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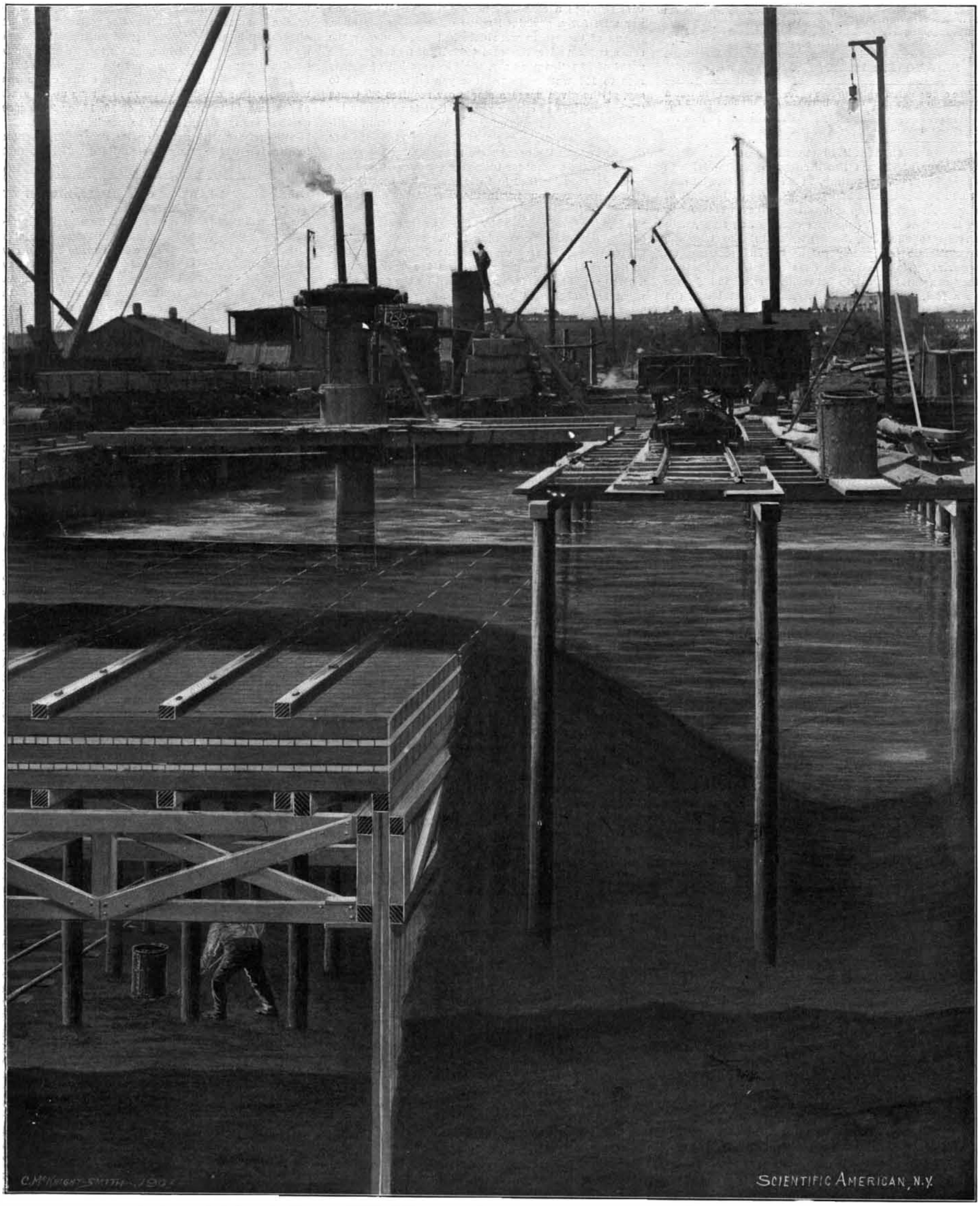

By this method an air-tight caisson is built on the line of the tunnel and the water is expelled by pneumatic pressure. The mud is then excavated and the cast-iron tunnel is built within the working chamber thus formed. Our illustration shows the excavation of the mud in progress.

CONSTRUCTION OF THE RAPID TRANSIT TUNNEL BENEATH THE HARLEM RIVER.—[See page 307.]

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NEW YORK, SATURDAY, OCTOBER 31, 1903.

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.

A TRANSATLANTIC CLIPPER SERVICE.

A lover of the sea has been prompted to write to the daily press, suggesting, in all seriousness, that it would be a profitable and popular move on the part of our leading steamship companies if they were to add to their fleet one or two passenger sailing ships, with a view to affording those passengers who take the transatlantic trip purely for health and pleasure, an opportunity to spend more days upon the ocean than they can enjoy in a trip between America and Europe on a fast, modern steamship. At the first blush, the suggestion that we should return to the leisurely speed of the clipper sailing ship, seems almost preposterous; and yet on second thought, when we bear in mind the wonderful growth of the yachting spirit, as shown by the vast fleet of sailing yachts and steam yachts that covers our waters in the summer season, the idea is by no means visionary; and, indeed, if put into effect to a limited extent, it would probably prove to be a very successful venture. To a large and ever-growing percentage of European travelers, the sea voyage is one of the greatest inducements to make the trip. With all our vaunted advance in speed and comfort, there is a question whether we have not sacrificed many of those very features of a sea voyage which tend to give rest to mind and body. The great demand for space for engines, boilers, and coal bunkers has made it necessary to cut down the stateroom accommodation to absurdly narrow limits—so narrow that not the most elaborate furnishings and finish can disguise the fact that the average stateroom is not much more than a stuffy little box in which one is veritably "cribbed, cabined, and confined." The compensation for many travelers is to be found in the short duration of the passage, and for those to whom time is an object, either for business engagements or to escape the inevitable miseries of seasickness, the cramped quarters are regarded as part of the price which must be paid for high speed. If a clipper sailing ship, however, were designed especially for transatlantic summer travel, it would be possible, in the absence of any provision for steam power or cargo, to give up practically the whole ship to passenger accommodation, and individual staterooms could easily be made double the size of those usually found on the modern liner. There would be a complete absence of vibration, and of smoke and cinders, and a general steadiness of motion which only those who sail the seas under canvas can properly appreciate. If the ship were built with modern speed lines, it should be able under favorable circumstances to make the eastward passage in from twelve to fifteen days. The westward passage would, of course, take longer; but as the travelers on such a vessel would be taking the trip largely for the sake of the sea voyage, a three or four weeks' journey would be looked upon rather with favor than with regret. Such a vessel would be fitted with every luxury that is to be found on the modern liner, and the absence of engine-room skylights and smokestack openings, would render it possible to provide magnificent promenades extending the full length of the vessel and almost entirely free from obstruction. The experiment is surely worth a trial on the part of one of the more wealthy companies; for it would be somewhat in line with that most successful venture of the German companies, in building steam yachts of slow speed exclusively for yachting cruises of many weeks' or months' duration.

WIND RESISTANCE IN HIGH-SPEED TRAIN SERVICE.

Just now the most interesting development of electric traction is its invasion of a field which was supposed to belong exclusively to the steam locomotive—that of long-distance interurban service. The success that has already been achieved in such service on the lines already built is naturally leading electrical engineers to consider the possibility of maintaining a regular long-distance service at speeds equal to those of the steam railway. Before such a competition can be successfully carried out, however, there are certain important elements of the problem, other than those of a strictly financial and commercial character, that must be fully recognized; and, perhaps, the most important of these is the question of wind resistance at high speeds, say of 40 miles an hour and upward. In a series of trials carried out two or three years ago on the Buffalo & Lockport electric line of the International Railway Company, it was proved that at the higher speeds it requires much more power per ton to drive a single car than it does per ton to drive a train of cars. Thus, it was found that whereas a train made up of several cars required a consumption of 47 watt-hours per ton per mile for a sustained speed of 75 miles per hour, if one of these cars were detached and run over the same track under the same conditions at the same speed of 75 miles per hour, the consumption of energy rose to 137 watt-hours per ton per mile. That is to say, at the given speed a single car requires 2.9 times the expenditure of energy per ton that is necessary for the same car if it forms one of a train of several identical cars. Now, assuming that the track, the weather conditions, and the speed were the same for the single car as for the several-car train, the engineers who made the tests were justified in their conclusion that the increased power necessary in the case of the single car was due almost entirely to air resistance. In other words, the work done by the car running alone and by the same car running in the middle or at the tail end of a train of cars was the difference, to borrow from bicycle parlance, between the work done at a given speed by a rider unpaced and by the same rider when he is behind the shelter of a pacing machine. That this view of the case is correct, is further borne out by the fact that the coupling of only two identical cars for a run at 75 miles an hour, showed that only 92 watt-hours per ton per mile were necessary, as against the 137 watt-hours required by a single car. This fact presents us with another parallel to bicycle conditions; for all of us who have ridden a tandem are well aware that, where two riders may be unable to make much headway against a strong gale of wind when they are riding separate wheels, they can make good speed if they couple up for united effort on a tandem. As a matter of fact, on level roads and a well-made track, by far the most serious element of resistance will be found to be the inertia of the air, and the higher the speed, the greater will be this resistance. The front face of a moving car has to open a path for the vehicle, and set the surrounding envelope of air through which it passes more or less in motion in its own direction. The car immediately behind it has no such head resistance to encounter, and is simply affected by the sliding friction ("skin friction" it would be called in considering the case of a sailing vessel), and, of course, the surplus power of the car is thus available to assist the leading car in overcoming the head resistance. Consequently, it follows that the longer the train, supposing the cars to be similar in weight, form, and power, the greater is the power available against head resistance and the less the expenditure of energy per car necessary to maintain a given rate of speed.

This fact will, of course, exercise a powerful influence in determining the character of future high-speed, long-distance electric service; and, where each car is a separate self-propelled unit, its tendency, because of the economies secured, will be to induce the companies to operate trains made up of several cars at long intervals, rather than run individual cars at more frequent intervals. The latter system would be the ideal one for the convenience of the public; but the cost, because of the larger amount of power that would be necessary, would probably render it impossible for the electric companies to compete successfully with the steam railroads. It must be understood that these considerations apply only to high-speed service; for up to speeds of 30 miles the difference in power required per ton per mile in running cars singly and in trains is so inconsiderable as to present no serious objection from the standpoint of economy to the operation of single-car service.

Another question to which proper attention has never yet been given, whether in steam railroad or electric railroad service, is that of the superelevation of the outside rail on curves. It is true that of late years engineers of maintenance of way on steam railroads have been showing a more intelligent appreciation of the necessity for superelevation; and on certain eastern roads where a high-speed service is to be maintained over a track with heavy curvatures, superelevation has been carried as high as 8 inches, with the very best results in safety and comfort of operation. Eight inches of elevation, however, is not by any means the maximum possible, and there is no physical reason why a train should not be run at 60 miles an hour around a 10-degree curve, provided the outer rail were elevated to the point at which the pull of gravity toward the inside rail balanced the centrifugal pull toward the outside rail. The trouble on steam railroads is that it sometimes happens that a slow passenger or freight train may, through the exigencies of traffic, be obliged to run at a low speed over the highly superelevated express tracks, and in such a case the component of gravity might be so far in excess of the centrifugal force that loaded freight cars with a high center of gravity would be in danger of capsizing to the inside of the track—and this has actually happened on some eastern roads. But on the high-speed electric road of the future, it will be absolutely necessary to take special precaution in the way of fencing in the tracks, and enforcing a very rigid observance of the block signal system; and these precautions will have to be arranged so that no train will have to slow up or stop upon any of the sharper curves. With the certainty that the electric train will be running at its maximum speed on such curves, it will be possible to give extreme superelevation; and by laying out the curves on what is known as the spiral system, where the curve commences with a one-degree curve and runs up by gradual increments to a maximum of 10, 15, or 20 degrees, as the case may be, it will be possible to maintain a 75-mile service with safety on the necessarily tortuous location on which many electric lines will have to be built.

PREHISTORIC DRAWINGS OF ANIMALS, ETC., IN THE CAVE OF ALTAMIRA, SPAIN.

Messrs. Emile Cartailhac and H. Breuil recently presented a paper to the Académié des Sciences relating to the discoveries which have been made in the cave of Altamira in the province of Santander. This cave was remarked in 1880 by M. Santuola as containing numerous debris of habitation and industry of the stone age, with paintings or drawings in red and black which represented various animals with great originality. At that time these cave drawings were the only ones which had been discovered, but in the last few years the discovery of several caves of the same kind in France has shown that the ornamentation of caverns by line drawings and paintings at an epoch as ancient as the quaternary is a question which should be carefully studied, and each new find will throw fresh light on the subject.

For this purpose Messrs. Cartailhac and Breuil made a trip to Spain and examined the cave very carefully during a month or more. The region is formed of cretaceous limestone and its aspect shows a considerable underground water circulation. In many places the cave has fallen in, especially in the front part, which is thus opened for a length of 800 feet. A series of narrow galleries branch off from the main cave. One of these is 150 feet long. The traces of prehistoric habitation are numerous, especially near the mouth of the cave. Here are to be seen most of the frescoes and drawings, which at first are almost all on the roof of the cave, and extend clear to the back. Their distribution is unequal and somewhat remarkable. Numerous small characters or signs drawn in black, and formed of points and lines, are to be seen only in the farther galleries and distributed without any order or appreciable significance. Five complicated figures drawn in black are observed side by side in the end of the last gallery. They have a certain analogy with the geometric decoration which is seen on the long Australian shields, made up of lines in a varied design. Numerous animal drawings are observed in all parts of the cave. Some of these are in black, generally of small size, 20 or 30 inches high, and are often indicated by a simple outline. Others are drawn in red dotted lines or in a broad line and are better executed, especially in the front cave.

Some of the most remarkable drawings are found superposed upon the former series and are consequently more recent; the latter are of larger size and have the appearance of frescoes. The exactness of the proportions and the correctness of the outline leaves but little to be desired. This perfection in the drawing is seconded by a good technique and the utilization of all the tints and effects which can result from a mixture or juxtaposition of red and black. The outline of the animal has been generally traced beforehand by a series of light scratched lines, in which the drawing of the feet, the eyes, nostrils, and horns is most noticeable. These large drawings, from 4 to 8 feet high, are distributed over a ceiling 140 feet long by 35 feet wide. Often the natural relief of the stone and its projections, which are sometimes large, has determined the choice of the place and the character of the drawing, so that the whole or a part of the animal has the appearance of a colored relief. The animals are represented standing, running, or lying down, and their attitudes are correct as well as singular. Among the fresco drawings are noticed the Bovidæ, with the bison in the majority, also the wild boar, horse, deer, and others. In the line drawings the deer's head is the most numerous, also the wild boar, and a very fine deer's head with the horns well drawn. On the ceiling around the animal drawings are noticed a great number of curious red characters, and these seem to have a certain significance. Other

signs which are drawn in scratched lines, form a second class. These seem to indicate huts or dwellings made of branches of trees. More than 20 of these are seen in the first chamber. Near them are some silhouettes of the human figure of a primitive design and rather vaguely sketched, but they are remarkable for certain details which will form an interesting study for comparative ethnography. The gesture of the arms seems to indicate that of a suppliant.

As concerns the drawings, there is evidently a connection between those which are observed in the Altamira cave and those of the six caves which have been already discovered in France. The technical processes are about the same, and the same idea predominates in all, but the Altamira drawings are far superior in all respects. The fauna which is represented here does not show, like those of the Gironde, Dordogne, and Gard caves, different extinct species such as the mammoth, nor is the reindeer to be seen. But the same is to be noted in the case of the intermediate cave of Marsoulas. The species peculiar to the cold period of the quaternary, while proceeding in a southerly direction, do not descend as far south as the latitude of Altamira.

M. Salomon Reinach makes the interesting observation that the animals which are represented in these cave drawings are all herbivoræ, and there are no carnivoræ among them. These animals are, therefore, of the class sought for by the cave dwellers, who were hunters and fishers. The fact that these were the only ones to be drawn seems to show that the object of the primitive artists was to exercise a magic attraction upon these animals. The natives of central Australia also have the habit of drawing figures of animals on the rock or the ground, with the idea of increasing the breeding of such animals, and the carnivoræ are excluded from these drawings, as this would bring bad luck. The drawings observed in the caves of the Reindeer epoch seem to have an analogous character. They were not drawn in the leisure hours of the hunter simply for his amusement, but were talismans by drawing which he expected to have an increased game supply. During this very ancient phase of human evolution, religion (in the modern sense) did not as yet exist, but magic played an important part and was associated with all forms of human activity. M. Reinach adds that according to a letter from Prof. Frazer, of Cambridge, certain facts which were brought from Australia by Messrs. Spencer and Gillen, and which are as yet unpublished, serve to confirm this opinion.

THE GANZ SYSTEM OF ELECTRIC CANAL HAULAGE.

With the Ganz system of electric haulage, a monorail track is used, and this largely accounts for the low first cost of construction, while the lightness of the locomotive used in proportion to its output, occasioned by peculiar construction, undoubtedly has much to do with the excellent showing as to working cost per ton-kilometer. The Ganz tow locomotive was designed by Engineer Fabre, and two inclined pairs of axles are provided, instead of the ordinary horizontal axles usually employed with two vertical wheels.

In the construction of this locomotive there is an inclined wheel on every axle, and each pair of wheels embraces the rail head. Since there is only a single rail, another lateral wheel is provided to brace and steady the locomotive, this wheel operating upon the ground or towpath. By the inclined wheel arrangement, the rope pull is utilized to increase the adhesion, and it is also claimed by the engineers favoring this system, that the adhesion is still more increased by the wedging action upon the inclined axles, due to the weight of the tow locomotive.

The locomotive was designed for a three-phase current, the motor operating with current of a frequency of 50 periods per second; and on account of the high speed of the motor and the low speed of the locomotive, spur reduction gearing was employed. It is stated that at 15 periods per second, this reduction gearing would not be necessary, and the motor shaft could be direct connected to the worm gear driving shaft. Mr. Szasz gives the following as the fundamental qualities of this locomotive:

1. With the use of one rail, a very high coefficient of adhesion, and consequently a very light-weight locomotive. 2. The utilization of the tow rope for the increase of adhesion of the locomotive. 3. Proportional increase of the stability of the locomotive according to the effort put forth. Continuing, he gives the following data in reference to this locomotive:

"It rests upon one rail only, which differs little in shape from the ordinary Vignoles rail. The two oblique pairs of wheels embrace the lateral and top parts of the rail head, a little room being left on the top. The weight of the locomotive rests upon the four oblique axles, being carried on one side by a spring. The motor shaft is disposed horizontally, the motor being built into the locomotive frame. Each of the four axles is driven by the worm gearing by means of two endless screw shafts, which are operated from the motor by a spur gear. The lateral broad supporting wheel serves the purpose of bracing the locomotive and thereby insuring equilibrium. This wheel is fixed on the side facing the canal, as the inclined towrope tends to tip the locomotive in this direction. If the locomotive represented a rigid system, the force of reaction on the rails causing the adhesion could only be as great as the weight of the locomotive itself, apart from that small part of the weight taken up by the wheel. As the adhesion is to be increased by the wedging action of the weight, it has been necessary to provide for a certain mobility in those parts by which the weight of the locomotive is taken up and transmitted to the rails. For this purpose the locomotive weight can be shifted on the axles. The bearings of only two axles are rigidly built together with the motor, these two axles being on the same locomotive side. The axles on the other side are able to turn round the endless screw shaft, and the locomotive weight rests on this side, by means of springs on the axle. In this way the relative position of the axles and the motor can be shifted in axial direction, and besides the axles of the one side can move around the shaft. This mobility of the axles enables the weight to develop the wedging action."

The Ganz locomotive for towing in the electric system of canal haulage has a controller, a rheostat, main switch, and plug contact for manipulating the three-phase motor. The current is directed to the motor through a flexible cable and trolley contacts, the rail being used as the third conductor. The overhead line consists of two copper wires .314 inch diameter, and the pressure used is 500 volts. The two contact wires are located 11.8 inches apart, and are placed 19.6 feet from the ground. The two conductors are supported on wooden poles placed about 100 feet apart.

"HOME MECHANICS FOR AMATEURS."

Doubtless many readers of the SCIENTIFIC AMERICAN, and all readers of "Experimental Science," will be gratified to learn that the late George M. Hopkins left a posthumous work, to which special interest always attaches. It is not always, however, that a work of this character possesses equal merit with one entirely completed before the death of the author. As a rule, such work has not had the advantage of the final perusal and correction by the author. Such has not, however, been the case in the present instance, for "Home Mechanics for Amateurs" was completed before the author's death. The present volume contains much matter which has never before appeared in print, and some articles which have already been published in the SCIENTIFIC AMERICAN. The work will furnish abundant food for thought for the amateur, and will give him suggestions whereby he may pass many pleasant hours in his workshop. Mr. Hopkins was an expert mechanic, and one of his chief pleasures was to make experiments at his home in his well-equipped workshop and laboratory. The work described in the present volume is nearly all the result of experiments made by him during such idle hours. It was the intent of the author to make the present work as suggestive as possible. No complicated aparatus is required in carrying out the experiments described. Anyone with ordinary mechanical ingenuity, having a lathe and a few tools, can make most of the articles and try the experiments illustrated and described in the 370 pages of the book. It deals with Woodworking, How to Make Household Ornaments, Metal Work, Model Engines and Boilers, Home-made Meteorological Instruments, How to Make Telescopes and Microscopes, Batteries, Electric Lights, a New Electrical Cabinet, Electric Motors and Dynamos of Various Kinds, an Electric Furnace, a Recording Telegraph for Amateurs, and How to Make a Telephone. The book is profusely illustrated with 326 illustrations. It is hoped that "Home Mechanics for Amateurs" will prove helpful to as many thousands as has "Experimental Science."

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1452, contains the usual variety of instructive articles. Mr. Frank C. Perkins presents an illustrated account of the use of electricity on Alpine railways. The use of the Parsons steam turbine in steamships is a probability that is discussed at length. A simple method of finding the capacity and horse power of pumps is outlined. The Eisemann and Bosch systems of electric ignition are described and clearly illustrated. Mr. Alfred Hands, in an excellent paper, enumerates some safeguards against lightning. Prof. Robert H. Thurston concludes his thoughtful paper on the "Functions of Technical Science in Education for Business and the Professions." J. M. Macfarlane has much to the point to say on the relation of science to common life. The Demeny contour indicator is described and illustrated. An article on the self-electrification of radium will doubtless be received with interest. How a lecture-room thermometer can be made is told in a very instructive article. The usual trade, electrical, and engineering notes are also published.

SCIENCE NOTES.

It has been stated by an eminent authority that the cyanide process "has done more than all other recent processes combined for cheapening the production of various metals, increasing the gold supply of the world, and advancing the standard of our progress and civilization."

The first recorded attempts to apply cyanide to ore treatment were by an inventor named Simpson, of Newark, N. J., who patented a process in 1885, followed by a process patented by Jules Rae, of Syracuse, N. Y., in 1887. The first really successful cyanide process applied on a large scale was that introduced by the McArthur-Forrest patent of the same year.

Curator Lucas of the National Museum, who went to Newfoundland a couple of months ago to obtain a plaster cast of a whale, has succeeded in his task. The cast is said to be the largest in the world, and when completed will be shipped to the museum. Later it will be duplicated and a replica sent to the St. Louis Exposition. It is seventy-nine feet long.

Definite words are necessary, says Engineering Record, for the expression of definite ideas. Hence scientific terms have to be employed. A term has one definite meaning which does not change with time. The rush of affairs drifts words from their original meanings, as ships drag their anchors in a gale, but terms sheltered from common use hold to their moorings forever. The word *let*, for example, has drifted in two hundred years from meaning *hinder* until now it means *permit;* but the term *bisect* has remained unaltered in significance for centuries.

Since the American occupation of Cuba, yellow fever is gradually being eradicated. This remarkable sanitary change is due partly to the explosion of the old superstitious beliefs by the army surgeons and partly to a systematic extermination of the mosquito. Dissipating the common notion that yellow fever is a deadly filth disease, highly contagious, our army experts showed that yellow fever could be spread, and was actually spread, by the mosquito. Attempts at the extermination of the mosquito in Cuba have borne such fruitful results that it can hardly be questioned that in time the leading Cuban cities will be as free from yellow fever as our Southern ports.

The recent announcement of a mosquito destroyer is commented upon in Popular Science Monthly in no very uncertain terms. It is pointed out that the original paper published in Bulletin 13 of the Public Health and Marine Hospital Service hardly justifies the newspaper claims which were made for it. Dr. Stiles, the author of the investigation, simply discovered a new parasite of the mosquito, several of which were already known, and pointed out that these organisms might be of value in holding in check the mosquito plague. There are many technical difficulties in the way of a practical utilization of these "destroyers," and there was in the original article no intimation that the Public Health Service is breeding the germs in order to infect mosquitoes.

Charles E. Bessey of the University of Nebraska writes to Science of a cedar which he claims to be over one thousand years old, as follows: "In the Garden of the Gods, near Pike's Peak, Colorado, there are many large specimens of the brown cedar, *Juniperus monosperma* (Engelm.), Sargent, and in a recent visit to that place it occurred to the writer that these trees must be very old. On the 13th of August he was fortunate enough to find the stump of a recently-cut tree, on which it was easy to distinguish the annual growth-rings. These were counted for a section of the trunk, care being taken to select a portion in which the rings were of average thickness, and on this basis the number for the whole stump was calculated. In this way it was found that this particular tree was between eight hundred and one thousand years old. In other words, this tree was a seedling some time between the years 900 and 1100 A. D."

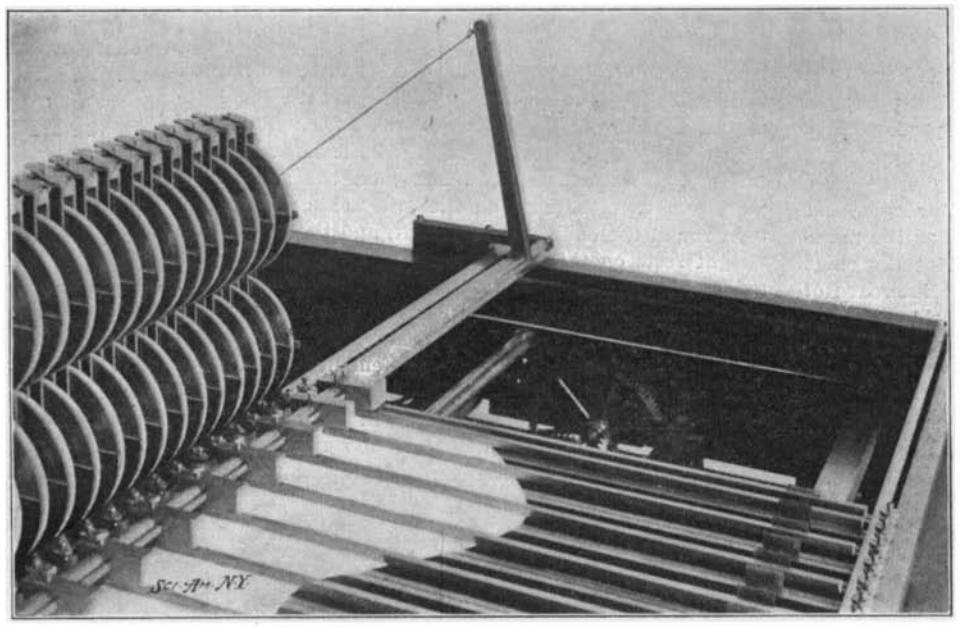
W. S. Hendrixson has studied the behavior of finely divided silver toward substances that readily give up oxygen such as chromic, chloric, bromic, iodic, and permanganic acids. In all the experiments silver was precipitated from an alkaline solution of silver oxide by formalin and afterward carefully purified. Both chloric and iodic acids are capable alone of oxidizing large quantities of finely-divided silver. Both acids react quantitatively upon silver, with the result that a molecule of the acid is completely reduced, and six atoms of silver are oxidized, one of which forms a halide, and five form silver chlorate or iodate. Bromic acid reacts in a similar manner. Dilute sulphuric acid alone is incapable of dissolving finely-divided silver, and the seeming solvent action is due to the oxygen of the air, oxygen dissolved in the acid, or to that derived from some external source. In the near future an attempt will be made by the author to ascertain whether, by excluding extraneous oxygen, the actual oxidizing power of a bichromate solution may not be very accurately determined with silver.

ANOTHER "LARGEST LOCOMOTIVE."

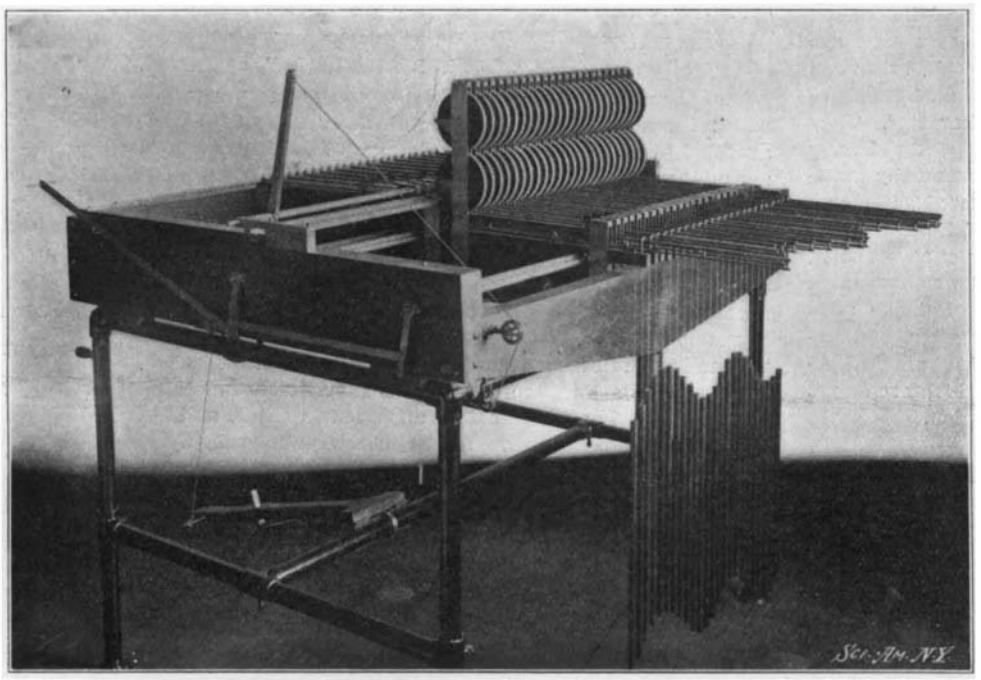
It was not so very long ago that the engineering world was interested to learn that a locomotive had been built that exceeded 100 tons in weight, and the engine was very properly regarded as a monster of its kind. Since then the power and weight of engines have increased by leaps and bounds until to-day we can present our readers with a view of a locomotive whose total weight when in working order is not far from 150 tons, or, to be exact, 287,340 pounds. The new locomotive was built at the Baldwin Locomotive Works as the first of an order for seventy locomotives for the Atchison, Topeka & Santa Fe Railway. These engines are of the tandem compound type, in which the high-pressure and low-pressure pistons are carried on a common piston rod, the high-pressure cylinders being placed forward of the low-pressure. The former are 19 inches in diameter, the low-pressure 32 inches in diameter, and the common stroke is 32 inches. There are 391 tubes, 2¼ inches in diameter by 20 feet long, in the boiler, which alone give a heating surface of 4,586 square feet. Adding the 210 square feet of heating surface in the firebox, we get a total heating surface of 4,796 square feet for the whole boiler.

The working pressure is 225 pounds to the square inch, and as the weight on the 57-inch drivers, of which there are five pairs, is 234,580 pounds, we find that the tractive effort is 58,645 pounds. The engine is carried on a forward pony truck, ten coupled drivers, and a pair of trailing wheels beneath the firebox, making fourteen wheels in all. The boiler is 6 feet 6¾ inches in diameter, and is built of sheets ⅞ and 15-16 of an inch in thickness. The firebox, which is built of steel, is 108 inches long, 78 inches wide, and 80¼ inches deep at the front, and 78¼ inches deep at the back. The total wheel base of the engine is 35 feet 11 inches, while the rigid wheel base is 19 feet 9 inches. The total wheel base for the whole engine and tender is 66 feet. The tank has a capacity of 8,500 gallons and the total weight of this huge engine, with its tender, is 225 tons. An interesting feature is the method by which the high-pressure cylinders are attached to the engine. They are held entirely by the front heads of the low-pressure cylinders, to which they are bolted, and a common piston valve, carried above the low and high pressure cylinders, does duty for both, the cylinders thus getting rid of the necessity for two pairs of eccentrics and valve gear.

Large as this engine is, it will be rivaled by another engine, which is being built by the American Locomotive Company for the Baltimore & Ohio Railroad. The weight of this engine will be about 2,000 pounds less than that of the Baldwin locomotive. Its peculiarity, however, lies not so much in the weight as in the novel system upon which it has been built (the Mallet articulated system), which has been used for many years with great success in France and Switzerland. The locomotive has practically two engines. The forward engine, which consists of two low-pressure cylinders, is carried on a separate truck, arranged to move radially below the boiler, and is held in place by a massive vertical hinge located just in front of the high-pressure cylinders, which are placed about the center of the boiler. Each engine is coupled to six driving wheels, which carry the whole weight of the locomotive.



A DETAIL OF THE MACHINE.



GENERAL VIEW OF THE ANALYZER OF PERIODIC PHENOMENA.

A MACHINE FOR FACILITATING THE ANALYSIS OF CURVES REPRESENTING PERIODIC PHENOMENA.

BY R. A. HARRIS.

The purpose of an analyzer like the one shown in the accompanying figures is to sum up into 24 partial sums the ordinates of a continuous record, or observation curve, with reference to any given period of time. For instance, the lunar, solar, or sidereal day can each be taken as a period with reference to which tidal records shall be summed for the purpose of analysis. The solar day is, of course, the period to be associated with several meteorological phenomena, such as the diurnal variation of the barometer, thermometer, wind velocities, etc.; also with the diurnal variation of the magnetic needle. The period being a day, or some fraction of a day, the 24 hourly sums form a complete cycle of values.

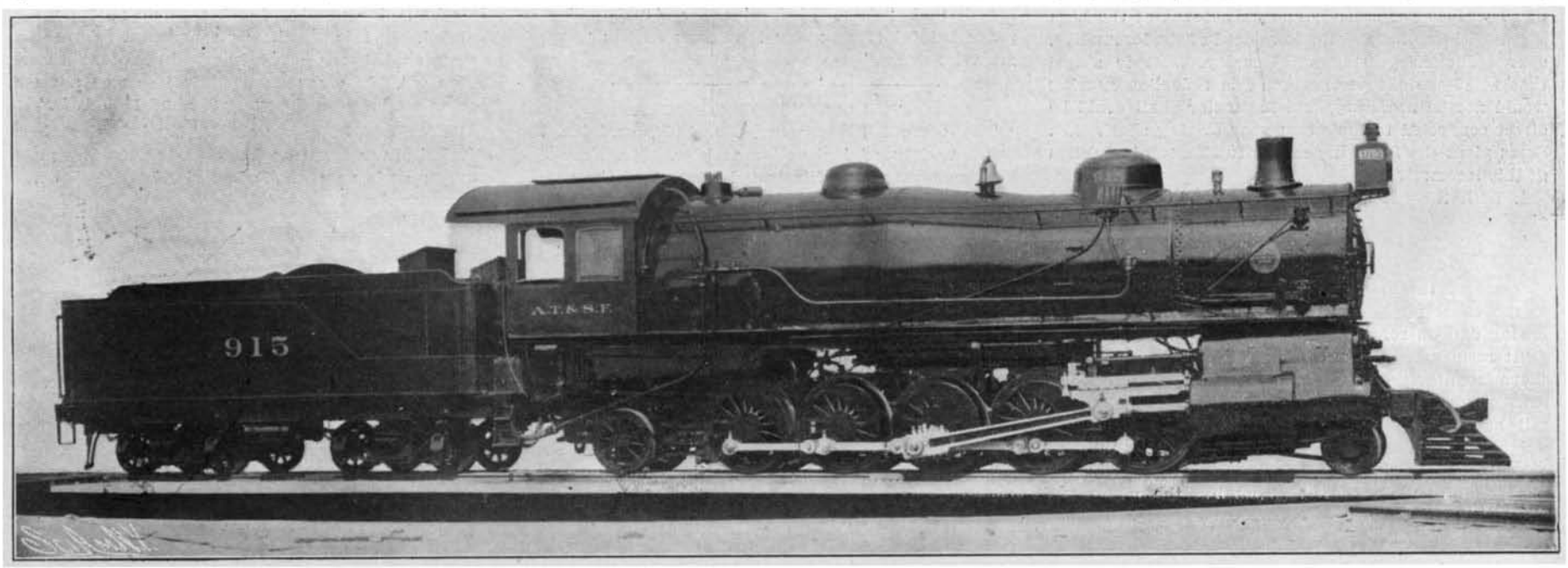
The machine consists essentially of 24 adding machines suitably mounted in a substantial frame. The individual machines are connected by jointed parallelogrammic frames or lazy-tong arrangements, which insure their parallelism and equable distribution over a length representing a given period. But to secure as great accuracy as possible, each machine, when in use, is clamped to fixed scales by means of thumbnuts, its exact position having been previously computed. The addition in each case is performed by means of a rack and a pair of wheels, the lower wheel having 200 teeth and the upper 199. The difference in their readings indicates the number of complete revolutions made by the lower wheel; the direct reading of the lower wheel shows the number of teeth in excess of multiples of 200.

The mechanism by which all racks are raised and lowered can be seen in the figures.

The "record," consisting of sheets of Manila, Bristol, or cardboard cut along the observation curve, rests upon a series of 24 grooved bars, through which slide indexes moving with the racks. The "record" is held in place by the weight of a series of bars, which are tilted up and down by aid of a treadle. The 24 racks are simultaneously drawn to their initial position by means of a straight edge mounted upon two comparatively heavy racks, which are driven by gears in the manner shown in the figures. The crank to which the necessary power is imparted is also shown. In the machine as constructed the racks and indexes can move forward and back over a range of 13.3 inches.

The dimensions of the main frame are 35 by 40 inches, inside measure. The distance from center to center of the adding machines may be anywhere from a little less than ¾ of an inch up to 1½ inches.

To operate the machine when once properly set, proceed as follows: Starting with the holders-up we first insert the first day's "record;" then lower the holders by unlatching the treadle; hoist the racks by pulling and latching the rod at the end of the frame; revolve the crank until a catch indicates that it has turned sufficiently; unlatch the end rod; revolve the crank back to its first position; raise the record holders by stepping on the treadle; slide forward the



Weight of engine, 148⅛ tons. Cylinders, 19 and 32 inches diameter by 32 inches stroke. Heating surface, 4,796 feet. Tractiveeffort, 29⅛ tons.

THE LARGEST LOCOMOTIVE EVER BUILT.

record and insert the record of another day. So proceed until the entire record has been passed through. It requires but a fraction of a minute to perform all of these operations upon a properly prepared day's record.

Forty-eight partial sums can be obtained by passing the record through twice, and 72 by passing it through three times.

In order to derive the full benefit from this mechanical treatment of the records, it is obvious that the instruments used in procuring the observation curves should trace the same upon tolerably strong boards, and not upon paper. Each sheet can then be cut in two along the curve; one portion of the sheet can be put away as an original record, and the other portion used upon the analyzer.

The advantage of this treatment depends largely upon the number of sum mations required for analysis. In the discussion of tidal observations, the number of periods used is about 20, and the saving of labor through mechanical additions should be much greater in this case than in the case of meteorological discussions.

TERMINATION OF THE NEW YORK-PITTSBURG AUTOMOBILE ENDURANCE TEST.

The 800-mile test of American-built automobiles, referred to in our issue of the 17th instant, was completed October 15. Of the 34 machines which started the first day, 20 succeeded in reaching Pittsburg on the date mentioned, and the following day 5 more concluded the run, thus making a total of 73½ per cent of the contestants who finally succeeded in getting their cars through. In view of the extremely bad weather encountered on the second and third days of the run, it is remarkable that such a large percentage succeeded in finishing. The very heavy rain storm which swept over New York city and a great part of New York State on October 8 and 9, and which was so heavy as to cause a precipitation of 10 inches, first came upon the automobilists about 10 A. M. during the second day of their journey, the second stage of which extended from Pine Hill to Binghamton; and the rain soon turned the roads into rivers of mud and water, through which the cars plowed as best they could, the majority of them doing so with considerable difficulty only by using their low speeds. The White steam tonneau, which acted as a pilot car, left Pine Hill at 6 A. M. for the purpose of scattering confetti along the route at all cross-roads, forks, or other places where the contestants were liable to miss the road. Being the leading car, it had a hard time, as the roads were soft from rain all the night before. The machine, however, overcame the adverse conditions, and reached Unadilla, 62 miles distant, in 7 hours. After its passengers had had dinner, they again started onward through the fast deepening mire, and finally arrived at Binghamton, 44 miles beyond, a little before 5 P. M. A Pierce "Arrow" machine, also acting as a pilot car, arrived just before the White.

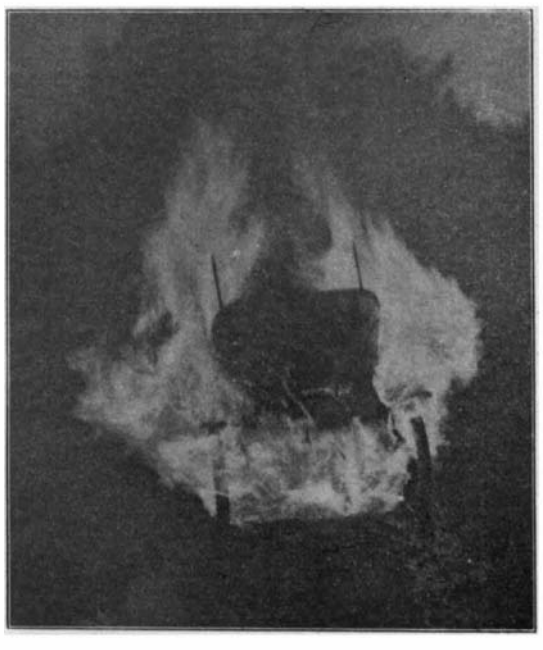
The first of the contestants to reach the noon stop, Unadilla, were the Stearns gasoline and the White steam tonneaus, neither of which had stopped throughout the morning's run. The third car, a double-cylinder Toledo tonneau, arrived at 1:54, and was followed at 2:18 by its mate, a four-cylinder car. The fifth to arrive was Oldsmobile No. 40, which also got in second at the night control at Binghamton. During the morning's run a Columbia touring car slid down a 7-foot embankment. A Toledo machine and a pair of horses, by their united efforts, pulled the car back on the road. The Phelps three-cylinder tonneau came to grief after covering about 30 miles of the day's run, due to the stripping of the driving pinion of the planetary gears used to produce the low speed; and the St. Louis single-cylinder tonneau sheared off a 1⅛-inch gear shaft while climbing a hill near Delhi. Its operator pluckily went to work and made a new shaft, which, with the facilities

The Automobiles Stored in the Official Garage at Pittsburg.

Knox Tonneau Arriving at Erie After an All-Night Run.

Helping Each Other up a Steep Hill.

Two Fredonia Machines Encountering the Flood Near Binghamton, N. Y.



A Franklin Machine Burning in the Rain.

TERMINATION OF THE NEW YORK-PITTSBURG AUTOMOBILE ENDURANCE TEST.

The report from the American consul at Tientsin describes the Chinese plow as very small and with but one handle and the mold-board having but a few inches of surface. It simply scratches the surface of the soil, and is frequently drawn by men and women. The Chinese have no conception of deep plowing, and it would be contrary to their traditional agricultural training to turn the valuable surface soil underneath.

afforded in a country town, was by no means an easy job; and, after a day's delay, the machine was under way again, keeping the road till it eventually finished at Pittsburg. This repair was one of the most noteworthy made during the run. About 20 miles from Pine Hill, in the vicinity of a place with the suggestive name of Andes, the automobiles experienced their first real hill-climbing test. Here between two and three miles of 6 to 8 and 8 to 15 per cent hills were encountered. Climbing these hills on the low gear at a speed of one to five miles an hour was tedious work, and here, as in many other places, the advantage of a three-speed gear became evident. The large percentage of low-speed work was especially wearing on the air-cooled motor machines having no mechanical cooling apparatus, while the Knox machines with fan-cooled (and, in this case, mud-and-water cooled) motors suffered especially from water and mud short-circuiting their spark plugs, which, though on top of the horizontal cylinders, were not, as they well might have been, waterproof. On account of these troubles, the three Knox machines did not reach Delhi, 35 miles from the start, till 2 P. M. They left there, preceded by a Franklin, two hours later; and, after 5 miles of hill climbing up 10, 12, and 15 per cent grades, the occupants of car 24 noticed smoke rising over the hillside where the road, curving, descended. A minute later they came upon the sight to be seen in the lower right-hand picture on the preceding page. The flames of the burning machine rose at first much higher in the air than the photograph shows, and made a great display in the dull light of the rainy afternoon. While all present were trying to extinguish the flames by splashing water from the ditch upon the burning wood, a rather faint explosion caused all to instinctively jump aside for the moment, until the discovery was made that a tire had been burned through and burst. As soon as the gasoline had been consumed, the burning wood was extinguished, and the machine was subsequently towed back to Delhi. The fire was one of those rare ones that sometimes occur on gasoline cars when the fuel tanks, carbureters, or piping are arranged over or near the muffler. Should a gasoline leak develop, the vapor or liquid is liable to come in contact with the burning exhaust gases. One of the surviving Franklin cars received its baptism of water just after leaving Bath. It broke through a bridge and was completely submerged, but its operator managed to get it hauled out again and to resume the journey.

The Knox tonneau and runabout spent the second night at Franklin, 17 miles from Delhi, to which place the former returned after experiencing a stuck transmission three miles beyond, and before reaching which the runabout stopped for the night with a bad rear tire. The Knox surrey returned to Delhi with a broken radius rod. It made an early start the next morning, and reached Unadilla in time to see the tonneau start from there the next noon. This machine and the runabout arrived at Binghamton the evening of the third day, just 24 hours behind time. The fourth day these two cars made only the 63 miles to Elmira, as they were detained by deep ponds over the road in two places. The machines were towed through one, and pushed up a rocky road on the side of a very steep hill in order to get around two others. Two Franklin machines caught up with them at this place, and all four cars entered Elmira together in a pouring rain, as usual, that evening. The Franklin cars were run all night and the following day (Sunday, the fifth day). They reached Buffalo Sunday night, and started for Erie the next morning with the rest of the contestants. Two Oldsmobiles reached Buffalo at 9:25 P. M. Sunday at the same time as one of the Franklins. The Oldsmobile Company was the only firm building machines of the runabout type, all of whose machines were on hand to start the morning of the third day, at Binghamton. Considering what they had gone through, this certainly speaks well for these light machines and the perseverance of their operators.

Including the White pilot car and a private White machine driven by Mr. Augustus Post, five White tonneaus completed the trying second day's run through the mud and rain. The White cars were the only steam machines in the run, and they entirely demonstrated their endurance and reliability.

The repairs made in Buffalo on the cars that rested there over Sunday were, in most instances, slight. A Columbia touring car skidded against the curb and broke its rear axle Saturday when a few blocks from the control. A new one was obtained from Hartford and put in place. One of the Franklin machines is said to have had a rear axle replaced also. The Toledo cars required new driving chains, on account of the excessive wear because of the mud.

Fifteen machines left Buffalo for Erie, Pa., the morning of the sixth day (Monday), and all arrived there safely shortly after noon. The Locomobile touring car, driven by its designer, Mr. A. L. Riker, who was accompanied by his wife, reached Erie at midnight. Mr. Riker had the misfortune to break his reverse gear about 12 miles east of Bath at 2 A. M. Saturday. He succeeded in obtaining new gears after a wait of 36 hours, and, although he lost two days, he succeeded in catching up with the run Monday night. The new reverse pinion of his machine broke just as he was backing out of the garage to start Tuesday morning, but he was able to remove the broken pinion and finish the run without further mishap, though minus a reverse. The Knox runabout and tonneau cars reached Bath Sunday afternoon. The latter replaced a broken radius rod at that town. It also ran out of cylinder oil, and, no supply being available, the operator was obliged to purchase and use, the following day, a poor grade of oil, which caused the pistons to bind and the cylinders to overheat, after which the machine worked poorly the rest of the trip, even though the proper cylinder oil was soon afterward obtained. These two cars reached Buffalo at 5:30 and 7:30 P. M. Monday, the tonneau breaking a second radius rod a few miles out. They were sent on the same night and arrived in Erie early Tuesday morning. The runabout's gasoline gave out 10 miles east of Erie, and the operator procured some kerosene and ran on that to the city. Bad luck still pursued the tonneau, as a roller bearing in the front wheel gave out at Painesville, 30 miles east of Cleveland, which put the machine behind again an entire day, while the runabout kept with the run. The Knox surrey caught up with the tonneau at Cleveland, and, although the two machines left there a day behind the other contestants, they finally reached Pittsburg only 4 hours after the control was declared closed, which was at 6 A. M. on Friday, the 16th instant, and the tenth day out. The way in which the double opposed cylinder surrey helped the similar tonneau car on some of the worst hills, thus relieving the mechanics from over-exertion, can be seen in one of the photographs, while another picture shows the latter car and its occupants after the all-night run to Erie. Decidedly the worst night run, however, was that experienced the last night, from Youngstown to Pittsburg. There were very steep clayey hills, made extremely slippery by thunder showers, and upon which it was next to impossible for the wheels to grip or a person to obtain a foothold. Both machines made a perilous descent down a steep, winding, and slippery hill into Beaver Falls, Pa., at 3 A. M., which thoroughly demonstrated the efficiency of lever steering aided by a good steering check and an equal distribution of weight, in preventing dangerous skidding. These two 2,500-pound machines completed the run without any tire trouble.

Among the last cars to reach Pittsburg were the two Fredonia machines, a tonneau and a runabout. A fair idea of what the cars that fell behind the second day of the run were obliged to encounter may be had from the photograph showing these two machines being towed through water, well over the hubs of the wheels, covering the road along a river bank. In an experience of this kind near Binghamton, the calcium carbide in a can in the tool box of the Knox surrey was attacked by the water so suddenly that the resulting heat ignited the acetylene gas generated, and the driver was badly burned when opening the tool box and throwing out the can of carbide. The machine in this instance, while being towed, ran off the road, and was submerged so that only the tops of the seats were above water. It was finally pulled out by a crowd of onlookers. New batteries and spark coil were obtained, and the car was run five miles on the railroad, across three bridges, in order to get around the pond.

The automobiles, upon their arrival in Pittsburg, were all placed in a garage, where a thorough examination was made of their condition. The report of the committee will not be out till November, but from the information at present attainable it appears that the nine machines which fulfilled all the requirements are, in their order of merit, as follows: No. 10. Two-cylinder Toledo touring car. No. 15. Pierce Stanhope fitted with single-cylinder De Dion motor. No. 6. White steam tonneau. No. 14. Pierce "Arrow" tonneau, fitted with two-cylinder De Dion motor. No. 5. White tonneau. No. 18. Single-cylinder Rambler runabout. No. 16. Single-cylinder Packard car that crossed the continent. No. 2. Four-cylinder Columbia touring car. No. 35. Double-cylinder Stearns touring car.

No such severe endurance test will in all probability ever be held again, and it is an encouraging outlook that so many of the standard American machines have been so thoroughly tried under the most unusual conditions, and even then have not been found wanting.

Death of Gordon McKay.

Gordon McKay died October 19, 1903, at his home at Newport, R. I. His inventions had a most marked influence upon the boot and shoe industry of the world. They closed the doors of the cobbler; but they supported large American factories. Mr. McKay peddled the stock of his first corporation from door to door. From the payment of the very first dividend the stockholders considered themselves wealthy men. Everyone who made American-made shoes paid tribute to Mr. McKay in the form of royalties.

Unconsidered Facts in the Art of Flying.

In spite of the universal interest felt in the art of flying, and the number of articles that have been written upon the subject, the public, and it may be said most of the workers in this line, have neglected some of the most important facts connected with the art. There are several ideas prevalent and generally accepted as facts that have retarded invention and have influenced engineers to work in wrong directions. First of these is, that the power required is enormous. The second is, that artificial flight has not yet been accomplished, and the third is, a general wrong idea of the essentials in construction.

Flying, from the figures available, may be considered the easiest of all methods of progression, calling for less horse power than any other. As a proof of this, take for example the case of the storks, which, in their annual migrations, make a flight between Buda-Pesth, in Hungary, and Lahore, in India. This, in an air line, is perhaps 2,300 or 2,400 miles, and the distance is accomplished in about twenty-four hours without a rest. A horse driven in a sulky a hundred miles in a long summer day is not far from the limit of endurance. Six hundred miles in a week is near the limit of a man in heel and toe walking. One thousand two hundred miles is approaching the record of the "go as you please gait." Among wild animals, 100 miles is about as much as can be found in the records for twenty-four hours, but the bird weighing anywhere perhaps up to twenty pounds, makes the 2,500 miles in twenty-four hours with ease and certainty twice in a year. If the weight is put at ten pounds, this equals 25 ton miles. On the best and most level railroad, and with carriages operating with the least friction, a ten-pound animal would find it difficult to haul 25 tons one mile in twenty-four hours. These birds fly at great heights, undoubtedly to reduce the resistance of the air. There are many other examples that might be given of long distances covered by heavy birds, showing the small amount of power required in flight. The immense speed of many of our birds when in ordinary flight is another proof of the small amount of power required.

The figures commonly accepted for the horse-power needed for mechanical flight, per pound of weight supported, are absurd when applied to birds. Taking the most liberal of them, we find that a 13-pound goose must exert a small fraction over one horse power when on the wing. Other figures have been published by experimentalists which would double this power for the weight. The machines which have actually flown have to some extent confirmed these figures, notably those of Mr. F. H. Wenham and Sir Hiram Maxim. There would be no escape from this conclusion but for the experiments of Mr. Marey. He found that the muscles of birds are not more powerful than those of terrestrial animals per square inch of section. This shows at once that there must be a mistake in the calculations, and that flying requires a minimum rather than a maximum of power.

Recently some doubts have been thrown upon some of the statements in regard to the speed of birds on the wing. The figures which have been given in regard to birds found in the Western States were obtained under conditions which insured great accuracy. The observations were made by government engineers making current determinations during surveys of western rivers. While watching their floats pass over measured distances along the "slues" or straight stretches lined with towering forests, they were provided with stop-watches and signals from station to station. As the ducks invariably follow the stream, in their flight from point to point, the observations were made with great ease and accuracy. This was done in the intervals of the current observations, and much valuable data obtained which would have otherwise been beyond our reach.

No animal, whatever its weight, a bird only excepted, can make any such speed as 90 to 100 miles per hour. Among the birds there is a long list of those whose speeds are from 80 miles an hour upward, their weights all being under 15 pounds. Parenthetically it may be remarked that naturalists will give dimensions of birds to an eighth of an inch, carefully spreading their wings and arranging the feathers, but it never occurs to them to give weights. The eagle may weigh 5 or 50 pounds, so far as the records show. Hunters rarely speak of the weight of birds, though the weight of game is often estimated and the weight of fish given to the nearest ounce.

The facts just given, when taken together, show pretty conclusively that the power necessary for animal flight is extremely small rather than very great. It also seems to be proved that to fly successfully the speed must be high.

In looking over the history of the art of flying, one is struck at once by the great number of persons who have accomplished flights of anywhere from one quarter of a mile to a mile by means of apparatus not

connected with a balloon. In a word, if we take the history as we find it, we learn of a great number of methods by which flight can be accomplished. What we need to know in this art is not so much how to fly, as how to alight with ease and safety. Experimenter after experimenter has found that after he had succeeded in flying, the cost of the repairs due to the accidents of alighting have put an end to his experiments. In other words, what we want to know is not so much how to go up as how to steer and how to come down safely.

Inventors are troubling themselves greatly in regard to balance and power. Lilienthal came to his death because he placed the weight too near the wing surface. Had his machines been arranged so as to bring his body six or eight feet lower, his wings would never have been upset in the air. The bird finds it easy to balance itself with its body, which is but a few inches below the line of the wing, but in the most complex air currents it is often in a condition which would wreck any structure not animate in every part.

It is strange how mistaken ideas of strength relative to weight, among engineers as well as laymen, prevail. Pine is stronger than steel, weight for weight, both in tensile and transverse strength. The bamboo probably exceeds in stiffness anything of the same weight that could be made in metal. The calculations show these facts, and Prof. Thurston's experiments, which have been more than once alluded to in the pages of the SUPPLEMENT, have demonstrated it beyond a doubt. The weak points of wood structures are in the joints. With proper attention paid to this feature, the structure of wood and wire becomes lighter per foot of surface than can be produced with metal.

HARLEM RIVER TUNNEL OF THE RAPID TRANSIT SUBWAY.

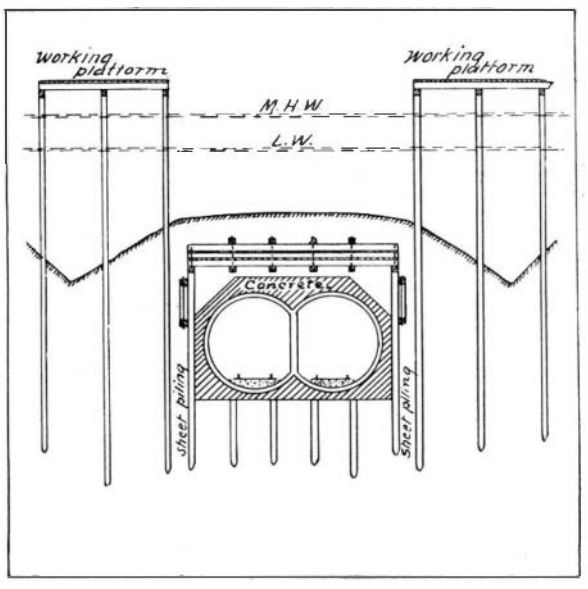
We present on the front page of this issue an illustration of a difficult piece of engineering work which has particular interest for two reasons: First, that it serves to carry the tracks of the new Rapid Transit Subway beneath the Harlem River; and second, that this tunneling has been carried out upon an entirely new system, and through about the most difficult material in which a tunnel could be built. The plans for the Subway called for a two-track tunnel at this point, and they left the character and method of construction of the tunnel open to the judgment of the contractor, the final decision as to whether the plan would be adopted being, of course, left to the Rapid Transit engineers. The work has been done by Messrs. McMullen and McBean, upon a plan devised by Mr. McBean, to whom we are indebted for courtesies in the preparation of the present article.

It was desirable, of course, in this tunnel, as in all tunnels passing below rivers, to keep the grade as near to the surface of the river bottom as possible, so as to avoid the use of heavy grades in the tunnel approaches. In the present case, however, the mud was so thin, weighing only about 80 pounds to the square foot and being of an almost liquid consistency, that the system of tunneling by means of a shield was practically out of the question. To have adopted it would have been to encounter the risks and accidents due to blowouts, which have made the present New York and New Jersey tunnel such a hazardous undertaking, and have rendered it impossible for the contractors to keep the tunnel in perfect line and level. The method used in the present case was to drive two lines of sheet piling parallel with the line of the tunnel, and wide enough to inclose the same; construct a strong roof of timber across from wall to wall of piling; and then, by means of pneumatic pressure and air locks, exclude the water and excavate the soft mud from within the tunnel caisson and build the tunnel structure, which is constructed, part of it of concrete and part of it of cast iron, within the working chamber thus provided. The construction of the caisson involved the driving of piling throughout the full length of the tunnel, and the piling, when cut off before commencing the construction of the tunnel proper, served to give a perfectly unyielding foundation upon which the completed work could rest, thus preventing the possibility of any future settlement.

In carrying out the work, the first step was to dredge out a channel to within about 6 feet of the sub-grade of the tunnel. Piling was then driven for two lines of working platform, one on each side of the tunnel. Next the supporting piles for the roof of the caisson were driven, each bent containing four piles, and the bents being spaced 8 feet from center to center. The duty of these piles was to support temporarily the timber roof; to assist in putting the transverse braces that held the side walls in line in place; and as we have said above, to give additional bearing to the finished tunnel. To preserve the two side walls of sheet piling accurately in alignment, a pair of continuous longitudinal trusses was used for each wall, the two trusses in each pair being spaced 12 inches apart, or the width of the sheet piling wall. To maintain the side trusses with their wall of piling at the proper distance apart, and preserve both walls in true line, a series of transverse trusses was constructed, which extended from wall to wall and reached almost to a contact with the longitudinal side trusses. Now, it can be seen that with the combination of these longitudinal and transverse trusses with the rigid line of piling, it was possible by the judicious use of wedges at the ends of the transverse trusses to keep the side trusses, and therefore the wall of piling, very accurately in line. The grade of the tunnel was also accurately determined by moving the cut-off circular saw upon a track supported on the working platforms, and giving this track the exact pitch or grade required for the tunnel. Then by moving the saw forward and maintaining always the same reach of the saw shaft, the cut-off of the piles necessarily presented the required grade for the finished tunnel.

The remarkable accuracy of the sheet piling and the tightness of the whole work is due very largely to the use of a compound pile which was designed especially for the work. This consists of three 12x12 sticks bolted together and driven as one pile, each three-fold pile being tongued and grooved to the next pile. The work was also greatly facilitated by the use of pilot piles, which were built of steel channels and plates and measured 12x12 inches in cross section. These were driven with the aid of the jet, and served to open the way for the wood piling. Moreover, by their use it was possible to detect the location and contour of bowlders, and when such bowlders were struck, it was only necessary to withdraw the pilot pile, blast out the obstruction, and drive the wooden pile.

The timber roof was built up, as shown in our drawing, of three transverse layers of 12 x 12 timber and two intermediate layers of 2-inch plank. The whole roof was well bolted and calked, so as to make it watertight. It was built in sections, varying from 40 to 130 feet in length, floated into place between the working platforms, and sunk until it rested upon the top of the sheet piling. The joint between the roof and the sheet



CROSS SECTION, SHOWING TUNNEL COMPLETED WITHIN THE CAISSON.

piling was closed by T-irons, and a very satisfactory air-tight joint was secured. About five feet of mud was then dumped upon the roof, to keep it down in place with a firm bearing.

It was necessary to maintain the Harlem River channel navigation during the prosecution of the work, and consequently, only half of the river was closed at one time. This involved the inclosing of the work by two air-tight coffer dams. In the portion of the work shown in our illustration, one bulkhead was placed at the city bulkhead line, and the other near the center of the river, the total length of the working timber thus formed being about 216 feet. Near the center of the roof of the caisson was built up a rectangular timber caisson with the usual air lock, and in this were placed the pumps for taking out the soft material of excavation. Cylindrical iron material shafts were also built in, as shown in our engraving, these being, of course, provided with the usual air locks. A pressure of 10 pounds to the square inch of air was sufficient for operation; but it can be seen that this method of tunneling would be available for any practicable depth at which it was desired to carry on excavation. The leakage of air from under the roof during the work has been very small, and it should be mentioned that a remarkable degree of accuracy was reached, considering the difficult and unprecedented method employed.

After the water had been lowered in the working chamber, the work of throwing out the mud and other material proceeded without any difficulties whatever, and when the excavation had been carried down to the desired level, the concreting of the floor was begun and carried up around the head of the piles. These were then cut off, and spikes were driven into them, so as to give them a good grip upon the concrete foundation. After several feet of concreting had been laid, the cast-iron lining was put in place, the concrete carried up around it, and the tunnel completed. There now remained nothing more to do but cut out the upper length of the sheet piling, remove the working platforms, and leave the river unobstructed for navigation.

It is claimed by Mr. McBean that the present system would be perfectly applicable to the North River tunnel; and that because of the fact that it would be possible to open the work at several points at once, the tunnel could be constructed more rapidly than by the shield method.

Reorganization Succeeds Organization.

Judging from the number of reorganization plans that have made their appearance within the last few months, the period of organization appears to have given way to the period of reorganization, in so far as it applies to industrial companies. Among the concerns that are going through plans of reorganization are the United States Shipbuilding Company, United States Leather Company, American Bicycle Company, American Ice Company and American Grass Twine Company. Other concerns are considering the question of reorganization, the plans of practically all of which provide for a radical scaling down of capitalization.

Commenting upon this situation, the Bankers' Monthly remarks that promoters admit the period of mushroom corporations is practically over. They say that any attempt to float a company with an overabundance of water in its stock would meet with dismal failure. Four years ago it was an easy matter for consolidations to sell their stock. The public, with enormous profits in view, was willing and eager to buy it, but the heavy shrinkage in values that the majority of the securities of new consolidations have experienced has resulted in a decided change in the attitude of the people. Most of the recent consolidations have been carried through by means of an exchange of the stocks of the constituent properties for that of the consolidated corporation. No new stock to speak of has been offered to the public for subscription.

If there were any lingering doubt of this change in the attitude of financial interests toward new enterprises, the recent low record prices established by the stocks of some very reputable companies would bring conviction. The troubles of the underwriting syndicate of the International Mercantile Marine Company is a case in point. Here is a company including such thoroughly established concerns as the White Star Line, the American Line, the Red Star Line and several other important shipping companies.

It does not appear that the capitalization of this consolidation is excessive, although every man has his own opinion as to that. The only cause for apprehension on this point is the failure of the company to furnish the public with any sort of information on which an estimate of the worth of the securities may be intelligently made. Brokers admit that to buy the shipping securities is much like the business of school boys when they trade pocket knives, "sight unseen."

And this, it should be remembered, is a consolidation of going concerns, owning property of immense, though uncertain, value. Its creation was the work of the very highest order of financial and legal talent, not to call it genius, which America has to offer. In other times new enterprises backed by the same interests have been received by the public with open arms and have poured millions into the coffers of their sponsors. And the public has not always known any more about these earlier projects than it does now about this one.

To see the public in a violently contrasting mood, it is only necessary to go back a year, to the International Power episode. That a company in the hands of speculators, pure and simple, with a very limited foundation of demonstrated earning power, should have been able to put its stock to 200 with ease looks now like a verdict of insanity against a whole community. It is with reason that the question is asked in Wall Street, Where are the lambs? Not half a dozen are to be found in a day's search, which fact alone is pretty good proof that they have developed into comparatively intelligent mutton.

One Hundred and Thirty Miles an Hour.

Amid the intense excitement of a vast crowd, consisting largely of experts, the Siemens electric train on October 23 achieved the record speed of 207 kilometers, or about 129¾ miles per hour, beating the record of the last previous trial by six kilometers.

After the recent trial on the experimental Marienfelde-Zossen line, near Berlin, when a speed of 125 miles an hour was attained, the engineers declared that this would be exceeded, and that a speed of even 140 miles an hour was practicable. The tests have been going on for several weeks, and are being watched with great interest by the Emperor William. The Reichstag has devoted the sum of 280,000 marks toward the cost.

BALTIMORE'S SYSTEM OF GARBAGE DISPOSAL.

BY DAY ALLEN WILLEY.

The question of disposing of the garbage which accumulates in large cities has been the subject of much study and, as is well known, a number of systems have been placed in operation, including not only sewage farms but crematories, also reduction plants. The latter plan appears to be especially favored, since by it most of the by-products of value can be secured from the refuse material. A plant has been recently constructed at Baltimore which in the opinion of sanitary engineers is the most complete of its kind which has yet been designed for this purpose. It has been in operation a sufficient length of time to demonstrate its capacity to dispose of all of the garbage collected in the city at present, while it is adequate to serve the needs of a larger community.

While similar in some respects to the installations in Philadelphia and Boston, the Baltimore plant embraces a number of new features. The system employed is widely known among engineers.

A notable feature is the comparatively small amount of space required. The site of the works is located on the harbor in the southern part of the city, so that the material can be brought to the place both by vehicles and scows especially constructed for the purpose. Tank wagons are used which regularly collect the garbage throughout the city. As fast as filled they are hauled to the plant and their contents dumped upon specially constructed scows, which are in turn emptied automatically by an endless conveyor operated by steam power. The first step in the reduction process proper is the thorough sterilization by steam of all the material in hermetically sealed chambers commonly called digesters. Of these there are twenty-eight, of a capacity of ten tons each, or 560 tons for the entire plant in twenty-four hours. This process is naturally one of the most important of the series. The garbage which is taken in at the tops of the digesters as received from the endless conveyor is treated to a steam pressure of 100 pounds, the steam being forced through pipes entering the bottom of the digesters. A temperature of 300 degrees is maintained until the sterilization is completed, when the digesters are freed from their contents by opening valves in the bottom, allowing the material to pass by force of gravity into reservoirs which connect with the several presses.

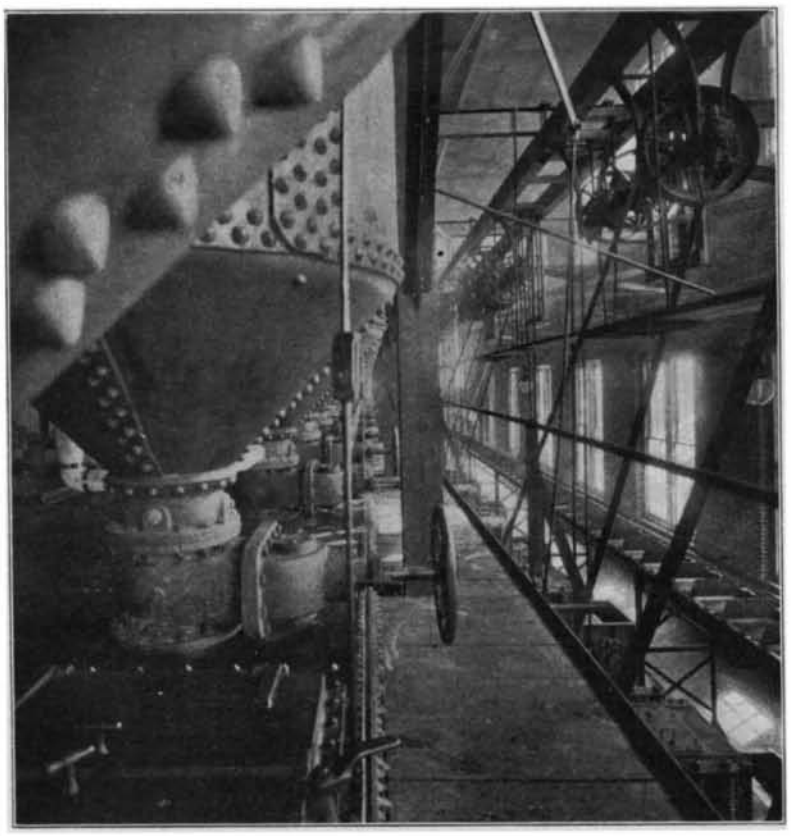
The next step in the process is the automatic separation of the solid from the liquids. This is done by a comparatively new device and consists of a powerful roller press, a late invention of the patentee. The material passes through a series of massive rolls, by which all liquids are pressed out automatically and the refractory substances reduced to such form that they can readily be handled as a base for commercial fertilizers. Similar machines are in use in plants previously built, but these later machines are much larger, each having a capacity of ten tons per hour, and requiring practically no attention from the operatives.

Tests which have been made at the works show that of the material passing through the presses about one-fifth is secured in the form of tankage containing 37 per cent moisture. The balance consists of a little over 1 per cent of nitrogen, about 1.57 per cent of phosphoric acid, 0.11 per cent of potash, and 7.91 per cent of grease, while about 3½ per cent is an equivalent of bone phosphate of lime. The liquid residue passes from the presses through conduits into a series of 14 catch basins. The basins are so arranged that the grease gradually accumulates at the top, where it is secured by pumping. Of this residue about 3 per cent represents grease which, with that obtained directly from the presses, is sold to be manufactured into soap and other compounds.

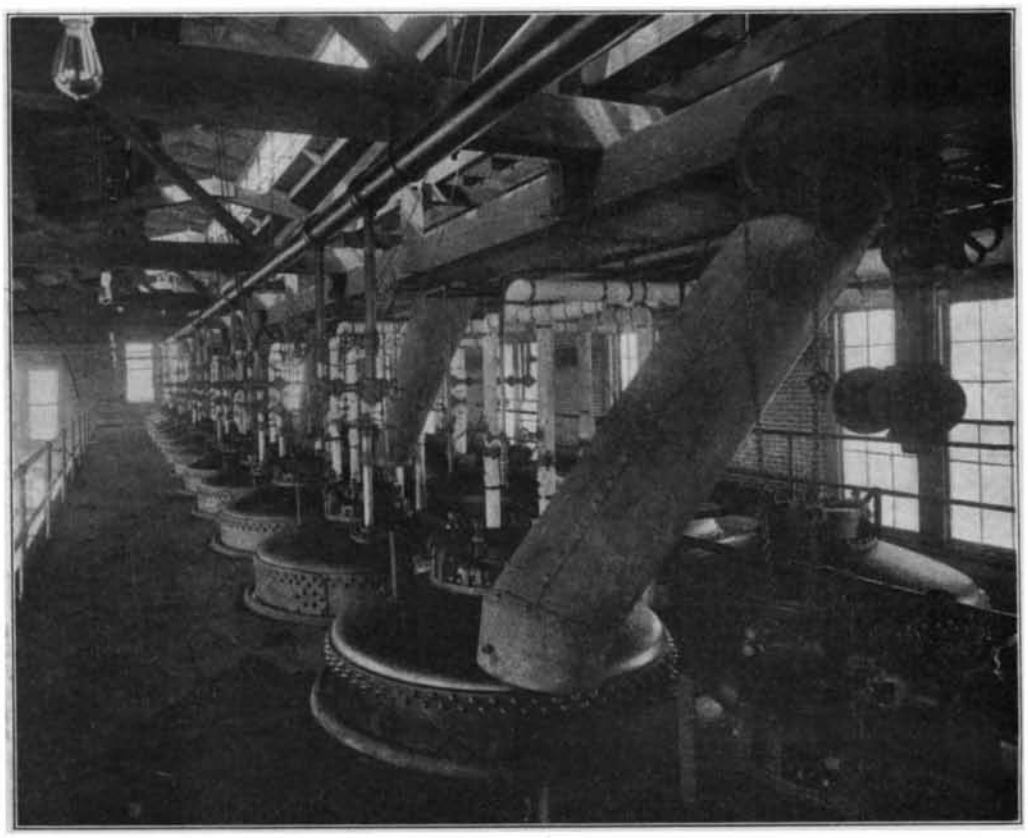
The solid matter when dry assumes a granulated form and is almost odorless. It might be added that a feature of the plant is its sanitary condition, and comparatively little odor is noted in its interior.

The mechanical outfit comprises a battery of six horizontal return tubular boilers of 200 horse power capacity each, constructed for a working pressure of 125 pounds steam. The boilers are so arranged that each can be used or its use discontinued without in any sense affecting the others. They are supplied by duplex high-duty pumps with modern heating device. The presses are driven by 50-horsepower horizontal engines, and the various systems of conveyors by vertical engines, all of modern high-duty type. The conveyors are of steel construction throughout and are practically indestructible, and all parts subject to wear throughout the plant are readily interchangeable.

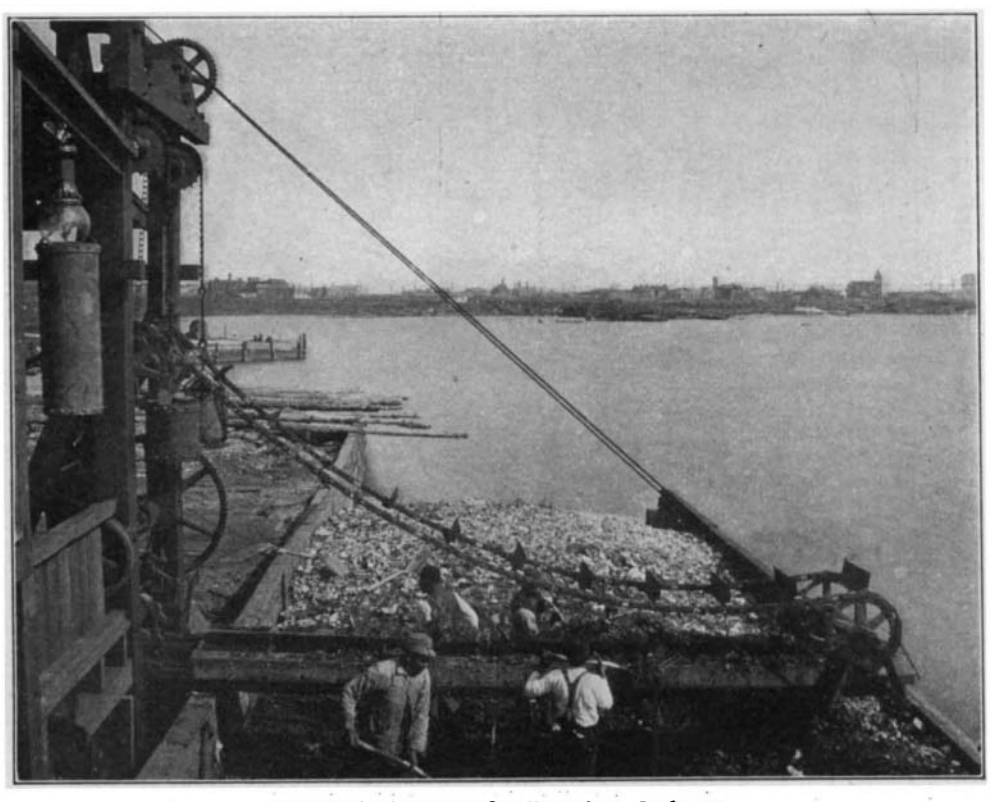
The company has begun the construction of a fertilizer plant in connection with its garbage works. This will probably be completed within the next year, and as fast as the "raw material" is turned out in the reduction process it will be transferred automatically to the other works. It is expected to treat from 15,000 to 20,000 tons of the tankage from the presses yearly by the acidulation method and thus form a fertilizer basis. The company which installed and owns the reduction machinery, and collects the garbage from the city, is building the fertilizer works as well.



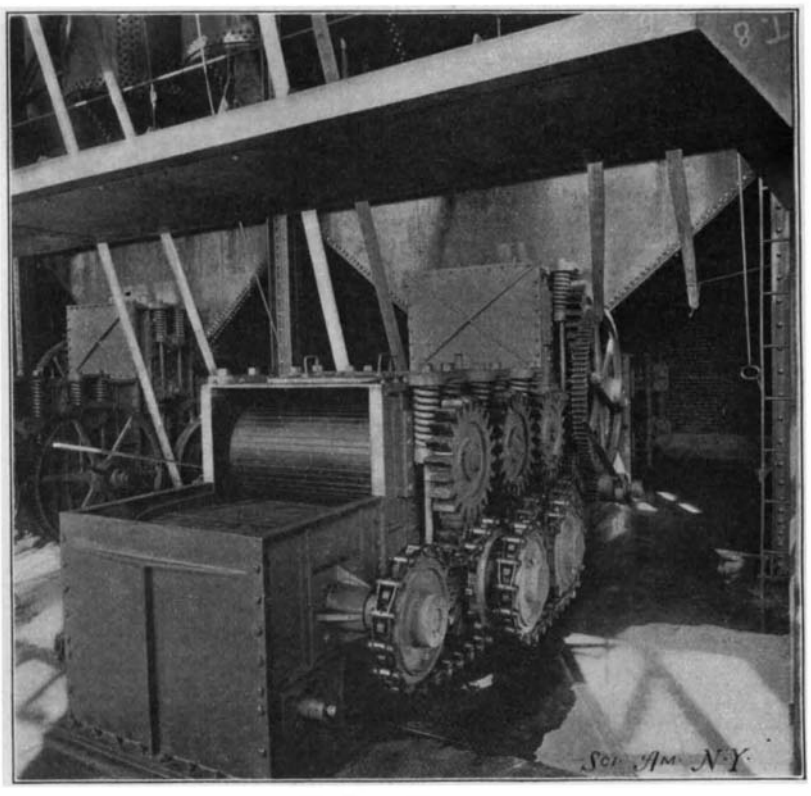
The Valve Gallery in the Digester Department.



Upper Portion of the Digester Department, Showing the Tops of the Digesters and Feed Pipes.



Automatic Conveyer for Unloading Garbage.



Details of the Press.

THE TORPEDO-BOAT DESTROYER "PERRY."

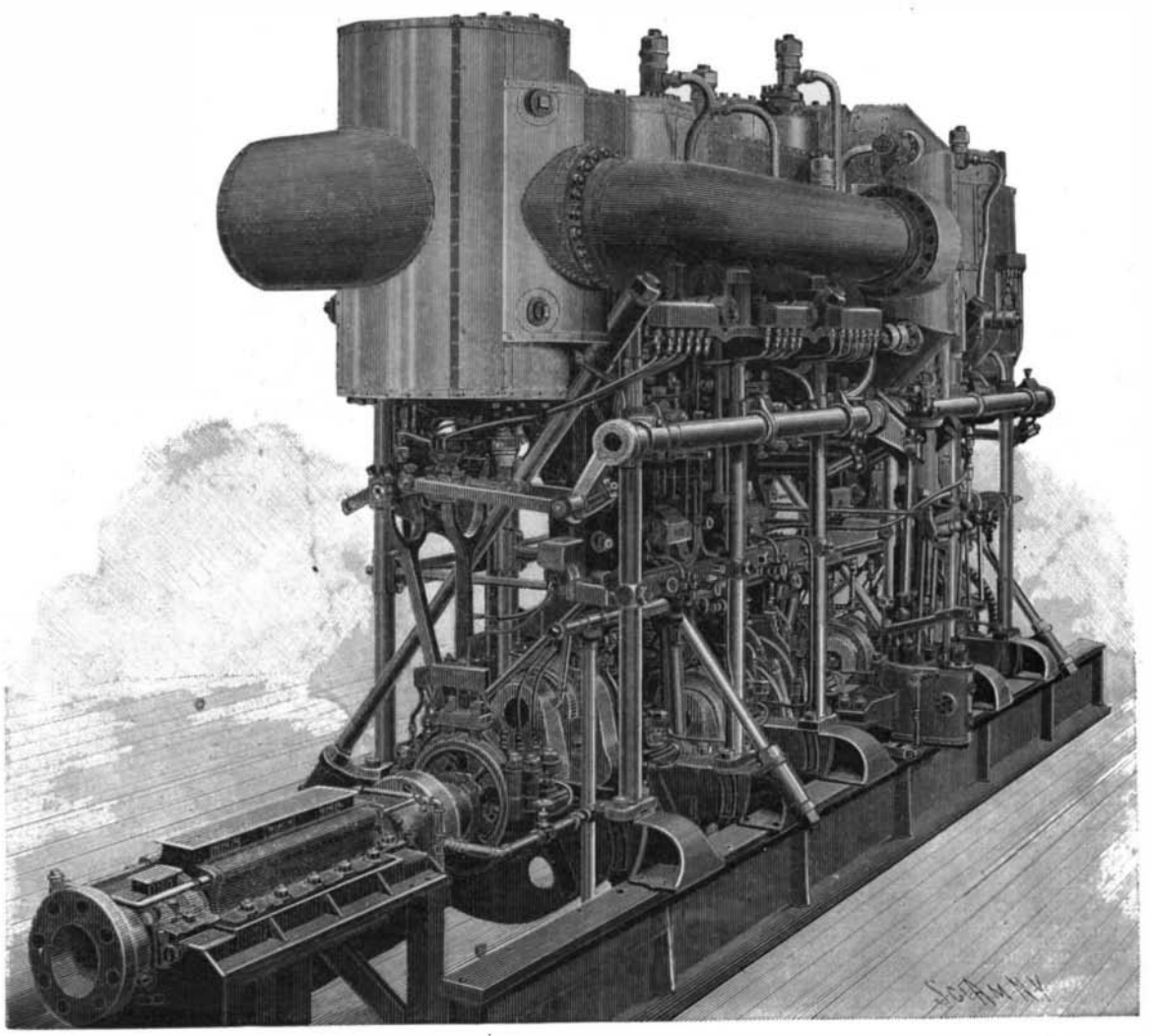
We present illustrations of the "Perry," one of the three destroyers built at San Francisco at the Union Iron Works. Two other boats, named the "Paul Jones" and "Preble," sisters to the "Perry," were built at the same yard. The three vessels are named after well-known commodores of our early navy, and they are in dimensions and workmanship identical in every respect.

The "Perry" has a length on the water line of 245 feet, an extreme breadth of 23 feet 7¼ inches, and mean draft of 7 feet 2½ inches. The displacement is 480 tons, and the speed 28.3 knots; gross tonnage 508.93 and net tonnage 83.14 tons. The normal coal supply is 25 tons; maximum draft when ready for sea, 7 feet 6¾ inches.

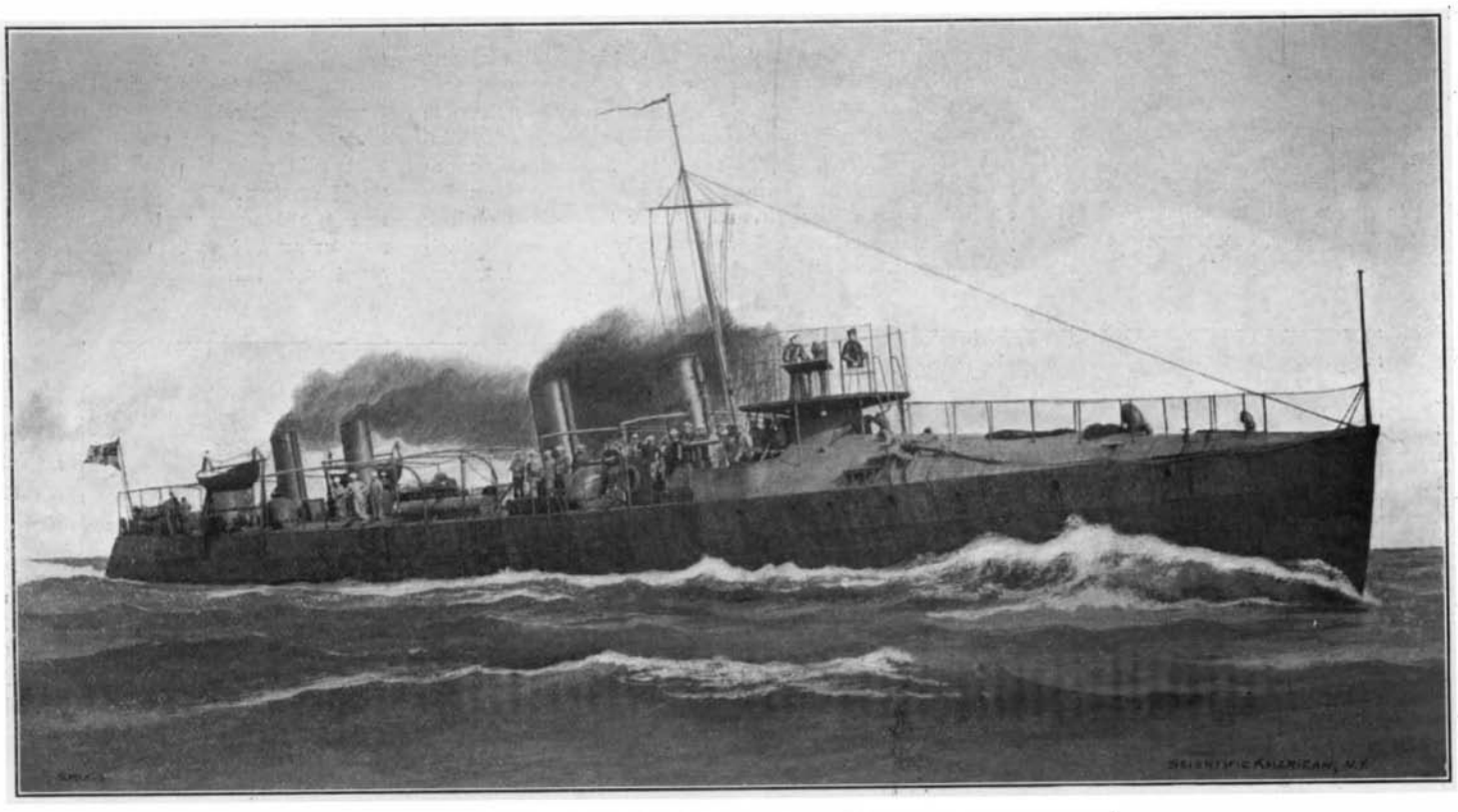
The armament consists of two long 18-inch Whitehead torpedo tubes, two 3-inch rapid-fire, and five 6-pounder rapid-fire guns. A complement of four officers and 69 men is required when in commission. All the wood used in construction is fireproofed. The cost without armament was $281,000. The engines of these torpedo-boat destroyers are in every respect identical. They are of the vertical, inverted-cylinder, direct-acting, triple-expansion type, with four cylinders, 20½, 32, 38, and 38 inches respectively, with stroke of 22 inches, and running 327 revolutions at 250 pounds pressure at an indicated horse power of 8,000. The cylinders are placed as follows, beginning forward: For the starboard engines, second low-pressure, intermediate, high, and first low-pressure, and for the port engine, first low-pressure, high, intermediate, and second low-pressure. Cranks are at 90 degrees, the high and first low-pressure being opposite, as are also the intermediate and second low-pressure. The second pair is at right angles with the first pair.

The two condensers are of composition and sheet brass with cooling surfaces of 3,470 square feet. The circulating pumps are of centrifugal type.

Each boat is provided with four water-tube boilers constructed for a pressure of 300 pounds. They are placed in pairs forward and aft in watertight compartments. The boilers aft are each provided with 80.5 square feet of grate surface, those forward having but 73.5 square feet. The four aggregate 308 square feet of grate surface. The total heating surface is 17,768 square feet.



ENGINES OF THE TORPEDO BOAT "PERRY."



THE TORPEDO-BOAT DESTROYER "PERRY."

Length, 245 feet. **Beam,** 23⅛ feet. **Draft,** 7 feet 2½ inches. **Displacement,** 480 tons. **Speed,** 28.3 knots. **Guns:** two 3-inch; five 6-pounders. **Torpedo tubes,** 2. **Complement,** 73.

According to the Anglo-Indian Review, it having been calculated that the energy stored up in one gramme of radium is sufficient to raise 500 tons weight a mile high, an ounce would, therefore, suffice to drive a 56-horsepower motor car at the rate of thirty miles an hour around the world. The calculator evidently confused intrinsic energy with capacity for transforming energy.

Preparation of Pure Hydrogen for Airships by Liquid Air.

A series of experiments has been carried out recently at the government aerostatic establishment near Paris by M. Georges Claude, a well-known scientist. An account of these experiments, which are of great interest as relating to the preparation of pure hydrogen for balloons and airships, has been lately presented to the Academie des Sciences by Col. Renard, who is in charge of the establishment. It is well known, since the experiments of M. D'Arsonval, that hydrogen can be easily separated from all the other gases that are mixed with it, and even from illuminating gas, by cooling the mixture by means of liquid air. The remarkable improvements which M. Georges Claude has brought about in the production of liquid air on a large scale lead to the hope that this process may be applied to purify the hydrogen which is produced in the modern forms of generator. This will be of great value as concerns the question of balloons and airships. M. Claude has designed an apparatus for purifying hydrogen on a large scale by the use of liquid air and the Aerostatic Service is now considering the question. Before going into the construction of the apparatus it seemed useful to determine, by experiments on a small scale, to what temperature the hydrogen must be lowered in order to free it from the most deleterious gases and especially from hydrogen arsenide. These preliminary experiments were carried out at the aerostatic establishment under the direction of M. Claude, who furnished a sufficient provision of liquid air for the purpose. The experimental device consisted simply in a cylindrical glass vessel 5 inches in diameter half filled with gasoline, through which the impure hydrogen produced from commercial acid and zinc was passed by means of a tube dipping into the liquid. In the center of the vessel was placed a test-tube first of glass and afterward of copper in which was poured the liquid air. The gasoline bath could thus be given a temperature of —130 deg. C. without difficulty. Each sample of the hydrogen to be purified contained about 1 gallon, and it passed over at the rate of ¼ or ½ gallon per second. The qualitative analysis of the specimens of gas had been made at the laboratory of the Artillery Section by Capt. Ducru with great care. The results of the experiments on cooling the hydrogen show that the arsenic was practically eliminated below —110 deg. C. and it may be considered as certain that by cooling the gas to —130 deg. the arsenic will be totally removed. These results are to be completed in the near future, but it seems certain from what has been already done that the process brought out by M. D'Arsonval and developed by M. Georges Claude can be applied on a large scale for purifying the gas which is used in balloons.

Wild Forms of Chrysanthemums.

The cultivation of the chrysanthemum in China may be traced back to a very early date, and already in the eleventh century two strains were evidently cultivated, the one bearing yellow ray flowers, and the other white. Dr. Henry, who has collected specimens now in the Kew herbarium, considers that there are two wild plants which may be the progenitors of the cultivated strains. Throughout China and Japan the form known as *Chrysanthemum indicum*, which has a yellow ray, is widely spread, while in the mountains of Hupeh there occurs a form with white or pink ray, which has been named *Chrysanthemum morifolium*. Another series of plants obtained in North China and Japan has been considered to show merely a variation of the second form, and this view is accepted by Dr. Henry, who points out the possibility of finding intermediate varieties in the unexplored districts in the interior of China.—Gard. Chron.

The Louisiana cotton growers are taking energetic steps to prevent the Mexican boll weevil from entering the State. No cotton seed from the affected district of Texas will be admitted into Louisiana.

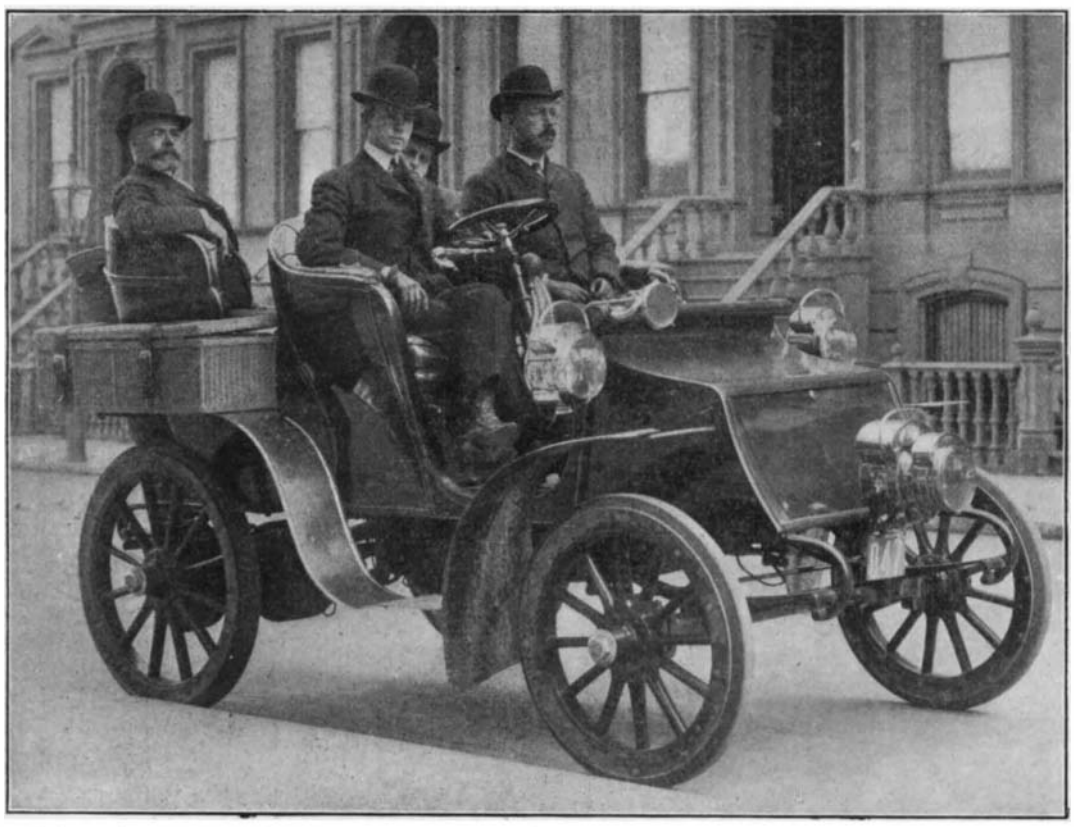
THE LONG-DISTANCE RECORD RUN OF AN AMERICAN ELECTRIC AUTOMOBILE.

The electric tonneau automobile shown herewith arrived in New York about noon on the 20th instant, after having made the journey of 244 miles by road from Boston in five days with five necessary re-chargings of the battery *en route*.

This is the first attempt that has ever been made in America to tour in an electric automobile, and great credit is due the Messrs. Babcock, father and son, of the Buffalo Electric Carriage Company, for demonstrating the entire practicability of touring in this, the pleasantest riding type of all automobiles.

Under the best conditions, the touring car illustrated is capable of making 75 miles on a charge; but, largely on account of rain and muddy roads, this mileage was reduced on the trip to an average of 47. The machine is fitted with forty 200 ampere-hour Helios-Upton lead storage battery cells of the pasted-plate type and weighing 31 pounds per cell. The battery is arranged in six crates placed in front and under the seats. Its total weight is 1,400 pounds, and that of the car, 3,640. The controller furnishes six speeds forward, the highest being 25 miles an hour, and the third, or regular running speed, 12½ miles an hour. Gilmore motors are used.

The trip from Boston to New York was made easily in five days, the tourists taking their time about it and thoroughly enjoying themselves, as they had no repairing or troubles of a mechanical nature to disturb them. A charging plug and rheostat were carried on the vehicle, and no difficulty was experienced in obtaining charging stations. Partial charges were put into the battery during stops for lunch at noon, and, altogether, the battery was charged ten times more or less completely throughout the journey of 244 miles. The cost for recharging was $15, or between four and five times the cost of gasoline for propelling a four-passenger gasoline car the same distance. Roughly speaking, therefore, this is the extra cost of safe, sure, and luxurious travel in an electric touring car.



ELECTRIC TOURING CAR WHICH RAN FROM BOSTON TO NEW YORK.

SUN SPOTS.

Mr. George H. Peters, of the Naval Observatory at Washington, D. C., has made probably the most elaborate investigation of the recently observed spots on the sun of which the daily press had so much to say. At first individual spots were seen forming a group; soon they diminished in number, the smaller spots consolidating with others. Altogether, the group was composed of about nine spots, and eventually condensed into two principal groups somewhat separated. On October 12 the total length of the disturbed region was 172,000 miles, with a width of about 59,000 miles, the aggregate length of the principal spots being about 123,000 miles. Such was the vast extent of the spots that they could easily be seen with the naked eye through a smoked glass.

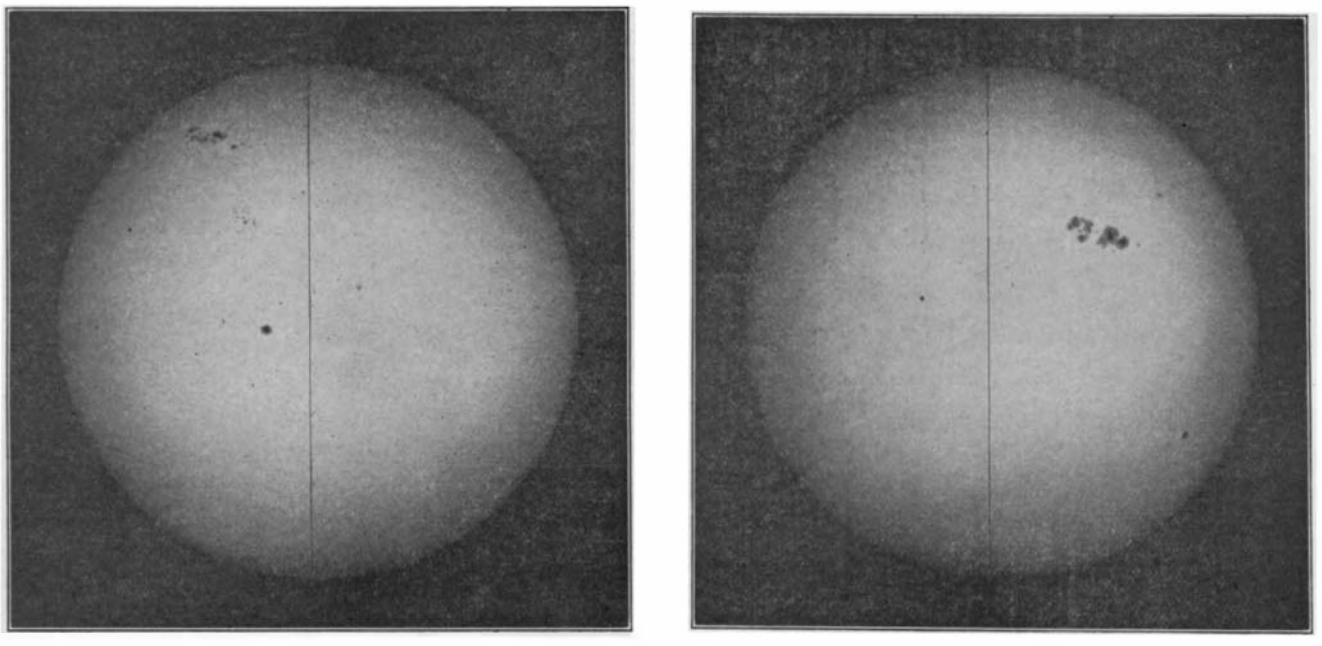
Hardly a year passes but the intense whiteness of the solar image, when viewed through the telescope, is darkened here and there by spots. Usually they are little more than specks. Sometimes, as in the present instance, they attain vast proportions.

The first systematic observation of this constantly recurring phenomenon was made by Schwabe, a German observer, who, however, was not a professional astronomer. With characteristic German patience he began in 1825 to note the spots that could be seen each day. Year by year he continued his work. By 1833 the spots had almost ceased to appear. Although little, if anything, was to be seen after that year, he continued his observations. Finally in 1836 the spots began to reappear. Apparently the appearance and disappearance followed some cycle. To determine whether or not the spots diminished and increased in number in accordance with any law, Schwabe kept up his daily observations for forty-two years. His patience was at last rewarded by the discovery of a law which has earned for him a lasting rank among astronomers. From Schwabe's observations it was found that the average period from one minimum to another is about 11.1 years, and that from one minimum to the next maximum is less than from that on to the next minimum again, or in other words, the spot quantity decreases through a little over seven years, and increases through less than four. No one knows just why this should be so. There is little substantial proof that the maximum and minimum periods coincide with other celestial phenomena.

It has been repeatedly stated that the appearance and disappearance of the sun spots have a marked influence upon the weather, and that it is possible by their means to predict good or bad years for farmers. Prof. S. P. Langley, who is probably the foremost American authority on solar physics, took the trouble to find out whether or not there was any marked influence upon agricultural conditions. Comparing the number of sun spots in certain years with the price of grain in the English market, for the corresponding years, he showed that there certainly was some coincidence. But no astronomer, least of all Prof. Langley, was quite satisfied with such evidence. As he himself said, we might safely undertake, with study enough, to find a curve depending solely on certain planetary configurations, which would represent with quite striking agreement for a time, the rise and fall of any given railroad stock, the relative numbers of Democratic and Republican congressmen from year to year, or anything else with which the heavenly bodies have as little to do. The trouble with such an investigation, as Prof. Langley pointed out, is that the price of wheat is affected by too many things quite apart from the operations of nature, such as wars and legislation, corners of the market, and the like.

Viewed with a powerful telescope. a sun-spot appears as an enormous ragged hole in what may be considered the sun's crust, followed by a number somewhat smaller in size. Clearly, the spot is a cavity and not a protuberance. Slopes are visible. The spot seems like a saucer of irregular outline; but where there should be a bottom there is nothing but the blackness of an immeasurable chasm. Considering the sizes of spots such as those which Mr. Peters observed, it is apparent that this little earth of ours might be dropped into one of them as a pea into a thimble, without even grazing the sides.

Although there may be little, if any, connection between terrestrial agricultural conditions and the appearance of sun-spots, still it cannot be denied that the appearance of the spots is attended with other disturbances upon the earth. To-day the connection between the earth's magnetic condition and sun-spots is almost incontestable. Authorities have traced a kind of coincidence between the solar changes and our cyclones, storms, droughts, and floods. But the absence of sufficiently old records prevents us from establishing more than the fact that the magnetic conditions of the earth are disturbed. Mr. Peters noted a considerable disturbance of the magnetic needle during the recently observed spots. It is to his courtesy that we are indebted for the two striking photographs which are herewith published.



SUN-SPOTS PHOTOGRAPHED AT THE NAVAL OBSERVATORY, WASHINGTON, D. C., ON OCTOBER 12, 1903.

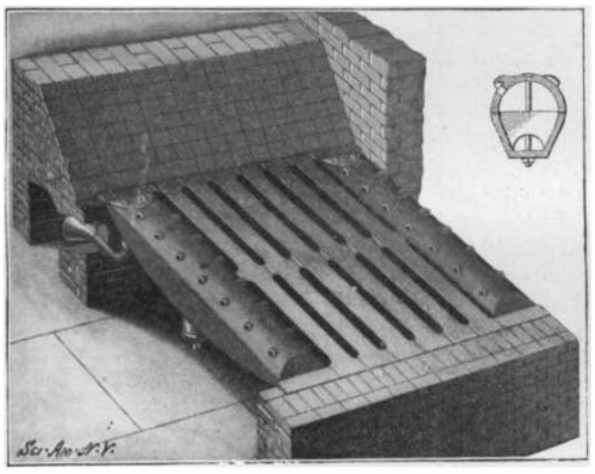
American Bridges on the Uganda Railroad.

One of the most distinguishing features of the recently completed Uganda Railroad are the several viaducts and bridges constructed by the American Bridge Company, of Philadelphia. These viaducts are located upon that section of the railroad climbing the great Mau range. At this point the track has a rise and descent of 2,000 feet in 113½ miles between Nakuru and Kibigiri. This section was one of the most difficult to construct, necessitating abnormally heavy earthworks. Throughout this 113½ miles there are twenty-seven viaducts—nine on the ascent from Nakuru and eighteen on the descent to Kibigiri. The first bridge in the ascent is between stations Njoro and Elburgon. The summit of the climb is at mile 490, and the longest and most important bridge is one measuring 760 feet in length between abutments. It consists of thirteen spans, each of 40 feet, and twelve spans of 20 feet. The second important bridge is at the 476½ milepost, which measures 639 feet from end to end, and comprises eleven spans of 40 feet and two spans of 20 feet. This bridge crosses a river at an altitude of 8,100 feet. On the descent the first of the eighteen bridges is located 8 miles from the summit of the escarpment, while the last is at the milepost 541. Near the station of Fort Ternan is built the most important of the various bridges in the whole 113½ miles at an altitude of 5,200 feet. This bridge is 881 feet long between abutments, and is built in twenty-nine spans of 40 feet and 20 feet respectively. The next in point of importance, and which is the highest situated, is 560 feet in length, built in nineteen spans. At the milepost 522 is another viaduct, measuring 579 feet in length, consisting of ten 40-foot spans and nine 20-foot spans. The total cost of these twenty-seven bridges, including construction and erection, was approximately $550,000.

Patent Department

A NEW TYPE OF HOLLOW GRATE-BAR.

We show in the accompanying illustration a new type of hollow grate-bar through which a current of air is passed to accelerate combustion of the fuel. The grate-bar is formed in two parts, as shown in the small detail view. The lower or body section has

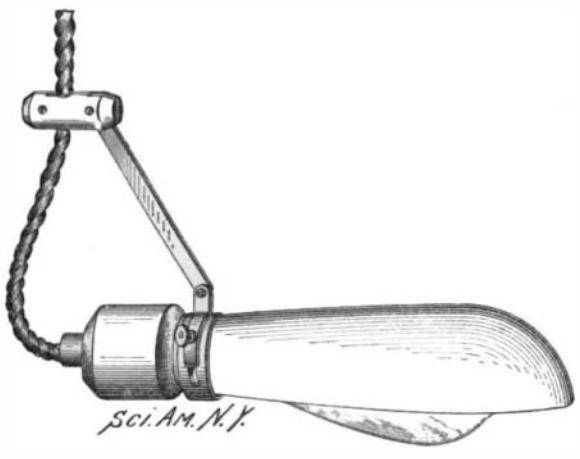


A NEW TYPE OF HOLLOW GRATE-BAR.

the shape of a trough, deepening toward the center, and provided with extensions at the ends for resting on the furnace setting. It is also provided with transversely-disposed bracing ribs having openings at their lower sides to permit ashes to pass down to the lower or central portion of the grate-bar, where such ashes may be withdrawn through an opening there provided. The upper section of the grate-bar is rounded so as to lie above the level of the rest of the grate. This section is formed with a number of orifices covered by shields which prevent entry of the ashes. The two sections are held together by tie-bolts, the center one of which serves also to hold in place a cover on the opening above mentioned. The grate-bar is used in connection with a bridge wall which is formed with a draft tunnel. Pipes from this tunnel admit air into the grate-bars and thus supply oxygen to the fuel through the shielded orifices. Two of these orifices in each grate-bar open toward the bridge wall and the shields also extend in this direction. This causes the draft to pass over the top of the bridge wall and to mingle with the products of combustion at that point, so as to bring about a very effective combustion of the fuel. The grate-bar being formed in two sections, may be readily repaired, since the greatest heat will be on the top section, and if this should become injured it may be removed and a new section applied to the old body, thus bringing about a great saving, as will be apparent. A patent for this invention has been granted to Mr. Theodore J. Pritchard, of Sunshine, La.

ODDITIES IN INVENTION.

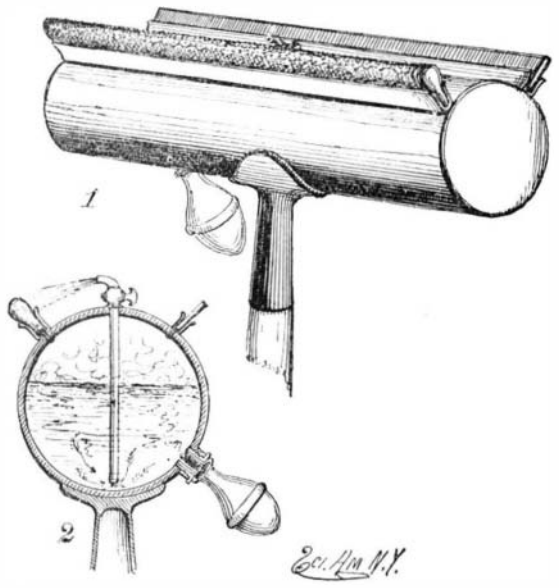
INCANDESCENT-LAMP SUPPORT.—A very convenient incandescent-lamp support has recently been invented, by



INCANDESCENT-LAMP SUPPORT.

which the lamp globe may be adjusted to any desired angle. The lamp shade is provided at the base with a slot in which a slide is secured. On one end of this slide an ear is formed, to which a connecting rod is pivoted. On its opposite end the connecting rod is pivoted to a clamping block, which binds upon the connecting cord of the electric lamp. By raising or lowering this block the lamp may be swung to any angle in the vertical plane. By moving the slide to various positions along the slot in the base of the lampshade, the shade may be adjusted to throw its shadow in any desired direction.

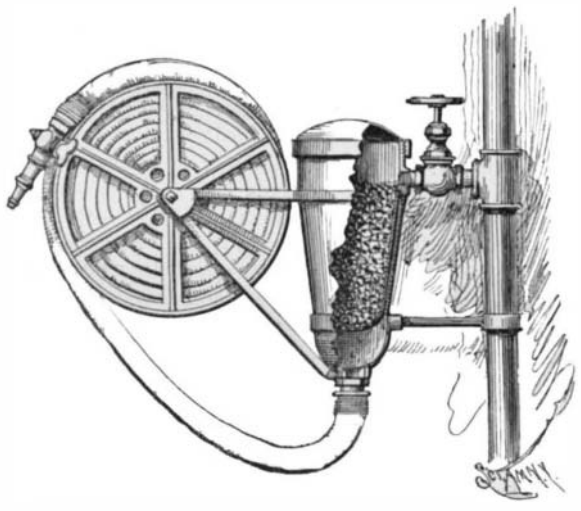
CLEANER FOR WINDOWS.—We show herewith an improved window cleaner of the "fountain" type, which has just been patented by a Colorado inventor. An important feature of the invention lies in the provision of independent washing and drying surfaces. From our view of the cleaner shown in section, it will be observed that a pipe passes down into the reservoir at the center and is provided at the top with a nozzle adapted to spray water onto the washing strip of ab-



WINDOW CLEANER AND DRIER.

sorbent material projecting along one side of the cylinder. The drying strip occupies a similar position on the opposite side, while at the bottom of the cylinder there is an extension into which a bushing is threaded. The bushing is provided with a valve and a compressible bulb. In use the bushing is first removed and the reservoir partly filled with the washing fluid. The bushing is then replaced and air is pumped into the reservoir by operating the bulb. On opening the valve of the spraying nozzle, the fluid will be sprayed out by air pressure onto the washing strip. The window may now be cleaned and then dried by rubbing thoroughly with the drying strip.

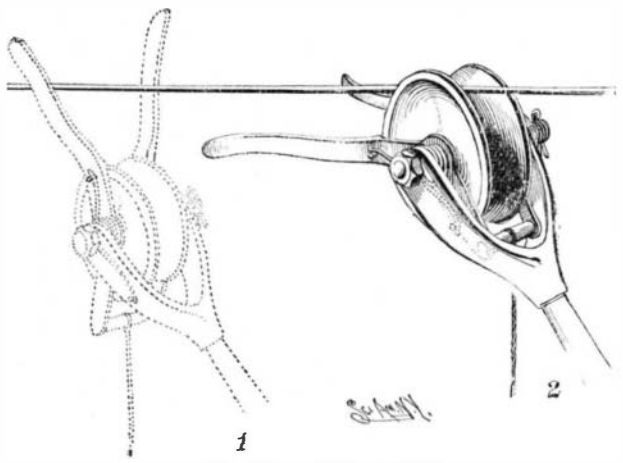
FIRE EXTINGUISHER.—A recent invention provides a means for extinguishing fires, which smothers the fire not only by shutting off the supply of oxygen to the flame as in apparatus heretofore used, but also by absorbing the oxygen, which would otherwise be available, with the products of decomposition of hyposulphite of soda. A receptacle containing the crystals of hyposulphite of soda is connected up with the water-supply pipe as shown in our illustration. In use the water is turned on, and in passing through the receptacle dissolves a portion of the hyposulphite of soda. This, upon coming into contact with the flames, is decomposed in such manner as to liberate sodium sulphite and sulphur. The latter then unites with oxygen to form sulphur dioxide and ultimately, with more oxygen, to form sulphuric acid. The sodium sulphite also unites with oxygen to form sulphate. A large amount of oxygen is thus taken up, which smothers the fire. Since the decomposition of the hyposulphite of soda takes place only when it is heated, it is evi-



NEW TYPE OF FIRE EXTINGUISHER.

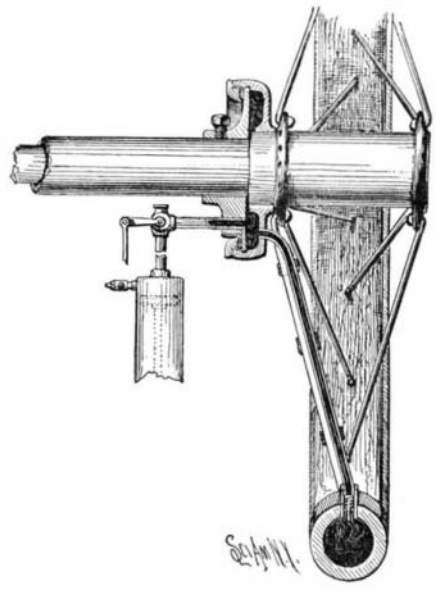
dent that any of the solution which might be spilled on delicate fabrics or other destructible materials which were not afire, would be perfectly harmless, being a neutral solution as regards alkalies and acids.

TROLLEY-POLE GUIDE.—It is so common an occurrence for a trolley-car to "slip its trolley," that the very phrase has become a stock slang expression. The trying delays, particularly at night, occasioned by the efforts of the conductor to guide the trolley back onto the wire have been experienced by us all. We illustrate herewith a Yankee invention calculated to expedite the operation of finding the trolley-wire. The usual cord pull, instead of being fastened to the trolley-pole, is secured at its upper end to a cross-piece connecting the shorter arms of two levers hinged on the pivot-pin of the trolley. The longer arms of these levers are flared out so as to form guides for easily finding the trolley-wire. Normally, the flared arms lie parallel with the trolley-wire, being so held by coil-springs on the trolley-pole to avoid striking the overhead cross-stays during propulsion of the car. When, however, the trolley has slipped from its wire, the cord is pulled, raising the flared arms to the position shown in dotted lines, and thus affording a ready means for guiding the trolley back on to the wire.



TROLLEY-POLE GUIDE.

TIRE-INFLATING DEVICE FOR VEHICLES.—An automobilist will find it very convenient in case of an emergency to have in connection with the wheels of his machine a simple device for inflating his pneumatic tires while the vehicle is in motion. Provision for such an emergency is afforded by the arrangement shown herewith. On the inner end of each hub of the vehicle is an annular casing or cup, which is closed



TIRE-INFLATING DEVICE.

by a stationary head forming an air chamber. A ring is screwed into the annular casing, and serves to hold the head firmly in place, while an interposed packing ring serves to effect an air-tight closure of the chamber. From the casing a tube leads down to the inlet valve of the pneumatic tire. An air-compressing device is connected by pipes to each hub-chamber of the vehicle, entering the same through openings in the respective stationary heads. A two-way valve, such as that shown, is provided whereby the operator of a vehicle may, whenever desired, direct the air from the compressor into the tire, or, in case it is not desired further to inflate the tires, may set the valve to permit escape of the air from the compressor into the atmosphere.

Brief Notes Concerning Patents.

Among the recent deaths announced is that of Thomas Jay Hudson, who for a number of years was principal examiner in the United States Patent Office. Dr. Hudson was also the author of several books of a psychological nature. He died at Detroit, where he had resided.

In some new freight engines constructed for the Central Hudson Railroad Company, there are independent braking systems for the train and engine. With this new arrangement, when it is desired to bring a train to a stop, the engineer will set his engine brake slightly, so as to take up the slack of the train, and it is said that this will prevent the possibility of the train parting, which is an annoyance and a source of danger of no small consideration.

The Rev. Ernest d'Aquilla, pastor of the Italian Roman Catholic church of Our Lady of Mount Carmel in Newark, N. J., has received a patent upon a

life-saving gas burner on which he has been experimenting for two years. It is designed to cut off the flow of gas automatically when the flame is blown out or accidentally extinguished. The flow of gas is cut off by the contraction of a curved strip of metal acting upon a valve.

Hugh Mann, brother of D. D. Mann, vice-president of the Canadian Northern Railway, was accidentally killed while superintending the operation of his track-laying machine just beyond Erwood, N. W. T. The massive machine got out of order, and, while endeavoring to set it right, he lost his footing and was crushed. Mr. Mann was taken to the station at Erwood, where he died. For years he had been perfecting this mechanism, which was his invention. Several times he had narrow escapes from death.

Ezra T. Gilliland, a well-known inventor who for many years was a co-worker with Thomas A. Edison, and who was responsible for many of the features of the Bell telephone, died on May 13 at his home at Pelham Manor, N. Y. He was 56 years of age, and at one time was a director of the Bell Company. Up to the time of his death he was an active worker in the electrical field, and maintained a very complete laboratory in the upper part of his handsome home, where he had seven skilled men employed on electrical work.

The Northern Pacific Railroad Company has been looking into the matter of fuel briquettes, and some tests have been made with a fuel of this character invented by Dr. R. J. Schrimper, of St. Paul, Minn. According to Dr. Schrimper's formula, soft-coal refuse largely enters into the composition of these cubes. It is said that they can be made at a cost of $1.25 per ton. The trial resulted in demonstrating the fact that the use of the briquettes showed an economy of forty per cent. It is said that one ton of the latter will go further than a ton of soft coal by about between twenty-five and fifty per cent.

Edward Atkinson, of Boston, Mass., the anti-imperialist and sociologist, has recently turned his mind in a more practical direction, and has been for some time giving his attention to the manufacture of fuel from mud. He has recently made a quantity of briquettes, the base of which is said to be mud, which Mr. Atkinson claims is as good as Irish peat. Samples of the fuel were burned and gave a very desirable flame, strong and clear, and calorimetric tests made by Prof. Norton, of Harvard, showed it developed about two-thirds as much heat as its weight in coal. Mr. Atkinson says that he will continue his experiments in the direction of making a machine for the pressing of the mud into the desired shape.

Irving M. Scott, the vice-president of the Union Iron Works, of San Francisco, Cal., who died recently in his 65th year, started in a very humble way, and finally worked himself to a position of unusual prominence, the shipbuilding feats of his company having been the means of making his name a familiar one in industrial circles all over the world. He found employment when a very young man in a machine shop in Baltimore, Md., receiving three dollars per week, but at the age of twenty-two he was not only an expert machinist, but a fine draftsman. He was sent to the Pacific coast at this time in charge of a steam engine, and while there accepted a position in the Union Works, which were then the property of Peter Donohue. It was not a great while before he was the principal member of the firm. It was with great difficulty that he secured for his company the contract for the construction of the protected cruiser "Charleston," and this work was so successfully carried out that other contracts were readily obtained. His name was among those presented at the convention which nominated Roosevelt for the Vice-Presidency.

By the use of a pneumatic device as a substitute for the spring on the arm of a trolley car, it has been found that the trolley wheel is held in much closer contact with the wire, and that a greater efficiency is secured and a higher speed accordingly maintained. The device is the invention of C. V. Greenamyer, the mechanical engineer of the Pacific Electric Company, and has been in successful use on that line, where high speeds are the rule. It is said that the wheel is in close contact with the wire constantly, thereby saving much power which is ordinarily lost through the formation of arcs in the circuit by imperfect contact. In this manner much of the energy which is intended to be utilized in the form of power is lost in light and heat. Another feature of the device is that when, occasionally, the trolley wheel does slip from the wire, as is often unavoidable, this pneumatic pressure is at once released, and the pole falls almost to the roof of the car, leaving no possibility of damaging the overhead work of the line. When the conductor has again secured control of the pole by grasping the cord which hangs from it, the power is thrown into action by the turning of a lever in the motorman's end of the car.

Legal Notes.

THE BRISLIN-CARNEGIE INFRINGEMENT SUIT ON APPEAL.—Some time ago we digested in these columns the decision in the suit of Brislin vs. Carnegie for infringement of letters patent 345,953, granted to Brislin and Vinnac, for "A Feeding Mechanism for Rolling Mills," and infringement of letters patent 352,748, issued to Hanley and Richey for "A Feed Table for Rolling Mills." It will be remembered that the Circuit Court of the United States for the Western District of Pennsylvania held that the first claim of the first patent had been infringed, and that the second patent had not been infringed. The case has now come up on appeal. The decision of the Circuit Court is reversed, a result that means much for the steel industry of this country.

In the process of rolling iron it is necessary to elevate the iron so that it will pass through between the upper and middle rolls when a three-high mill is used. In the case of a two-high mill it is necessary to pass the iron over the top of the upper mill in the process of rolling. When moving the iron from one groove to the other, and from one set of rolls to another, the iron must be moved sidewise bodily. In heavy rolling, the labor of elevating the heated iron and of moving it laterally for the several passes required in the process of rolling is arduous, and the difficulty of this manipulation causes much loss of time as well as of heat. Consequently, it is more difficult to roll the iron; indeed, the stiffening of the iron as it cools, which is occasioned largely by this loss of time, often results in the breaking of the mechanism connected therewith. It was the purpose of the Brislin invention not only to effect the vertical lifting of the iron, but also to move it laterally in the process of rolling. Broadly speaking, the invention consists in a lifting mechanism and laterally-moving mechanism combined with rolls of a rolling mill for the vertical lifting and lateral movements of the heated iron in the operation of rolling it. The first claim of the patent, which alone was in contention on appeal, reads as follows:

"1. The combination, in a rolling mill, of rolls, a carriage, a roller frame therefor for feeding to the rolls and pivoted at its outer end means for laterally shifting said carriage and roller frame, and devices for inclining said roller frame on its pivot, so as to vary the feed of the latter to the rolls, substantially as set forth."

The history of the prior art was carefully considered by the Circuit Court, and likewise by the Circuit Court of Appeals. Both conceded that hand feeding to the rolls was at one time general, and that various devices for lifting billets and bars, by hooks attached to pulleys for heavy work, were in use before mechanical rolling was practised. The court, however, did not find that the invention of the patent in suit made the first advance from manual rolling to complete mechanical rolling. "It no doubt made an advance in mechanical rolling, which is quite a different thing from an advance to mechanical rolling." The French patent to Sauvage, May 27, 1858, which had been cited as an anticipation by defendants in the prior suit, and which had been rejected as such by the Circuit Court, was carefully considered on appeal. It was considered by the Circuit Court that the device of Sauvage's patent, so far as a single stand of high rolls is concerned, presents all the advantages of complete mechanical rolling. All that it lacked were means of laterally shifting the table. The suggestion of the moving of such a table on a carriage or truck laterally, so as to bring it successively in front of stands of rolls placed side by side, did not, to the Circuit Court of Appeals, seem to involve patentable invention. Indeed, it distinctly stated that the mounting of such a table upon the truck moved upon rails in front of the rollers would violate a patent monopoly were it granted. "The traveling crane comes within its functional principle."

A patent granted to Alleyne in Great Britain on April 4, 1861, describes a rolling mill of several stands of two-high rolls, combined with both laterally-moving mechanism and vertically-moving or lifting mechanism, the lifting mechanism differing from that of the patent in suit only in that the table is raised bodily and horizontally, instead of the free end next the rollers only being raised on the fulcrum of the pivoted farther end.

The next development of the art of complete mechanical rolling is illustrated by the feed roller tables of the Fritz and Wellman types, which are practically the alleged infringing devices. In the Fritz apparatus the feed rollers are positively driven by a shafting and operating gear, and their rotation is reversible. Fritz also devised a turning and lifting mechanism, by which the piece to be rolled could be turned upon the moving table, so as to be rolled both sidewise and edgewise. "So far as there was necessity for only one stand of rolls, complete mechanical rolling could be accomplished by the Fritz device. The roller table, to be sure, was lifted vertically and horizontally, but the function of such movable table and the positively-driven rollers was the same as that of the pivoted table and rollers of the patent in suit." The tables of the Fritz invention were raised and lowered by hydraulic cylinders. There was no lateral movement of these tables, which being of the width of the rolls were sufficient to serve the several passes of the single stand of rolls.

Wellman followed the general prior teaching of the art. He employed a table pivotally supported at its outer end on a stationary foundation. This construction, of course, leaves the inner end free to be raised or lowered simultaneously by hydraulic cylinders placed on one side of the rolls. The Wellman tables do not travel laterally, for the simple reason that there is no necessity to transfer the rolled product from one stand to another.

The most pertinent reference cited in anticipation of the Brislin patent is that granted to Saylor, June 30, 1885. In the device of that patent may be found feed tables equipped with positively-driven feed rollers, which are raised and lowered vertically and horizontally. These tables are mounted upon carriages run upon tracks parallel to the axis of the rolls, and are operated on both sides of the rolls. The Court below took the position that the combination described in the first claim of the patent in suit, inasmuch as it provides for the lateral movement of a feed roller table pivoted at its outer end, involves such an invention as to entitle it to the monopoly of the patent. The Circuit Court of Appeals held that this decision is too sweeping, that Brislin cannot claim all lateral movement of a feed roller table capable of vertical lifting, because more than one previous patent has described a device for accomplishing this result.

WHAT CONSTITUTES PUBLIC PRIOR USE OF A DESIGN.—The case of Young vs. the Clipper Manufacturing Company (121 Fed. Rep. 560) admirably exemplifies what constitutes public use of a design. The suit in question depended upon the alleged infringement of a design patent granted to R. McIntosh, assignor to the plaintiff "for a clip or fastener" of resilient wire to hold together sheets of paper, documents, and other articles by slipping over and clamping their edges. The defense set up that the design was in public use for more than two years before the application, which was filed June 24, 1897.

The inventor made some of the clips in May, 1895, and gave one to a printer, who had an engraving company prepare an engraving of the clip for letterheads. The qualities of the clip were set forth both on the letterhead and on envelops. Some of the clips were placed upon the edges of letters and tags sent by the inventor in correspondence concerning them, before June 24, 1895.

The court held that since a design is patentable for its appearance, exhibition constitutes a public use within the meaning of the statute and the patent was therefore declared void.

THE EFFECT OF AN INVALID PATENT ON A CONTRACT TO PAY ROYALTIES.—The case of the Willcox & Gibbs Sewing Machine Company vs. Sherborne (123 Fed. Rep., 875) brings out an interesting state of facts which probably occurs not infrequently. In an action to recover royalties from a licensee under a patent, the defendant pleaded as a defense that the contract had terminated because the patent was invalid. The Court held that a judgment for plaintiff is conclusive between the parties on this issue, and cannot be raised by defendant and again litigated in a second action to recover royalties subsequently accruing. A decree dismissing a bill for infringement of a patent, filed by a licensee thereunder, where the defenses pleaded were the invalidity of the patent and non-infringement, and the decree is not based specifically on either, will not be construed as an adjudication of the invalidity of the patent, which will be conclusive to relieve the complainant from liability for further royalties under the license contract.

The owner of a patent, in selling the patented article, may reserve to himself, as an ungranted part of his monopoly, the right to fix the price at which it may be sold by jobbers, or dealers purchasing from them; and a dealer who buys with knowledge of such reservation is bound thereby, and may be treated as an infringer if he sells in violation thereof.

Prior adjudications sustaining a patent, but which were entered by consent as the result of settlements between the parties, and in which the questions of the validity and scope of the patent were not considered by the court, are not sufficient as the basis for the granting of a preliminary injunction in a subsequent suit against another alleged infringer.

RECENTLY PATENTED INVENTIONS.

Apparatus for Special Purposes.

MEANS FOR UTILIZING OIL OR GAS IN ORE-REDUCING FURNACES.—W. KEMP, Tucson, Ariz. The objects in this invention are, to equalize the flow and pressure of air around and to the flame at that part of the burner in a combustion-chamber; to provide for the circulation of the air-blast around the shell of the chamber, to protect the shell against heat in the furnace; to provide means for regulating the inflow of air and the liquid or gaseous fuel independently of each other, to the end that intense or modified heat may be produced.

LOADING OR UNLOADING APPARATUS.—J. A. PASTUREAU, Laplace, La. To render this apparatus capable of transportation the inventor has mounted it upon a suitable wheeled truck. The apparatus comprises a frame-work as well as hoisting mechanism of special embodiment, combined with a trackway, whereby a load may be elevated from one point and transferred to another, where it may be deposited. The apparatus is capable of withstanding considerable strain and can be easily and readily manipulated.

Electrical Devices.

COMBINED TELEPHONE TRANSMITTER AND RECEIVER.—C. YEACK, Akron, Ohio. The more particular object of this inventor is to produce a combination instrument which may be used as a transmitter or as a receiver and also in other relations more or less analogous. When used either as a transmitter or receiver, the currents produced in the windings should be in phase with each other, and the windings should be of proper direction to attain this end rather than to cause the currents to destroy each other.

WIRE-SUSPENDING DEVICE.—H. E. STEVENS, Windber, and B. GELLATLY, Pittsburg, Pa. This improvement relates to means for suspending wires, especially electric trolley or feeder wires. The aim is to devise a suspending means which shall obviate many former difficulties, such means being so constructed and placed in the roof of the mine or building that it is very difficult for the same to be forced or pulled therefrom. The device may be readily placed, and on deciding to abandon a passage-way in the mine it may be quickly removed from the roof and used in a new passage-way.

Engineering Improvements.

MARINE VESSEL.—C. H. LEE, Southampton, N. Y. The broad features of this invention consist in the arrangement outside of the hull, of the fuel-pipe which conveys liquid fuel from a storage-tank to the engine, in connection with devices by which an upstanding branch of the pipe is surrounded by a standpipe open to the water and serving to discharge leaking fuel into the water without any possibility of the fuel escaping into the vessel's interior.

ROTARY ENGINE.—L. VAN D. SUTTON, West Newton, Pa. In this engine two cylinders are used, which have the form of hollow rings, and the pistons are in the form of curved cylindrical bodies. Motion of first one piston and then the other is communicated to the main shaft by means of an ingenious construction, comprising a disk mounted on the shaft and having flanges which alternately engage the pistons by projecting through slots in the lower halves of the cylinders. The feed-valves are operated by means of cams on the shaft and the abutment-heads are operated by eccentrics.

FURNACE.—G. C. CANNON, New York, N. Y. This furnace is adapted for burning gaseous fuel, and is primarily for use in connection with boilers of steam automobile vehicles. In operation the gas-tubes will thoroughly distribute the gaseous fuel, and as the vehicle gathers way the scoop will increase the draft through the tubes, thus increasing the intensity of the combustion at the upper surface of the top plate. The boiler is located above the furnace.

BOILER-FEEDER.—M. CASTELNAU, 8 Rue Richepanse, Paris, France. To avoid many inconveniences very prejudicial to instantaneous-vaporization boilers in preventing them from becoming general, the inventor has devised to feed the same by means of compressed air or gas, which is inclosed with the feed-water in a closed receptacle and which yieldingly forces the water into the boiler through a pipe. He can use either an air-pump, or a water-pump, or preferably a double pump, which forces simultaneously the water and air under pressure into the reservoir.

Machines and Mechanical Devices.

PUMP-ROD LIFTER.—T. H. TREGELLAS, Iuka, Kan. In the present case the invention is an improvement in devices for lifting or pulling pump-rods; and it consists in certain novel constructions and combinations of parts whereby the rods may be readily lifted, devices being supplied for securing such lifting action by an operation similar to that of pumping.

FLESHING AND SHAVING MACHINE.—E. SCHROEDER, New York, N. Y. The object of this invention is to provide a new and improved machine for quickly and accurately removing the surplus flesh from the under or flesh side of raw furs or skins and for paring or shaving the under or flesh side of dressed furs or skins to reduce them to a desired uniform thickness.

COIN VENDING-MACHINE.—C. R. SMITH, Montpelier, Vt. This apparatus is operated by the weight of a coin and is adapted to deliver goods of values which differ according to the position of a distributer wheel which is concealed from the view of the customer. This introduces an element of chance which adds greatly to the interest which the machine would attract. However, goods of one-value or another are always delivered, there being no blanks.

GAGING AND COUNTING ATTACHMENT FOR WOODWORKING-MACHINES.—H. O. FRY, Cosmopolis, Wash. Mr. Fry's invention has particular application to a mechanism adapted to be used in conjunction with sawing-machines for cutting off different lengths of stock used in the manufacture of boxes, blinds, furniture and the like. Primarily the inventor has in view the provision of a mechanism which may be applied to any sawing-machine and shall gage each and every piece of stock cut to the exact length desired and at the same time will keep an accurate account of the number of pieces so cut. The machine is a money and a labor saving contrivance and is entirely automatic.

WINDMILL.—T. W. LOWE, Stockton, Cal. In this case the inventor seeks to produce a construction wherein the wings normally present a large area to the pressure of the wind, which pressure-surface is of increasing effectiveness from the larger to the smaller ends thereof. The wings or vanes automatically adjust themselves. Through certain means the pressure of the wind on the vanes will throw them edgewise to the wind, and thus permit the wind to pass with freedom through the wheel. The windmill belongs to structures of the class disclosed in a prior patent of Mr. Lowe's.

SPRING-MOTOR.—E. L. GARVEY, Asheville, N. C. In this case the invention is in the nature of an improvement in spring-motors for furnishing motive power for such light uses as the running of sewing-machines, the driving of fans, the operation of churns, etc. The motor may be stopped at any time by simply pressing the brake-shoe into contact with the disk.

SAFETY DEVICE FOR ELEVATORS.—W. S. FULWIDER, Diamond, Indiana. Primarily the invention in the present instance provides the car or cage of the elevator with means which, should the cable supporting the car be accidentally severed or broken, will engage with the standards or vertical supports of the walls of the well and will check the descent of the car to the bottom of such well.

TOOL-HOLDER FOR LATHES OR PLANERS.—J. BRANDSTETTER, Salem, Ohio. The purpose of the improvement is the provision of details of construction for a tool-holder that may be employed for the support of a cutting-tool used on a lathe, planer, shaper, or slotting-machine and enable the proper adjustment of the cutting-tool for height and also adapt the holder to afford resilience or render the support rigid, as the work may require.

WASHING-MACHINE.—L. E. POLLARD, Denison, Texas. This invention utilizes a vessel or boiler having corner spray-tubes formed of an angular rear plate and an attached front oval plate, the latter having its lower edge bent outwardly forming a ledge, located above the lower end of the rear angular plate. Adapted to rest upon the ledges at the lower end of the oval plates is a false perforated boiler bottom, a packing is fixed to the edges of the false bottom, flanges are formed on the lower side of the bottom, and means are adapted for securing the spray-tubes.

Of Interest to Farmers.

HARROW.—H. HAILEY, Great Wymondley, Herts, England. In this patent the invention refers to harrows, and the more particular object is to produce a device which is flexible relatively to the ground and provided with bush-teeth of different lengths and with adjustments for governing the relative positions of different parts of the framework of the machine.

GRAIN-STORAGE TANK.—G. H. WARREN and S. FONTAIN, Minneapolis, Minn. In this patent the invention refers to improvements in the construction of grain-storage tanks, silos, and the like. In this connection the inventors have particularly in view a storage-tank which will be fireproof and the parts of which are composed of such material that all danger of the contents being ruined or damaged by dampness will be obviated.

Miscellaneous.

KEEPER-RING FOR BUTTONS.—A. H. BRYANT, East Hartford, Conn. The improvement refers to means for detachably holding shanked buttons upon garments, and has for its aim the provision of a keeper-ring which is shapely, very convenient to apply and remove, and that may be manufactured readily at low cost. The device is formed from a single piece of resilient metal.

HORSESHOE.—A. G. JENNINGS, New York, N. Y. This shoe is particularly adapted for use when the surface over which the horse is to travel is slippery or where heavy loads are to be drawn over undulating ground or surfaces of uncertain footing. The shoe to that end is provided with metallic points extending below the tread of the shoe, as usage, or conditions may require, which points may be round, square, or of other shape in cross-section and blunt or sharpened at their lower ends.

HAND-MEASURE FOR GLOVES.—J. J. SUMMERSBY and J. GRIEVE, Dodge City, Kan. The present invention refers to improvements in measuring devices, and has particular application to an article of this type for measuring the hand to determine the size of the glove to be worn. It is simple in construction, accurate in its measurement, and will be much more convenient than the ordinary spring-tape now in use. It may be readily adjusted to fit any size of hand.

CORSET.—E. SAVOYE, 35 Rue du Caire, Paris, France. The invention made by Mr. Savoye refers to improvements in corsets; and it consists, essentially, in a new way of cutting out the component parts of a corset for the purpose of obtaining by the mere design of the parts a more stylish appearance, more suppleness, and greater comfortableness than heretofore. The parts may be provided with gussets, plaits, and the like.

BELT-BUCKLE.—L. SANDERS, New York, N. Y. The purpose of the invention is to provide a construction of belt-buckle comprising a frame or a body of skeleton construction and a central-cross-bar offset from the rear of the frame, upon which the tongue is mounted in such manner that its inner end will have a cam action upon the end of the belt passed beneath the bar and over teeth on a second rearwardly-offset bar more or less close to the tongue-carrying bar.

FIRE-ESCAPE.—J. R. PROUTY, Chicago, Ill. One of the principal objects of this invention is the provision of effective means for facilitating the escape of persons from burning structures without liability to injury and also to provide means whereby firemen and others may ascend to any desired height of the structure for the purpose of directing streams of water upon the flames to extinguish them.

SUN-BLIND FASCIA.—S. PREBBLE, 67 Atlantic Road, Brixton, England. Mr. Prebble's invention relates to an improvement in connection with awnings for shops and other business premises; and it consists in the combination, with a roller-awning adapted to be distended in front of the window by means of hinged arms in the usual manner, of what may be termed a "fascia" or "name-plate," hinged to the awning-lath, and so weighted as to maintain a vertical position in all positions of the awning, so as to always present its face to public view.

HAT.—R. PLATO, New York, N. Y. In this patent the invention has reference to summer or outing hats made of canvas or like fabric material, and its object is to provide a hat arranged to allow free circulation of air through the crown to keep the wearer's head cool and to greatly strengthen and reinforce the rim to prevent the latter from losing its shape.

NOZZLE.—W. C. OBERWALDER, New York, N. Y. The object of the present invention is principally to provide means for completely shutting off the flow of water through the nozzle, and this the inventor effects by providing an interior bead located inward of the mouth of the nozzle and arranged to be engaged by the conical divider-block when the block is drawn inward, thus closing the nozzle and attaining the end desired. It is an improvement on a nozzle disclosed in a prior patent granted to Mr. Oberwalder.

DEVICE FOR OPERATING THE VENTILATING-DOORS OF TOBACCO-BARNS.—W. D. CASE, Granby, Conn. The purpose of the invention is to provide a simple and easily manipulated means whereby to simultaneously open and close a vertical tier of ventilating-doors, particularly such doors as are used in the construction of tobacco-barns, and to provide means for holding the doors in a fully-open or a partially-open position.

BELT-PULLEY.—G. A. ENSIGN, Defiance, Ohio. The inventor claims as his object the provision of a belt-pulley arranged to prevent lateral shifting of the belt by keeping the latter in a central position on the belt-surface, to furnish a ready escape for the air between the belt and the peripheral face of the pulley, to insure proper contact between the belt and pulley, and to increase the adhesion between the contacting surfaces to produce a more positive transmission of the power.

DESK AND SEAT.—A. C. HENDERSON, New York, N. Y. Mr. Henderson's invention relates to an improvement in desks and seats particularly adapted for use in school-rooms; and his object is to provide a desk and seat so connected and arranged that they may be simultaneously adjusted to desired heights and to retain their proportionate relations as to height.

ILLUMINATED MAP.—T. IKEMORI, New York, N. Y. This map is for use in a classroom to instruct in geography and history. Means are provided to make the back of the map appear plain, the outlines of countries appearing at the front; but the subdivisions, their names, and other detail will remain hidden until an electric or other light is moved over the back, whereupon the concealed matter will be visible from the front, thus enabling a teacher to make plain any routes, and locations of cities, mountains or rivers, etc.

SUPPLY-VALVE.—W. T. NICHOLS, Hempstead, N. Y. In this instance the object is to provide a supply-valve, more especially designed for use in overhead tanks for water-closets and the like, and arranged to prevent leakage by being abnormally held to its seat by the pressure-supply and to automatically open against the pressure-supply by the action of a float or similar device on the water falling below a predetermined level in the tank.

PANEL-WORK OR WAINSCOTING.—D. P. MILLER, Cumberland, Md. One of the principal objects in this case is to provide means whereby the different elements or parts contributing to the structural organization of panel-work or wainscoting for ceilings, partitions, walls, and the like may be united together in their intended positions practically without the use of nails, screws, or their equivalent.

TOY FOR EXPANDING THE LUNGS.—O. HENRICHSEN, New York, N. Y. This toy affords amusement as a trick device, and is a lung developer. The construction includes a blowpipe, a guide rising from the pipe, a vessel to be blown up from the pipe upon the guide to a position of rest above the pipe, and a second vessel having flexible connection with the frame of the toy which is to be raised by air introduced through the pipe and made to engage with a bail carried by the first vessel or any support located at a point above the pipe.

OVEN-VENTILATOR.—J. F. FERRY, Leadville, Col. Mr. Ferry's invention relates to improvements in ventilators for ovens, stoves, ranges, or the like, the object being to provide a ventilator so arranged as to automatically open upon the opening of an oven-door and permit the escape of smoke and fumes that may be in the oven to a flue or to the atmosphere.

PROCESS OF TREATING CYANID SOLUTIONS.—W. H. DAVIS, Boulder, Col. In this patent the invention has reference to the extraction of gold and silver from ores by means of a dilute solution of potassium cyanid. The object is to provide a continuous process for treating cyanid solutions either during or subsequent to their contact with the ore, whereby the double salts in the solution are dissociated and the regeneration of the cyanid in the solution is simultaneously accomplished with the purification of the solution.

LINE-HOLDER.—W. J. DOTY, Clifton, Kan. The object of this improvement in line-holders and shingling devices is to provide a novel construction of a device whereby one end of the line may be held in position to mark a line across a roof or other object which it may be desired to mark and then be released and will fly back automatically to position to hold one end of the cord in marking another line.

DEVICE FOR HOLDING FLEXIBLE SENSITIVE SHEETS.—R. BECKMANN, Charlottenburg, Germany. The purpose in this case is to provide a device to permit the use of flexible sensitive paper sheets, films, and the like in a camera in place of the ordinary dry-plates and to allow the photographer to manipulate the device and the sheet carried by it during the process of filling the camera, exposing, developing, fixing, washing, and drying to form the photograph, and to allow quick removal of the finished photograph and replacing it by another sensitive sheet.

FOLDING BEDSTEAD.—M. BENZ, Nashville, Tenn. The principal object of this improvement is to provide a folding bedstead which is readily portable for shipment or storage and one which occupies but small space in either position thereof, besides being comparatively light in weight and composed of few parts. The contrivance may be readily manipulated with small exertion of the operator, and may be carried into and out of position for use without noise or friction.

FURNACE-DOOR-OPERATING DEVICE.—L. I. NEWTON, Fort Dodge, Iowa. In this case the invention consists in means specially designed for operating locomotive fire-box doors, though adapted to be used in connection with any ordinary furnace, whereby the fireman may open and close the door with his foot and thus leave his hands free for feeding fuel into the furnace, and thereby facilitate the coaling process in addition to opening and closing the door at each operation.

HOT-WATER HEATING SYSTEM.—A. B. RECK, Copenhagen, Denmark. This hot-water heating system is worked by steam, and the invention relates especially to low-pressure steam; and the object is to create means for attaining this by only changing the load on the pressure-regulator that controls the pressure of the steam. The hot-water system can be worked in two distinctly different manners, one for low and the other for high temperature on the water.

WATCH-PROTECTING FOB-CHAIN.—D. SUMMA, New York, N. Y. This device may be used to advantage by either ladies or gentlemen and may be employed to protect such articles as keys, scissors, and the like as well as articles to be worn for ornamentation. If a person should seize a watch or other object to be protected or pull heavily upon one of the chains, the watch protector cannot be removed from the clothing, for the reason that the teeth cannot be disengaged. The invention is an improvement on a former protector covered by letters patent granted to Mr. Summa.

APPARATUS FOR TREATING SKIN DISEASES, ETC.—J. KJELDSEN, Copenhagen, Denmark. The special feature in this invention consists in using electric-arc lamps provided

with electrodes which wholly consist of metals whose illuminating-vapors form a linear spectrum of wholly or about wholly chemical rays which are specially adapted for the treatment of skin diseases, for telegraphic and photographic purposes, etc. To prevent the melting of these electrodes, they may be cooled in the usual way. Means are provided to permit the passage of the ultra-violet rays. The rays pass through the windows or lenses of the casing to the object to be treated.

SAFETY-BUCKLE.—A. ENGLERTH and H. SCHUETT, Chicago, Ill. The improvement of these inventors resides in a buckle adapted for attachment to a riding-saddle for the purpose of connecting a stirrup-strap thereto in a way to retain the strap on the saddle under normal conditions of use, but when the rider is thrown the pull of the strap in an abnormal direction operates to open the buckle and automatically release the stirrup and strap.

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.

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Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

Inquiry No. 4727.—For makers of experimental supplies such as brass strips, aluminium wire, tin foil, etc.

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The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

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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.

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Minerals sent for examination should be distinctly marked or labeled.

(9210) E. E. H. says: Can you give me any information in regard to vaporization of alcohol and kerosene? Or can you tell me of any book or publication in which I could get the information? A. In reply to your question regarding the vaporization of alcohol and kerosene, we would say that you will find a very complete statement about alcohol in the "Tables of the Properties of Saturated Steam and Other Vapors," by C. H. Peabody; price $1.00 postpaid. Kerosene is not a single chemical substance like alcohol, but is a mixture of a large number of different hydro-carbons which are vaporized at different temperatures and which obey different laws. It is therefore impossible to give for it information similar to that contained in the tables referred to above for alcohol.

(9211) L. A. I. says. Suppose you take a steel cylinder and completely fill it with a mixture of air and gas under pressure, say, 40 pounds per square inch, similar to the mixture in a cylinder of an ordinary gasoline engine just before ignition. Now suppose the mixture is exploded by an electric spark. What would be the temperature and pressure immediately after the explosion and what would be the pressure after the cylinder had cooled to the original temperature? Are indicator cards ever taken from cylinders of gasoline engines? How much is the average M. E. P. generally found in gasoline engines—that is, how many pounds per square inch? A. Replying to your inquiry we would say that it is impossible to accurately estimate the temperature in the cylinder of a gasoline engine after ignition without knowing the exact amount of gasoline consumed. One pound of gasoline, when completely burned, will generate about 20,000 British thermal units, and each B. T. U. will heat each pound of the products of combustion, if there is no heat lost by radiation, about four degrees. At atmospheric pressure, about thirteen cubic feet of air weighs one pound. From this you may be able to get some idea of the temperature which is possible when the gasoline is burned. Our judgment is that the temperature of the flame in the cylinder may vary from perhaps 1,500 or 1,600 deg. F., according to the mixture, to over 2,400 deg. The pressure is increased in the same ratio as the absolute temperature; after the temperature is lowered to the original temperature, the pressure would be slightly less than it was before combustion took place, because the hydrogen which forms a part of the gasoline would burn out some of the oxygen, forming steam which would condense. The carbon, the other constituent of the gasoline, burns the CO which occupies the same space as the oxygen consumed. Indicator cards are frequently taken on gasoline engines, but the M. E. P. varies very greatly. "Gas Engines," by D. Clerk, price $2.00, and "Gas and Petroleum Engines," by William Robinson, price $5.50, will give you a great deal of valuable information on this subject.

(9212) I. L. says: Thanking you for your answer to my previous questions, I beg to submit some more to you. Does an eel have two hearts, and, if so, how many times per minute does each beat? If not, is there any living organism having two or more hearts, and, if so, what is the respective number of beats per second of each? Has lightning any real width, and, if so, what is it? What is the apparent width? Does it have any shape, that is, the cross section of a stroke? What is the length of an average stroke? Of an extreme one? Of a short one? What is the actual mechanical power in lightning? That is, if we transformed the high pressure of an ordinary stroke of lightning down to a low pressure, raising, of course, the amperage as we decreased the voltage, grant that there is no loss of current in transforming, would the current that we got have any power to decompose water or run a motor to any appreciable extent? Is there such a thing as "ball lightning," and if so, what are the known facts concerning it? Has it, if a reality, been produced artificially; and, if so, how? Is the cause of thunder known? If so, what is it? If not, what is the most probable theory? What about "the air rushing into the vacuum" theory? What are the weak points in this theory? Has thunder been known to kill ducks or chickens in the shell? Does thunder curdle or sour milk, and, if so, why? What is the largest number of people ever carried in one day by the B. R. T. railway system? On what day were they carried? Do you consider the ——— ——— cycle the equal of any other motorcycle? Do you consider it the best? Do you consider the ——— automobile a reliable automobile for ordinary usage? If a perfect vacuum is a perfect non-conductor of electricity, why can't an induction coil be insulated by being "jacketed" in a vacuum tube? If silver is 100, what is the electrical conducting power of glass when heated? I have an induction coil wound with Nos. 14 and 36 wire. What amperage and voltage should I give it? It is a large coil, and I think it was made from plans in one of your SUPPLEMENTS. If you could tell me which SUPPLEMENT it was, I would like to get it. It gives ordinarily 1½-inch spark. Is radium a metal? What is the numerical radio-activity of radium, polonium, actinium, and uranium? What is a good book treating of Geissler tubes and of fluorescence? A. Your questions about lightning have no exact answers, as any can see. No two flashes are necessarily alike. The distance from the cloud to the earth, or rather the resistance between them, determines the intensity of the flash discharge, and so all the quantities you ask for. We know nothing at all about the actual mechanical power of lightning. We may surmise about it, but there is no basis in actual fact for the surmise. It has power enough to split trees, etc., which would require many horse power. Ball lightning is admitted by most to be a reality. Little else is known about it. Thunder is the concussion of the air as it closes up after the discharge has taken place. We do not know whether it has killed ducks or not. Milk is usually found sour the morning after a thunder storm. We cannot explain why. As it is impossible to produce a perfect vacuum, it is not clear how you would put an induction coil into a perfect vacuum. It is still more obscure how you could carry the wire into the vacuum to bring out the discharge of the coil. The specific resistance of glass at 20 deg. C. is given by Thompson as 91 followed by 18 ciphers, and at 200 deg. C. as 227 followed by 11 ciphers. The resistance for silver is 1.492 annealed, and 1.620 hard. You can change this to silver 100 in each case. You do not specify the kind of silver you have in mind, and we leave the calculation for the case in hand to yourself. The coil you have, giving an inch and a half spark, is described in the SUPPLEMENT, No. 160, which we furnish for 10 cents. As you desire to get the paper, you will find all needed instruction and information therein regarding the use of the coil. Radium is supposed to be a metal allied to uranium. The radio-activity of various degrees ranges from small powers up to several hundred thousand. Geissler tubes are not specifically treated in any separate book. Any good book on electricity gives enough regarding them. Try Thompson's "Elementary Lessons," which we send for $1.40 by mail. We have no information relating to eels. Answers to this and your other questions can be given for a fee of $10.

(9213) L. S. asks: I have eight carbon cylinder cells and use sal-ammoniac solution for lighting a few miniature lamps, but the lamps are only bright a few minutes. What formula could I use in the carbon cylinder cells so the lights should burn bright for about one-half hour at a time? A. We would advise that the sal-ammoniac battery is not adapted to lighting an electric lamp. If used constantly it soon falls off in current, as you have observed. A steady service will soon destroy the battery. The Edison-Lalande cell, using about twice as many as of the Leclanche, will give much better satisfaction.

(9214) G. A. V. B. says: Can you give me any information in regard to making brick from cement and sand or cement, sand, and lime? How will cost compare with burned clay brick, also are they as durable and desirable as common clay brick? How much sand and cement are required per 1,000, and proportion of same? How are cementine houses constructed, and are they more costly than lumber houses? I understand there are a great many in California. What are the best proportions for making cement for walls of houses? What kind of cement is generally used for all these different kinds of work—Portland or Rosendale? A. In reply to your inquiry regarding the making of brick from cement and sand, or from cement, sand, and lime, we would say that, as a rule, the cost of such brick will exceed the cost of burned clay brick. For some purposes, however, such bricks have been successfully used, especially for pavement purposes, where the wear is not too heavy. For sidewalk pavements, if properly made, cement and sand brick are very durable, and are preferable to common clay brick. They should be made of the best Portland cement, clean, sharp sand, and finely broken stone or some other hard and durable material. The best proportion of these ingredients will vary somewhat with the character of the cement, sand, and stone. A good average proportion, however, is one part of cement, three parts of sand, five parts of broken stone. If Rosendale cement is used, the mixture should be a trifle richer in cement, and the bricks will not be nearly so durable. They will, however, be less expensive. Cement houses are made by filling in the space between temporary planking, which is constructed so as to form a box, with concrete, the width of this box being equal to the desired thickness of the walls. After the concrete has set, the temporary woodwork is removed and placed higher up, so that more concrete may be filled in. Two or three feet is added to the walls in this way at a time until they are carried to the desired height. Both Rosendale and Portland cements are used for this purpose, but Portland cement is much more durable and decidedly preferable. The proportion for the concrete for such houses is substantially the same as that given above for paving brick. The cost of these houses usually exceeds that of ordinary frame houses. They are, however, more substantial.

(9215) C. D. J. writes: I have read with some interest query 9036, A. W., June 6; 9086, A. M. W., July 11, and 9184, S. R., September 26, regarding the purple coloration of glass. I suppose window glass is the only kind referred to, because it is the only kind I have ever seen the discoloration, or coloration as you might call it, in. I am a window-glass worker, and have been for twenty years, and have the tradition of several generations before, and faded or discolored glass has always been the bane of the window-glass industry. There is no known cause, and one known remedy—that of reannealing it. I can show you glass made ninety years ago in the Catskills, using wood fire to melt, and making the glass with sand, slaked lime, and potash made from ashes; one light of glass as clear as the day made, the other has the coloration. I can show you glass made in 1903 in Indiana, with natural gas; glass made with sand, carbonate of soda, sulphate of soda, and raw lime. One is faded, the other not, and this has always been the way in high altitudes, in low, in hot and cold. We have tried all kinds of experiments to overcome this; different kinds of fuel. Our mix we cannot change much. That is practically the same as it has been for years. We have dipped our glass in the different acids without any seeming difference; some will fade, and some will not. If the SCIENTIFIC AMERICAN or any of its correspondents could suggest something to overcome this, it would be a great boon.

(9216) F. H. asks: 1. Kindly let me know the operation of a Crookes tube. My understanding is that the platinum terminal is the anode and connected to the positive side of the generator and the concave aluminium terminal to the negative side. If the current travels as claimed from the positive to the negative, why does it leap from the aluminium to the platinum, which acts as a target? A. The platinum terminal is the anode of an X-ray tube. From the negative terminal or cathode the stream of particles proceeds which bombard the anode and produce the rays. We do not see that this is connected with the direction in which a current flows through a conductor. The streaming is from the cathode. The current may be in the opposite direction. However, the direction of a current is entirely conventional. We speak of it as from plus to minus. Who knows that it is so? It is as conventional as to shake hands with the right hand, or to call the north pole of a magnet plus. 2. Also the action of the auxiliary tube of a Crookes in connection with X-ray work to adjust the vacuum—how the vacuum is raised and lowered, as well as kept stationary; what connections are made to the auxiliary, when to raise and to lower the vacuum. A. The vacuum of an X-ray tube is lowered by heating the chemical in the auxiliary tube and driving some of it as a vapor into the larger tube. This is absorbed again, and the vacuum rises. Before the tube will work properly the vacuum must be lowered again. The connections are variously made for different tubes. The maker furnishes the proper directions with his tube.

(9217) Mrs. W. C., who inquires for names and addresses of bell founders, should give us full address, as we only answer queries of this nature by mail.

(9218) F. M. W. says: Lawrence, Mich., is a town of 800 population, and has voted lights and water-works. A proposition has been received of a cold process gasoline plant for gas lighting and heating. What do you think of its practicability and expense for this size town? What would be an average price for gas per 1,000 cubic feet in cities? As compared with electricity, what do you think the expense would be? A. The gasoline and air "vapor gas" is in general use in country houses and in villages. There is no objection to its use save the possibility of condensation of the vapor in the pipes in very cold weather, which is not serious with good management in laying out the pipe work. If the company is responsible, they may guarantee this. For heating purposes, coal is the cheaper and safer to manage. Illuminating gas costs in large cities about $1 per 1,000 cubic feet, and in small towns from $1.50 to $2 per 1,000 cubic feet. We advise that the gasoline system is practical and the cheapest for your town. Electrical lighting will be very expensive on a small scale.

(9219) B. K. D. asks: 1. Will you please tell me whether the induction on a

telephone line that is bracketed to an electric light pole, in the following way, would amount to anything? The electric wires are tied in on glass insulators, and 10 feet down a telephone line (running at right angles to electric wires) is tied in on glass insulators. A. If the current flowing in the electric light line is alternating, we should expect to hear a buzzing sound in the telephones connected to the same posts, even though the telephone wires are 10 feet away. Induction will act through greater distances than that. 2. Some one said that more or less current leaked across the glass. Is that so when the voltage is 2,200? A. There is more or less leakage across glass insulators with high voltages. In wet weather there is often considerable leakage.

(9220) P. G. W. asks: 1. Why is it that ice, with salt, freezes cream more quickly than ice alone? A. The action of a freezing mixture of salt and ice is due to the fact that salt is dissolved very readily in water, and liquefies ice very rapidly. Now, ice cannot melt without it gets heat from some other matter, any more than iron can. The freezer is arranged so that the heat which melts the ice is taken from the cream, and the cream is frozen. That is the action of freezing ice cream. 2. Would a thermometer register lower in this combination than in ice alone? A. The temperature of ice melting in the air is 32 deg. Fahr. With a mixture of salt and ice in the proportions of 2 of ice to 1 of salt, a temperature of 0 deg. Fahr. can be produced. It was in this way, it is said, that the zero of the Fahrenheit scale was fixed.

(9221) W. R. C. asks: Will a person standing on platform scales on an elevator register *more* than his normal weight when elevator is *ascending* and *less* when elevator is *descending*? A. A person would register more than his weight in the case stated while the elevator was accelerated, that is, gaining speed in ascending. When the speed became uniform, the scales would register the correct weight. In descending, the scales would register less than the correct weight while it was gaining speed, and show correct weight while it was moving at a uniform speed.

(9222) C. A. P. asks: 1. Is there such a power as suction? A. In the ordinary use of language there is such a power as suction. It may be explained that the effect is due to a secondary power; the elasticity of the air or other gas in the air pump, or the presence of the atmosphere in the suction water pump; but still, the use of the term supposes something to which the term corresponds. To argue that there is no force of suction is to play with words. 2. What causes an induction motor to change its direction of rotation when any two of its terminals are reversed? Please give me names of books which treat these two subjects fully. A. It is only true of a three-phase motor that it can be reversed by transposing the supply connections to any two terminals of the motor. In the case of a two-phase, four-wire motor, the connections of either one of the phases may be transposed, but not any two terminals. The reason is that the direction of the rotation of the field must be reversed to reverse the direction of rotation of the rotary part. Sheldon's "Alternating Current Machines," price, $2.50, treats the induction motor very fully.

(9223) O. N. P. asks: Would you kindly answer me in your paper the following questions? 1. A and B being two points on a seashore with 180 sea miles between them, can I establish a wireless telegraphic communication between A and B without intermediary stations? A. It is entirely possible to send by wireless telegraph to a distance of 180 sea miles. Mr. Marconi has sent messages from the sea to northern Europe across the British Isles, the North Sea, and then more land. 2. If intermediary stations are necessary, how many? A. No intermediate stations are necessary if the transmitting and receiving apparatus be sufficiently powerful and delicate. 3. What would be the electromotive force necessary at A and B to operate the wireless telegraph? A. We are not able to give a definite statement as to the electromotive force required. 4. What would be the height of the antennæ? A. Poles of 100 to 250 feet have been used. It is now claimed that recent discoveries have rendered such tall poles unnecessary. Of that we have no definite knowledge.

(9224) E. A. J. asks: Will you kindly state in Notes and Queries just where the north magnetic pole is located? If near Hudson Bay, is it one point? Or does it encircle the globe? If it encircles the globe, how does the needle act when north of that circle? If one point, how does the needle act when east, west, or north of that point? Does the North Star have any attractive influence on the magnetic needle? A. We do not know the exact location of the north magnetic pole. It was located very nearly in 1831 by Ross on the island of Boothia Felix. An expedition is making the effort to find it again. In two or three years, more will be known concerning the matter. The pole is a point. On all sides of it a magnetic needle will point toward it. On it all directions are south. On the pole there is but one point of the compass. That is south. Around it, it is north in any direction. The North Star does not affect the earth's magnetism.

NEW BOOKS, ETC.

RECENT RESEARCHES ON THE VOICE. By Prof. E. W. Scripture. Reprint from the Medical Record, February 28, 1903.

A RECORD OF THE MELODY OF THE LORD'S PRAYER. By Edward Wheeler Scripture. Reprinted from Die Neuern Sprachen.

Prof. Scripture has made a most interesting psychological study of the words of the Lord's Prayer by means of recording instruments. It will appeal to all of those who are interested in either acoustics or psychology.

ELECTRICIAN'S MANUAL OF DIAGRAMS. By E. W. Smith. Philadelphia: Philadelphia Book Company. 1902. 18mo Pp. 79.

This little book of diagrams will prove very useful to the beginner in electricity, and will be specially useful to locksmiths and others who have occasion to do small electrical repairs.

TWELVE PLATES ON PROJECTION DRAWING. By Oswald Gueth, M. E. New York: Spon & Chamberlain. 1903. Small quarto, 12 plates. Price 75 cents.

The author is instructor in mechanical drawing at Cooper Institute, New York, and is eminently qualified to deal with the problems proposed.

L'AIR LIQUIDE—SA PRODUCTION, SES PROPRIETIES. SES APPLICATIONS. Par Georges Claude. Preface de M. d'Arsonval. Paris: Vv. Ch. Dunod, Editeur. 1903. 8vo. Pp. 125. Price 70 cents.

This interesting volume details some new and curious experiments with liquid air. It is illustrated by engravings taken directly from the experiments.

HOW TO BUILD A LAUNCH FROM PLANS. By Charles G. Davis. New York: Forest and Stream Publishing Company. N. D. 16mo. Pp. 159, plates. Price $1.50.

More than half the joys of boating are found in building one's own boat by one's own labor and skill. This book will help, the author hopes, to make the way a little smoother for the amateur than he found it when he tried to build his first boat. The instructions are common sense, and the plans and details are clear and concise. With the aid of this book we see no reason why any amateur should not be able to make a satisfactory launch.

THE RESISTANCE AND POWER OF STEAMSHIPS. By W. H. Atherton, M.Sc., and A. L. Mellandy, M.Sc. Manchester, England: Technical Publishing Company, Ltd. 1903. 16mo. Pp. 200, 64 illustrations. Price $2.

The topic is admirably discussed by the authors, and in addition to the subject of the resistance and power of steamships, the subject of the fouling of ships has also been dealt with very fully, because of its important influence on the actual resistance of sea-going ships. The book describes the latest experimental apparatus, and cannot help but prove of the greatest possible value to marine designers and shipbuilders.

THE WORLD'S COMMERCE AND AMERICAN INDUSTRIES. Graphically Illustrated by 86 Charts. Prepared by John C. Macfarlane, A.M. Philadelphia: The Philadelphia Commercial Museum. 1903. 8vo. Pp. 112. Price 50 cents.

The graphic method shows more clearly than statistics alone could do what proportion of the world's trade belongs to each of the principal nations, and the relative importance from a manufacturing standpoint of the leading cities of the United States. It is a most useful pamphlet, and is most admirably compiled.

ENGINEERING PRELIMINARIES FOR AN INTERURBAN ELECTRIC RAILWAY. By Ernest Gonzenbach. New York. McGraw Publishing Company. 1903. 8vo. Pp. 71. Price $1.

The electrical engineer is often handicapped when he starts to lay out an electric railway. The investment is heavy, and no mistakes can be tolerated. The present volume is intended to show the way in which certain conditions were to be met in a certain case, together with the reasons which led up to the recommendations and plans submitted. It is believed that by the aid of this book economies can be effected which will diminish the total investment per mile of track, and also the operating expenses per car mile. The author warns the electrical engineer not to put a young company under the financial burden of an elevated equipment and country road income.

READING ARCHITECTS' DRAWINGS. Practical Suggestions for Young Mechanics. New York: David Williams Company. 1903. 16mo. Pp. 28. Price 25 cents.

While it may be argued that facility in reading drawings is best acquired by becoming proficient in the practice of architectural drafting, which offers the student an insight into the preparation and reading of drawings, there are, nevertheless, in the articles reprinted in this little book, many valuable hints and suggestions, which will serve to assist those who have not had the advantage of careful training in that direction.

HOME MECHANICS FOR AMATEURS. By George M. Hopkins. New York: Munn & Co. 1903. 12mo. Pp. 370, 326 engravings. Price $1.50 postpaid.

This valuable work will prove of interest to all who are desirous of obtaining a knowledge of the mechanical art. It deals with the subject in a most comprehensive manner, and all readers of "Experimental Science" know that the late George M. Hopkins' treatment of subjects was most lucid, and the present volume is no exception to this rule. The book begins with an easily-constructed wood lathe and instructions for using the same. Then follow Woodworking on a Lathe; Work Bench and Tools for Woodwork; Whittling; The Different Shapes of Saw Teeth and the Way They Cut; and Wood Carving. The Second Part of the volume deals with Household Ornaments, and describes how to make Home-made Grills and Gratings; Wall Ornaments; Pseudo-Ceramics; Stained Glass and Objects of Wire Cloth; A Japanese Portiere; Repoussé; Making of Bas-Reliefs; Ornamental Iron Work for Amateurs; Some Things in Wire; Some Things in Burnished Brass; and the Forming of Plaster Objects. The Third Part deals with Metal Working, and begins with the Sawing of Metals. Then follow Soldering, Grinding, and Polishing; Silver Work; Instructions about Drills and Drilling. Then comes hints concerning Centering and Steadying; Chucking; Metal Turning; Chasing and Knurling; Rotary Cutters; An Easily-made Slide Rest; Index Plates; Gear Cutting; Hints on Model Making and Metal Spinning. The Fourth Part is devoted to the subject of Model Engines and Boilers. The Fifth Part considers the subject of Home-made Meteorological Instruments. The Sixth Part describes Telescopes and Microscopes and How to Make and Choose Them. The Seventh and last part is devoted exclusively to Electricity, and the subjects are Batteries; An Electric Chime; Electrical Cabinet; A Simple Electric Motor; and a number of other easily-constructed motors are considered. Then follows a description of an Electric Furnace, and an Electric Printing Telegraph and the Telephone. The book is one which will commend itself to both old and young, and will make an admirable Christmas present.

PORTLAND CEMENT SIDEWALK CONSTRUCTION. Based Upon the Experience of Many Successful Contractors. Compiled by B. D. Peery. Chicago: Cement and Engineering News. 16mo. Pp. 27. Price 50 cents.

MAP OF THE REPUBLIC OF PERU. With a Short Description of the Country, Its Geographical Features and Resources. Compiled, edited, and issued by Edouardo Higginson, Consul of Peru, Southampton, England.

SOLAR ELECTRIC DISTRIBUTION AND SUN HABITATION. By Alexander Young. Laporte, Ind.: C. E. Cochrane & Co. 1903. 18mo. Pp. 132. Price $1.

DIE NUTZBARMACHUNG DES FREIEN STICKSTOFFES DER LUFT FUER LANDWIRTHSCHAFT UND INDUSTRIE. Von Dr. Adolph Frank, Charlottenburg. Vortrag gehalten auf dem V. Internationalen Congress für angewandte Chemie zu Berlin am 3. Juni 1903.

DIE ENTWICKLUNG DER DEUTSCHEN MOSAIKINDUSTRIE. Vortrag gehalten im Verein zur Beförderung des Gewerbfleisses am 4. Mai 1903. Von Dr. Adolph Frank. Sonderabdruck aus den Verhandlungen des Vereins zur Beförderung des Gewerbfleisses. Berlin: Druck von Leonhard Simion. 1903. Pp. 9.

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Scrubbing machine, T. Gossack	741,787
Seal, car, H. Thompson	742,085
Sealing device, automatic envelop, L. Madas	741,805
Sealing device, bottle or jar, E. D. Schmitt, 741,843,	741,844
Seaming machine, can double, C. Stecher	741,942
Seed stirring mechanism, W. Fetzer	742,016
Sewing machine hemmer, A. Laubscher	741,682
Shade roller spear, W. D. Janes	741,670
Shelf supporter, F. L. Collis	742,007
Shoe, electric, J. S. Busky, Jr.	741,623
Shoestring tip, R. M. Seibel	742,074
Shredding machine, M. F. Williams	741,947
Shuttle guard, A. Aube	741,612
Sickle bar, B. F. Stuart	742,084
Sifter, ash, T. McGowan	741,696
Sign, revolving, G. W. De Camp	741,635
Signaling, coherer for wireless, T. E. Clark.	741,767
Sink trap, C. E. Morrison	741,815
Smoke bell, H. E. Butler	741,883
Soap feeding receptacle, liquid, G. A. Schmidt, Jr.	741,981
Speed changing device, N. Lombard	741,686
Speed driving mechanism, variable, Herbert & Vernon	742,025
Speed regulator, H. E. Warren	742,106
Spinning apparatus, ring, G. O. Draper	741,777
Spinning spindle, J. C. Edwards	741,638
Spooling machine thread guide, L. T. Houghton	741,666
Spraying or ejecting apparatus, oil or liquid, E. Castle	742,113
Spring. See Vehicle spring.	
Spring structure, E. A. Hoefer	742,117
Spring wheel, E. D. Johnson	741,797
Stacker, straw, M. Heineke	742,116
Stamp mill, G. Thomson	741,852
Station indicator, P. P. I. Fyfe 741,651,	741,652
Steam boiler, J. W. East	741,779
Steam engine, C. E. Van Norman	741,743
Steam engine, compound, J. E. Sague	741,838
Sterilized substances, closure for vessels for, J. K. Van der Heide	741,989
Sterilizing apparatus, G. Van Eyck	741,742
Stone blocks, device for making artificial, H. G. Goodwin	742,019
Stove, M. Hertenstein	741,790
Stove, J. Wood	742,108
Stove, car heating, Grant & Middlebrook	741,658
Stove, hot blast, H. Lang	741,680
Stove lid lifter, J. F. Rose	741,835
Stove lighting attachment, gas, L. E. Adams	741,991
Stovepipe fastener, A. J. Forsythe	741,648
Stove, vapor, I. Kinsey	741,913
Strength testing or punching machine, R. J. Carson	741,625
Stud member, J. V. Washburne	742,089
Sugar making, M. H. Miller 741,689,	742,127
Sulky, F. Rudolph	742,067
Switch indicating mechanism, snap, C. G. Perkins	741,825
Tablet, writing, P. B. Bogart	741,878
Tailor's cloth cutter, custom, P. E. Salin	741,930
Tanning, bleaching, scouring, and oiling leather, apparatus for continuously, W. T. Forbes	742,115
Telegraph, geometric, G. B. Rossman	742,066
Telegraphy, system of wireless, S. G. Brown	741,622
Telephone substation apparatus, H. F. Farwell	741,899
Telephone switchboard circuits and apparatus, S. B. Prentiss	741,713
Telephone system, D. F. Stakes	741,847
Telephone system, central energy, K. B. Miller	741,807
Tentering machine, A. A. Whitley	742,107
Testing machine, T. Olsen	741,703
Threshing machine, F. T. Parkhurst	742,058
Ticket of varied value, G. T. Murray	741,693
Ticket, transportation, A. A. Anderson	741,871
Timber clamp, cross, W. Louden	741,803
Tire armor, pneumatic, E. C. Radick	741,714
Tire joint closing machine, rubber, F. H. Guber	741,788
Tire remover, H. L. Doane	741,891
Toaster, C. A. Roseland	741,720
Tongs, fire, L. McKinniss	741,816
Tooth regulating apparatus, J. N. MacDowell	741,687
Torch, R. Thayer	741,737
Torpedoes, gyroscopic apparatus for steering, F. M. Leavitt	741,683
Toy, E. A. Sanguinet	741,932
Toy, E. S. Hale	741,963
Toy, H. Johnson	742,032
Toy, optical, P. D. Smith	741,730
Toy or game apparatus, educational, E. Gates	741,903
Toy railway rolling stock, A. Schutze	741,982
Track fastening, L. Sweeney	741,943
Traction wheel or runner, A. Sell	741,938
Train signaling and controlling system, H. O. Westmark	741,858
Trolley stand, Goodrich & McPherson	741,786
Trousers stretcher, S. Gasser	741,654
Truck, car, F. W. Luedke	741,917
Truss, hernial, W. S. Rice	741,929
Tug hook, A. Anderson	741,755
Tunnel boring machinery, J. Price	741,829
Turbine, compound steam, W. E. Shepard	741,940
Turbines, means for improving the efficiency of, A. R. Dodge	741,776
Turbines, support for intermediate buckets in, A. R. Dodge	741,775
Typewriting machine, E. Thurey	741,739
Umbrella, Myers & Jacoby	742,049
Umbrella and cane rack, C. J. Monfort	741,811
Umbrella stick, J. Rose	741,978
Unloading apparatus, C. P. Martin	742,125
Vaccine tube, W. H. Chandler	741,886
Valve, J. Erwood	741,641
Valve, cylinder relief, C. L. Presnell	741,828
Valve gear, explosive engine, Starr & Cogswell	741,848
Valve gear for explosive and internal combustion engines, F. M. Rites	741,977
Valve mechanism, gas engine, W. J. Wright.	742,142
Vaporizer, G. Beaumont	741,996
Vault cover, Shade & Knapp	742,075
Vaults, means for excluding dampness from, H. L. Kubbernuss	741,679
Vehicle body, W. G. Dorland	741,893
Vehicle controlling device, motor, J. Sachs	741,837
Vehicle, motor, A. W. Sandell	741,931
Vehicle spring, J. Cummings	742,114
Vending cabinet, J. M. Shelton	741,939

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Vending machine, J. B. Hurd	741,667
Vending machine, F. F. Pulver	742,063
Vessel loading or unloading apparatus, B. J. Harris	742,023
Vise, bench, J. R. Long	742,096
Wagon jack and end gate, W. R. Buchanan	741,705
Washboard, M. Zemelman	741,950
Washer. See Lock washer.	
Watch holder, Hohmann & Rosenfeld	742,029
Water closet, P. J. Madden	741,919
Water closet, A. Ek	742,014
Water gage, W. R. Malcolm	741,972
Water lifts, continuous power chain of, G. A. Crofutt	741,631
Water motor, J. W. Brooks	741,762
Water purifier, O. M. R. Moller	741,690
Weaner, calf, C. B. Wagner, Jr.	741,856
Weighing device, automatic electric, N. Newman	741,975
Well rigs, casing or drive pipe screwer for, R. S. Oiler	741,925
Wheel, D. Best	741,877
Windmill, L. C. Hamel	741,660
Window fastener, W. D. Watson	742,090
Window fastener, storm, F. D. Rumford	741,721
Windows, device for opening swinging, M. Prior	741,830
Wire weaving loom, I. J. Neracher	742,053
Wrench, H. Scheffer	741,841
Wrench, A. P. Hartzell	741,906
Wrench, L. Coes	742,006
Wrench, J. Litschge	742,043
Wrench, S. Ondrey	742,055
Wringer, P. Kibby	741,911
Yoke, neck, A. S. Lewis	742,042

DESIGNS.

Chair bar rest, Morris, E. A. Gay	36,597
Electric light fixture, H. G. Willard	36,592, 36,593
Go-cart body, M. B. Lloyd	36,598
Lamp shade, G. W. Blair	36,591
Lavatory, W. C. Peet	36,594, 36595
Piano case, G. Brunninghausen	36,599
Stove, Kennedy & King	36,596

TRADE MARKS.

Axes and hatchets, Hockaday Hardware Co.	41,340
Batteries, carbons, and agglomerates for electrical purposes, Soc. Anonyme le Carbone	41,342
Blacking, dressing, and polish, shoe, Whittemore Bros. & Co.	41,331
Boilers, hot water and steam, Wm. H. Page Boiler Co.	41,346
Cement, Portland, Mitteldeutsche Portland-Cement-Fabrik Prussing & Co. in Schonebeck/Elbe Commanditgesellschaft auf Actien	41,329
Cigars, M. Lopez	41,325
Compounds for certain named purposes, H. B. Wiggin's Sons Co.	41,330
Cotton fabrics, Newmarket Mfg. Co.	41,315
Fruit preserves, Martin Wagner Co. of Baltimore City	41,327
Fruits, fresh, dry, and conserved, A. Morando	41,326
Ham and bacon, A. E. Jordan	41,328
Hats, stiff and soft felt, Price & Vogt	41,310, 41,311
Knives, certain named, A. O. Meyer	41,341
Lamps, incandescent electric, Bryan-Marsh Co.	41,343
Medicated tablets for la grippe and its after effects, Ewell & Everett	41,336
Medicinal foods, tonics, and cordials, C. Keefe, Jr.	41,337
Packing, braided flax, Greene, Tweed & Co.,	41,319, 41,320
Packing, sheet and piston, Charleston Metallic Packing Co.	41,321
Paper, all kinds of writing, Sir Isaac Pitman & Sons	41,318
Paper bags, H. E. Westervelt	41,317
Porcelain and china ware, Kristal-Glas-en Aardewerk Fabrieken De Sphinx Voorheen Petrus Regout & Co.	41,316
Purgative syrup, California Fig Syrup Co.	41,338, 41,339
Remedy for coughs and colds and affections of the throat, Sharp & Dohme	41,334
Remedy for stomach disorders, R. R. Smith	41,335
Rubber belting, Gibbens & Stream	41,322
Silk and silk piece goods, Duncan & Stenz	41,314
Skin bleaching preparation, Rose Manufacturing Co.	41,332, 41,333
Suits for boys and children, I. Frank & Co.	41,312
Tires, solid and pneumatic, Goodyear Tire & Rubber Co.	41,344
Tobacco and cigarettes, smoking, A. Levy	41,324
Tobacco, smoking, American Tobacco Co.	41,323
Trousers, W. C. Mertz	41,313
Umbrellas and parasols, L. Schuller	41,309
Vehicles, certain named, Mitchell, Lewis & Staver Co.	41,345

LABELS.

"Bankers Union," for cigars, Schmidt & Co.	10,434
"Bon Ton Brand," for olives, C. Gulden	10,440
"Dr. W. H. Alexander's Healing Oil," for healing oils, W. H. Alexander	10,426
"El Friar," for cigars, G. H. Crouss	10,432
"El Genio," for cigars, C. B. Henschel Mfg. Co.	10,431
"Heirloom Rye Whisky," for whisky, H. Wheaton & Sons	10,437
"Kellum's Sure Cure," for medicine, Kellum Med. Co.	10,428
"Lotus," for flour, George Urban Milling Co.	10,442
"Millard Fillmore," for cigars, S. Levyn (Incorporated)	10,433
"Peacock Pure Paint," for paints, Allegany Paint Co.	10,425
"Pie Flour," for flour, George Urban Milling Co.	10,441
"Queen Quality," for coffee, B. Fischer & Co.	10,439
"Revelation," for cigars, C. B. Henschel Mfg. Co.	10,430
"Salome," for a medicine, E. S. Frank	10,427
"Schollian's No. 1," for cigars, Smith, Lichty & Hillman Co.	10,435
"Stars and Stripes," for beer, Willow Springs Brewing Co.	10,436
"Sunoleum," for washing compound, Sunoleum Mfg. Co.	10,443
"The 'Winona' Scratcher," for stockings, Columbia Hosiery Co.	10,424
"Thor Rye," for whisky, D. Leffingwell	10,438
"Wakega Medical Co.," for medicine, Wakega Medical Co.	10,429

PRINTS.

"Buster Brown," for shoes, Brown Shoe Co.	845
"Friend Overcoats," for men's winter apparel, Friend Bros. Clothing Co.	844
"Friend Suits," for men's winter apparel, Friend Bros. Clothing Co.	843
"Mistletoe Congress Playing Cards," for playing cards, United States Playing Card Co.	846

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.

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