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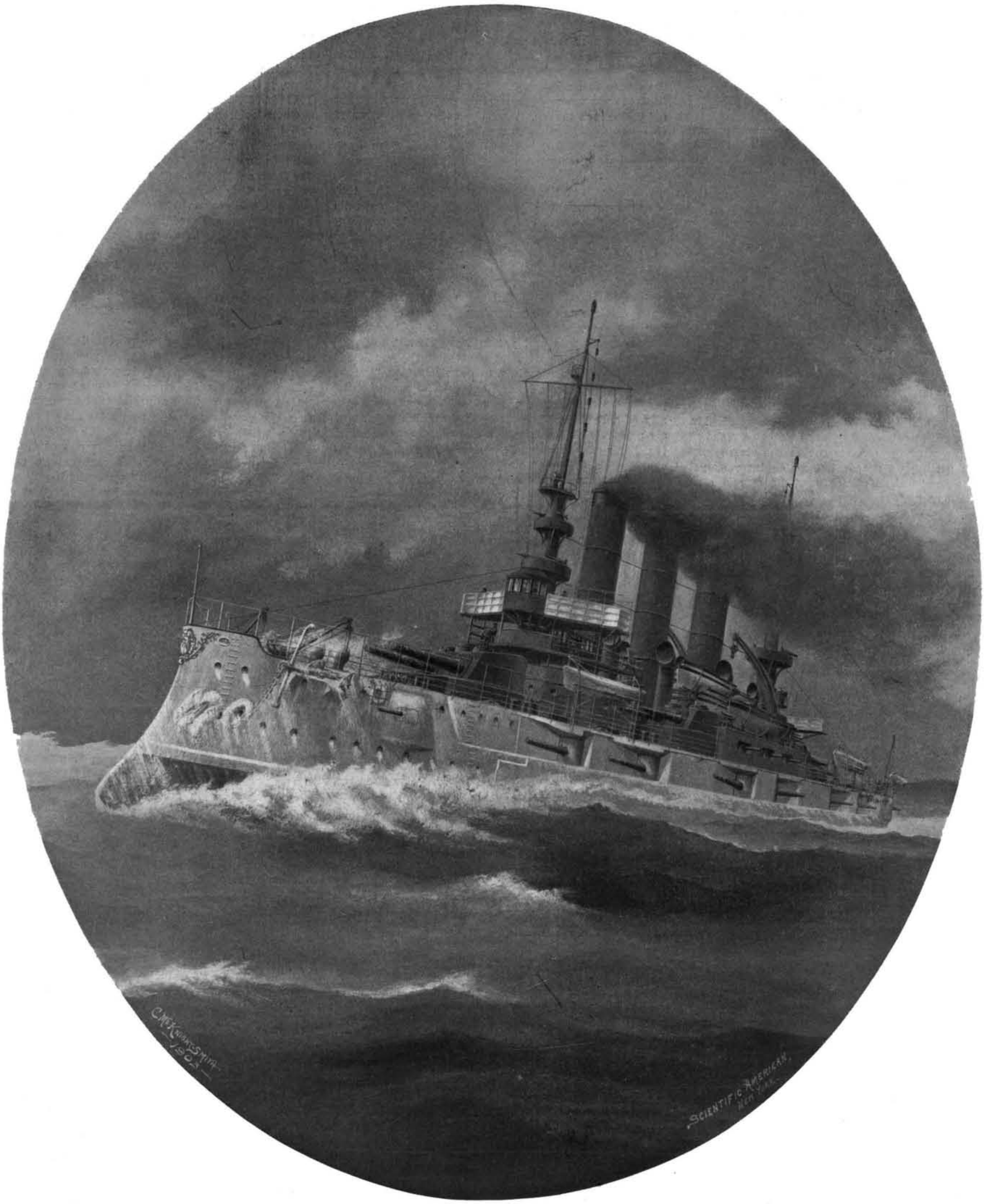

Displacement, 16,000 tons. **Speed,** 18 knots. **Armament:** Four 12-inch; eight 8-inch; twelve 7-inch; twenty 3-inch. **Belt armor,** 11 inches; battery, 7 inches.

THE LATEST BATTLESHIPS OF THE UNITED STATES NAVY.—[See page 274.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, OCTOBER 17, 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.

ONE HUNDRED AND TWENTY-FIVE MILES AN HOUR—A NEW RAILROAD RECORD.

The speed of one hundred and twenty-five miles an hour, attained the other day by an electric car on the military road extending from Berlin to Zossen, means something more than the hopeless outdistancing of the best record ever made by a steam locomotive and the outdoing of anything that has hitherto been attempted in the way of fast railway traveling. To electrical engineers it means that it is possible to construct an electrical equipment capable of driving a car at almost any speed a roadbed can bear.

Train acceleration has been studied by engineers ever since railroad engineering became something of an exact science. For that reason many have doubted the ultimate value of this Berlin-Zossen undertaking. But the mere duplication of train acceleration figures was something far beyond the purpose of the engineers by whom the speed trials were conducted. Mr. Bion J. Arnold in this country has conclusively shown the superiority of the electric car to the steam locomotive in getting up speed; but no engineer as yet knows the comparative efficiency of steam and electric traction at high speeds, and still less the cost of driving an electric train at the rate of one hundred miles an hour. It was for the purpose of determining these very questions that the Berlin-Zossen experiments were undertaken, and not simply for mere record breaking. Science is not a sport; it is the gathering and classifying of facts for practical use.

The speed of one hundred and twenty-five miles an hour represents the culmination of the experimental work of two great German electrical companies, who, in the interests of electrical engineering, were willing to sink commercial rivalry, to give up all prospect of gain for the time being, and to determine by a series of carefully conducted scientific trials just what an electric car can do at high speeds. Probably nowhere in the annals of modern engineering is there to be found an example so characteristic of German patience and thoroughness. We hear much these days of syndicates formed for the purpose of cheapening the productive cost of goods; but this is surely the first instance of the formation of a syndicate for the sole object of solving a much-discussed problem in electrical engineering.

The history of this Berlin-Zossen scheme is not without interest. Begun some two years ago with practically the same rolling stock used in the recent trial, the experiments had to be temporarily abandoned when a speed of ninety miles was reached, the track proving far too light to withstand successfully the enormous strains imposed by a swiftly-moving vehicle. Electrically considered, however, these early trials were anything but failures. The motor equipment proved well-nigh faultless; dangerously high tensions of thousands of volts were handled with comparative safety. With a roadbed vastly improved, tests were resumed a short time ago at ninety miles an hour. The speed was successively raised from ninety to one hundred and from one hundred to one hundred and seventeen miles, until at last a velocity of one hundred and twenty-five and four-fifths miles was attained, for which the undertaking was originally planned.

It is to be regretted that the military road from Berlin to Zossen is far too short to realize all the advantages to be obtained from high speed. The car could hardly have traveled any great distance at its unprecedented rate when it became necessary to slow down, as the end of the line was near. Still, the results obtained will serve to clear up many a doubtful point in electric traction. Something of the braking power required to stop this one-hundred-mile-an-hour car will surely figure in the reports of the tests.

To the man who has an eye for dramatic effects, the Berlin-Zossen record lends itself well to striking comparisons. If electric expresses traveling at the rate of one hundred and twenty-five miles an hour were as common as sixty-mile-an-hour trains, it would be possible to journey from New York to Philadelphia in little more than forty-three minutes, and to cover in seven minutes the short distance of fifteen miles between the Battery and Spuyten Duyvil, or in other words, the entire length of the island of Manhattan.

DANGERS IN IRRIGATION.

A "well-known government scientist," was recently quoted in the columns of the New York Sun as stating that irrigation is only a temporary expedient for making arid lands productive, and that genuinely arid countries are always sooner or later ruined by the alkali on the soil, which is brought to the surface by the waters of irrigation and there deposited. Such a statement, ascribed to one presumably connected with the Department of Agriculture, deserves somewhat more than passing attention, particularly in view of the extensive irrigation carried on in these very lands in the improvement of which this very Department has spent so much money. That the evil was exaggerated there seemed no doubt. An inquiry directed to the Agricultural Department brought a reply from Prof. Elwood Mead, Chief of the Irrigation Investigations, who shares our view of the matter.

The Department is well aware of the fact that water dissolves the salts contained in the lower soils of arid regions, and that the water rises by capillary action, and carries these salts in solution up to or near the surface, where they are deposited when the water is evaporated. This state of affairs would be extremely serious, so serious, indeed, that further irrigation would be of doubtful value, if not an absolute waste of time and money, were not the remedy for it, which the unnamed "government scientist" demands, already discovered and put into practice. The investigations of the Department show that the conditions in question are due mainly to over-irrigation, that is, flooding of the arid lands; but can be remedied by proper drainage. The soils of arid regions are usually of a sandy and silty nature, in which water and air penetrate to great depths. In consequence of this, the roots of plants in these regions reach down to considerable depths to obtain moisture and nutriment, instead of spreading along the surface as in humid climates. If, by over-irrigation, the water level is allowed to rise close to the surface, the layer of soil which supplies the plant with food is shallower, and its nutriment soon exhausted. Furthermore, if the water is within reach of surface evaporation, the alkali it contains in solution will accumulate to such an extent as to render the soil unfit for cultivation. The employment of judiciously disposed drains serves the double purpose of preventing undue rise of the irrigation water and of carrying off the objectionable alkali. The depth to which these drains are laid is a matter of great importance. The limit has been placed at four feet from the surface, though greater depths have been recommended. Careful consideration of the source and flow of water sometimes permits the location of a single drain in such a manner as to carry off water which might otherwise injure hundreds of acres of land. The drainage water may be collected in reservoirs, and then redistributed in the irrigation ditches. In localities where water is scarce, the economy of such a system is apparent. Such operations have been successfully and very extensively carried out in Colorado, where it has also been demonstrated that lands already injured by alkali can be restored to productiveness by means of proper subsoil drainage.

INDIA RUBBER AND ITS SUBSTITUTES.

More than 50 million pounds of India rubber, valued at more than 30 million dollars, were imported into the United States last year. In 1890 the quantity was only 33 million pounds, in 1880 16 millions, in 1870, 9 millions, and in 1862, the earliest date at which it was separately shown in the import statements, merely 2,125,561 pounds. This very rapid growth in the importation of crude India rubber is of course due to the great increase in its use in manufacturing, both as to rubber garments, shoes, etc., and its use in machinery and as tires for vehicles. Over 100 million dollars' worth of manufactures from India rubber are now turned out from the factories of the country every year, and about half of this total is in the form of boots and shoes. So great is the demand for India rubber for use in manufacturing that, not only has the importation grown from 2 million pounds in 1862 to over 50 millions annually at the present period, but in addition to this the forests of the East Indies are called upon for several million pounds annually of a new substitute for gutta-percha, known as "gutta-joolatong," while at the same time the highways and byways of Europe and other continents are ransacked for cast-off rubber manufactures from which the rubber is "reclaimed" and re-used in conjunction with the new rubber from the forests of Brazil, Africa, and the East Indies.

Figures just compiled by the Department of Commerce and Labor, through its Bureau of Statistics, show the importations of three classes of material utilized as India rubber in recent years. They show that during the past few years the importations of crude rubber have ranged from 50 to 55 million pounds; of gutta-joolatong from 5 to 15 million pounds, and of "old and scrap rubber, fit only for remanufacture," from 10 to 20 odd million pounds per annum, and of gutta-percha a half million pounds.

The industry of importing and "reclaiming" India rubber for re-use in manufacturing is a comparatively new one, and while it utilizes large quantities of worn-out rubber boots and shoes and other articles of this character from the scrap heaps of the United States, it has extended to other parts of the world only in recent years. In 1893, for example, the total importation of "old and scrap India rubber fit only for remanufacture" was less than a million pounds. In 1896 it was over 3 millions, in 1898 more than 9 millions, in 1900, 19 millions, in 1902, 22 millions, and in 1903 24,659,394 pounds, valued at $1,516,137.

Gutta-joolatong is another comparatively new material which may be utilized as a substitute for or in conjunction with India rubber. It is a product of the East Indies, chiefly the island of Borneo, located not far from our Philippines, and in the form in which it is imported is described as "whitish in color, looking something like marshmallow candy, smelling strongly of petroleum, and oxidizing on exposure to the air, becoming hard." The same description says: "It is not a substitute for gutta-percha or India rubber, but is used chiefly as a filler in manufactures of India-rubber gum, and gutta-percha." The importation of this newly developed aid in the manufacture of India rubber has increased from 6½ million pounds in 1899 to 14 million pounds in 1903.

A very large proportion of the India rubber imported into the United States is produced in Brazil. Over one-half of the total is imported direct from Brazil, while considerable quantities come from the United Kingdom, presumably the products of her colonies, and from Belgium, chiefly the product of the Congo Free State, which is under control of the Belgian government, and its industries of this character controlled by the people of that country. Recent reports received by the Division of Consular Reports of the Bureau of Statistics prove that experiments in the East Indies have shown the entire practicability of producing the best Para rubber in territory immediately adjacent to the Philippines from trees transplanted from South America, and suggesting the possibility that the Philippine Islands may in time supply at least a part of the growing rubber consumption of the United States.

NEWS FROM THE ZIEGLER EXPEDITION.

The "America," bearing the second Ziegler polar expedition, has been heard from. Mr. Ziegler has received a letter from Anthony Fiala, who is in command, written in the Barentz Sea July 20. The letter reads as follows:

"We are rapidly nearing a sail, and in hopes of this reaching you I write hastily. We left Archangel on the Fourth of July, but were delayed by a storm in the White Sea, reaching Vardo, Norway, July 9. At Vardo we took on additional coal and water, leaving there the evening of the 10th. Since then we have been skirting the edge of the ice pack, vainly looking for a lead. We made a direct course from Vardo, striking the ice at 38:30 east longitude, 75 north latitude, and then went into the ice to 75:38, but it was so solid that we returned and went eastward and southward along the edge of the pack looking for a lead until we were near the shore, in plain sight of Nova Zembla, last night, in latitude 72:45 north. Not finding a lead of any character worth going into the ice, we are returning northward and westward, where we intend to push into the ice between the 46th and 47th parallels of east longitude, as Capt. Coffin thinks it will be the best place to try to force our way. Instead of being a particularly good year as to ice conditions, the indications thus far seem to prove otherwise, and the strange silence from the lack of life that broods over this waste of ice is peculiar. We have indeed struck a peculiar season. Numbers of dead birds strew the cakes of ice, and not one polar bear has been sighted, and only a stray seal once in a great while. It either indicates immense fields of ice north or lots of open water; let us hope for the latter. Everything aboard has been pleasant and harmonious. Men are in splendid condition and happy, although impatient to get north. The horses and dogs are in particularly good form, and we are thankful for the coal we took on at Vardo, for we shall need every ounce of it as we look at the long, unbroken mass of ice."

This letter having been written over two months ago, it is believed that a favorable lead was found and the party's base, Franz Josef Land, successfully reached.

NEW AUTOMOBILE TRACK RECORDS.

The second automobile races of the year to be held in the vicinity of New York occurred on the Empire City Track on Saturday, October 3. Barney Oldfield, on the Winton eight-cylinder "Bullet No. 2," was again the hero of the hour, and he startled the several thousand spectators there assembled by covering the mile course fifteen times in 14 minutes 35 seconds. This remarkable performance was incidental to the 15-mile free-for-all race. The machines competing against the 70-horsepower Winton car were a 40-horsepower Decauville, a 60-horsepower Mercedes, a 25-horsepower Packard racer, and a 24-horsepower Renault. The Decauville made the best showing next to the Winton, and finished in 15:07 1-5, thus making a new track record for machines weighing under 1,800 pounds. Oldfield's fastest mile, the tenth, was covered in 56 seconds, just one-fifth of a second more than his best record made on the same track last July on the Ford racer. After the first five miles, which were covered in 5 minutes 1 second, Oldfield maintained a pace of 56 or 57 and a fraction seconds to the mile, up to the last circuit, which he made in precisely one minute. His performance was a good example of the mastery of man over mechanism, for it should be remembered that the car is the same one which balked so badly with Mr. Winton in the Gordon Bennett race, and Oldfield himself did not succeed in getting the best he could out of it earlier in the day, when he ran a mile against time in 56 2-5 seconds. The machine took the turns with much less slewing than the old Ford racer, and driver and machine almost seemed one piece of mechanism as they flew past the grand stand.

One of the first records to be broken was that for 10 miles, for cars weighing under 1,800 pounds, which had 36 2-5 seconds clipped off it by the Decauville machine, which, in a race with the Packard and the Renault machines, covered the distance in 10 minutes 16 3-5 seconds. The last-named car dropped out, and the 25-horsepower "Grey Wolf" was lapped at the end of 8½ miles.

A 5-mile race for machines under 1,200 pounds was won by a 21-horsepower Georges Richard-Brazier machine in 6 minutes 16 3-5 seconds. Despite the fact that one of the four cylinders was inoperative, the machine, running on three cylinders, made a new track record for each mile, its fastest circuit being covered in 1:13 1-5.

By no means the least interesting of the events was a 5-mile race between four 16-horsepower gasoline locomobile machines, driven by their owners. Archibald McNeil, Jr., of Bridgeport, Conn., won in 7 minutes 19 2-5 seconds.

FIRST DAY'S RUN OF THE NEW YORK-PITTSBURG AUTOMOBILE ENDURANCE TEST.

BY THE SCIENTIFIC AMERICAN'S OBSERVER.

Thirty-four American-built automobiles were started Wednesday morning, October 7, at 7 o'clock, from the historic heights of Weehawken, N. J., opposite this city, on an 800-mile test over all kinds of roads to Pittsburg, Pa., on the first annual endurance run of the National Association of Automobile Manufacturers. The weather was damp and foggy, threatening rain, which fell in a misty drizzle in the afternoon. The distance to Newburg, the mid-day control, was 60 miles, and this was covered by most of the machines in about four hours, as a splendid, smooth road was run over nearly all the way. One machine, the Toledo, made the distance in two hours and fifty minutes. After an hour spent for lunch at Newburg the majority of the contestants left there for Pine Hill, 70 miles distant, between 11 and 1 o'clock. Fairly good roads were met with to Kingston—35 miles—after which came long stretches of poor and muddy road, with many mudholes and soft spots, extremely dangerous on account of skidding. No more serious accidents occurred, however, than the striking and overthrowing of an iron hitching post, and the taking off of a hub-cap of the Knox surrey by the Packard "Old Pacific," in passing the Knox while endeavoring to avoid a rut in the road. The locomobile touring car, in making a plunge into a deep mudhole, bent its starting handle and jammed it against the radiating coils, damaging them slightly but not breaking them. The Fredonia runabout, however, was not so fortunate, for, while rushing a hill behind the transcontinental Oldsmobile, it ran into the latter and broke its radiating coils. This and other troubles prevented it from reaching Pine Hill till quite late. Two of the White steam machines had trouble with their tires, owing to the tire not fitting the wheel rim properly. One of the rear tires on the White tonneau No. 5 could not be made to stay on, and after trying first rope and afterward chain, the machine was run 35 miles into Newburg on the bare rim. At that place a tire that fitted was secured, and the car finally arrived about 8:30 P. M., while its mate was some miles behind.

The Pierce "Arrow" tonneau ran out of gasoline a few miles before reaching its destination, but fortunately managed to procure a supply from a store in a nearby village and finished the run in good time.

L. L. Whitman's Oldsmobile, which has already crossed the continent, ran from New York to Newburg on 2½ gallons of gasoline, and averaged 12 miles an hour. His average speed for the rest of the day's run was about 10 miles an hour, which was very good considering the execrable condition of the roads in many spots. The new Knox tonneau car, with double, opposed cylinder, air-cooled motor, on which machine the writer rode, made a perfect score and proved itself a very smooth-running car. The three Franklin cars, as well as two other Knox machines, all demonstrated the entire practicability of the air-cooled motor over bad, muddy roads, as well as on smooth macadam.

The presence in the run of the two machines which have lately crossed the continent—the Packard single cylinder "Pacific," and the regular Oldsmobile runabout, speaks well for the enduring qualities of American machines; and the way the former plowed through the mud and made its way over the rough spots was an object lesson in staunch construction.

The rain in the afternoon made the roads over the last stretch from Kingston to Pine Hill, N. Y., very soft and slippery—conditions extremely unfavorable for rapid automobiling; and the next day in going from Pine Hill to Binghamton, N. Y., the unfavorable conditions were greatly intensified by a driving rainstorm, which made washouts everywhere, covering soft spots with water, causing the wheels in places to sink up to their hubs in mud. Many machines had ropes wrapped around their rear tires to prevent skidding, but even then the wheels would rotate in muddy, soft spots without propelling the machines. Of the thirty-four machines started, the first thirty-three completed the day's run, the Holley motorette being the only one unable to traverse the bad roads encountered. From Binghamton the route as arranged is to Buffalo, N. Y., thence to Cleveland, Obio, and from there to Pittsburg, Pa., the run to terminate on October 14. The conditions of the run formulated provide 6,000 points as the maximum obtainable, as follows: Run without stops, 3,000; condition at finish, 1,500; weight-carrying capacity, 1,000; hill-climbing, 250; brake test, 250. Each minute of a penalized stop counts one point against the vehicle.

QUEEN VICTORIA'S IVORY CHAIR OF STATE.

Among the priceless treasures comprising the Jubilee presents of Queen Victoria, which have been sent to America by King Edward of England for exhibition at the World's Fair, is a wonderful ivory chair and footstool. These were presented to the late Queen by the Maharajah of Travancore.

The carving on the chair and footstool is a revelation of the possibilities of art. The feet are in the form of lions' paws, and the arms terminate in lions' heads. The back is in the form of a shell, supported by elephants rampant. The seat is of alabaster, and the chair has a gold and silver tissue drapery around the underside of the frame, finished with tassels and richly chased ormolu ornaments. The cushions are of green velvet, embroidered in gold and silver thread. Every outside part of the chair is covered with delicately carved figures of men and animals.

This maharajah, not satisfied with this truly princely gift, presented also to her Majesty two immense pairs of elephants' tusks. The official descriptions of these are as follows:

1. Pair of elephant's tusks, mounted on a buffalo's head, carved in ebony, which is supported on four griffins. The tusks are supported higher up by a crossbar of ebony and resting on the heads of four figures representing some of the incarnations of Vishnu. Rushing from the projecting ends of the crossbar to the tusks are two griffins with two elephants under them, linking their trunks. On the center of the bar is a sixteen-handed figure of Shive, standing on the prostrate form of an Abamaram, or fiend. All figures are ebony.

2. Pair of elephant's tusks, mounted as flower vases on a stand of rosewood covered with ivory. The tusks are mounted with gold and entwined by a pepper vine in fruit, worked in gold. The vases are supported on two elephants' heads carved in ebony, and rising from out of a base of rock and jungle worked in ivory and elephants' teeth. The trunks of the elephants support a lotus of ivory, on which is seated a golden image of Lukshine, the goddess of prosperity.

BATTLESHIP "MISSOURI'S" BUILDERS' TRIAL.

The battleship "Missouri" had her builders' trial trip recently. She steamed out to sea, and it is authoritatively stated that her performance, when no special effort was made for speed, shows conclusively that she will easily go above the contract requirement of eighteen knots an hour. All of her machinery worked perfectly.

SCIENCE NOTES.

To the Paris Academy of Sciences Dr. Finsen has reported a tabulated list of cases of lupus on which the Finsen light cure has been successfully tried. Out of 804 cases, 412 have been pronounced cured. Of this number of cured, 124 have shown no signs of a recrudescence of the disease after a period of from two to six years. The other 288 cases are of more recent date, but there are no signs of a recrudescence, and they are believed to have been cured.

J. C. Umney and C. T. Bennett have examined a sample of non-freezing fish-liver oil which, in many respects, responded to the Pharmacopœial tests for cod liver oil. The refractive index and the percentage of free fatty acids were found to be the most valuable tests for purity, the fish oil showing over 3.0 per cent of the latter. The B. P. nitric acid test has also been found to be useful for excluding fish oils from cod liver oil when time is not a matter of importance.

W. A. Jones and C. E. Waters have independently investigated the action of ozone on carbon monoxide. It is found that ozone does not act on carbon monoxide as readily as might be expected from its apparent unsaturation; there is some oxidation to carbon dioxide at high temperatures, the oxidation depending on the amount of ozone present in the oxygen. Jones did not find the least evidence of oxidation by hydrogen peroxide, even when concentrated solutions were employed.

A Liverpool firm which does a large trade with East and Southwest Africa, received recently a species of a plant hitherto unknown, which produces rubber. The plant grows under ground, and probably will be found in English East Africa. If the bark of the plant is broken the rubber keeps the pieces together and is of extraordinary elasticity. The rubber is directly beneath the bark and is of unsurpassed quality. Ordinarily the roots, when about one month old, contain from 6 to 6½ per cent of rubber; if the bark is removed, the percentage is from 12 to 15.

P. Duhem reaches the following conclusions in an investigation of Röntgen rays and Hertzian oscillations: (1) Transversal electromagnetic waves are propagated in dielectric media according to the laws of the electromagnetic theory of light. (2) Longitudinal electromagnetic waves are propagated in all dielectric media with the same velocity, equal to the velocity of light *in vacuo;* they travel also with this same velocity in perfect conductors. Attention is called to the analogy which appears to exist between longitudinal electric oscillations and the Röntgen rays.

M. G. Claude, of the French Académie des Sciences, has discovered a further development of the well-known process of obtaining oxygen from air by the liquefaction of the latter. In the general method of obtaining oxygen by this process, the *modus operandi* is to condense the air as a whole, and then to re-evaporate it, thereby enabling the nitrogen, which is the more volatile gas, to escape first, leaving subsequently a liquid containing a richer proportion of oxygen until the last 10 per cent of the liquid contains approximately 92 per cent of oxygen. M. Claude conceived the possibility of obtaining a gas richly impregnated with oxygen without previously liquefying the whole proportion of nitrogen present. For this purpose he designed a special apparatus, and by this means the liquid was drawn off as rapidly as it was produced. The result of this experiment demonstrated that as much as 48 per cent of the liquid was oxygen.

The use of balloons for keeping a lookout upon the coast has been attempted in several cases by steamships, but the trials which have been made with the ordinary spherical balloon did not prove successful, and difficulties arose which were insurmountable, owing to the fact that the balloon is constantly driven about by the wind. A new system has been devised by a Swedish inventor, Parseval-Siegsfeld, which bids fair to be successful, as it consists of a balloon-kite, and like all apparatus of this kind it takes the direction of the wind and keeps its position with but little oscillation. As the character of the Swedish coast, with its numerous rocks and islands, makes it difficult to observe the different straits which separate them, an apparatus of this kind is especially needed, and therefore a special boat has been constructed which carries the kite-balloon, and in this way affords an observation point over a great extent of the coast, and any hostile approach can be at once noted. The new vessel measures 152 feet long and 34 feet maximum width, and gages 200 tons. It is provided with a set of apparatus which inflates the balloon with hydrogen. The gas is contained in large reservoirs and is sent to the balloon through a set of tubes. The machines which serve to inflate the balloon or to draw out the gas are operated by electric motors. The current is produced on board the vessel by a dynamo which is driven from two petrol motors of 40 horse power. One peculiar feature is that the vessel is not built to be propelled by its own motive power, but is towed by a small tug.

THE FAILURE OF LANGLEY'S AERODROME.

Those who have the interests of aerial navigation at heart will regret the failure of Prof. Langley's last experiment, not so much because the aerodrome refused to fly, but because of the adverse newspaper comment which the trial has prompted. No scientist was ever absolutely successful in every experiment which he has undertaken, least of all is success to be expected in so precarious an undertaking as that of testing the capabilities of a new flying machine. Prof. Langley, despite his failure, deserves his full meed of praise for the earnest attempt which he has made to solve a problem which has puzzled inventors ever since the days of Icarus. He has attacked that problem in no uncertain fashion. This aerodrome of his is the result of years of arduous study and ceaseless experimentation. That it should have failed is to be regarded simply as one step in the solution of the problem of aerial navigation, and not altogether as an abject failure.

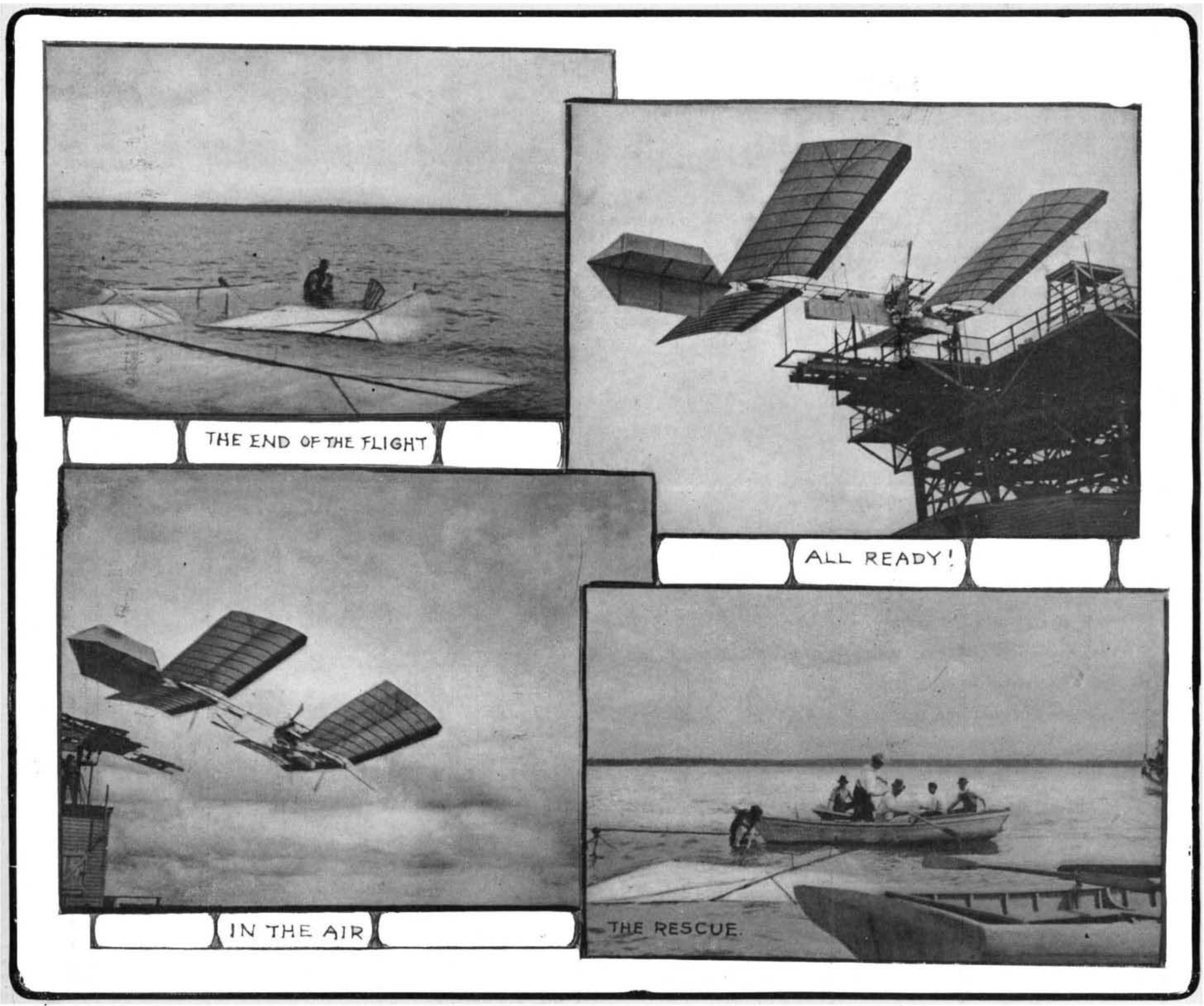
A few months ago a preliminary trial was made, which proved abortive. Prof. C. L. Manley, one of Prof. Langley's assistants, entered the 60-foot aerodrome, and started the machinery. The aerodrome refused to move. The cause was a broken valve and other defects in the machinery. A second trial was no more successful, for, although the engines operated perfectly, one of the propellers flew off the shaft and caused no little injury. The last attempt, made on October 7, had at least the merit that the machine started. The aerodrome slid along 70 feet of elevated track at the rate of 40 feet a second, darted into the air, hovered uncertainly for a moment and then plunged downward into the Potomac. Buoyed up as it was by a number of hollow cylinders, the aerodrome soon arose with its occupant. From all accounts the aerodrome is rather badly damaged. Prof. Manley was rescued by a rowboat.

Prof. Langley in an interview with a representative of the Washington Star said that he was not an eyewitness of the experiment, having been detained in Washington by business, but he added that on the report of Mr. Manley, who was immediately in charge, he is able to say that the latter's first impression that there had been defective balancing was corrected by a minuter examination, when the clutch which held the aerodrome on the launching ways and which should have released it at the instant of the fall, was found to be injured. Prof. Langley continued:

"The machinery was working perfectly and giving every reason to anticipate a successful flight, when this accident, due wholly to the launching ways, drew the aerodrome abruptly downward at the moment of release and cast it into the water near the houseboat. The statement that the machine failed for lack of power to fly was wholly a mistaken one. The engine, the frame, and all the more important parts were practically uninjured. The engine is actually in good working order. The damage done was confined to the slighter portions like the canvas wings and propellers, and these can be readily replaced. The belief of those charged with the experiments in the ultimate successful working of the machine is in no way affected by this accident, which is one of the large chapter of accidents that beset the initial stages of experiments so novel as the present ones. It is chiefly unfortunate as coming near the end of the season when outdoor work of this sort is possible. Whether the experiments will be continued this year or not has not yet been determined."

The Star states that apart from the main body practically nothing that went to make up the airship as it was last launched can be made over for use again. The wings, propellers, and rudder are now masses of threads, rags, and splinters. But fortunately these are the parts which, of the whole, are the least expensive and the least difficult of construction. There are several pairs of propellers now in the houseboat shop. These, however, are not of the improved type which Prof. Manley perfected just before the experiment. But it does not require more than three or four days to make a pair of propellers. There are now at least two of the big 22 x 12-foot wings in the shop. The work of producing a wing is much more difficult and takes more time than that of constructing a pair of screws. The same is true of the rudder.

The photographs presented herewith are reproduced through the courtesy of the Washington Star.



THE FAILURE OF LANGLEY'S AERODROME.

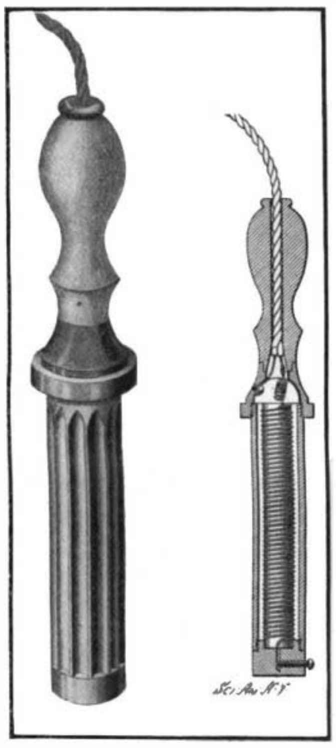
Magnetic Experiments on Metals.

A long investigation of the connection between the magnetization and the mechanical deformation of the ferro-magnetic metals has been concluded by Messrs. H. Nagaska and K. Honda, of Tokio. From the results published it seems that in reversible nickel-steel, such as is used for scales on account of its small expansion, mechanical elongation in the direction of magnetization produces an increase of magnetism. On the other hand, the same substance stretches on being magnetized, especially when it is annealed instead of being hard drawn. Iron, steel, nickel, and nickel-steel increase in volume by magnetization, but cobalt shows contraction. The greatest volume change was observed in a nickel-steel containing 29 per cent of nickel, in which it is in a strong field forty times that of iron. As regards the Wiedemann effect, the twist produced by the combined action of circular and longitudinal magnetization in iron, nickel, and nickel-steel increases with the longitudinal field strength, and reaches a maximum, whence it decreases gradually as the field is further increased. The sense of twist in iron and nickel-steel is opposite to that in nickel. The transient current produced by twisting a longitudinally magnetized wire, and the longitudinal magnetization caused by twisting a circularly magnetized wire, are reciprocally related to the twist produced by longitudinal and circular magnetizations.

Papier mache mushrooms and toadstools will form an interesting and instructive exhibit prepared for the World's Fair by the Massachusetts Agricultural College. The difference between the edible and poisonous mushrooms will be made clear.

ELECTRIC HEATER.

It is often desirable to heat a small amount of water or other liquid in a hurry, and in buildings where electricity is used for lighting purposes this can be readily done by means of the device which is illustrated herewith. This device is the invention of Mr. Fernan O. Conill, of Havana, Cuba, Box 123.



ELECTRIC HEATER.

The inventor claims that with his little electric heater half a pint of water can be raised from freezing point to the boiling point in only four or five minutes. The heater may be cheaply made, as will be readily seen from the following description of its construction. The handle of the device, which is made of insulating material, is secured to a tube or cylinder of metal which surrounds a core of porcelain formed with a spiral groove to receive the resistance wire. The spiral coil of the core may be cut on an engine lathe by means of a diamond or quartz point. The resistance wire is a small platinum wire which, at its lower end, is secured by means of a set screw to the metal plug which closes the bottom of the cylinder. The other end of the heating wire is connected to one of the main wires or lamp cords which pass out through the handle. The other lamp cord is electrically connected to the cylinder. The latter may be fluted to increase its radiating surface. In use, the lower portion of the device is submerged beneath the surface of the liquid to be heated. The conducting cords are connected with the lamp socket or with the terminals of a source of electricity, whereupon the current in passing through the small platinum wire causes it to become intensely hot. The heat is then radiated to the cylinder, which in turn communicates it to the liquid. Practically no danger attends the use of the device, and it can be manipulated by any person of ordinary intelligence.

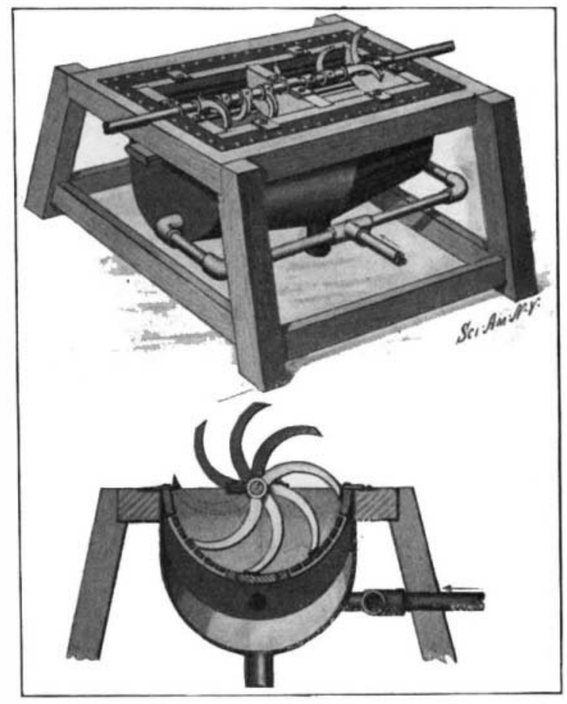
The Dynamic Flying Machine.

At a recent meeting of the Aeronautical Institute and Club, Herr Wilhelm Kress, of Vienna, read a paper on "The Dynamic Flying Machine." He stated that it would be necessary to overcome constructional difficulties before the dynamic flying machine was entirely successful. The greatest difficulties would be in the initial trials, and the man had yet to be born who could create a flying machine that would sail in the air at the first trial. He went on to say that much depended on material and conscientious workmanship, and expressed the conviction that the dynamic principle would overcome all difficulties, and that such a machine would sail through the air at a greater speed and with greater security than the motor-car of the day ran along the roads. The paper was illustrated by working models.

At a meeting of the Vienna Photographic Society, Eder exhibited a new light filter. The dye used is nitroso-dimethylaniline, which is of a yellow color and absorbs all the visible rays, but transmits the whole of the ultra-violet. By combining this dye with cobalt glass, a filter is produced that transmits the ultra-violet only. Some remarkable photographs of landscapes taken with these filters were also shown.

MACHINE FOR DRYING COCOA BEANS.

In the preparation of cocoa beans special conditions are met with which are not encountered in any similar process. Cocoa beans should never come into contact with metal while they are fresh, because they are very acid and such contact would turn them black at once. Furthermore, the beans must be kept in motion while fresh, otherwise they will stick together and form a solid mass. On the other hand, any stirring device that may be employed for agitating the beans during the drying process should be very carefully arranged, because the skins of the beans are very tender and easily injured. With these limiting conditions in mind, Mr. Leon G. Laprade, of San Jose, Costa Rica, has invented a drying machine which is calculated to dry the cocoa beans in a most efficient manner. It comprises a non-metallic receptacle in the form of a half-cylinder below which is a tank of similar form. The upper receptacle or basket is formed of longitudinally extending slats and is divided by a partition into two compartments. The bottom of each compartment is provided with a panel which may be withdrawn at will to empty the contents of the basket into the tank, whence they find an exit through a bottom outlet. The stirring device consists of a shaft mounted centrally over the baskets and provided with curved fingers in spiral arrangement thereon, so that, on rotating the shaft, when one finger is entering the basket, another will be leaving it, and more or less of the fingers will be in the baskets at all times, acting on the beans therein. The blades pass in close proximity to the bottom of the basket, and are triangular in cross section, the point of the triangle being on the inner side, so that they act as wedges to gently force the beans sidewise. A hot air supply is fed into the tank at each end, and this on rising through the slotted bottom of the basket takes up and carries off the moisture of the beans.



MACHINE FOR DRYING COCOA BEANS.

THE KAMM TYPEWRITER FOR USE WITH WIRELESS TELEGRAPHY.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

An ingenious new office printing typewriter for utilization with wireless telegraphy, or if necessary with wires, has been devised by Mr. Leo Kamm, a well-known electrical engineer of London, England. The apparatus consists in the main of a typewriter, which can be used for transmitting or receiving messages, and the general instruments associated for the dispatch or receipt of ether waves. The most important part of the installation, however, is the typewriter, or zerograph as it is called. This apparatus in general appearance is not widely dissimilar from the ordinary typewriting machine. It consists of a row of keys, which when depressed cause the typewriter so actuated to record the imprint upon paper in the usual way, and to transmit through the air two ether waves, which cause the distant receiving typewriter to record the same letters upon paper tape in much the same way as the Morse tape instrument.

Although similar in working to the ordinary typewriter, the principle and mechanism are widely different. The type keys are ranged in a quadrant in the orthodox style. In order to obtain the maximum number of signs with the minimum number of levers, only twenty-eight type keys are provided, twenty-six of which correspond to the letters of the alphabet. In addition there are two shift keys to change from letters to figures and signs or *vice versa*, these keys also serving for spacing purposes. The quadrant on which the types are placed moves up and down according to which shift key is depressed. Each key is connected with a lever, and at the opposite ends of these levers are fixed vertical rods, the upper ends of which are ranged in another quadrant. When a letter type key is pressed down, the vertical rod is forced upward, and at the same time the synchronizing arm is set in motion, and the first impulse is sent to line. This arm, which is the most vital part of the apparatus, and travels in a horizontal plane, is operated from the axis of the circle, corresponding to the quadrant, and travels round the circular path until its progress is arrested by impact with the projecting vertical rod of the depressed type key. The corresponding letter is then printed, a second impulse is sent to line, and the synchronizing arm is then returned to its original or zero position by an electromagnet.

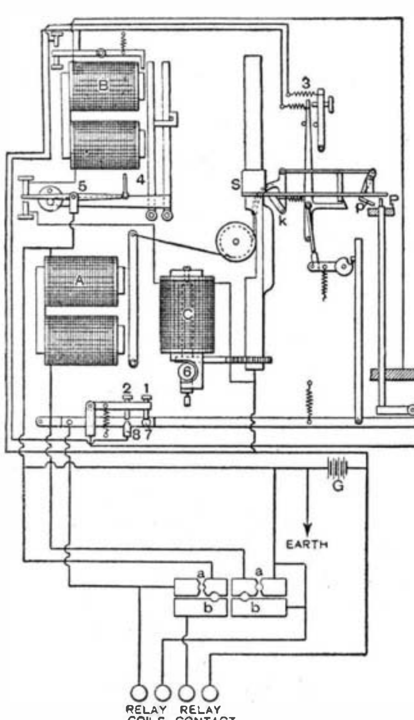


Fig. 1.—Diagram of the Working Parts of the Typewriter.

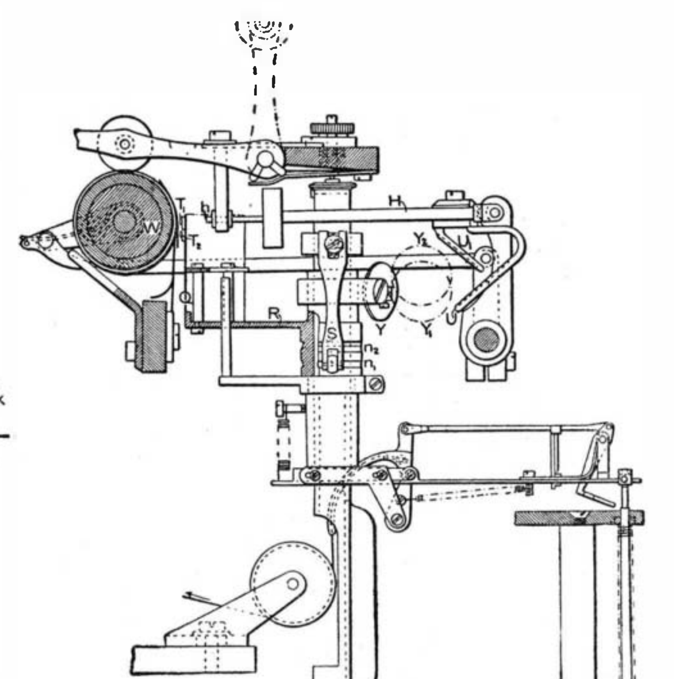
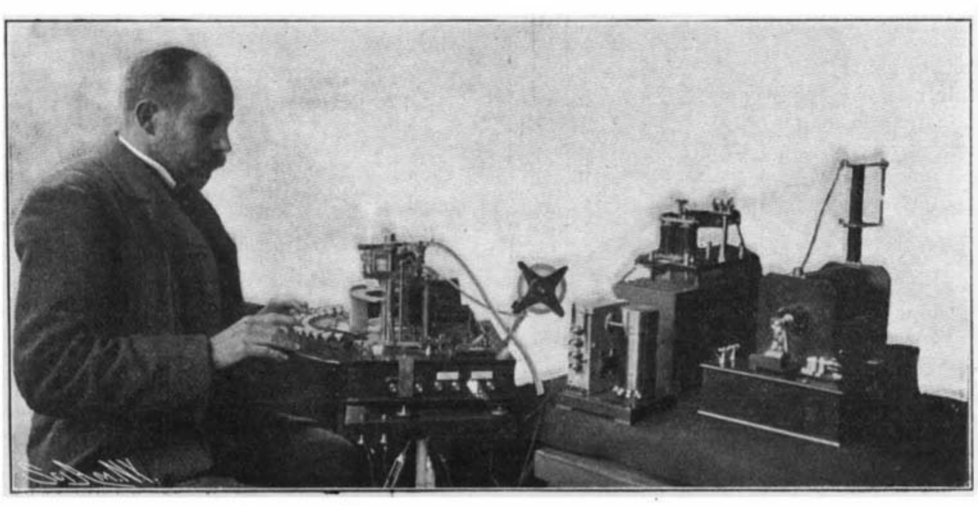


Fig. 2.—Part Elevation Illustrating in Detail the Synchronizing Arm, Type Quadrant Attachment, Printing Hammer, and Upper End of a Contact Pin.



A WIRELESS TELEGRAPHIC TYPEWRITER.

In order to comprehend the *modus operandi* of the apparatus, which is somewhat intricate, it is necessary to refer to the diagrams, of which Fig. 1 is a diagrammatic view of the working parts of the zerograph, and Fig. 2 is a part elevation illustrating in detail the synchronizing arm the attachment of the type quadrant, the printing hammer, and the upper end of a contact pin. The figures on the diagram, it may be explained, are applicable to either the transmitting or receiving zerograph, as each machine fulfills either function as required.

When the type key *K* is depressed, the vertical rod at its opposite end, which terminates in its upper end in a contact pin, *P*, is raised. The synchronizing arm or balance *S* has its zero position at the extreme end of the quadrant, and if set in motion without the depression of a type key, would swing in a horizontal circular path to the opposite extreme end of the quadrant. But the depression of the type key and the corresponding rise of the contact pin offer an obstacle to its progress. The stud 7 on the rocking lever beneath the key is caused to leave the receiving contact 1, thus enabling the contacts 2 and 8 to come together. Simultaneously there is another contact at 3, and a current is sent to line from the battery *G*. If there is no relay being used, plugs are inserted at *a a*, and the current received passes through the releasing magnet, *A*. This current, as it is received at the receiving zerograph, attracts this armature, thereby pulling back the little catch *k* on the synchronizing arm. By this arrangement, as the arm on the transmitting instrument is set in action by the depression of the type key, the similar arm on the receiving instrument moves simultaneously along its path. When the arm on the sending instrument comes in contact with the raised pin, the current is passed through the printing magnet *B* to the battery *G*. On the printing magnet *B* is a light armature, and this is now attracted, sending a second impulse to the line, which is received by the magnet *A* on the receiving instrument. This magnet again pulls the cord on the balance, and a small plunger *p* is caused to protrude against the nearest pin. This action closes the local circuit of the printing magnet in exactly the same manner as it is closed in the transmitting instrument. Across the printing magnet is bridged a condenser to diminish the sparking. A hammer is set in motion by the armature 4 of the printing magnet, and strikes the type against the paper tape, thereby leaving the impression of the letter. Simultaneously with the movement of the armature 4 the rocking arm 5 is tilted over. This breaks the circuit of the printing magnet, and closes the circuit of another magnet *C*. This latter is a strong magnet, and is called the zero magnet, as it returns the synchronizing arm to the zero position.

Fig. 2 illustrates the detail of the synchronizing arm, the attachment of the type quadrant, the printing hammer, and the upper end of one of the contact pins. When the shift key is depressed the quadrant carrying the type keys is moved up. The types are mounted on springs, each spring having two types, T_1 and T_2, placed one above the other. To the printing hammer, *H*, is fixed a small piece of metal, 1-16 inch thick, $U\,U_1$ the ends of which are grooved, as shown by the dotted line in the diagram. When the printing magnet is excited, the end of the hammer moves forward, and strikes one of the types against the tape and ink ribbon on the wheel *W*. When the shift key is depressed, a pin is raised which arrests the synchronizing arm when the flat wheel *Y* is in the position Y_1—that is to say, in the same plane as the end *U* of the piece $U\,U_1$. As the synchronizing arm travels forward, it raises the wheel *Y* and the whole carriage *R* upon which is fixed the type quadrant *Q*. The latter is lifted by exactly the difference in height between the two types T_1 and T_2, so that the type T_2 comes into action and records upon the paper. A light spring *S*, resting in one of the grooves n_1 or n_2, retains the carrier in its upper or lower positions. When the second shifting key is actuated, the synchronizing arm is stopped in a position in which the wheel *Y* is at Y_2, in the same plane as the end U_1 of the piece $U\,U_1$, this end being bent round by the angle equal to that between the two contact pins. The part U_1 on the stroke of the printing hammer is pressed against the upper end of the wheel *Y* and forces the type carriage down.

As the synchronizing arm has to return to zero after the completion of each letter is transmitted, it will be realized that a little longer time must elapse between each impulse when some type keys are depressed than with others. For instance, when the key at the extreme left of the type lever quadrant is depressed, the synchronizing arm has only about an inch to travel to transmit the impulse before it is stopped by the contact pin; but when the letter *Z* at the extreme right of the keyboard is pressed down, the arm has to travel the whole distance of the quadrant before sending the impulse. Still, a speed of nearly thirty words a minute can be maintained with but little practice on the part of the operator. An important feature of the instrument is that confusion of the letters cannot possibly result through the too rapid manipulation of the keys, since until the synchronizing arm has returned to zero after the depression of one key, another key will not operate. Should two keys be accidentally struck at the same time, only one key records its type upon the paper.

To apply the zerograph to wireless telegraphy, it is only necessary to connect it to the usual apparatus utilized for that work, the typewriter being substituted for the Morse transmitter. To insure satisfactory and successful operation, however, the inventor, Mr. Kamm, has devised several contrivances, such as an automatic coherer to enable rapidity in transmission and receiving to be attained, a new and special relay, and other important connections.

The machine is most favorably adapted to ether communication, owing to only two impulses being necessary for transmitting or receiving any sign. As each of these impulses corresponds to a dot on the Morse instrument, it is much easier to manipulate, and furthermore no apprehension need be entertained of a mistake arising through a dash being misconstrued into a dot, which is a feature of the Morse system of transmission and receiving, as there is always great difficulty in reading a dash correctly. The speed of operating the zerograph under wireless conditions is also immune from the many disadvantageous influences characteristic of the Morse system, being purely dependent upon the skill of the operator. By means of the zerograph it is possible to transmit at a speed of about twenty words per minute. Another important feature of the system is that it is free from tapping, or if not absolutely secure from outside influences, it is at any rate perfectly secret. If the impulses from one instrument are intercepted during their transit through the ether, the intercepter would be completely mystified, owing to each impulse being practically resolved into a dot, so that only an incomprehensible collection of dots would be received, and these would be of no value to the tapper at all. Furthermore, the nature of the apparatus admits of great differences in synchronism, so that only those instruments which are synchronized to one another will receive messages correctly.

For ordinary telegraphic purposes the zerograph is always ready for sending or receiving, but when used for wireless telegraphy two switches are provided. On the instrument is a small handle, and on the coil is another switch, which make the necessary connections for sending or receiving.

The coherer is of special design, and is absolutely different from any other type of coherer at present in vogue. Its principles of construction and working are preserved a secret, but its most salient characteristics are its extreme sensitiveness, being affected by the faintest ether wave, and automatic or quick self-decoherence, dispensing with the assistance of a tapper back. It decoheres instantaneously, thereby enabling more rapid communication to be established.

In the utilization of the apparatus for wireless telegraphy, when the type key is depressed, instead of the impulse being sent to line, it is passed round an electromagnet, which actuates the key closing the primary circuit of the induction coil and making the spark. The coil is exceptionally powerful, a 15-inch spark being obtained, which is ample to meet all demands. The relay is also of great power, and will overcome an exceedingly large resistance.

The zerograph has not yet been submitted to any tests over long distances with wireless telegraphy, but other experiments have been carried out with it over short distances under conditions so difficult that the trials corresponded to long-distance working under normal conditions. The German government has tested several of the instruments in the telegraph service for use with ordinary land lines, and they have proved eminently successful. They have also been operated in connection with the metallic current line between Brussels, Antwerp, and Ostend, and between Paris and Rouen. The latter line is particularly difficult in character, consisting of 100 miles of phosphor bronze, a similar distance of iron, and the remaining distance subterranean cable. It has also been tested between Paris and Brussels over a telephone line, simultaneously with a conversation being carried on, thereby proving its value for international purposes. No difficulty has been experienced in these operations, and the instruments have proved to be free from failure or breakdown.

THE LATEST BATTLESHIPS FOR THE UNITED STATES NAVY.

The designs for the "Louisiana" class of battleships were found to be so satisfactory that they were adopted for the latest battleships authorized this year by Congress. Very few alterations, and these quite of a minor character, were made in the original plans. The new ships will have a displacement of about 16,000 tons when they are fully equipped ready for sea with all stores on board, and are carrying their normal coal supply. Their principal dimensions are length over all 450 feet, breadth 76 feet 8 inches, and mean draft 24 feet 6 inches. They will be driven by twin-screw, vertical, triple-expansion engines, at a speed of 18 knots an hour, the estimated indicated horse power for this speed being 16,500. Steam will be supplied by batteries of Babcock & Wilcox boilers. The normal coal supply will be 900 tons, and the bunker capacity, estimated on a basis of 43 cubic feet per ton, will be 2,200 tons. The defensive arrangements of the new ships have been worked out after a careful comparison with our own and foreign ships, and are about the most complete to be found in any design, built or building in the world to-day. In the first place, there is an unbroken belt of Krupp armor from stem to stern, which is 11 inches in thickness at the waterline amidships and tapers gradually to a minimum thickness of 4 inches at the ends. Associated with this is a complete steel deck, 3 inches in thickness, which slopes toward the sides of the vessel to a junction with the side armor below the waterline. It is also sloped forward and aft to a junction below the waterline with the stem and stern. Upon this deck forward and aft, and extending above the main deck, are erected two barbettes of 12-inch Krupp steel; while above the main belt of side armor, and extending along the sides of the vessel for the full distance between the barbettes, and for the full height from the main belt to the upper deck, or main, is a continuous wall of 7-inch Krupp armor. The ends of this armor turn in across the vessel to a junction with the 12-inch barbettes. Within the armored citadel thus formed there are mounted four 40-caliber, 12-inch, high-velocity guns, and eight 8-inch 45-caliber high-velocity, rapid-fire guns, all twelve of these guns being protected within barbettes and turrets of Krupp steel, the 12-inch gun turrets being 10 inches in thickness, and the 8-inch turrets 6 inches in thickness. These twelve guns all have large arcs of fire above the main or upper deck. On the gun deck below, and firing through casemates in the wall of 7-inch armor just mentioned, are twelve 7-inch rapid-fire guns, arranged six on each broadside. There are also about a score of the very handy 3-inch rapid-fire guns scattered throughout the ship, six of them being carried on the gun deck, two forward and four aft, and three on either broadside on the main deck between the turrets of the 8-inch guns; the other 3-inch guns are carried on the bridges and superstructure. In addition to these there are twelve 3-pounders, semi-automatics, eight 1-pounder automatics, and two 3-inch field guns.

It goes without saying that this is a tremendous battery. All the guns are the latest high-velocity, long-caliber, rapid-fire type. The 12-inch has a muzzle velocity of 2,800 foot-seconds, an energy of 46,246 foot-tons, and a penetration of iron at the muzzle of 47.2 inches. The 8-inch gun has also a velocity of 2,800 foot-seconds, and its energy at the muzzle is 13,600 foot-tons, while it is capable of penetrating 31.4 inches of iron at the muzzle. The 7-inch gun is 50 calibers in length, has a velocity of 2,900 feet per second, a muzzle energy of 9,646 foot-tons, and can penetrate 28.7 inches of iron at the muzzle. The excellent 3-inch gun has the high velocity of 3,000 feet per second and a muzzle energy of 874 foot-tons.

In addition to the belt of Krupp steel that protects the waterline, nearly 8,000 cubic feet of corn-pith cellulose will be driven in back of the belt armor throughout the length of the ship, the mass being tightly rammed into a steel cofferdam, which is worked in as part of the structure of the ship. Should a penetration of the belt occur, the shot would probably pass through the corn-pith cofferdam; but as soon as the water followed, the saturation of the corn-pith would cause it to swell with great rapidity, until it acted with an obturating effect in closing the hole. Before the shell could reach the engine room or boilers, or magazines, it would have to pass through several feet of coal stored in the coal bunkers, and then it would have to effect a very oblique penetration through the sloping sides of the 3-inch deck. If it should penetrate the 3-inch steel deck, several feet more of coal would be encountered, and it is pretty safe to say that such fragments of the shell as might reach the vitals of the ship would have lost so much of their velocity as to be capable of doing very little harm when they got there.

One of the greatest improvements that has been made in the modern battleships, as compared with such old vessels as the "Oregon" and "Massachusetts," is the great increase in the freeboard, the upper or main deck of our latest battleships being from 8 to 10 feet loftier than that of the early battleships. This change is twofold in its advantages. In the first place, it provides very liberal berthing space and living accommodations for the officers and crew, and in the second place the command (height above sea level) of the guns is proportionately increased, and the vessels are much more comfortable in a seaway. The water, which is shown in our front page engraving as flying over the bows and across the turrets of the battleship, is simply surface spray; and it will be only in the very heaviest weather that green seas will be shipped. It will be a very rare case, indeed, when our latest battleships will be unable to cast loose their guns for action.

A New Star.

A telegram has been received at the Harvard College Observatory from Prof. Kreutz at Kiel Observatory, stating that a new star was discovered by Prof. Wolf, at Heidelberg, Germany, September 21.4388d. Gr. M. T. in R. A. 20h. 14m. 57s. and Dec. +37 deg. 9 min. 49 sec.

Correspondence.

A Free Electric Current.

To the Editor of the Scientific American:

Thinking it would interest some of the readers of your paper, I wish to mention a little experience I had on some electric work.

I was working on bell work in Tremont, N. Y., in a new building and was to find out where the trouble was which had given the men so much annoyance. Testing out, I got in circuit a Croton water lead pipe and also a New York Telephone lead cable and to my surprise I received a current of 6 volts and about 10 amperes.

The current I found strong enough at times to run an Edison dental battery motor. Now I believe this lost current is coming from a trolley line in its return circuit, or it may be the discovery of tapping the earth for current. I notice the current becomes stronger when a trolley car is coming near, also that it is a steady current night and day, as I have the motor running all the time now. John J. Kehoe.

Fordham, N. Y.

Suburban Side-Door Cars.

To the Editor of the Scientific American:

In the last issue of the Scientific American your editorial is enthusiastic over the advent of side-opening street cars. Now, while these are undoubtedly ideal in theory, in practice they have not proved an unmixed blessing. For several seasons they have been used regularly in Cleveland, and although they possess the merits which you ascribe to them, the great and almost insuperable difficulty of keeping the car warm has made them lose in popular favor. The constant opening and shutting of the doors, the forgetfulness of passengers, who fail to close the doors when the conductor is inside the car and unable to close them, subjects the passengers not only to the chilling blasts, but causes numerous draughts which are extremely unhealthy.

The Cleveland cars are provided with only two doors, and you will always find the seats opposite the doors vacant, as few people are hardy enough to withstand the direct force of the wind. Imagine what the conditions will be in the midst of winter in Chicago with twelve openings. It will be worse than riding in open cars, for there at least you have no draughts. Moreover, the necessity of running boards adds an element of danger, owing to their becoming slippery. So that in spite of the superior unloading ability of this style of car, the bodily discomfort ensuing prevents it from being as desirable as supposed. None of the new cars in Cleveland are being made in this style. Mortimer T. Strauss.

Cleveland, O., October 5, 1903.

Optical Atmospheric Phenomena.

To the Editor of the Scientific American:

At page 317 of the last monthly Bulletin de la Société d'Astronomie de France, under the heading, "Optical Atmospheric Phenomena," is a communication from Mr. C. Jassenne, of Pervyse (Belgium) to the effect that on September 2, 1902, from the point where the sun had just disappeared below the horizen, he had observed immense divergent rays ("d'immenses rayons divergents").

This communication seems to have been made with the view of an explanation of the phenomenon; but no such explanation is given. I have written Secretary Flammarion, editor of the Bulletin, explaining the phenomenon, and it may be interesting to your readers to know how these divergent rays occur and are made visible to us.

Instead of the phenomenon being exceptional, as Mr. Jassenne's letter would lead me to suppose, it is, on the contrary, a thing of frequent occurrence, or on any fine day when the sky in the vicinity of the sun is covered with light, fleecy, cumuli clouds; and yet, strange to say, not one person in a thousand probably has ever given the phenomenon any attention, or if so, has never inquired into the why or wherefore of the occurrence.

Now, let any cloud stand between us and the sun's light, and let this cloud extend upward; there will be formed on the opposite side of such cloud a focus of light. Then, if there be below the sun other clouds, further away or more remote from us than that upon which impinge the sun's rays, intercepted or cut off from our sight by the cloud, the focus of light alluded to, or an imaginary or reflected sun situated at that distance from us, will send forth rays in all directions around it, those extending upward being hidden by the upper cloud or clouds, while those extending downward will be reflected to our eye from the lower cloud or clouds on which they fall.

If the sun be near the horizon, and its direct rays hidden from us by a stratus cloud in that vicinity, while there are above it other clouds more remote from us than that intercepting the solar rays, we will have divergent ascending rays.

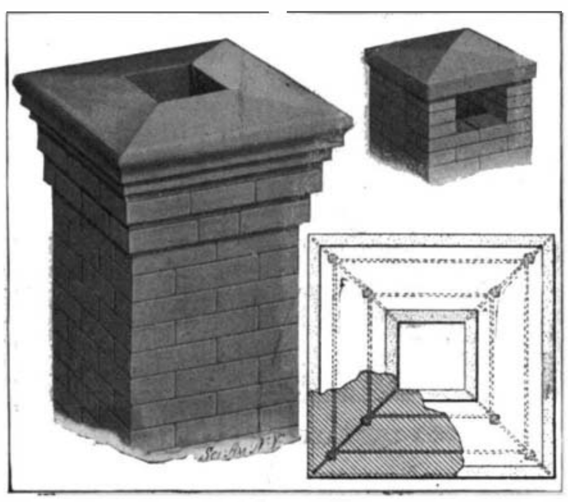
If again the cloud intercepting the sun's light happened to be forward, or nearer to us than all those surrounding it, we should see the secondary rays diverging and extending from in rear of the nearer cloud, both upward and downward or all around the line of sight from the eye to the sun, a phenomenon of rarer occurrence.

I believe there appeared in your journal, some years ago, a different explanation of this phenomenon, and it now remains for you, sir, or some of your readers, to say which of the two you consider the true explanation of the phenomenon. Charles Baillargé.

Quebec, September 15, 1903.

CHIMNEY CAP.

The accompanying illustrations show a shapely, inexpensive, and durable cap-piece for stone or brick chimneys. The cap-piece is formed of cement, being molded in any ornamental shape desired by means of a suitable matrix. An essential feature of the construction lies in the provision of a reinforcing frame preferably formed of metal strips imbedded in the cement. In order to prevent the metal from oxidizing the strips are galvanized or coated with some suitable paint. The frames may be made in the form of several rectangles suitably spaced apart by corner strips. It will be seen that the cement cap-block thus reinforced will be adapted to sustain considerable breaking strain without permanent injury, as the block if cracked by rough usage will not fall to pieces, being held by the metal frame from fragmentary separation, so that the crevices may be filled and the block be rendered solid by the introduction of liquid cement into the cracks which when set will reunite all the parts of the cap-blocks. The cap-block is formed with a recess or seat in its lower surface adapted to fit on to the top of the chimney. In mounting the cap upon the chimney a thin coating of cement mortar is first applied to the top surface of the chimney, so that when the cap is seated it will practically unite the cap-block with the chimney. In this way the chimney top is greatly strengthened. The chimney cap may be formed of any required shape to fit different styles of chimneys, as shown in our illustration. A patent on this invention has been granted to Mr. George R. Cross, of 116 Holland Street, Lewiston, Maine.



CHIMNEY CAP REINFORCED BY METALLIC BAND.

The Current Supplement.

The transmission of electrical energy from Hochfelden and Glattfelden to Oerlikon (a distance of about eleven miles) possesses the rare peculiarity of being the only installation in Europe in which a triple-phase current is transmitted at a pressure of 30,000 volts. The line is fully described by Mr. Emile Guarini in the current Supplement, No. 1450. The text is well illustrated by many engravings. Mr. Marcus Ruthenburg's paper on the electro-metallurgy of iron, read at Niagara Falls, is also published. Mr. James Alexander Smith, who is well known to readers of the Supplement as a contributor, writes on testing the specula of reflecting telescopes, and takes occasion to correct Draper's method of parabolization by measure. John W. Alvord discusses sewage purification plants for summer cottages. The engineering subjects at the British Association are reviewed in a careful retrospect. Dr. Joseph Frank Payne tells much that is interesting of Anglo-Saxon medicine. The Paris correspondent of the Scientific American describes in a well-illustrated article a system of compressed-air locomotives used on Parisian suburban lines. Mr. D. G. Purse, president of the Savannah Board of Trade, read an interesting paper before the Farmers' National Congress on the sugar supply of the United States. The paper is published in full. "Producing Helium from Radium" is the title of an article which narrates the work of Messrs. Ramsay and Soddy. The usual electrical notes, engineering notes, and consular matter will be found in their accustomed places.

Engineering Notes.

The American company which is building the railway from Guayaquil, Ecuador, to Quito has opened the station at Guamote, at an elevation of 10,000 feet, and 126 miles from Guayaquil. The most difficult part of the work on the railroad has now been accomplished. With the exception of Lhassa in Thibet, Quito, in Ecuador, is the only capital in the world that to this day can only be reached for a considerable part of the journey from the sea on muleback.

A recent investigation into the question of the relative cost of running trains at high speeds, as compared with low speeds, has developed the fact that an increase in speed from 32 to 48 miles per hour, or 50 per cent, accompanied by a decrease in the number of cars per train from seven to four, has resulted in an increase in absolute coal consumption of 12 per cent, or about 90 per cent when figured on the basis of the number of cars, which, of course, represents the earning capacity.

Severe tests have been carried out in England with a ferro-concrete floor built on the Hennebique system. The section tested was of 25 feet 7 inches clear span between walls, and was composed of a 5-inch thickness, with a layer of cement paving 1½ inches thick. The main ferro-concrete beams which were to support this floor were 22 inches deep by 14 inches wide, and spaced at 11 feet 3 inches centers. Between these main beams were placed ferro-concrete joists 5 inches wide by 9 inches deep at 5 feet centers. A load of 6 hundredweight per square foot was placed upon this section over an area of 25 feet 7 inches by 11 feet 3 inches, and records of the deflection caused by this load were accurately taken by means of instruments capable of recording a deflection of 1,500 inch. The load was slowly increased and records taken. The deflection under the maximum load was only 0.149 inch, but with the load for which it was designed—4 hundredweight—the deflection was 0.079 inch. When the load was removed the flooring returned to its original level, thereby showing that the weight caused no permanent sag.

The relative advantages of milling and planing machines is a subject that frequently comes to the front. Both machines occupy an important place in the machine shop, and neither of them could very well be dispensed with profitably. One, however, cannot help but notice that many of the jobs that have until recently been undertaken on the planer are now being relegated to the milling machine, and that the latter is gradually coming more into favor. As regards cost of production by the two methods, we think the advantage is on the side of the milling machine. While the cost of milling cutters is certainly more expensive than planer tools, in making a comparison it should be noted that the milling cutter will do much more work as a rule per tooth, without sharpening, than the planer tool. The time each cutting point or tooth of a milling cutter is actually in the work is usually very short; using a planer tool it is long. Therefore, the cutting tooth has an opportunity to cool while the planer tool point has not. Thus, while the first cost of the milling cutter is much greater than the planer tool, taking results into consideration it works out the cheapest.

In connection with the experiments of the British Admiralty in the storage of coal under water for the purpose of retaining the calorific value of the fuel, some interesting information upon this subject has been vouchsafed by Mr. J. Macaulay, the general manager of the Alexandra Docks and Railroad of Newport, Mon. (Eng.). He recovered a quantity of coal that was known to have been submerged in the docks under his control for periods varying from three to ten years, and also further quantities from the estuary of the River Usk, whither the fuel had been carried by currents and tides from wrecks in the Bristol Channel. The latter coal was considered to have been for more than two years under water. This coal was experimented with upon the locomotives employed at the docks in competition with the best freshly mined coal obtainable. The trials were carried out under similar conditions so that absolutely comparative data might be obtained. The results showed that the first place was taken by the river-submerged coal, followed by that which had lain submerged in the docks for ten years, with the newly mined coal third. According to this expert, coal loses about 10 per cent of its steam-generating power when stored in the open air for any great length of time, the greater part of this deterioration taking place during the first year. From these tests it is apparent that the best method of storing coal with a high calorific value is under water, if it is to be stored for any great period. Subaqueous storage is cheap, and has the further two important advantages of immunity from hostile attack, and ready access when required, and permits the utilization of a great space for other purposes that would otherwise be occupied by the bunkers of coal on land.

THE SUB-TARGET GUN MACHINE.

A most interesting exhibit at the recent meeting of the National Rifle Association, at Sea Girt, N. J., was the sub-target gun machine, an illustration of which appears herewith.

This machine is designed, primarily, to instruct recruits in the art of rifle shooting, although, as a matter of fact, it is in daily use by expert riflemen, who find it of great advantage in keeping in practice without the necessity of frequent visits to outdoor ranges. No ammunition is required, and the machine may be operated in the armory or at home.

By reference to the illustration, it will be noted that the apparatus consists of a sub-base or stand; a carriage base adjustable by locked vertical and horizontal screws; a ground-steel carriage rod, having at the target end a steel scoring-needle accurately spring-balanced on ground-steel ball-joints; a sub-target holder, which is released electro-magnetically by the trigger when the gun is fired, driving the sub-target against the scoring-needle, thus giving an absolute record of the aim or hold of the gun; a gun-holder proper, so designed and constructed that it is absolutely impossible to secure a point of rest with which to steady the gun when aiming, the complete holder so counterbalanced that only the weight of the firearm is supported by the marksman. The entire apparatus is scientifically correct and absolutely accurate. The machine may be quickly changed from the standing to either kneeling or prone position, as may be desired by the marksman.

These machines are in daily use at United States army posts and in State guard armories, where they are proving invaluable in the training of recruits and, incidentally, the affording of otherwise unobtainable practice for qualified marksmen, and have already raised the standard of marksmanship in the United States and other countries, wherever used.

In one instance thirty men who had never had any rifle practice, were selected and divided into three teams of ten men each. The first team was put on an outdoor range with service rifles and ammunition; the second on a miniature range with miniature ammunition, and the third in the armory with the sub-target gun machine. After several weeks' practice, as above, the three teams were pitted against each other on an outdoor range, and the sub-target gun team, the members of which had had no practice with loaded rifles, defeated both the other teams. This was a natural consequence, because with this machine the recruit becomes thoroughly familiar with the holding, sighting, and firing of the rifle before he can acquire the gun-shyness usually accompanying the use of loaded firearms by beginners.

Referring to the use of the sub-target gun machine, the inspector of small arms practice of the 71st Regiment, N. G., N. Y., writes: "By personal observation and instruction, I practised and qualified nearly 650 men. The result of that indoor practice demonstrated itself when the regiment was ordered down to Creedmoor for actual work. We qualified as marksmen 538 men out of a total of 539 turnout. The elimination of ammunition for this past winter has been a saving of several hundred dollars, which was principally brought about through the use of the sub-target gun machine."

At the International Rifle Meeting recently held at Bisley, England, the machine attracted great attention and was daily used by members of the American team, which won and brought back to the United States the Palma trophy.

At this time, when every military power finds itself with very powerful rifles, but with a very small percentage of men who can effectually use them, the advent of these machines is very timely, as by their use any number of men may be rapidly qualified as marksmen.

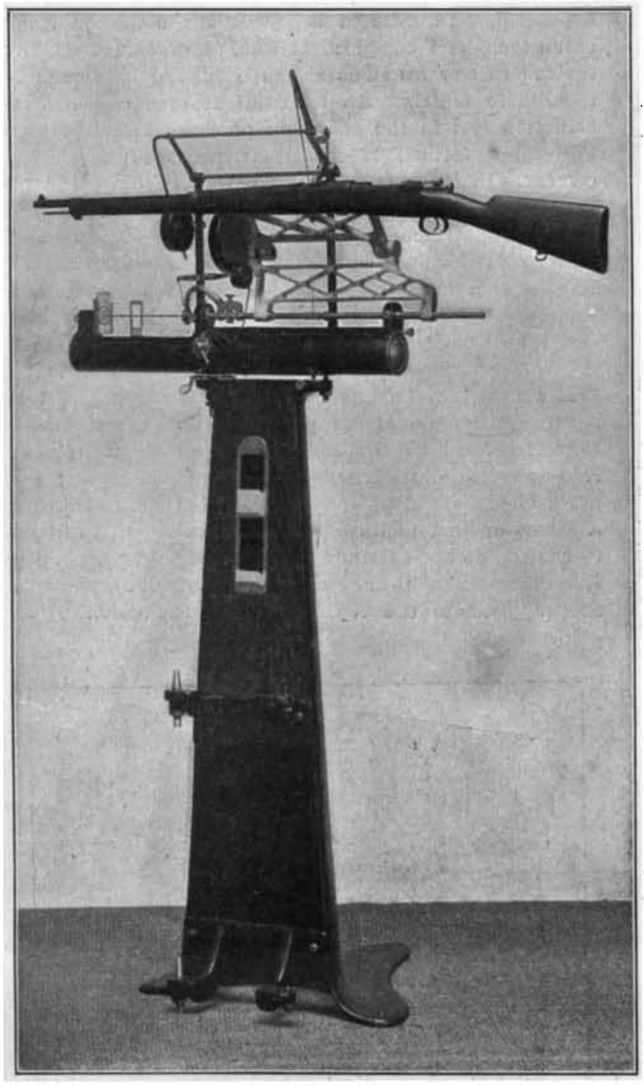
Becquerel Rays and Water.

In a paper recently read before the German Physical Society Mr. F. Kohlrausch resumes some interesting observations relative to the influence exerted by Becquerel rays on water. Having passed the rays given off from a mixture of radium and barium bromides through an aluminium plate 0.1 mm. in thickness, and a layer of water of about 18 mm., the author failed to note any immediate effects of the radiation. Under the influence, however, of a prolonged radiation, Mr. Kohlrausch noticed a considerable acceleration in the increase of the electrical conductivity.

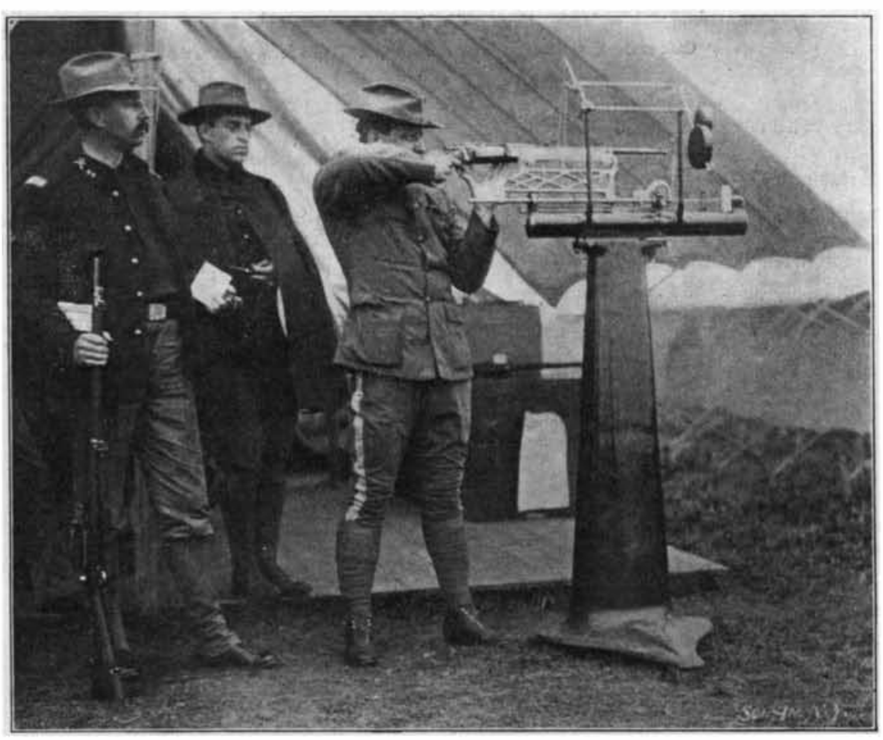
As regards the interpretation of the above phenomenon, the author is not able to decide between two hypotheses, viz., that of a direct development of ions in the water, and that of an accelerated disaggregation of the walls of the glass tube. As to a third equally admissible hypothesis, i. e., that the surrounding air should have absorbed some substance, such as, for instance, bromine, introduced besides the stopper, the author does not think it to be true, as a special experiment made with a view to confirm it has given negative results. With this experiment an air current having passed through the radio-active substance was led through water provided with electrodes.

The Bactericidal Effect of the Arc Light.

The bactericidal effects of the arc light are much superior to those of sunlight, says M. K. Walsham, in Röntgen Ray Archives; the very rapid ultraviolet is absorbed by the atmosphere. A rapid oscillation high-tension arc, particularly between iron points, gives off an abundance of ultraviolet rays of extremely small wave length, with a fair proportion of lower refrangibility; to these ultraviolet rays quartz is transparent, transmitting 60 per cent through 4.4 millimeters, gelatine is quite opaque, ice is as transparent as air, and a film of iron oxide quite opaque. For use, as blood is opaque to the rays, they are passed through ice made to press upon the region affected, so as to make it anæmic.



THE SUB-TARGET GUN MACHINE.



TARGET PRACTICE WITHOUT AMMUNITION.

Abraham Lincoln's genius as an inventor will be exploited at the World's Fair. His famous device for lifting steamboats off the shoals will be shown in the transportation department.

THE TRANSPORTATION OF LUMBER.

BY WALDON FAWCETT.

Few industries can compare with lumbering operations in the variety of the methods of transportation employed to convey the product to market. From the time the woodland monarch is felled in the heart of the forest until the material has passed from the sawmill into one of the various avenues of utilization open to it, the problem of speedy and economical transportation is well-nigh a foremost consideration, and is accomplished by means of a variety of facilities, prominent among which are steam railroads, natural and artificial waterways, and ice-paved highways. The transportation phase of the industry may almost be said to be in a state of transition. The latest approved practice can scarcely be designated as the perfect practice, inasmuch as improvements are being made constantly.

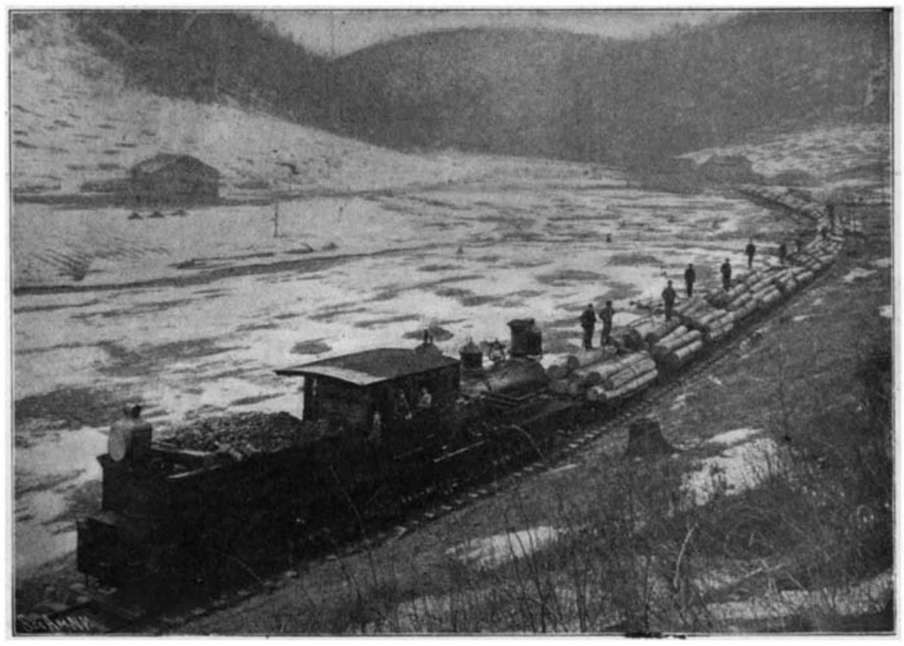
Nowhere, however, has recent progress been more remarkable than in the methods attending the first stages of lumbering. Logging by steam is now an accomplished fact. The first steam log-skidding system was devised in 1886, and was introduced in the pine forests of Michigan. By gradual and almost continuous improvement there has been evolved from this nucleus the steam skidder of the present day. This consists of a main cable suspended from two trees about 750 feet apart, upon which the skidding engine travels, and also a short cable used for loading the logs, which is attached to a third tree. The carriage supports a hoisting rope, to the end of which are attached one or more pair of tongs for grappling the logs. In operation the tongs are fixed to the ends of one or more logs, which are hoisted well into the air, and then the hoisting rope is drawn in, the logs being thereby dragged or skidded to the end of the cableway and deposited ready for loading.

A loading cable spans the railroad track, the block being located directly over the track, and carries the loading line, to the end of which is fastened a pair of tongs. When the tongs have been attached to a log, it is dragged from under the main cable up to the car, and then hoisted clear and landed on the car. The two operations of skidding and loading are carried on at the same time. In localities where, as in the swampy districts of the South, logs find their outlet to market through canals in which they are towed by tugboats, a steam skidder is often installed on a scow, where are located the engine, boiler, mast, and rigging. Skidders of this type handle logs six feet in diameter and weighing six tons each.

In the cypress swamps of Louisiana there are employed what are known as pull-boats, an evolution from the plan of placing a hoisting engine upon a scow and snaking the logs out of the swamp. By this plan the logs, which are drawn in at the rate of 600 feet a minute, are capped with steel cones, which prevent them from imbedding in the soft ground or catching against obstructions. The endless-rope pull-boat engines have 44-inch winding drums, and each weighs 33,000 pounds. Another up-to-date apparatus is the log gatherer, which is similar in construction and operation to the steam skidder previously described, but which is designed for lighter work than the skidder, being especially applicable to conditions in the low flat pine regions upon the Atlantic coast.

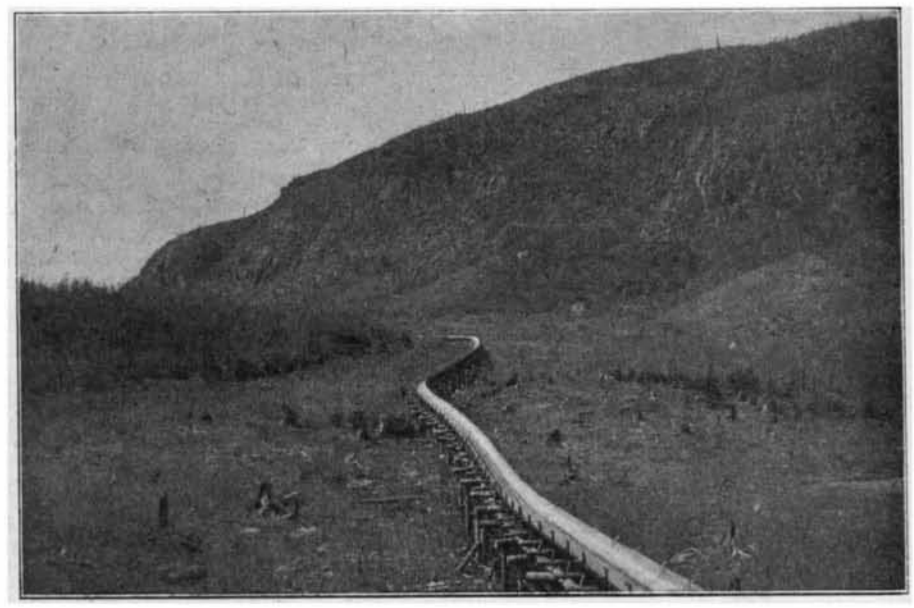
On the Pacific coast log-hauling engines with cylinders 10 by 12 inches and drums capable of holding 3,000 feet of wire rope are in use and in mountainous districts there are utilized what are known as mountain loggers. The logging railroad is run up the valley or cove between the ridges, and the logs are gathered by means of conveying cableways, and, clearing the rocks and creek in the bottom of the gorge, are deposited along the railroad, where they can be loaded upon cars by a steam loader, or even by the same engine which has moved them to the loading point. This system is in extensive use in the pine regions of Maine and the hemlock regions of Pennsylvania as well as on the Pacific slope. In the northern lumber districts, embracing all sections of the country from the Adirondacks to the extreme Northwest, where logs must be taken out during protracted periods of cold weather *via* ordinary highways, remarkable achievements have been made in the operation of ice logging-roads. Such a road is laid out and graded in the autumn, and upon the advent of cold weather is flooded by any one of a variety of methods. In many localities the water is hauled in eighty-barrel tanks mounted on sleds, and with an arrangement of pipes which directs the flow over the roadway as the sled progresses. During the season of activity many teams must be kept busy hauling water night and day, in order to keep the roads in condition. A rut-cutting

Hauling Logs on Sled.

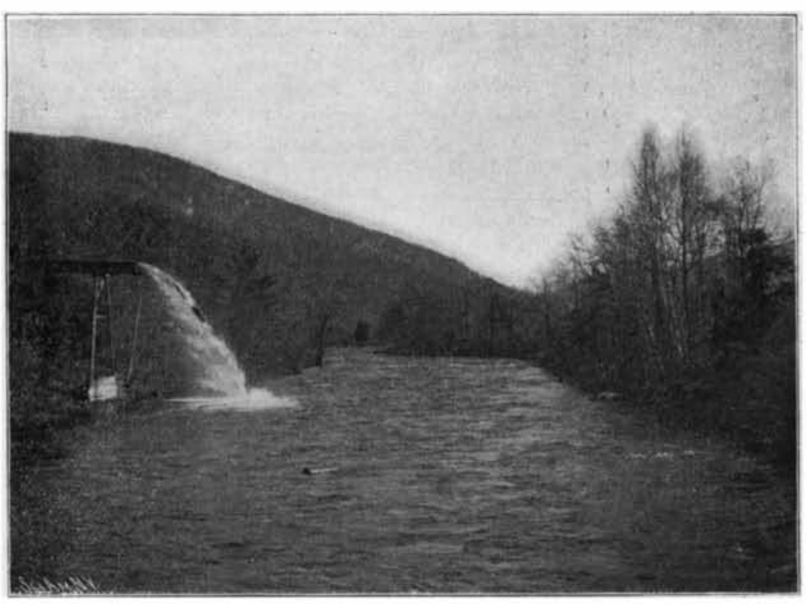


A Logging Railroad.

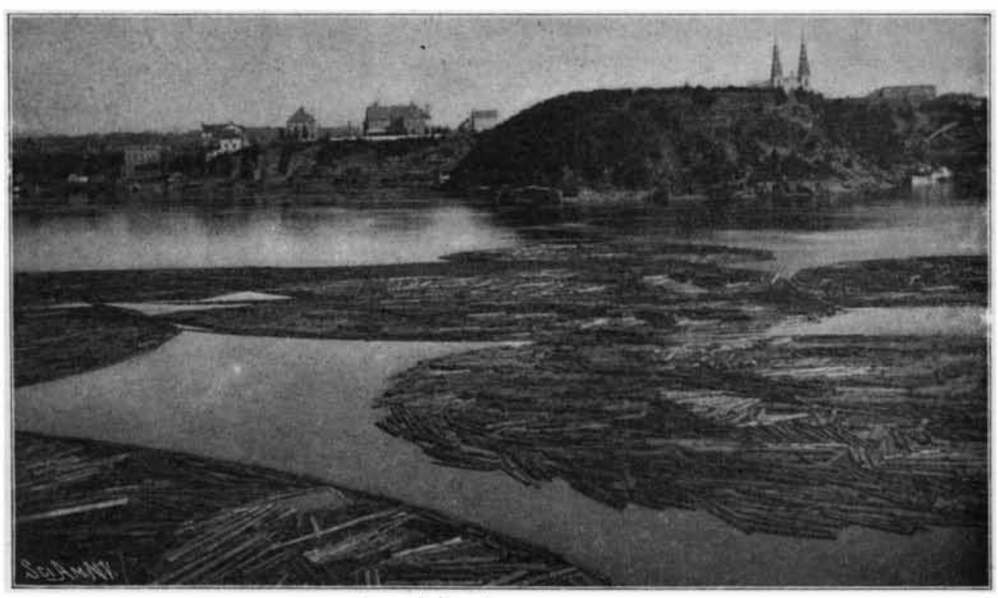
A Lumber Slide, Showing a Feeder.



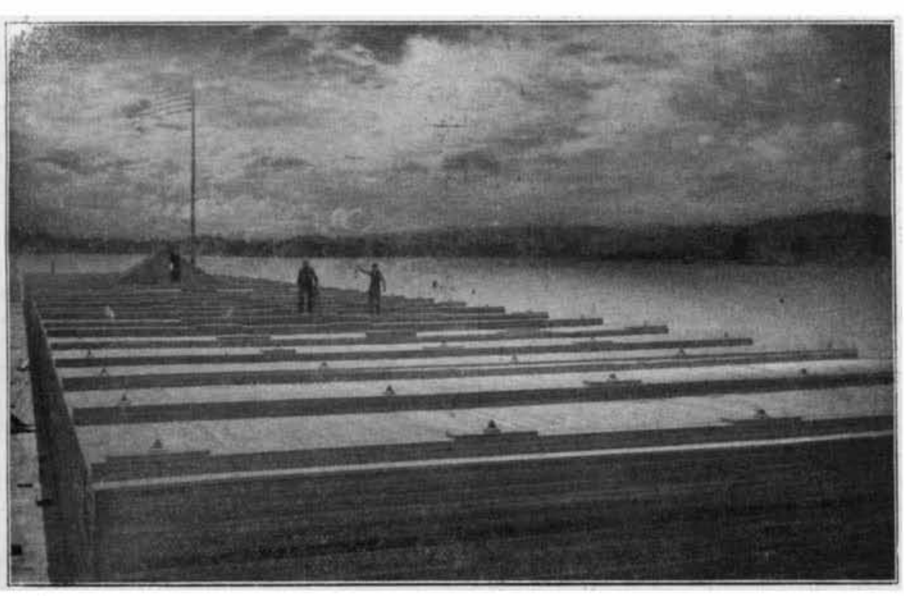
A Typical Lumber Slide or Flume.



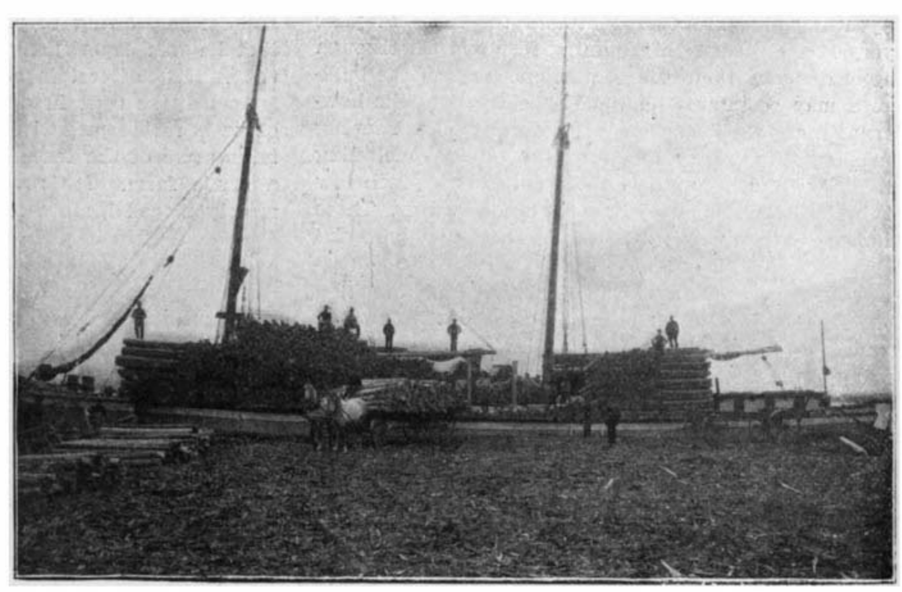
The End of a Seven-Mile Lumber Slide.



Lumber Booms at Ottawa.



Lumber Raft on Puget Sound.



Loading Lumber on a Lake Schooner.

THE TRANSPORTATION OF LUMBER.

machine cuts out the ice where the runners of the log sleds run. A team of horses will haul surprising loads over these ice-paved highways. Fifteen tons of logs is accounted only an average load, and in some districts there has been adopted a system known as trailing—hitching three sleds one behind the other and pulling them with the same horse power. In this manner loads aggregating seventy-two tons have been moved successfully.

The redwood forest belt of California, which extends along the coast range of mountains from the vicinity of the Oregon line southward three hundred miles to the bay of Monterey, affords most striking exemplifications of the possibilities of machinery and power applications to transportation in the lumber industry. Power appliances are utilized almost exclusively in getting out and loading the logs, and bull teams, each consisting of seven or eight yoke of oxen, are employed for ordinary highway transportation. At the mouth of the Noyo River and other points, where the seacoast is bold and where wharves cannot be maintained, an ingenious method is employed for loading deep-sea ships. A steel-wire cable is stretched from the high bank to the vessel, and on this is operated a traveler from which depends a sling of chains carrying the load of lumber. The force of gravity carries the load to the ship, and the traveler is hauled back by a donkey engine. About one hundred and fifty thousand feet of lumber is the daily loading record with this apparatus at Noyo River. At many points along the Mendocino coast this plan of loading lumber is employed where there is no harbor at all, and where the cable is run directly out to the open sea.

In California also the employment of the traction engine as a transportation agent in the lumber industry has reached its highest development. Loads too large to be hauled easily by six and eight horse freight teams, and yet forming a traffic scarcely large enough to justify the construction of a railroad, are hauled expeditiously and economically by the traction engine freighting outfits. The engines in use in the lumber districts of the Pacific coast will haul a load of from 40 to 60 tons at a speed of two to three miles an hour, and will ascend, with full load, grades of 10 per cent. A traction engine freighting train consisting of the engine and five lumber trucks is capable of turning in a circle the diameter of which is only 49 feet.

The traction engine is also employed to load the logs on the trucks. The engines travel through forests without having the roads previously prepared, and under such conditions a traction engine has hauled 15,000 feet of logs on two trucks down a 17 per cent grade. An aggregate of 30,000 feet of lumber has been hauled up a 10 per cent grade by a single engine, and a 60-horsepower engine on one occasion unloaded 50,000 feet of lumber from six trucks and took on water and fuel for the return trip in the total elapsed time of only 55 minutes.

The water transportation of lumber partakes of its most picturesque form in the construction and management of the giant rafts, which are used to convey logs and lumber from Puget Sound to San Francisco. A lumber raft of the type constructed on the Pacific coast is about 400 feet in length, and contains approximately 5,000,000 feet of lumber. The log or pile rafts are usually made up of logs averaging about 60 feet in length. From 12,000 to 15,000 piles are embodied in such a raft, which thus contains about 800,000 feet of piling. One of the log rafts constructed at Astoria a short time since was 625 feet in length, 60 feet beam, 32 feet deep, and had a draft of 20 feet. Some of the piles had a length of 120 feet and a diameter at the butt of 22 inches. A large force of men worked for eight months in the construction of the raft, which cost $30,000 to build.

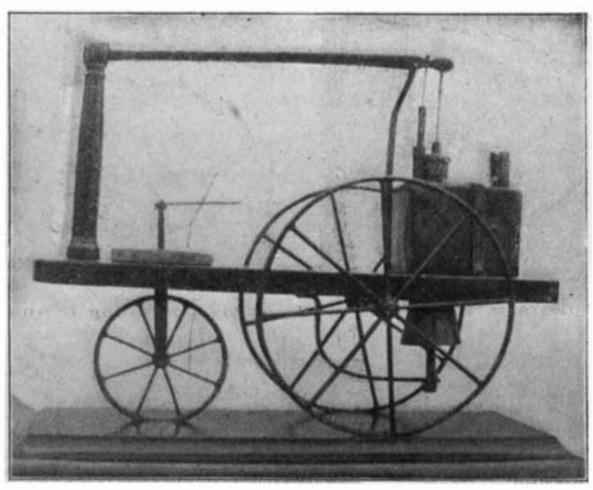
In order to hold the logs forming the raft in place, 1½-inch chains are passed around the mass of piles every 12 feet of length. Running fore and aft through the center are two 2-inch chains, one holding the bulkheads at each end and the other attached to the hawser. From this tow chain are lateral chains running out from the center to connect with the encircling chains. There is provided 75 fathoms of 1¾-inch tow chain and 150 fathoms of 14-inch manila hawser. These immense rafts are towed to San Francisco by powerful tugs. Some idea of the saving in cost effected by the rafting method may be imagined, when it is stated that in the case of the annual consumption at San Francisco alone, amounting to 30,000 piles a year, the saving over the cost of material prior to the introduction of rafting amounts to $150,000 per year. The rafting method has been employed to some extent on the Atlantic coast, and on one occasion a raft of 645 feet in length, containing 1,000,000 feet of piling, was towed from Nova Scotia to New York.

Almost every phase of lumber transportation is characterized by an element of the picturesque, but the spectacular features of the industry reach their climax in the "drive," whereby advantage is taken of the spring thaw to float the winter's accumulation of logs down streams and rivers to the sawmills. When a "jam" results, the lumbermen are called upon to perform some of the most arduous and most hazardous work known to the world of industry, and very frequently it is found necessary to employ dynamite to break the jam. The logging railroad has to a considerable extent displaced this old-fashioned method of bringing the logs to the sawmill, and even in localities, such as some parts of the Adirondacks, where water transportation is still adhered to exclusively, the lumber companies have constructed great flume systems, often many miles in length and with "feeders" similar to those of an irrigating canal. By means of these narrow artificial waterways, logs are conveyed from remote lumber camps to the rivers or streams, down which they float to the sawmills.

AN EARLY ROAD LOCOMOTIVE.

The early miniature road locomotive which we illustrate was the ingenious mechanical creation of William Murdoch, the well-known assistant to James Watt, and the first to discover the illuminating properties of coal gas and to reduce his discovery to practical application.

The machine should, perhaps, be more strictly termed an automobile, since it was essentially a road machine. Murdoch, as is well known, while co-operating with Watt, invented several devices in connection with steam engines, the most important of which, no doubt, were the "D" slide valve and the eccentric. The precise date at which Murdoch made his first attempt at the construction of this workable locomotive is not known. According to the testimony of Murdoch's son, it was invented and constructed in 1781, but another reliable source places it at 1784. Certain it is, however, that it was built some time between 1781 and 1786. During these years, Murdoch was working at Redruth, in Cornwall, upon the erection of some pumping engines for Messrs. Boulton & Watt, and in August of 1786 the firm's agent at Redruth wrote to his principals: "William Murdoch desires me to inform you that he has made a small engine of ¾-inch diameter and 1½-inch stroke, that he has applied to a small carriage which answers amazingly." Upon the receipt of this intelligence, Boulton inspected Murdoch's creation, and described to Watt, in a letter the next month, that Murdoch "had made his steam carriage run a mile or two in River's great room, making it carry the fire shovel, poker, and tongs. William uses no separate valves, but uses the valve piston."



MURDOCH'S ENGINE.
Length, 19 inches; height, 14 inches; extreme width, 7 inches; piston, ¾ inch diameter; stroke about 2 inches.

James Watt, however, had long before devoted his attention to the question of steam propulsion upon roads, but although he took out a patent describing a locomotive in 1769, he did not build an engine upon his designs, owing to pressure of work, and trouble that he was experiencing in establishing and proving the validity of certain of his previous patents.

As may be seen in our illustration, Murdoch's machine is rather primitive in its design, but yet it contains some of the features of the engine of to-day in a crude form. It is very small, and is in reality merely a model, since it is only 19 inches in length, by 14 inches in height, and 7 inches in extreme width over the driving wheels. The frame of the locomotive consists of a rectangular piece of wood mounted upon three wheels—two driving wheels at the rear mounted on an axle with a crank, and a single steering wheel in front, placed in the center underneath the board, and running in a fork. Steering was accomplished by moving the little handle above, to which the fork was attached, in the desired direction.

The boiler is placed behind the driving wheels. It is a small rectangular vessel, made of brazed copper, 4¼ inches long, by 3⅛ inches wide, and 3⅜ inches high. A flue is fitted obliquely into the boiler, contracting from a circular chamber, forming the firebox, to a small funnel in the top of the boiler. Murdoch used a small spirit lamp to generate the necessary heat, arranging it to burn within the firebox, and the gases of combustion were carried off by the flue. The steam cylinder is mounted above the boiler, with the lower part thereof passing into it, so that part of the cylinder is surrounded by steam. The piston rod passes out of the cylinder upward, and is connected to one end of the vibrating beam, which passes to the front of the carriage, where it is pivoted into the upper end of an upright stout pillar. The diameter of the piston is only ¾ inch, and the stroke is approximately 2 inches. The piston rod is actuated simply by the expansive force of the steam alternately raising and depressing the piston, after which the exhaust passes out into the atmosphere. The piston rod, in moving up and down, causes the beam to turn the driving wheels, by means of a connecting rod attached to the crank of the axle, and the carriage then moves either forward or backward. The arrangement of the steam valve is ingenious, as it is driven from the beam by a projecting rod, in such a way that the valve is moved at the finish of every up and down stroke by the last portion of the upward or downward movement of the beam. The valve piston has two pistons, ground to work easily, yet pressure proof, in the valve cylinder. The space between the two pistons is in constant communication with the boiler, and the steam enters through two orifices—one at the top and the other at the bottom of the cylinder—arranged in such a manner that when the piston valve is up, the steam enters the upper orifice, and forces down the piston, while the exhaust steam from the under side escapes through the lower orifice into the air through a tube connecting the two pistons of the valve. Thus this valve is virtually a double piston slide valve, with a hollow piston rod for the exhaust.

The safety valve is placed near the steam cylinder, being let into the boiler and held down in position by a small tongue of metal. To preserve the balance of the engine, and to prevent its tipping up through the extra weight thrown on the back by the admittance of water into the boiler, a compensating leaden weight is placed above the steering wheel. The wheels are built of brass tubing brazed at the joints.

When Murdoch had convinced himself of the practical working of his engine in running round his room, he submitted it to a severe trial on the high road, where it gave a very conclusive evidence of its traveling powers by outrunning its designer. It was on one of these trials that Murdoch threw the unsophisticated village vicar into a terrible paroxysm of fear. Murdoch had taken his engine, one night, out on the high road near Redruth, lighted the lamp, got up steam, and started the engine, he himself following it. The vicar was walking along the road, when he espied the light of the lamp, heard the steam hissing, and the rumbling of the wheels. As it was too dark for him to perceive the object, he gave vent to terrific shrieks of terror and fled for his life, thinking His Satanic Majesty was after him.

When the possibility of Murdoch's engine was shown to Watt, the latter advised the inventor to discontinue his experiments, as he feared they might seriously interfere with the inventor's regular work. Subsequently, however, Watt offered to advance Murdoch $500 to found a locomotive business, with the latter as partner, if the inventor could build, within a year, an engine capable of hauling a carriage carrying two persons, in addition to the driver, together with two hours' supply of fuel and water, to travel at four miles an hour. It is said that Murdoch built three locomotives in all, the last of which was a large one, but of this there is no conclusive evidence. Certain it is, however, that in 1786, Murdoch abandoned his experiments. The inventor never again attempted to solve the problem of steam locomotion, and only kept his first engine to exhibit as a curious toy to his intimate friends. The engine remained in the hands of the Murdoch family until a few years ago, when it was secured by Sir Richard and Mr. George Tangye, the eminent English engineers, to whom we are indebted for permission to publish the photo of what is indubitably the most historical relic in the annals of steam locomotion.

Rotary converters operated six-phase will give from 35 to 45 per cent greater output than when operated three-phase, according to an article by Mr. A. S. M. Allister in the American Electrician. Hence economy dictates three-phase transmission, with transformation to six-phase at the converters. The simplest method is to use three transformers, the primaries being either star or delta connected, and the secondaries star connected. A delta connection on the low-tension side, as well as on the high-tension side has, however, the advantage that the breakdown of one transformer does not render the plant useless, as the two remaining transformers take the load of the missing one.

The United States Steel Corporation will make an exhibit at the World's Fair that will cover two acres of floor space in the Palace of Mines and Metallurgy. It will be the first exhibit of so wide a scope ever attempted, and will cover every branch of the industry.

A CHILDREN'S SCHOOL FARM IN THE HEART OF A GREAT CITY.

It may come as a surprise to some of our readers that there are children in New York that have never seen a tree—the parks are too far away, and the car fare is not forthcoming. Practical sociology in New York has developed wonderfully in the last few years, and some of its most interesting phases deal with children. We hear constantly of the "East Side" of New York, but how about the great *terra incognita*, the West Side? One block houses 636 families, and it has only one bathtub. This awful congestion results in the creation of a hotbed of crime. Environment is a most important element in life, and this fact is recognized by all workers for social and industrial betterment. To the poor child, flowers and plants are everything; their unfolding life and beauty is a constant source of wonderment and delight to them. What can be done in the way of uplifting a whole neighborhood can be seen at De Witt Clinton Park, a tract of barren and unpromising land at 53d Street and the North River. Here swings, band stands, and an open-air gymnasium are provided, and in time it will become a real park, but at present there is only one bright feature, and that is the Children's School Farm, which owes its being to the wise work of Mrs. Fannie G. Parsons.

A plot of ground 200x100 feet was fenced off, and surfaced with new earth. Then the area was broken up into plots 4x12 feet, the paths being 1½ feet wide. Each boy or girl is assigned one of these plots to cultivate, and they grow radishes, peas, lettuce, onions, beans, beets, turnips, endives, carrots, and kale, as well as buckwheat, wheat, and rye for nature-study in the schools. There is great rivalry among the children as to who shall grow the largest radish or have the best-kept plot. A gardener furnished by the city Park Department, together with the lady superintendent, who is a graduate from an agricultural school, furnish the instruction. The children are allowed to take home the produce or sell it. Gradually the parents become interested, and as a power for good this little plot of ground is phenomenal. As Mrs. Parsons says, it is easier to furnish an occasional farm plot than to maintain reformatories and prisons later on. To those who are not actually criminal, such an environment would be the salvation of many.

In addition to the farm, there is a farmhouse on a plot 50 x 50 feet. While very small and made of the cheapest materials, it shows how it is possible to make a single room homelike. Two little housekeepers a day are appointed, and they are taught how to clean house, and in their excitement and pleasure they have been known to wash clean towels and dust the roof! In one corner of the yard is an inclosure devoted to "Clinty," the young pig, which is certainly the most bewashed young porker in the world. On the whole a trip to the park is an inspiring one, as showing what a few people are willing to do for the uplifting of their brethren of the slums.

A CHILDREN'S FARM IN THE HEART OF NEW YORK.

THE LATEST APPLICATIONS OF THE GASOLINE AUTOMOBILE MOTOR.

Following the lead of the De Dion & Bouton Company, of France, the Olds Motor Works, of Detroit, Mich., have started to adapt their automobile motor—a motor that has stood the test of three seasons' use in their popular runabout, one of which made the journey overland from San Francisco to New York recently—to some of the various uses to which it can be put.

Our illustrations show a railway inspection car, consisting of a standard runabout outfit mounted on a suitable frame and carried on four 20-inch pressed steel car wheels of very light construction. The axles and underframe are of cold-rolled steel, with outer casings of number 11 gage steel tubing. As the motor, which is the standard, 4½-horsepower, runabout engine of 4½ inches bore by 6 inches stroke, is fitted with the regular two-speed-ahead-and-one-reverse transmission, the car will ascend any grade met with on rails up to a point where traction fails, and carry four people while so doing. The speed on the level which it is able to attain, is said to be 35 miles an hour, while it will travel from 80 to 100 miles on one filling of the water and gasoline tanks. The views of the inspection car and its chassis give a good idea of its appearance and construction, and show some of the recent improvements that have been made. The Olds motor has been lightened by reducing the water jacket to about half the length of the cylinder. Heat radiating flanges are now cast on the lower half of the cylinder in place of the water jacket, which only covers the combustion chamber and the travel of the piston head. In all other respects the chassis is the same as that shown in our Automobile Number of April 11 last.

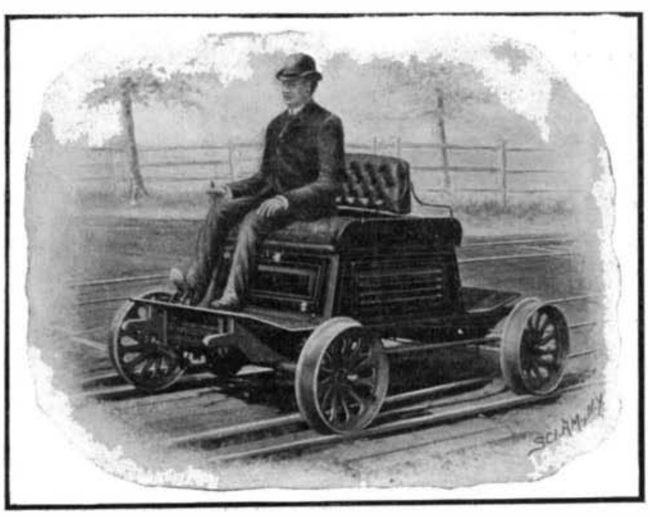
Another new application of the Olds motor is its use on a light delivery wagon. This wagon was designed to fill the demand for a vehicle which should be instantly available for quick work over long distances into the country, where the use of a horse-drawn or an electrically-propelled delivery wagon would not be considered. The machine has a carrying capacity of 500 pounds and a space in the box of one cubic yard. It is 8 feet, 2 inches long; 5 feet, 2 inches wide, and 6 feet, 8 inches high. Its wheel base is 6 feet, and its tread 4 feet 7 inches. The wheels are of the artillery type, and are fitted with 28 x 3-inch detachable tires. The water and gasoline tanks are of sufficient size to run the machine 100 miles on one filling. The vehicle is suitable for all kinds of light delivery work, and, although normally the heat of the motor is not communicated to the box to any great extent, a heat radiating system by means of pipes coming from the muffler, can be arranged for use in winter, if the wagon is to be used for the delivery of perishable goods, such as flowers, or the like.

These two recent productions of the Olds Company will undoubtedly find a wide use in the field for which they are intended, and they are but a sample of the many fields of usefulness which lie open for the exploiting of the modern American gasoline motor.

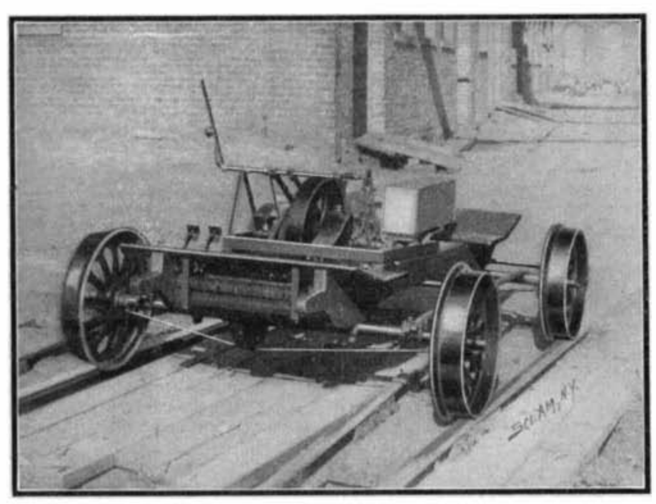
French Naval Programme.

The naval construction programme of the French Admiralty for 1904 comprises 70 vessels. Of this huge total, 59 are to be torpedo boats, which are to be constructed by private shipbuilding firms. Sixteen new submarine boats are to be laid down. The remaining vessels comprise one armored cruiser of 13,644 tons and 23 knots speed and two torpedo-boat destroyers of the Stylet type with a displacement of 335 tons and a speed of 30 knots. The torpedo boats are to be of 26 knots speed, and, like the new English vessels of this type, are to be stoutly constructed without sacrificing strength for speed.

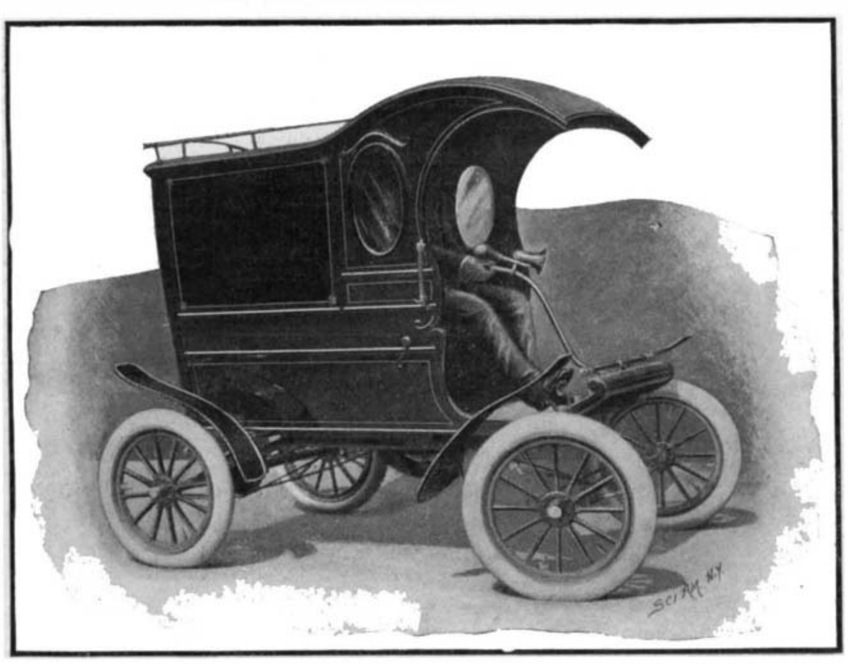
Rev. O. H. Lee, Milwaukee, Wis., has recently made arrangements with a company which will engage in the manufacture of typewriters after a design worked out and patented by him. The advantage of this machine is that the operator is not compelled to pause at the end of the line to return the carriage, as with nearly all of the machines at present on the market, but as the cylinder is perpendicular and the lines run around it, the writing is continuous.



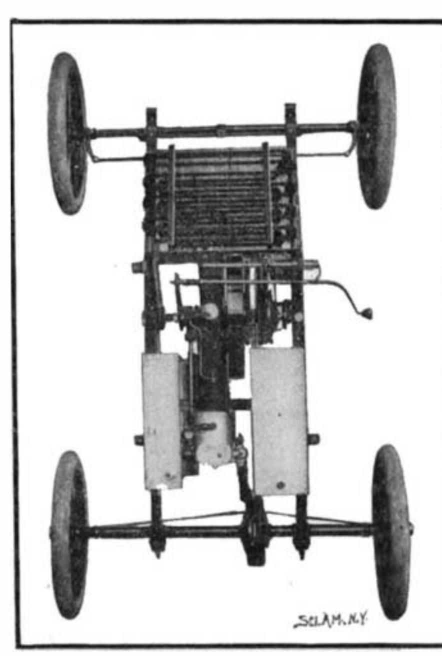
A Gasoline Inspection Car.



Chassis of the Inspection Car.



A Light Gasoline Delivery Wagon.



Chassis of Delivery Wagon.

THE LATEST APPLICATIONS OF THE GASOLINE AUTOMOBILE MOTOR.

RECENTLY PATENTED INVENTIONS.

Apparatus for Special Purposes.

PROCESS OF MAKING ALUMINA AND BY-PRODUCTS.—L. R. Keogh, Hamilton, Canada. The object of the invention is to provide an improved process for the manufacture of alumina and by-products, such as hydrochloric acid, sodium sulfate, sodium aluminate, sodium carbonate, and other substances that may be contained in clay, kaolin, bauxite or other aluminous ores, sulfate of aluminium or other aluminous materials to be treated, and sodium chlorid. This invention is a division of the application for a former letters patent filed by Mr. Keogh.

Electrical Devices.

TROLLEY.—S. Stitts, Ironton, Ohio. The invention has reference to a means for facilitating the lubrication of trolley-wheels; and it comprises certain novel devices enabling grease or any other lubricant to be used and to be pressed steadily into the bearing of the trolley-wheel, thus keeping the wheel constantly lubricated.

Engineering Improvements.

AIR-BRAKE ATTACHMENT. — F. B. O'Bannon and F. J. Chamberlain, Albuquerque, New Mex. The prime object in this case is to enable the auxiliary reservoirs in an air-brake system to be recharged without releasing the brakes by the engineer in his cab, thus placing the absolute control of the system in the engineer's hands. This is attained by providing a cock or other means for controlling the exhaust from the triple valve and providing for the cock an actuating means itself actuated by the pressure in the train-pipe. Thus the valve may be permitted to exhaust or prevented from exhausting at the engineer's will, by raising or lowering the train-pipe pressure.

STRAINER.—F. G. Brown, Sheffield, Ala. Mr. Brown claims that the object of this invention is the provision of a new and improved pipe-line attachment for straining water or other liquid flowing through the pipe-line to prevent trash or other extraneous matter from passing with the feed-water into the boiler or other apparatus.

BOILER.—J. McWilliams, Jersey City, N. J. The object of the invention in this case is to provide a new and improved boiler which is arranged to insure quick circulation of the water and to produce a large heating-surface in a comparatively small space. The boiler is very serviceable for use as a marine boiler.

MARINE BOILER.—P. Grünewald, Duisburg, Germany. The aim of the inventor in this case is to provide a new and improved boiler, more especially designed as a marine boiler and arranged to insure quick heating of the water and generation of steam to a high pressure with safety and without requiring undue increase in the thickness of the boiler material.

Hardware.

SASH-FASTENER.—I. A. Shaw, Hutchinson, Kan. The object in view in this case is the provision of a construction capable of easy application to a sash for the purpose of holding it tight against the window-stop, for stopping it at any height, and for locking the sash when lowered. The device will not be clogged by dust or dirt, and it embodies a pull or lift by the aid of which the operator is able to secure a firm grip on the sash, so as to raise it to good advantage should it become wedged in place.

NUT-LOCK.—F. M. Boss, Waldron, Ark. This invention has reference to that class of nut-locks in which the bolt is provided with a longitudinal groove or recess, in which is arranged a suitably-constructed spring adapted for engagement with one of a series of grooves or notches formed interiorly in the nut or bur, and thereby locking it against reverse turning on the bolt.

Machines and Mechanical Devices.

SHREDDER-FEEDER.—G. W. Crane, Veedersburg, Indiana. In this patent the invention refers to improvements in devices for feeding corn to shredding-machines; and the purpose is to provide a feeder of simple construction that will obviate the necessity of a person placing his hands near the shredding devices, thus avoiding accidental cutting or injury to the hands.

WASHING-MACHINE.—P. R. Ensminger, Anaconda, Mont. The present invention is related to improvements in washing-machines, the object being to provide a washing-machine by means of which fabrics may be rapidly and thoroughly washed by forcing the water through the material by both compression and suction. The material is kept in constant agitation and rubbing action.

Of Interest to Farmers.

HARVESTER.—E. A. Mainguet, Evangeline, La. In this harvester the cutter bar is supported in guides in advance of an endless carrier which carries the grain to the packer. The packer comprises an endless apron provided with teeth which is operated by pitman connection with the cutter bar. The base of the packer consists of spring plates of special form. The operating parts are so disposed as not to become clogged by the grain.

Miscellaneous.

CABINET.—B. W. Sholty, Decatur, Indiana. Two patents on cabinets have been granted to Mr. Sholty which relate to former patents granted to him. The cabinets are supplied with numerous drawers and above these a sliding board which can be drawn out for use as a desk. Above the board a slide carries the typewriter and the case, the latter having an adjustable copy-holder and a prop for tilting the case to bring the holder nearer the eye. The cabinet has side shelves which can be drawn forward and means to automatically adjust brackets to hold the shelves up for use. The brackets turn out of the way when the shelves are pushed back.

DESIGN.—E. T. Whelan, Jersey City, N. J. This is an ornamental design for a grave-mark. The figure in front elevation shows the body of a wreath representing a series of overlapping leaves tied at the lower central portion and an ornamental open panel at the top in which a name plate is to be fitted.

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

Business and Personal Wants.

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

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Inquiry No. 4673.—For makers of machines for pulling trees and stumps.

Inquiry No. 4674.—For manufacturers of a pneumatic floor sweeper or cleaner.

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Inquiry No. 4676.—For a gas engine of ½ horse power.

Inquiry No. 4677.—For address of the makers of the Brotherhood three cylinder engine; cylinders 120 degrees apart.

Inquiry No. 4678.—For parties who manufacture and install small gas plants for small town.

Inquiry No. 4679.—For manufacturers of a double stereopticon, using acetylene gas or electricity (gas preferred.)

Inquiry No. 4680.—For machinery to manufacture apple barrel stock.

Inquiry No. 4681.—For addresses of electrical jobbers and manufacturers of electrical goods.

Inquiry No. 4682.—For manufacturers of small mechanical novelties.

Inquiry No. 4683.—For a flax-spinning machine.

Inquiry No. 4684.—For a small box-nailing machine, a sand wheel and a press for printing wood boxes.

Inquiry No. 4685.—For machinery for making wood tanks, etc.

Inquiry No. 4686.—For manufacturers of toy rubber gas balloons.

Inquiry No. 4687.—For wholesale dealers in an alloy called "Magnalium."

Inquiry No. 4688.—For the maker of a hack saw blade known as the "Horse Shoe Brand."

Inquiry No. 4689.—For manufacturers of machinery for making gas for gas engines.

Inquiry No. 4690.—For makers of small stationary engine 1 h. p. and not heavier than 20 pounds for running ice cream freezer or churning butter.

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Inquiry No. 4691.—For makers of small steam engine castings, also of small, double upright marine engines.

Inquiry No. 4692.—For castings and materials for building a one-half horse power dynamo.

Notes and Queries.

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

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Minerals sent for examination should be distinctly marked or labeled.

(9205) J. McD. says: 1. What is the proper pressure to figure the nominal horse power of a steam engine—half the boiler pressure, or two-thirds? 2. What per cent do you subtract from answers when you have figured horse power of engine? That is, what per cent do you allow for friction? I know that the indicator is the only proper method, but want to know the proper answers to questions. We will say that 8 per cent is allowed for friction. 3. Give receipt for a lubricant for fast-running bearings that heat up. I want to make it in small quantities. Shaft makes 1,600 turns a minute. They will run for weeks, and all of sudden they will heat. A. We would say that the nominal horse power of a steam engine depends on the character of the engine as well as on the boiler pressure. If you know the boiler pressure, the average point of cut-off, and the average amount of compression, you can construct an imaginary indicator card which will give you the probable mean effective pressure, neglecting the throttling effects of the valves. It is customary to assume that the true mean effective pressure will be from 80 to 95 per cent of the mean effective pressure determined in this way, depending on the type of engine. The friction of an engine also depends on the character of the engine, and varies from about 4 per cent of indicated horse power to about 12 per cent of the indicated horse power; 6 or 8 per cent would be perhaps a fair average. We can give you no receipt for making a lubricant which will prevent your bearings from heating. If they run satisfactorily for weeks and then suddenly heat, the difficulty probably is that small particles of dirt or grit occasionally get into the bearings, which cause them to heat. The only practical suggestions that we can give you are always (1) to be sure that the boxes and shaft are as smooth as it is possible to get them; (2) to protect them in every possible way from dust and dirt; (3) to be sure that they are continuously and generously lubricated with a suitable oil that is absolutely free from dirt. A pure, light mineral oil is probably the best lubricant for your purpose. For high-speed bearings the oil should be very fluid.

NEW BOOKS, ETC.

The Tower Clock Designed and Made for the University of Chicago by the Chicago Manual Training School of the University of Chicago. By Earl Bixby Ferson, A.M. 12mo. Pp. 57.

It would be hard to conceive a more eloquent drummer for a school than such an exposition of work actually accomplished. It is a mistake to suppose that a clock must be made by a clock maker. A large clock is within the province of the mechanical engineer. Both the time train and chime train are admirably designed. The pamphlet is reprinted from the American Jeweler.

Municipal Civil Service Examination Papers. New York: William Beverley Harison. 1902. 16mo. Pp. 149. Price 25 cents.

Report on Cuba. By H. D. Dumont. New York: The Merchants' Association. 1903. 8vo. Pp. 40.

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AND EACH BEARING THAT DATE.

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Elevator locking device, D. C. Jenkins 740,568
Elevator locking device, H. M. Jenkins 740,570
Elevator mechanism, G. Visco 740,956
Elevator safety appliance or attachment, G. Holger 740,566
Engine controlling device, antomatic, H. J. Mohlenhoff 740,454
Engine cooling attachment, internal combustion, J. W. Sutton 740,711
Engine gasoline and air feed device, gas, Thompson & Koeb 740,488
Engine steering mechanism, traction, G. E. Wilkinson 740,504
Engines, electric sparker for explosion, E. C. Richard 740,924
Engines, electric sparking igniter for gas, T. L. & T. J. Sturtevant 740,781
Engines, superheating the driving mediums of cold vapor, A. Houkowsky 740,859
Engraver's block, F. Thirion 740,713
Evaporator tube, S. M. Lillie 740,449
Exercising machine, J. C. Korth 740,443
Explosion engine, G. F. Jaubert 740,864
Eye forming machine, Lamb & Snedeker 740,444
Eyeglass guard, J. C. Wells 740,721
Eyeglasses, H. Brinkhaus 740,624
Feed water heater, R. H. Hornbrook 740,655
Feed water heater, R. H. Fraser 740,841
Feed water purifier, T. O. Organ 740,904
Fence post, J. C. Simmons 740,933
File, letter, A. Don 740,406
Filling machine, G. W. Blake 740,735
Filter, A. H. Kohlmeyer 740,574
Filter, oil, W. F. Warden 740,957
Fire alarm and sprinkler system, automatic, F. K. Ludlow 740,450
Fire escape, J. R. Prouty 740,917
Fire signal, J. H. Dixon 740,823
Fish hook, F. H. Pandon 740,775
Fishing bob, J. S. Scott 740,474
Flange, F. C. Billings 740,796
Flax carrier, J. Degendorfer 740,820
Flour bolts, etc., cloth cleaning attachment, J. Charles 740,806
Flue, smoke and air, C. Faust 740,835
Fly paper, sticky, O. A. Jones 740,870
Fodder, machine for the manufacture of molasses, R. Schrader 740,699
Folding table, J. P. Gaertner 740,844
Frame. See Curtain stretcher frame.
Frame, J. Koster 740,765
Fruit drier, A. A. Quarnberg 740,588
Fruit washing machine screen, E. J. Kessler 740,441
Fuel, device for producing and consuming hydrogenic, A. G. Ingalls 740,759
Funnel, B. Paulini 740,689
Furnace, H. B. Cary 740,528
Furnace, J. MacCormack 740,668, 740,609
Furnace door operating device, L. I. Newton 740,987
Furnace draft, auxiliary, T. Young 740,509
Furnace spraying attachment, J. O. Morris 740,986
Furnaces, utilizing the products of combustion of steam boiler, G. A. Schutz 740,700
Game apparatus, S. Levin 740,448
Game device, puzzle, J. W. Hughes 740,980
Game piece, conversational, W. Chaffin 740,397
Garment fastener, Croom & Ledger 740,813
Garment folding apparatus, McKay & Wenzell 740,458
Garment supporter, Gall & Annan 740,414
Gas burner, E. O. Daniels 740,402
Gas burner, J. Guimaraes 740,645
Gas burner, acetylene, W. T. Free 740,750
Gas compressing machine, T. McIntyre 740,771
Gas cut-off, automatic, V. E. Campbell 740,805
Gas engine, G. Joranson 740,571
Gas from gas generators during stoking, apparatus for preventing escape of, Hofmann & Von Stach 740,757
Gas generator, acetylene, T. F. Williams 740,726
Gas main stopper, E. A. Behringer 740,795
Gas or vapor lighting, apparatus for incandescent, W. Hooker 740,857
Gasket, water gage, H. K. Gilbert 740,640
Gate, S. A. Taylor 740,783
Gear, reversible transmission, J. A. Dickey 740,822
Gear, variable speed, J. S. Fairfax .740,545, 740,546
Gearing, variable speed, W. N. Dumaresq. 740,829
Gold, silver, brass, etc., composition of matter for use in polishing, R. Scannell 740,697
Golf club, R. H. White 740,500
Governor, J. Scherer 740,473
Governor, J. B. O'Donnell 740,688
Grain bin ventilator, H. A. Hannum 740,754
Grain separator, E. M. Kramer 740,575
Grate, H. E. Parson 740,463
Grate, duplex, L. Little 740,880
Grinding mill, ball, P. T. Lindhard 740,879
Grinding mill quick release device, S. Snyder 740,479, 740,480
Gun barrels or tubular articles, apparatus for testing and straightening, Driver & Norman 740,975
Gun cleaning rod, H. A. Tellerson 740,486
Gun gas check, breechloading, V. C. Tasker 740,782
Gun trigger mechanism, K. Voller 740,716
Hame and trace connector, T. E. Kellogg 740,573
Harrow, riding, M. Langellier 740,875
Harvester, H. Traeger 740,949
Harvesting machine, Taylor & Hunter 740,947
Hat, R. Plato 740,913
Hat fastener, lady's, J. T. Bluff 740,797
Hat holder, M. F. Bishop 740,734
Hat holder, lady's, M. C. Wintter 740,965
Hat shaping die, M. A. Cuming 740,815
Hay rake, W. Lincoln 740,760
Header, C. W. Harvey 740,427
Heating and lighting apparatus, combined, C. B. Clark 740,530
Heating furnace, reverberatory, S. Uren 740,786
Hinge, seat, L. D. Petre 741,000
Hog tongs, J. L. Vanderburg 740,715
Hoist, chain, J. Johnson 740,660
Hoisting device for sacks, boxes, etc., C. Serley 740,475
Horn stand or support, A. S. Marten 740,886
Horseshoe, G. & W. H. Bradley 740,623
Horseshoe pad, A. Larsen 740,665
Hose coupling, C. W. F. Kroll 740,664
Hose supporter, M. Marks 740,580
Husking machine, G. R. Sherwood 740,596
Hydraulic brake, Barsley & Rosentreter 740,513
Ice cream storage tank, E. Walker 740,718
Index, H. P. Jones 740,869
Induction motor, R. B. Williamson 740,963
Inkstand, R. H. Young 740,508
Insulating handle connection, D. Heer 740,649
Interchangeable wrench, O. E. Covar 740,812
Iron or steel alloys, forming diamond draw plates in, F. Krause 740,874
Jack. See Lifting jack.
Jack, W. R. Lewis 740,878
Journal lubricator, B. R. Stare 740,482
Journal lubricator, Busenbenz & Lange 740,525
Ladder, collapsible, G. W. Naylor 740,460
Ladle for carrying and tipping blast furnace slag, J. H. Dewhurst 740,404
Ladles for carrying and tipping blast furnace slag, carriage for, J. H. Dewhurst 740,405
Lamp bracket or holder for miners' lamps, W. Israel 740,862
Lamp burner, C. E. J. Grube 740,425
Lamp, gas, C. W. Currier 740,401
Lamp, hydrocarbon, J. Bystrom 470,392
Lantern, Dressel & Black 740,974
Lantern bottom, T. J. Little, Jr. 740,667
Last, darning, D. H. Cox, Jr. 740,400

CHICAGO EXCURSION
via NICKEL PLATE ROAD. Tickets on sale from Buffalo September 26 and 28 at $12.00, good returning to October 2. See local agents or A. W. Ecclestone, D. P. A., 385 Broadway, New York.

Lasting, means for securing shoe uppers preparatory to, W. A. Smith 740,938
Lasting tool, hand, S. Beauregard 740,794
Lathe, C. Glover 740,641
Lawn shears, J. G. Thrasher 740,489
Leather, machine for treating shin or shank, A. F. Stowe 740,709
Leather stock moistening apparatus, R. W. Blaisdell 740,388
Letter boxes, adjustable indicating dial for, G. H. Huntington 740,861
Level and inclinometer, combined, T. S. Tilley 740,491
Lever, ratchet, L. P. Jacobs 740,863
Lifting jack, W. W. Simonton 740,597
Limb, artificial, J. K. Shanaman 740,476
Limb support, G. E. Brown 740,740, 740,741
Linotype machine, J. R. Rogers 740,470
Linotype matrix cleaner, C. P. Rubly 740,471
Loading or unloading apparatus, W. T. Smith 740,940
Lock and latch, combined, A. M. Doyle 740,826
Logging car stake holder, E. Ludford, Jr. 740,885
Loom needle motion, pile fabric, A. J. O'Reilly 740,903
Loom, swivel, J. Wadsworth 740,717
Lubricator, Erickson & Young 740,409
Lubricator, C. L. Hofmann 740,856
Malt turner, J. Mueller 740,770
Match box, B. F. Daniels 740,541
Match box, single delivery, E. C. Davey 740,542
Match safe, J. J. Sullivan 740,710
Measure for gloves, hand, Summesby & Grieve 740,943
Mechanical movement, J. D. A. Johnson 740,868
Medication of air, apparatus for the, J. & W. Titus 740,714
Mercurous chlorid, C. H. von Hoessle 740,855
Metal rods, etc., machine for cutting off, C. H. Veeder 740,492
Metallic mat, P. J. Shrum 740,478
Milk crock hoop or band, C. M. Bronson 740,390
Mine skips, cages, etc., safety gear for, W. B. Stevenson 740,942
Miner's safety cage, F. C. Kerst 740,872
Mining apparatus, phosphate, J. Beatey 740,731
Mixing device, D. S. Goss 740,752
Mold washing machine, J. L. Barrick 740,793
Monoformyl derivative of 1-3 dimethyl 4-5 diamido 2-6 dioxypyrimidin, making the, M. Engelmann 740,636
Motion converting mechanism, G. L., R. A., C. B., & H. E. Griffin 740,423
Motion driving and reversing mechanism, W. & G. F. Meischke-Smith 740,984
Motion, means for preventing lost, G. W. Schock 740,594
Motors, controller for weight operated, R. W. Page 740,907
Mower, A. Hart 740,561, 740,562
Music box star wheel, F. A. Richter 740,925
Musical instrument, J. H. Tann 740,485
Musical instrument, R. J. Bennett 740,514
Musical instrument, pneumatic self-playing, F. F. Schoenstein 740,993
Musical instruments, pneumatic action for self-playing, T. P. Brown 740,391
Night light, F. Hirth 740,433
Nozzle, W. C. Oberwalder 740,900
Nut lock, W. A. Young 740,510
Oil burner, L. H. Wattles 740,959
Oiler, automatic, B. Poulson 740,992
Oven, mechanical, P. F. Carroll 740,395
Package, merchandise, F. H. Roberts 740,927
Pad. See Horseshoe pad.
Paper folding machine, G. W. Schock, 740,592, 740,593
Paper roll holder and cutter, W. E. Blue. 740,389
Paste pot, C. B. Gordon 740,848
Pea blanching apparatus, H. D. Hutcheson 740,758
Pedometer pendant, W. E. Porter 740,915
Pen, fountain, J. Blair 740,618
Pencil holder, I. T. Alvord 740,791
Pencil sharpener, C. F. Littlejohn 740,881
Pencil sharpener, L. G. Wilcox 740,962
Photographic plate holder, G. A. Hagner. 740,850
Photographic ray filter, R. H. Stocoum 740,484
Pianos or other musical instruments, bass string for, A. D. Ramacciotti 740,918
Pianos, pianofortes, etc., device for closing pedal openings in, E. Hilger 740,853
Picture hanger, O. A. Wade 740,493
Pill counting machine, W. Brough 740,801
Pipe bending tool, C. W. Miller 740,893
Pipe coupling, train, J. E. Forsyth 740,749
Pipe shellacking machine, C. O. Strutz 740,604
Pipe threading machine, B. Borden 740,799
Pipes, mechanism for running underground, O. E. Brown 740,521
Plant protector, L. G. Hunter 740,487
Planter, seed, W. H. Coble 740,586
Planting machine, seed, U. A. Fitz Maurice 740,748
Plate or sheet surfacing machine, F. S. Brockett 741,001
Plumber's sanitary cross, J. L. Fruin 740,413
Pole or post anchor, I. E. Clum 740,399
Potato bug catcher, W. E. Southwood 740,481
Poultry, game, or bird rearing apparatus, partly applicable to hatching apparatus, R., S. H., M. L. G. E., M. H., S. H. & J. Youde 740,728
Precious stones, holder for cutting, H. W. Oostendorp 740,902
Printing machine bed motion, E. T. Cleathero 740,533
Printing or similar machines, sheet delivery mechanism for, Wich & Hoyt 740,724
Printing press attachment, S. G. Goss 740,552
Projectile, S. A. Groff 740,849
Projectile, I. N. Hamilton 740,977
Projectile, enveloped, H. Platz 740,914
Propulsion, marine, A. J. Taplin 740,946
Pulverizing apparatus, W. A. Koneman 740,764
Pump, R. L. Benson 740,386
Pump, G. W. Meyer 740,892
Pump, air lift, J. P. Couse 740,999
Pump, oil, Bradford & Gordon 740,738
Rail bond, L. Pfingst 740,912
Rail joint, Flannigan & Partridge 740,411
Rail joint fastener, W. H. Logan 740,883
Railway gate, G. E. Jackson 740,658
Railway train arrest, C. Yingling 740,969
Razor, safety, J. Guinan 740,555
Razor safety attachment, J. Guinan 740,556
Reclining chair, W. A. Wylie. 740,966 to 740,968
Refrigerator drip pan attachment, A. Bessette 740,516
Rheostat, J. C. Vetter 740,787
Rheostat, A. Eimer 740,831
Rivets, etc., portable heater for heating, J. & T. Macdonald 740,670
Road machine, W. A. Heusner et al. 740,430
Roasting furnace, Repath & Marcy 740,589
Rock drill, W. Brady 740,890
Rock drill attachment, D. A. Owen 740,906
Rocking chair, B. Klein 740,661
Rolling mill feeding mechanism, J. R. George 740,418
Ropeway gripping apparatus, aerial, W. Eichner 740,830
Rotary engine, L. V. Sutton 740,944
Rotary motor, A. Patschke 740,908
Rotary piston engine, C. E. Hite 740,979
Rotary steam engine, Duysens & Klijnen 740,544
Routing cutter, J. L. Perkins 740,690
Rowlock for metallic boats, J. L. Burton 740,626
Rubber heel holder, P. A. Jahn 740,769
Rule, J. F. Bush 740,742
Rule for measuring openings, E. Hipolito 740,653
Sad iron, O. Tverdahl 740,996
Sad iron handle, W. C. Fawkes 740,410
Sad iron support, A. Lapinski 740,876
Sand, gravel, etc., apparatus for washing, P. Maurice 740,887
Sarcophagus, C. A. Landon 740,766
Saw file attachment, O. B. Blocher 740,736
Saw filing device, Evans & Fraser 740,833
Sawmill set works, J. Scherer 740,477
Saw set, H. Caldwell 740,393
Saw tooth swage, insertible, J. F. Finnegan 740,747
Sawing machine, W. H. Clendenon 740,535
Sawing machine, head block, G. F. Wissmann 740,727
Scaffold, M. A. Cheves 740,398
Scaffold bracket, W. Michael 740,452
Scale, platform, C. H. Vincent 740,955
Scoop, gathering, W. E. Hamilton 740,560
Scraper, road, O. T. Patterson 740,909
Screen. See Fruit washing machine screen.

(Continued on page 282.)

Section liner, R. Kastmann.............. 740,871
Seeding machine, A. O'Connor.............. 740,687
Sewing machine attachment holder, J. M. Greist 740,644
Sewing machine, buttonhole, F. L. Harmon 740,755
Sewing machine cabinet, E. E. Manning.. 740,579
Sewing machine embroidering attachment, A. Hochstrasser 740,654
Sewing machine folding and ruffling device combined, J. Douglas.............. 740,632
Sewing machine horn, I. A. Cook.......... 740,810
Sewing machine tuck folding guide, J. M. Greist 740,643
Shade and curtain pole bracket, window, V. Hildebrand 740,431
Shafts and wheels, flexible connection for drive, W. E. Hamilton.............. 740,559
Sharpener, knife, F. Foster.............. 740,840
Shears, combined split and crosscut, F. G. Koehler 740,763
Sheep shears, J. F. Burgher.............. 740,523
Sheet feeder control, E. T. Cleathero..... 740,532
Sheet feeding apparatus, lifter for pneumatic, E. T. Cleathero.............. 740,534
Sheet metal cutting machine, E. Zeh.... 740,730
Shoe, electric, J. W. Gibbs.............. 740,548
Shoe jack, W. A. Blain.............. 740,971
Shovel nose, W. E. Hamilton.............. 740,557
Show box lid, W. D. Harrison.......... 740,647
Shredder cylinder, W. A. Bush.......... 740,627
Shutter bower and fastener, C. Zimmerman 740;970
Shutter or blind slats, device for fastening, W. W. Du Bois.............. 740,634
Sieve, flour, E. M. Jones.............. 740,439
Signaling apparatus, marine, W. J. Smith.. 740,939
Sink overflow attachment, J. Blum........ 740,737
Skein holding device, Benzinger & Freund 740,616
Skin diseases, etc., apparatus for treating, J. Kjeldsen 740,873
Sleigh, bob, I. K. Storms.............. 740,603
Smoke machine, G. W. Heiland.......... 740,650
Smoke preventer furnace, R. W. Cavenaugh 740,743
Snap fastening, H. Booth.............. 740,518
Snapping rolls, H. L. Ferris.............. 740,637
Snow plow, Kiefer & Freeman.......... 740,572
Soap cake, R. A. Jones.............. 740,440
Soap cakes provided with inserts, making, W. Berry 740,387
Soap frame, Houchin & Huber.......... 740,438
Soap holder, J. S. Roake.............. 740,469
Sodium, acetylsalicylate of, Seifert & Engelhardt 740,702
Sole edge burnishing machine, C. F. Stackpole 740,601, 740,602
Sound transmitter appliance, S. J. Ballard 740,512
Souvenir, G. Fantoni.............. 740,834
Spark arrester, F. J. Wilke.............. 740,503
Spark gap, J. O. Heinze, Jr.............. 740,428
Speed and direction indicator, B. A. Fiske 740,547
Speed indicator, rotary, H. W. Schlotfeldt 740,698
Spike puller, Gartshore & Maxwell........ 740,415
Spinning frame guide eye, W. O. Aldrich.. 740,611
Spittoon, B. G. Meszaros.............. 740,891
Spittoon, flushing, M. A. Coykendall...... 740,538
Spool making machinery, J. S. Goldberg.. 740,422
Spring structure for seat or bed bottoms, L. H. Lawhon.............. 740,983
Sprocket wheel, A. Langerfeld.......... 740,445
Stack anchor, J. Monahan.............. 740,894
Stacker, straw, W. N. Rumely.......... 740,695
Stamp affixer, J. Olsen.............. 740,901
Stamp, drop, B. Lohr.............. 740,884
Stand. See Horn stand.
Star wheel, F. A. Richter.............. 740,926
Steam boiler, G. H. Rheutan.............. 740,922
Steam trap, H. H. Humphrey.......... 740,435
Steam trap, G. M. Hilger.............. 740,854
Stencil, E. A. Wilcox.............. 740,961
Still, ammonia, E. A. Moore.............. 740,678
Stirrup, J. Wright.............. 740,789
Stirrup and connections therefor, W. J. May 740,888
Stove, T. J. March.............. 740,674
Stove, combined heating and cooking, F. J. Smith 740,706
Stove hot air feeder, A. E. Whitney...... 740,501
Stove self feeding attachment, cooking, N. Joergensen 740,866
Strength testing device, Stock & Boegner 740,708
String cutter, G. R. Butler.............. 740,526
Sulfid-ores, treatment of, A. M. G. Sebillot 740,785
Sun dial, E. G. Hewitt.............. 740,978
Suppository, A. H. Peloubet.............. 740,910
Suspenders, E. McGuire.............. 740,584
Swath turning implement, S. A. Peto...... 740,911
Switch joint, hinged, W. A. Fort.......... 740,839
Switch stand and lock, H. H. Warner.... 740,788
Table frame, S. P. Giddings.............. 740,846
Telephone switchboard timing device, B. F. Merritt 740,889
Temperature chart, O. Wider.............. 740,502
Temperature of substances to be heated, apparatus for controlling, C. F. Ruby.... 740,472
Theater seat attachment, S. W. Van Nostran 741,004
Threshing machine cylinder tooth, J. Dahl 740,540
Tile or shingle, metal roofing, A. Friedley 740,842
Tire for vehicle wheels, clencher, De Laski & Thropp 740,877
Tire, pneumatic, P. Magnus.............. 740,578
Tobacco leaf stripping machine, G. A. Marier 740,675
Tobacco pipe, S. Wenzel.............. 740,722
Toothpick, J. A. Ohlsson.............. 740,586
Toy, D. Gibbs.............. 740,419
Toy, F. R. Davis.............. 740,817
Trace, F. D. Thoman.............. 740,948
Track laying indicator, L. Dunn.......... 740,408
Track sweeper, B. Hemann.............. 740,851
Tripod, H. H. McNaughton.............. 740,459
Trolley, B. Stenvall.............. 740,707
Trolley pole, J. F. Mackin.............. 740,577
Truck, T. H. Brown.............. 740,802
Truck, car, E. W. Summers.............. 740,605
Truck, car, W. B. Bettendorf.............. 740,617
Truck, lumber, J. Barker.............. 740,613
Truck wheel, adjustable, W. E. Hamilton 740,558
Tube bending machine, C. A. Briigel........ 740,803
Tubing, apparatus for the manufacture of seamless, King & Wolfe.............. 740,442
Tubular articles, testing for or detecting and correcting faults or errors in, Driver & Norman 740,727
Turbine, steam, J. Richards.............. 740,780
Turbine, steam, A. J. Taplin.............. 740,945
Twisting machine stop motion, G. I. Fiske 740,638
Type bar bearing, L. Myers.............. 740,682
Type space and means for co-operating therewith for justifying lines of type, C. H. Cochrane 740,537
Typewriter desk, F. H. Howe.............. 740,434
Typewriter ribbon reversing mechanism, W. F. Helmond 740,651
Typewriter tabulating device, L. Myers.. 740,680
Typewriting machine, J. Felbel.......... 740,836
Typewriting machine, H. W. Merritt...... 740,890
Typewriting machine extensible platen, H. J. Halle 740,426
Umbrella, T. Pachali..............740,988, 740,989
Valve, J. B. Waring.............. 740,494
Valve, W. F. Singer.............. 740,704
Valve, J. H. Clune.............. 740,807
Valve, acid, J. Koch.............. 740,762
Valve, combined hand and automatic shut off, N. C. Locke.............. 740,882
Valve, dry pipe, F. H. Rice.............. 740,467
Valve, engine, O. W. Young.............. 740,729
Valve, float, E. Benson.............. 740,515
Valve, reducing, J. B. Waring.............. 740,495
Valve, reducing, S. Munson.............. 740,898
Vehicle body, C. J. Moore.............. 740,895
Vehicle door and seat, combined, L. S. Chadwick 740,396
Vehicle driving mechanism, motor, F. D. Howe 740,656
Vehicle, motor, D. P. Sanders.............. 740,591
Vehicle, motor, J. H. MacAlman.......... 740,896
Vehicle oscillating body support, C. N. Conlee 740,809
Vehicle transmission gearing, motor, Porter & Stevenson 740,777
Vending machine, J. A. Williams.......... 740,998
Vending machine, coin, C. R. Smith...... 740,935
Vending machine, coin controlled, F. G. Hartell 740,563
Ventilator. See Grain bin ventilator.
Ventilator, W. F. Slack.............. 740,598
Wagon, Boone & Staples.............. 740,798
Wagon brake, C. E. Sherman.............. 740,595
Wall cleaner, E. Hilker.............. 740,756
Warp stop motion, A. P. S. Macquisten.. 740,672

(Continued on page 283.)

DENVER AND RETURN, $42.00.

The NICKEL PLATE ROAD will sell Special Excursion Tickets October 3 and 4, Buffalo to Denver, Pueblo or Colorado Springs, Col., at rate $42.00, good returning to October 30, account Brotherhood St. Andrews meeting. Splendid opportunity to visit Colorado. See local agents or A. W. Ecclestone, D. P. A., 385 B'way, N. Y. C.

Waste and vent system, J. L. Fruin...... 740,412
Water closet, Knapp & Rollins.......... 740,662
Water, hydraulic plant and vessel or reservoir for containing, C. Coda.......... 740,808
Water motor, impact, S. Rawlings........ 740,919
Waterer, automatic hog, B. F. Booth...... 740,972
Well driving hammer, T. D. Westbrook.... 740,497
Whiffletree hook, J. E. Taylor............ 740,606
Winding machine, S. W. Wardwell....... 740,958
Window and shutter operating device, E. Van Noorden.......................... 740,953
Window fixture, G. Wolfe................ 740,610
Window screen, H. L. Peters............ 740,587
Window screen mechanism, C. Bimel..... 740,517
Window, swinging, E. Van Noorden...... 740,954
Wire or like cutter, E. Baartmans....... 740,612
Wire stretcher, P. M. Darst.............. 740,630
Wire working tool, P. Broadbooks....... 740,739
Wrapping machine, T. G. McGirr........ 740,457
Wrapping machine, G. P. Davis.......... 740,818
Wrapping machine, box, F. Henry....... 740,852
Yarns, etc., with volatile liquids, treating, J. E. Prestwich...................... 740,778
Zinc peroxid, making, F. Ellas........... 740,832

DESIGNS.

Basin, wash, J. Zipp.............36,574 to 36,577
Bottle, J. W. Wood...................... 36,573
Brooch, button, or buckle plate, etc., C. M. Wendelstein....................... 36,568
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Spoons, forks, or similar articles, handle for, P. J. Cheron........................ 36,569
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Toy money bank case, A. H. Kimberling.. 36,579

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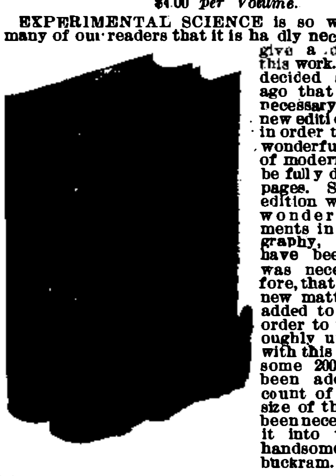

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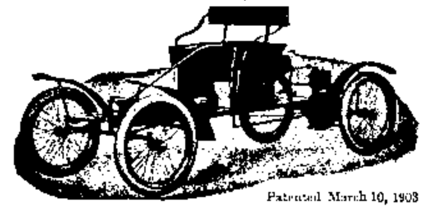

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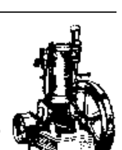

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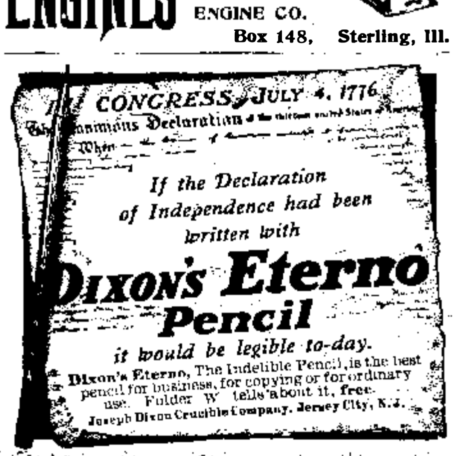

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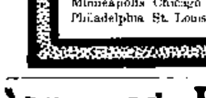

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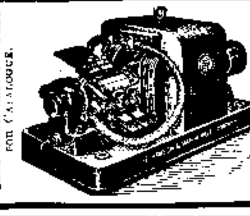

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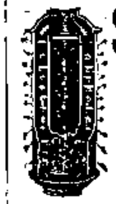

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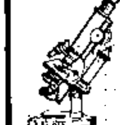

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