry training which would enable them to fully develop the great natural forest resources of the islands. It was with the view of obtaining these men that the Taft Philippine Commission sent Capt. Ahern to the United States in May of the present year. As a result of this visit, six professionally educated foresters sailed for Manila November 1, and another will sail early in February. This number, although small, will make quite a gap in the ranks of the small band of foresters now existing in this country. We have now, however, two fully organized schools of forestry, one at Cornell with 38 students and one at Yale with 30 students; hence we may soon hope to have a supply of professional foresters sufficient for the existing demand. The inducements and opportunities offered by the Philippine forestry service are, however, sufficiently alluring to draw a small percentage of our graduates for some time to come.

The New York State College of Forestry this year furnishes the largest quota of men for the Philippine forestry service. Its contribution consists of two members of the senior class, Messrs. Clark and Klemme, who were sufficiently advanced to pass the Civil Service examinations; Mr. Hagger, a German-trained forester who has been manager of the College Forest in the Adirondacks; and Mr. Bryant, the first student to receive a forestry degree from an American forest school, who leaves a position with the New York State Fish, Forest and Game Commission. From the United States Bureau of Forestry Capt. Ahern secured the services of Messrs. Hareford and Griffith and of Mr. S. N. Neely, a civil engineer.

The duties of these men will be of a varied nature. Briefly stated, their first work will be to learn what they have in the way of forest products, determine the possible uses of the woods, and to look up markets for the forest products. A stop, too, must be put to the illegal cutting and selling of the rich tropical woods. Under the present conditions much timber is cut on government land and no revenue paid on it. At Manila a laboratory for the study of timber physics and for wood-testing will be established, in which will be determined the values and properties of the many woods found on the islands. In addition, a botanical classification of the existing species will be carried on. There are at present 665 species classified and over 50 varieties of the rubber tree identified, but much work is yet to be done along these lines.

That the Bureau will be successful from a financial standpoint is evident from recently published figures: The Spanish Forestry Bureau at its best never collected over $12,500 per month (Mexican money). Under the American regime $8,000 (gold) per month was received at the very start while the total received in revenues during the first fiscal year was $199,000. At present the revenues are about $30,000 (Mexican) per month.

The Transpacific Cable.

The actual work of laying the British Government Transpacific cable connecting Australia with the home country via Canada will be begun toward the end of 1902. The manufacture of the various cables is well in hand. The Telegraph Construction and Maintenance Company, of Greenwich, London, is carrying out the contract. In order to complete the work within the specified time, the company is building a new cable-laying steamer which will be the largest cable-laying vessel afloat. The total length of the cable, including 10 per cent allowed for "slack," will be about 8,000 nautical miles. The longest span is that from Kelp Bay, on the south coast of Vancouver, to Fanning Island—about 3,561 miles. The shorter sections are from Fanning Island to Suva Fiji, 2,093 miles; from Fiji to Norfolk Island, 961 miles; from Norfolk Island to a point near Brisbane, Australia, 834 miles; and from Norfolk Island to the northern end of New Zealand, 537 miles.

The time taken by an electrical pulsation to pass through a submarine cable increases with the length of the cable, in proportion to the square of the length. That is to say, if it takes the signal one second to travel 1,000 miles, it will take four seconds to travel 2,000 miles, nine seconds to travel 3,000 miles, and so on. But the speed also depends on the dimensions of the "core" and its insulation gutta percha, or india rubber. A thicker copper wire and coating of gutta percha gives a higher speed. The Vancouver to Fanning Island section of the Imperial cable will be "fast," owing to its heavy core, which weighs about 650 pounds of copper and 400 pounds of gutta percha per mile. Such a cable will carry seven or eight paying words a minute, and as it is the longest section, this will be the speed of "through" messages. For the shorter spans of the line smaller cores will suffice. The messages will be received on the "siphon recorder" and "mirror instrument" of Lord Kelvin. The "duplex" system of Dr. A. Muirhead, by which two messages, one from each end, pass through the wire at once, will be employed on the southern sections at least. Although this system nearly doubles the capacity of a cable it is not considered so advantageous for this cable as for others, owing to the fact that only a few business hours in the day are common to Great Britain and Australasia. It is anticipated, however, that there will be a certain amount of telegraphic communication between this country and Australasia, over this cable, in which event the adoption of the system will prove very convenient. Dr. Muirhead has recently improved his system by applying a "self-induction shunt," to the receiving instruments, which has the effect of "curbing" the signals, making them easier for the clerk to read, and increasing the speed of messages. Lord Kelvin has recommended the utilization of this appliance for dispatching messages, for the same purpose. Two repairing ships will be retained to maintain the cable in working order. There is some fear of earthquakes or landslips breaking the cable in the direction of Fiji. Not long ago the Eastern Telegraph Company's cable between Sydney and Nelson was bitten by a shark, in 300 fathoms, and so injured that it had to be recovered and a splicing made.

THE DUKE OF SAXE-COBURG-GOTHA'S COLLECTION OF NEFS.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Considerable anxiety is being experienced in England regarding the destination of the late Duke of Saxe-Coburg-Gotha's remarkable and extensive collection of model silver ships, or as they are technically called "nefs." The collecting of these picturesque and rare specimens of the silversmith's craft constituted his principal hobby. At present they are resting in the special airtight glass cases he had specially designed for their accommodation at Clarence House, his London residence. His assortment contains the finest specimens of this obsolete decorative plate extant. In the middle ages, when a sovereign desired to display his or her friendship to another monarch, the gift invariably comprised a nef. Consequently the demand for these curious examples of silver workmanship was strictly limited, and it is estimated that there are no more than sixty of them in existence. Their rarity may be adequately comprehended from the fact that very few European museums contain a single specimen, and even the British Museum, London, does not contain a solitary example. The Czar of Russia has a few specimens which are jealously preserved in the Kremlin at Moscow; there is also one in the Hotel du Cluny, Paris; another is exhibited in the Galeries du Louvre; and a few are distributed throughout the world in private collections. Those represented in the late Duke's collection, however, numbered forty-one examples—some of the largest and most beautiful nefs ever made. Why the art became extinct is inexplicable, unless it was due to the fact that this form of monarchical presentation fell into desuetude.

This peculiar craft was confined almost entirely to the silversmiths of Nuremberg and Holland, though the work of the former is generally conceded to be superior to that of the latter. During his lifetime the Duke retained two of the most skilled silversmiths in London to attend to them.

The most conspicuous specimen in the collection is that which was presented to the Duke of Edinburgh by the Elder Brethren of Trinity House, to commemorate the twenty-fifth anniversary of his holding the post of Master of this corporation. This nef measures 28 inches in length and was made in Nuremberg about 1650. It is a trading ship with two masts, and has a large figure of Neptune seated in the stern, and a draped female figure forming the prow. The most salient characteristic of this work is the remarkable fidelity with which it is executed. The ropes and rigging, together with the sails and various appliances on the deck, and even the crew itself, are reproduced delicately in the solid metal. In this particular model the rigging is crowded with sailors furling the sails. One curious feature of this nef, and which may also be noticed in several others is that the captain is represented twice the size of a member of his crew, as if to assert his authority.

These pieces of plate were designed for utility. For the most part they were used as vessels for containing wine, the deck being either removable to allow the insertion of the bottle or else the hull is hollow to permit the wine being poured therein, while in the bow is a small orifice through which the liquid can be withdrawn. Some were intended for containing sweetmeats or other table delicacies. Owing to their immense size and corresponding weight, they were mounted on small silver wheels, richly pierced and chased to facilitate their movements upon the table.

The hull was invariably heavily embossed with an appropriate design, nautical in subject, and at times further embellished in gilt. The nef presented to the Duke of Edinburgh bears no such picture, however, but is beautifully engraved with a scroll design. The sails are made from thin sheets of silver and are bellied as if with the wind. This specimen was evidently intended purely as a table decoration, since it contains no provision for holding wine or other delicacy, the deck being quite open.

Another prominent nef represents a three-masted vessel in full sail. The crew may be seen replete in their military uniforms; from the portholes project miniature guns, exact facsimiles of their prototypes, while small cannon are distributed about the deck with the gunners standing beside them. This specimen is of Dutch origin, dating from the year 1600. The arms of England are emblazoned upon the sails, and also heavily embossed upon the body of the ship itself.

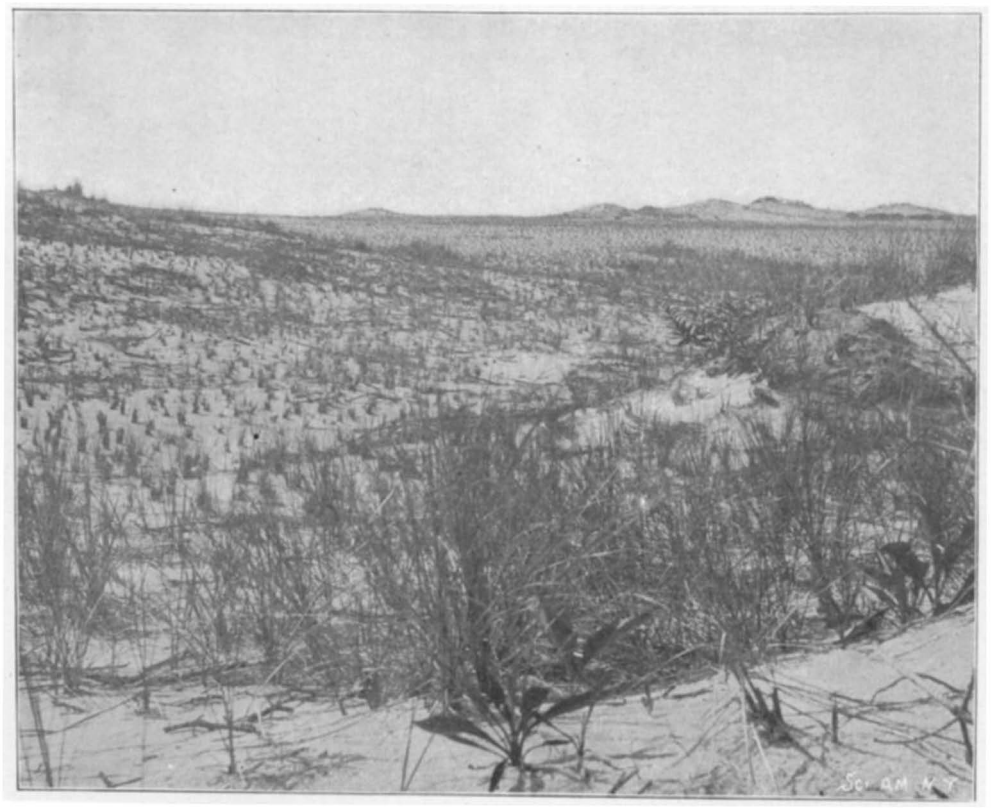
The fighting merchant vessel is also represented, and in this instance the sailors manning the deck can be recognized as of English nationality. Although not so large as the two previous models, it is a far more artistic piece of work. The hull in this instance bears a pretty representation of the figure of Neptune accompanied by tritons and dolphins. It is dated Nuremberg, 1700. This vessel was intended for holding sweetmeats. On the bridge may be seen the captain shouting his commands. Two conspicuous features of this example are the real compass with which it is fitted in front of the wheel—which was

probably added at a later date—and the airshafts upon the deck. This is the only vessel in the whole collection containing the latter fittings.

A third war vessel shows the ship cleared for action. It has four masts, and the diminutive crew on the deck are carrying baskets of ammunition to the guns, while the gunners are standing with the sponges in their hands to clean the muzzles after the discharge. The captain is provided with a telescope with which he is scanning the horizon, and in the crow's nest are the sharpshooters or lookout men. The design on the hull depicts Venus rising from the sea with a host of Cupids. This example is Dutch, as may be determined from the bizarre horned mask with a protruding tongue from which the wine could be poured, constituting the figurehead. The model contains no hallmark, however, so that it is impossible to locate the date of its manufacture.

Although the majority of these nefs are mounted upon four wheels, some of them were treated much more fancifully. One is a single-masted ship with the deck merging into a huge shell. This specimen, which closely resembles our present-day bonbon dish, is mounted by means of a slim stem, comprising sea horses attended by boys, upon a tall stand, and measures twenty-four inches in total height. The sails are emblazoned with the arms of the Scottish lion and the French *fleur-de-lis*, respectively, interwoven. From the peculiarity of the figures on the deck it is surmised that they are supposed to represent Ferdinand, Alonzo, and Sebastian, while the winged figure on the mast is Ariel raising a storm.

The most modern example in the collection is inscribed with the year 1746, and was made at the town of Maestricht. It is not till one has closely examined the workmanship of the models that one can realize the immense amount of time and labor that must have been expended upon them. Without a doubt they are the finest specimens of silver carving and chasing in existence. The Nuremberg and Dutch silversmiths of the sixteenth and seventeenth centuries, to which period these nefs belong, were unrivaled in their skill and artistic taste, as this work abundantly testifies. It is mooted that the present Duchess intends bestowing them to the British Museum as a gift to the English nation. At any rate, it would be a matter of regret if such a unique collection should be permitted to be broken up and distributed in various directions.



INTRODUCTION OF DUNE GRASS TO PREVENT THE DRIFTING OF SAND.

THE SANDS OF CAPE COD.

BY L. P. GRATACAP. NATURAL HISTORY MUSEUM, NEW YORK CITY.

Cape Cod, the long forearm with clenched fist that holds back the surges of the Atlantic from Boston Harbor, is a sand ridge covering tertiary clays, mingled with alluvial material and vegetable débris, and sparsely covered with woods. Its surface is irregular, made up of groups of low hills separated by depressions, inundated swamp country, and broad long plains supporting a thin herbage. There is enough nutriment in the sands assisted by the rainfall to bring to maturity the more common fruits, and vegetables flourish, in some places perhaps precariously, upon a soil ninety per cent of which is pure silica.

It is an interesting region geologically, and, apart from its pictorial interest, furnishes the tourist with abundant opportunities of observing the shifting nature of sandbeds, and the topographical features their movements create or destroy.

The rounded extremity pushed eastward by the winds, or driven northward, forms a wide two-horned head or spit behind which a sea of little hills recedes from the shore line, surrounding Provincetown and blending into the "peaked hill" district, and the rolling plateau of North Truro. Dr. Julien has recently laid before the New York Academy of Sciences the results of his study of this capricious landscape, and the sands that give rise to its protean character. He remarks upon the obvious contrast between the sands of the Cape and those of the Atlantic coast southward. The former are almost pure silica, while in the latter there is a greater prevalence of garnet iron oxides, and in the sands of Staten Island, as the writer has noticed, of serpentine feldspar and even mica. The Cape Cod sands have been longer exposed to the separative action of wind and water, have undergone far more violent intervals of translation, and are less immediately subject to replenishment from continental drainage.

Dr. Julien notes the preponderant recession of the tops of the bluffs, observing that "a very large part of the damage has been done by the violence of the wind, reinforced by vast quantities of sand and spray lifted up and hurled continuously for hours against all opposing objects." At the Highland Light, North Truro, this is evident, but it can be in a measure also accounted for by the firmer barrier presented to the sea in the basal beds of more or less consolidated clays. The writer has noticed a process of detachment along the planes of contact between the sands and the underlying clays. Water penetrating the sand layers oozes out on the face of the cliff at the junction of the clay and sand, and, if the clay has a seaward dip, the superincumbent sands slip, by levigation, over the clays and spill outward on the beach, to be later carried away by wind and water.

The rapid movement of the sand, its constant volatility, under the influence of strong winds, is a menace to the harbor of Provincetown, where broad shoals and bars have been formed by its recurrent deposition. The Cape Cod Railroad also suffers from its mobility. The national government has, in recent years, attempted a systematic repression of this instability of the sand by planting over broad areas dune grass (Spartina) in regularly separated and alined bunches and covering the farmed area with pine boughs carrying cones. The rotting and dispersion of the grass, reinforced by the occasional dropping of the pine seed and its development was expected to furnish a substantial remedy for overcoming the unstable sands. It has proved a success. The illustration shows the long distances of sand, between the high hill, past the water station at Provincetown, and the Race Point Life-Saving Station, covered with the planted grass.

In the "peaked hill" district on the road to the life-saving station at that point is a desert of sand lying between elevated summits almost invariably topped by grass. These summits seem anchored by the grass, and form resistant points around which the sand accumulates. The extension of the government work is watched with interest. Its practical benefits will be great, and, as a demonstration, under the most obstreperous conditions, of the steadying effects of vegetation upon large non-coherent bodies of sand, subjected to the most powerful impacts of air, of great importance.

THE DUKE OF SAXE-COBURG-GOTHA'S COLLECTION OF NEFS.

The Rome correspondent of The Morning Post reports that, after several months of experiments and trial trips, the electric railway between Milan and Varese has been opened to the public. The railway, which is 90 kilometers (about 46 miles) in length, is the first line in Italy to be built on the "third-rail system." It consists of a double line of ordinary rails, between which runs a single conductor rail raised about a foot from the ground on earthenware insulators. The cars, which are about 40 feet long, are not unlike those of the Central London Railway, though they are somewhat more spacious. Each car is furnished with four projecting arms, at the end of which is a steel brush in contact with the conductor rail. On the journeys from Milan to Varese the arms to the right of the cars are in contact with the rail, and on the downward journey the left arms are in contact. At the level crossings the conductor passes underground, but as none of the crossings are 40 feet wide, the car remains in constant touch with the rail by means of its fore and aft arms. Under the car is placed an electric motor, and each car is furnished with an electric air pump for the Westinghouse brake and the whistle. The current is furnished from a station on the banks of the Ticino, where it can be generated either by water or by steam power, as the railway company has duplicate plant in case of a breakdown. Both plants dispose of 11,000 horse power. The current is conveyed from the generating station to the third rail by an elevated cable. Each car conveys 73 persons, and covers the distance from Milan to Varese in an hour. Departure takes place from Milan and Varese every 15 minutes.

Mr. J. Pierpont Morgan has purchased Raphael's Madonna of San Antonio for $500,000. This is the highest price ever paid for a picture, and the painting, which has been on the market for a number of years, is far from being one of Raphael's best. This sale naturally raises the question, What would a masterpiece like the Sistine Madonna sell for? Mr. Morgan is also said to have purchased the Psalmorum Codex, printed by Füst and Schoeffer, in 1459, for $26,000.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

CULTIVATOR.—GEORGE W. HENRY, Oil City, Pa. The cultivator comprises handles supported by a traction-wheel. At the forward portion of the handles, cultivator-teeth are arranged, between which and the traction-wheel is a driving connection. A rod is extended from the shaft of the traction-wheel; and with the rod a frame has swinging connection. A protecting hood is connected with the frame. During the forward movement of the machine, the hood will ride upon the ground; and the swinging connection of the frame with the rod will permit the hood to adjust itself to the formation of the ground.

FEED-REGULATING DEVICE FOR GRAIN-DRILLS.—ROBERT H. SCHLACHTER, Clay Center, Neb. The invention provides a means whereby the amount of seed delivered from the discharge-opening of a grain-drill feed-box can be simply and accurately regulated. A threaded sleeve is employed, through which the shaft carrying the feed mechanism passes. The sleeve, when turned, shifts the shaft and the feed mechanism across the discharge-opening of the feed-box, thereby regulating the amount of seed fed with the utmost nicety.

Tools and Special Implements.

DEVICE FOR CLEANING WATCH-MOVEMENTS.—JOHN J. HIGGINS, Duquoin, Ill. This simple device is especially adapted for cleaning any watch or clock movement. The principle of operation consists in imparting a rapid alternating motion to the device in the presence of a cleaning compound or liquid, and for holding the parts to be cleaned in such position that the compound will reach all faces or surfaces.

Vehicles and Their Accessories.

WAGON-BRAKE. — THOMAS CALLISTER, Queens, Borough of Queens, New York city. The inventor has found by practical experience that brakes having their main parts supported entirely on the axle are objectionable, because by their shaking in the joints with every rise and drop they rattle and get out of order. The present invention provides an improved form of brake which will be effective for securely holding the wheels of a heavy wagon when descending a hill, and in which the rear or actuating lever and all joints, except one, are supported by the wagon body, and are relieved through the medium of springs of much of the jarring and shaking.

Railway Appliances.

SEAT.—FREDERICK H. JANSON, Brooklyn, New York city. Combined with a base are a reversible seat, a back, and a member on which the back is carried. By means of a pivotal and slidable connection the member is mounted on the base. The member, moreover, has a part movable into engagement with a part of the base to hold the member. Between the member and the seat is a connection whereby the seat is reversed. The construction is such that the seat and back can be easily mounted reversibly.

COUPLER.—CHARLES A. MCKERAHAN, Wilmerding, Pa. The coupler is of the Janney type, and has for its object to provide novel features of construction which render the parts very reliable in service, adapt them for automatic connection, and afford means for their safe detachment from either of two cars coupled together. Owing to the simplicity of the improved car-coupling and its peculiar construction, great strength is obtained with a minimum of weight.

Miscellaneous Inventions.

HATCH-COVER. — WINFIELD W. DAWLEY, Geneva, Ohio. Mr. Dawley has devised a hatch-cover, which, when battened down, will hermetically seal the hatch, and which, though it be of large size and great weight can be lifted readily from the hatch-coaming by means of a cable passing over a post and connected with a windlass.

APPARATUS FOR AERATING WORT AND IMPROVING THE QUALITY OF YEAST.—MAX WALLERSTEIN and HANS H. FREUND, Manhattan, New York city. By the use of this apparatus wort is aerated with filtered air in any desired quantity during fermentation with the result that yeast of healthy growth and great purity is obtained. As the quantity of air introduced is very small, it is possible to aerate the wort even when the yeast is in vigorous fermentation—an end which, although of great importance, has never been hitherto attained, since the wort would overflow.

NECKTIE-FASTENER. — ERNEST KIENE, Spokane, Wash. The fastener is composed of a strip of spring metal constituting a neck-band. One end of the strip is turned for a short distance within the band. In the upper edge of the turned portion a notch for engagement by the shank of a collar-button is provided. The device holds the tie properly in position and permits its ready removal.

METHOD OF MAKING HYDROGEN DIOXID.—PAUL L. HULIN, Clavaux, par Rioupéroux, Isère, France. The process enables oxygenated water to be made upon a commercial scale by the direct employment of sodium dioxid. The sodium dioxide is decomposed by hydrofluoric acid in the presence of water to form hydrogen dioxid, and the sodium is converted into an insoluble precipitate of cryolite by aluminium fluorid.

SCREEN-DOOR FASTENER.—WILLIAM B. COCHRANE, Pocatello, Idaho. The purpose of the invention is to provide a door-fastener for holding a spring-door completely closed, and yet permitting the door to be pushed open without using the hands. The simple device which the inventor has patented to attain his purpose is of such construction that the door can be secured in closed position at any time desired.

STOPPER FOR BOTTLES.—JACOB A. MOLLER, Jr., Brooklyn, New York city. The stopper is of the ball or rotary type and is especially adapted for sauce and cologne bottles. The stopper can be made to close the mouth of the bottle tightly, and can be quickly brought into position to discharge the liquid contents of the bottle either from a point at the central portion of the mouth or at any point at either side of the center.

DOUCHE-BENCH. — THOMAS F. MCCULLOUGH, Memphis, Tenn. The bench has a frame; a leaf; a leg intermediately pivoted on the frame and arranged when in operative position to engage one end with the leaf to hold it raised; and a hinged extension on the end of the leg. The bench can be folded and stored away in a small space.

DEVICE FOR SMOKELESSLY HEATING INSECT-POWDER.—JOHN C. SEARLE, Hilea Kau, Hawaii. The device can be applied to a lamp-chimney, gas-globe, or the like, and is adapted to contain a powder, the fumes of which have a destructive effect upon mosquitos. The device is applied to the lamp so that the powder is roasted and not consumed by the fire, thereby obtaining fumes noxious to insects and yet free from smoke.

BUSTLE AND HIP EXTENSION.—MARY E. WETHERELL, Boston, Mass. The subject of the invention is a new and improved bustle and hip extension arranged to give the desired hang and fulness to the skirt. The bustle, hip portions, and hip extension portions are all fastened together at their middle and extend one outside of the other.

GRAIN-ELEVATOR.—PAUL BÉDARRIDES, Rue de la Verrerie 4, Paris, France. The grain is elevated by means of a vacuum obtained by an ejector of steam in a separating chamber, where the blast of air which carries forward the product is separated. The novel application of an ejector of steam to produce the vacuum in the suction-pipe offers great advantages over the pumping apparatus which might be used for the same purpose; for a uniform suction is produced, which can be easily regulated at will.

COMBINED HEATER, COOLER, AND STORAGE BASKET.—NONNA FERNER BONIFACE, P. O. Box 95, Madison Square Branch, Manhattan, New York city. Mrs. Ferner Boniface is the inventor of a combined heater, cooler, and storage basket for containing filled and empty nursing bottles and other articles and food products, as well as fuel. The arrangement permits the convenient heating or cooling of the milk in the nursing bottle. The entire basket is portable and is of special service during a railway journey, or during a stay at a hotel. A supply of milk or food can be kept on hand, hot or cold, for immediate use by invalids or infants. That the basket is also serviceable for outing parties goes without saying.

PROCESS OF REFINING OILS.—FRITZ LINDE, Dortmund, Germany. This process of treating rape-seed oil and other sweet oil consists in the following steps: adding 10 to 15 per cent of rich milk to the oil; heating the mixture and continuing the application of heat until a thick covering or layer is formed; and removing the layer or covering. The layer prevents the rising and boiling over of the liquid. The oil is purified and its odor and taste improved.

GARMENT-HANGER.—MARTIN H. BUSHNELL and BENJAMIN F. STARSKY, Hazelhurst, Pa. The inventors have devised a novel, simple and cheap garment hanger, which can be used to hang up men's or women's clothes. When not in use the hanger can be quickly reduced in length to permit its convenient storage in a small case.

FISH-TRAP.—EPHRAIM W. LIVERMORE, New Whatcom, Wash. The fish-trap is of the class designed to be floated in the water and anchored in proper place. In construction, the trap comprises a lead, a heart and a crib, with certain peculiar features of construction producing a trap efficient in every respect.

ANIMAL-POKE.—CLAYTON W. FORD, Findlay, Ohio. This simple and effective device prevents cows from butting or "jamming." The invention consists of the peculiar combination of a face-plate having a hooked upper end; a curved head-plate pivoted directly to the face-plate near its upper end; a spur or point forming a prolongation of the curved head plate; and a spring for forcing the curved head-plate away from the face-plate by butting. Pressure against the curved plate overcomes the force of the spring and causes the spur to be buried in the tender part of the neck of the cow.

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

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 2076.—For manufacturers of paper boxes for boxing screws, tacks etc.

For mining engines. J. S. Mundy, Newark, N. J.

Inquiry No. 2077.—For dealers in glass show cases.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 2078.—For makers of machinists' tools.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 2079.—For dealers in fireproof wood for building purposes.

Stencil Machines.—A. J. Bradley, 101 Beekman St. N.Y.

Inquiry No. 2080.—For manufacturers of machines for mixing baking powders.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 2081.—For dealers in gas for balloons.

Sheet metal stamping and light manufacturing. Forskell Motor Co., Anderson, Ind.

Inquiry No. 2082.—For parties engaged in constructing fire escapes.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 2083.—For makers of sand pumps and fixtures for the same.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 2084.—For makers of conjuring apparatus.

For sheet metal stampings and novelties try Standard Stamping Co., Seventh and Hudson, Buffalo, N. Y.

Inquiry No. 2085.—For makers of air compressors.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 2086.—For stone crushers for crushing sandstone into sand.

Are you looking for anything in bent woodwork? Write Tucker Bicycle Woodwork Co., Urbana, Ohio.

Inquiry No. 2087.—For manufacturers of novelties for the mail order business.

We develop inventions through their several stages, manufacturing for the market. Amstutz Osborn Co., Cleveland, O.

Inquiry No. 2088.—For makers of small locomotives of 2 or 3 horse power.

PATENTS FOR SALE. — Improved fishing nets for steam or sailing vessels; deep or shallow waters. M. A., Box 773, New York.

Inquiry No. 2089.—For dealers in cotton seed oil machinery.

Automobiles built to drawings and special work done promptly. The Garvin Machine Co., 149 Varick, cor. Spring Streets, New York.

Inquiry No. 2090.—For makers of mica machinery.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 2091.—For the manufacturers of the "Elgin Alligator Wrench."

Designers and builders of automatic and special machines of all kinds. Inventions perfected. The W. A. Wilson Machine Company, Rochester, N. Y.

Inquiry No. 2092.—For machines to cut and finish slats for Venetian blinds of about 38 inches wide.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 2093.—For dealers in the Phillips Morse Automatic Telegraph.

NOVELTIES. — Dealers and inventors of novelties should write with full particulars to J. W. Rowe & Co.'s Successors, 15 Aldermanbury, London, E. C., England.

Inquiry No. 2094.—For a firm or corporation with salable article used around steam plants, to give full control of same to a corporation for the New England States.

PATENT NO. 680,913 FOR SALE.—Incandescent electric light support. Light movable to any spot wanted. Simple and practical. Address Inventor, Box 48, Springfield, Vt.

Inquiry No. 2095.—For parties making an electric welding machine for welding bands of steel ½ to 1⅛ in. in width.

WANTED.—A first-class engineer to take charge of a Corliss compound condensing engine. Recommendation required. Apply Royal Bag and Yarn Manufacturing Company, Charleston, S. C.

Inquiry No. 2096.—For makers of castings for steam engines.

Wanted—Revolutionary Documents, Autograph Letters, Journals, Prints, Washington Portraits, Early American Illustrated Magazines. Correspondence Solicited. Address C. A. M. Box 773, New York.

Inquiry No. 2097.—For dealers in Java and artificial Indigo.

EXPERIMENTAL MACHINE SHOP.—We are not using our shops at present. Well equipped with lathes shaper, woodworking machinery, etc. Will rent use and power very low. Fine place for automobile work. Billings Clapp Co., Boston, Mass.

Inquiry No. 2098.—For a machine for printing on calico.

MANUFACTURER WANTED.—For patent shaft-governed high-speed engine, fully demonstrated, authentic tests. All machine works standarized for cheap production. Full working drawings and personal supervision if required. Address Y. K. E., at Horncastle's Advertising Offices, 61 Cheapside, London, England.

Inquiry No. 2099.—For dealers in weaving and knitting machines.

FOR SALE.—U. S. Patent No. 686,521. Device for oiling or tarring overhead cables. Parties familiar with this class of work will at once recognize the merits of this patent. Only device out. Large profits to investor. For particulars, address C. Larsén, Crockett, Calif.

Inquiry No. 2100.—For dealers in manual training tools.

WANTED.—Reliable, sober and competent foreman for machine shop department. Thorough mechanic, one who understands up-to-date metheds of producing work economically and handling men. State experience, give references and salary. Great Western Mfg. Co., Leavenworth, Kansas.

Inquiry No. 2101.—For soap molds, etc., for making soap.

WANTED. — One copy of Hendrick's Architectural Engineering and Mechanical Directory of the U. S. Estate of Henry Miller, 1 Barclay Street, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

February 11, 1902,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.

(Continued on page 129)

Duster for cleaning walls, etc., G. M. Bell.. 693,100
Easel back, H. W. Jones 692,857
Electric circuit controller, C. J. Coleman.... 693,110
Electric conductors, insulator or sheathing for, E. Witzenmann 692,960
Electric currents, electromagnetic regulator for, J. D. Ihlder 693,023
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Trousers, D. Present. 37,778
Typewriters, H. D. Carey. 37,798
Waists, Sablin Corset Co. 37,774
Watches, watchcases, and watch movements, Philadelphia Watch Case Co. 37,771
Whiskies, Hilbert Brothers. 37,794
Windmills, pumps, towers, tanks, and cylinders, R. G. Marcy Mfg. Co. 37,800

LABELS.

"Akins Dropsy Cure," for dropsy cure, W. Akins & Sons. 8,969
"Antigia," for medicine, J. F. Gibboney. 8,968
"Essex Brand Condensed Milk," for condensed milk, Hires Condensed Milk Co. .. 8,956
"Grid Iron Club Rye Whiskey," for rye whisky, Power & Drury. 8,961
"Harifoam Vegetable Shampoo Tonic and Dandruff Cure," for tonic and dandruff cure, Childs Drug Co. 8,964
"Home Brand," for canned salmon, Griggs, Cooper & Co. 8,953
"Home Brand," for canned lobster, Griggs, Cooper & Co. 8,954
"Karlsbader Hair Regenerator," for a hair regenerator, J. Mrazay. 8,965
"Kudros," for a beverage, A. M. Hellman & Co. 8,959
"Malt Pepsin," for chewing gum, Lidwell Gum Co. 8,955
"Proof Mark," for cigars, Schmidt & Co. 8,962
"Siempra Viva," for medicinal preparation, Rio Grande Medicine Co. 8,967
"Split Rock," for mineral spring water, Roewekamp Bros. 8,958
"Steeplechase," for whisky, M. Weisberg. 8,960
"Tar Heel Tonic and Blood Purifier," for medicine, C. D. Higgins. 8,966
"Tissera's Tea-Bu-Eis," for compressed Teas, V. L. Tissera. 8,957
"Vis Vitae," for a hair restorative, N. E. Smith 8,963

PRINTS.

"Armour's Star," for cured meats, Armour & Co 465
"Balanced Rations for Feeding Beet Pulp," for feeds and feeding stuffs, National Starch Co. 467
"Hoyt's 5c Cologne," for cologne, E. W. Hoyt & Co. 463
"Hoyt's 10c Cologne," for cologne, E. W. Hoyt & Co. 464
"Liebig's," for beef tea, Liebig Extract Co. 466
"Oriental Rug Weaving," for rugs and carpets, N. K. Davidyan. 462

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

NEW BOOKS, ETC.

HANDBUCH DER INGENIEURWISSENSCHAFTEN. Zweiter Band. Der Brückenbau. Dritte vermehrte Auflage. Die eisernen Brücken im allgemeinen. Theorie der eisernen Balkenbrücken. Bearbeitet von J. E. Brik, Th. Landsberg und Fr. Steiner. Herausgegeben von Th. Landsberg, Geh. Baurat, Professor an der Technischen Hochschule in Darmstadt. In erster und zweiter Auflage von Dr. Th. Schäffer und Ed. Sonne. Mit 186 Textfiguren, Sachregister und 6 lithographierten Tafeln. Leipzig: Wilhelm Engelmann. 1901. Pp. 374. Price, paper, $4.25.

We have had occasion previously, in these columns, to comment upon the first volume of the Handbuch. We regret that our very limited space prevents us from devoting to the second volume the extensive review which it deserves. The book is certainly one of the most exhaustive treatises on modern civil engineering that has come to our notice. Prof. Landsberg and his colleagues deserve the thanks of every engineer for the painstaking manner in which they have treated one of the broadest of modern scientific subjects.

HOW TO MAKE BASKETS. By Mary White. New York: Doubleday, Page & Co. 1901. 12mo. Pp. 194. Price $1.

The twisting and weaving of nature's materials, grasses, twigs, rushes and vines, into useful forms seems almost instinctive in man. Perhaps it came to him as the nest-weaving instinct comes to birds: for at first he used it as they do in the building of his house. In many parts of the world to-day wonderful examples of the basket-weavers' art are being produced, and basketry is also taking an important position in manual training, following the kindergarten, and enabling the child to apply the principles he has learned there. He still works from the center out, and weaves as he wove his paper mats, but permanent materials have replaced the perishable ones, and what he makes has an actual value. The present volume gives definite instructions for making baskets of all kinds, and with its aid the reader ought to have no difficulty in producing handsome designs. The baskets will be of permanent value.

ELECTRIC SEWING MACHINE MOTOR.—The instructions and numerous illustrations of details contained in this article will enable any mechanic of average ability to build an efficient motor that will operate a sewing machine. The cost of materials for this machine should not exceed five dollars. See SCIENTIFIC AMERICAN SUPPLEMENT, No. **1210.** Price 10 cents by mail, from this office and from all newsdealers.

WIRELESS TELEGRAPHY.—SCIENTIFIC AMERICAN SUPPLEMENT Nos. **1213, 1327, 1328** and **1329,** contain illustrated articles on this subject by G. Marconi. Additional illustrated articles by other authors are contained in SCIENTIFIC AMERICAN SUPPLEMENT Nos. **1124, 1131, 1177, 1192, 1217, 1218, 1219** and **1304.** These papers constitute a valuable treatise on wireless telegraphy. Price 10 cents each from this office. and all newsdealers.

HOW TO MAKE AN ELECTRICAL Furnace for Amateur's Use.—The utilization of 110 volt electric circuits for small furnace work. By N. Monroe Hopkins. This valuable article is accompanied by detailed working drawings on a large scale, and the furnace can be made by any amateur who is versed in the use of tools. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1182.** Price 10 cents. For sale by MUNN & Co., 361 Broadway, New York City, or by any bookseller or newsdealer.

SYNCHRONOGRAPH.—A NEW METHOD of rapidly transmitting intelligence by the alternating current. A full description of the interesting apparatus of Crehore and Squier. 13 illustrations. SCIENTIFIC AMERICAN SUPPLEMENTS **1114** and **1115.** Price 10 cents each. For sale by Munn & Co. and all newsdealers. Send for new catalogue.

Notes and 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.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
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.

(8529) J. A. B. asks: 1. Could you tell me how to wire in a transmitter on an opera stage with two cells of gravity battery, to not affect a 'phone (series) on the same line? A. You can connect the transmitter in the same manner as an extension is connected to be thrown in by a switch when wanted. 2. Is there such a thing as winding a permanent magnet so that there will be a current produced without using batteries? A. The telephone receiver is a permanent magnet wound with a coil of wire. By vibrating a plate of iron in front of the pole of the magnet, a current of electricity is produced in the coil of wire. The magneto call of the telephone is another arrangement for producing a current of electricity without a battery.

(8530) H. R. writes: I read recently with much interest a note in the SCIENTIFIC AMERICAN regarding a new system of wireless telephony discovered by an Englishman. Is it too early to ask for details of the invention, whether it is simple enough for amateur's use, and if it could easily be installed in an uncivilized country like this up here? We live 15 miles from the little settlement, and *much* need telephonic communication. The country between is nearly all bush, and running a wire would be expensive. Your paper is a most welcome visitor in these wilds, coming once a month. A. In the article to which you refer you have all that has appeared regarding the matter. Such inventions are not yet beyond the experimental stage. The Marconi system is probably equal to your demands.

(8531) J. R. asks: Would the current of a half-inch coil be dangerous to encounter? Would it kill a person? A. The current from an ordinary induction coil giving a half-inch spark would not be dangerous to most persons. By this we mean a coil whose largest spark is a half-inch long, and which is actuated by one or two cells of battery. If a coil were wound so as to carry in its primary a heavy current, and the secondary were wound with a wire which could carry a correspondingly heavy current, the shock from such a coil might be fatal. There is voltage enough in forcing a spark through a half-inch of air to force current enough through a man's body to kill him. A voltage much less than this is used in killing criminals by electricity.

(8532) Subscriber asks for the component and proportionate parts of a good welding compound. A. There is nothing better than borax and good management for welding steel of low grades or for welding tool steel to iron. Mixtures of ten per cent sal-ammoniac pulverized with the borax, also mixtures of iron filings with the above, have been recommended, and special compounds advertised. For iron to iron alone there is nothing better than clean white sand, and with difficult pieces a mixture of sand and borax.

(8533) H. E. G. asks: 1. What actually occurs when an alternating current is run through an electrolytic solution, using lead plates for electrodes? Theoretically, I know that no electro-chemical action should take place, but by experiment I find that by using for the anode a plate of, say four times the area of the cathode, a sort of plating process seems to occur and a small amount of solution is decomposed. A. Houston and Kennelly state in their book on "Alternating Currents," price $1 by mail: "Permanent electro-plating effects can be produced by alternating currents, when certain relations exist between the size of the article to be plated and the strength of the current." 2. How are the lamps connected in the large cars of the Metropolitan Street Railroad? I have noticed that a broken lamp does not affect the other lamps and that the dash and overhead sign lamps can be extinguished without affecting the remainder of the lamps, which would not be the case if they were in series. Have lamps with greater voltage than 220 ever been manufactured? A. The lamps in street cars, using 500 volts pressure, are arranged in multiple series, five in series of 100 volts each. If a series is not cut off by the breaking of any lamp in it, it may be that an automatic device is employed to cut in a resistance equal to lamp.

THE STEAM TURBINE; THE STEAM Engine of Maximum Simplicity and of Highest Thermal Efficiency. By Prof. R. H. Thurston. A valuable series of articles having cuts of some of the more efficient engines of this type—the Parsons', De Laval, Dow, etc.; with exhaustive tables giving the result of tests and much general data on the subject. Contained in SUPPLEMENT Nos. **1306, 1307** and **1308.** Price 10 cents each. For sale by Munn & Co. and all newsdealers

BABBITT METALS.—SIX IMPORTANT formulas. SCIENTIFIC AMERICAN SUPPLEMENT **1123.** Price 10 cents. For sale by Munn & Co. and all newsdealers. Send for catalogue.

RUBBER STAMP MAKING.—THIS article describes a simple method of making rubber stamps with inexpensive apparatus. A thoroughly practical article written by an amateur who has had experience in rubber stamp making. One illustration. Contained in SUPPLEMENT 1110. Price 10 cents. For sale by Munn & Co. and all newsdealers.

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SENSITIVE LABORATORY BALANCE.—By N. Monroe Hopkins. This "built-up" laboratory balance will weigh up to one pound and will turn with a quarter of a postage stamp. The balance can be made by any amateur skilled in the use of tools, and it will work as well as a $125 balance. The article is accompanied by detailed working drawings showing various stages of the work. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1184. Price 10 cents. For sale by MUNN & Co., 361 Broadway, New York City, or any bookseller or newsdealer.